

Biological Opinion

**On the Bureau of Land Management's Approval of the Proposed Resource Management
Plan for Western Oregon**

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Prepared by the Oregon Fish and Wildlife Office

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The three triggers for reinitiation of section 7 consultation (including a table of future annual rates of population change) specific to the spotted owl and the efficacy of a barred owl management program on pages 791-792 should read as follows:

1. Implementation of a barred owl management strategy and associated monitoring program that the Service concludes are adequate to achieve and measure the results described in paragraph 3, below, will begin on BLM lands in the action area by year 8 of PRMP implementation.
2. Rates of spotted owl territorial site abandonment resulting from timber harvest in the Harvest Land Base will not exceed 10 percent in the first decade of implementation, 15 percent in the second decade, and 20 percent in each subsequent decade. For decades where BLM impacts are less than these maximums (e.g. 7 percent loss occurs in first decade), the remainder (e.g. 10 percent - 7 percent actual loss = 3 percent remaining) will be added to the following decade (e.g. decade 2 would then have a maximum loss of 15 percent + 3 percent = 18 percent).
3. The following benchmarks for the rate of spotted owl population change on BLM lands within the action area will be met or exceeded (Table 232 and 256). These rates of population change were used in estimating the number of occupied owl sites discussed above and meeting them would be expected to achieve similar results. Determination of whether these benchmarks have been met could be achieved in a number of ways; however, we suggest utilizing results from ongoing spotted owl demographic analyses to assess whether benchmarks have been achieved. For the barred owl management scenario we have described in this BO, spotted owl demographic rates from the NWFP Effectiveness Monitoring Program demographic study areas (see Dugger et al. 2016 for details) can be used to assess the effectiveness of barred owl management. There are 3 northern spotted owl demographic study areas (Oregon Coast Ranges, Tyee, Klamath) (Dugger et al. 2016) and the Union/Myrtle barred owl experiment area that overlap the 5 potential barred owl management areas we described above. DSAs overlap the OCR-N, OCR-S, KLE-N and KLE potential barred owl management areas (Figure 28) and comprise approximately 40 percent (324,398 acres) of these areas. While the KLE-S and WCS barred owl management areas do not include DSAs, we believe that changes in population growth rate obtained from portions of the demographic study areas that do overlap potential barred owl management areas are sufficient to assess the effectiveness of a barred owl management program on BLM lands because the demographic study areas are representative of forest types within the barred owl management areas and provide robust data for estimating rates of population change. Rates of population change should be assessed using estimates of population change for the portions of these demographic study areas that overlap the barred owl management areas. If barred owl management occurs within a portion of a DSA, it is highly likely that the scientists conducting the analyses will conduct separate demographic analyses for areas where barred owl management is occurring and areas where it is not (see analyses for Green Diamond Study Area described in Dugger et al. 2016 for an example). These population parameters have been estimated every five years since the mid-1990s. Anticipated future analyses would occur in 2019, 2024, 2029, 2034, 2039, 2044, 2049, 2054, 2059 and

2064, and results from these analyses can be used to determine whether benchmarks have been met. The first benchmark for evaluating reinitiation of consultation related to this assumption would be 2029, because this would provide the first demographic analysis following implementation of a barred owl management program. If separate analyses are not conducted as part of these 5-year analyses, the Service and BLM biologists will work with these scientists to derive estimates of annual rates of population change for the portions of the DSAs within barred owl management areas.

Table 256. Annual rate of population change (λ) for spotted owls in demographic study areas within barred owl management areas on the six potential barred owl management areas if barred owl management is successfully implemented.

	Years after implementation of the PRMP					
	2029	2034	2039	2044	2054	2059
Annual rate of population change (λ) for spotted owls within demographic study areas on the barred owl management areas	0.9720	0.9950	1.0000	1.0100	1.0200	1.0275

TABLE OF CONTENTS

TABLE OF CONTENTS.....	I
LIST OF TABLES	XIX
LIST OF FIGURES.....	XXXII
INTRODUCTION	1
OVERVIEW OF THE PROPOSED ACTION	2
GOALS AND OVERVIEW OF THE PROGRAMMATIC SECTION 7 CONSULTATION PROCESS	2
KEY CONSIDERATIONS REGARDING THE NORTHERN SPOTTED OWL IN THIS SECTION 7 CONSULTATION PROCESS	4
CONSULTATION HISTORY	5
BIOLOGICAL OPINION	6
DESCRIPTION OF THE PROPOSED ACTION.....	7
<i>Land Use Allocation Overviews</i>	<i>10</i>
<i>Congressionally Reserved Lands and National Landscape Conservation System</i>	<i>10</i>
<i>District-Designated Reserves.....</i>	<i>10</i>
<i>Eastside Management Area</i>	<i>11</i>
<i>Harvest Land Base.....</i>	<i>11</i>
<i>The Uneven-aged Timber Area is located in —</i>	<i>11</i>
<i>Late-Successional Reserve</i>	<i>12</i>
<i>Structurally-Complex Forest</i>	<i>12</i>
<i>Large Block Forest Reserves: Late-Successional Reserve - Moist and Late-Successional Reserve - Dry.....</i>	<i>12</i>
<i>Riparian Reserve (west of Highway 97) - Moist</i>	<i>12</i>
<i>Management Objectives by Land Use Allocation.....</i>	<i>15</i>
<i>Congressionally Reserved Lands and National Landscape Conservation System</i>	<i>15</i>
<i>District-Designated Reserves.....</i>	<i>15</i>

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

<i>Eastside Management Area (forested lands)</i>	15
<i>Eastside Management Area (non-forested lands)</i>	15
<i>Eastside Management Area - Riparian Reserve</i>	16
<i>Harvest Land Base</i>	16
<i>Late-Successional Reserve</i>	16
<i>Riparian Reserve</i>	16
<i>Management Objectives by Resource Program</i>	17
<i>Air Quality</i>	17
<i>Areas of Critical Environmental Concern</i>	17
<i>Cultural Resources</i>	17
<i>Fire, Fuels, and Wildfire Response</i>	17
<i>Fisheries</i>	18
<i>Forest Management</i>	18
<i>Hydrology</i>	18
<i>Invasive Species</i>	18
<i>Lands, Realty, and Roads</i>	18
<i>Livestock Grazing</i>	19
<i>Minerals</i>	19
<i>Paleontological Resources</i>	20
<i>Rare Plants and Fungi</i>	20
<i>Recreation and Visitor Services</i>	20
<i>Soil Resources</i>	21
<i>Sustainable Energy</i>	21
<i>Trails and Travel Management</i>	21
<i>Visual Resource Management</i>	21
<i>Wild Horses</i>	22

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

<i>Wildlife</i>	22
<i>Special Provisions for Spotted Owl Management</i>	23
<i>BLM Participation in Barred Owl Management</i>	23
<i>Incidental Take of Northern Spotted Owls</i>	24
<i>Management of Northern Spotted Owl Known Sites Associated with the Harvest Land Base</i>	25
<i>Known Sites Located in the Harvest Land Base</i>	26
<i>Known Sites Located Outside the Harvest Land Base</i>	27
<i>Description of the Action Area</i>	29
<i>Analytical Framework</i>	30
<i>Analytical Framework for the Jeopardy Determination</i>	31
<i>Analytical Framework for the Adverse Modification Determination</i>	31
<i>Scope of the Analysis</i>	33
<i>BLM Lands</i>	33
<i>Coquille Tribal lands</i>	33
<i>Non-Federal Lands</i>	34
BULL TROUT	35
<i>STATUS OF THE SPECIES - BULL TROUT</i>	35
<i>Taxonomy</i>	35
<i>Species Description</i>	35
<i>Legal Status</i>	35
<i>Life History</i>	36
<i>Population Structure</i>	37
<i>Population Dynamics</i>	39
<i>Habitat Characteristics</i>	39
<i>Diet</i>	41

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Status and Distribution	41
Emerging Threats	56
Conservation	59
Population Units	60
<i>STATUS OF BULL TROUT CRITICAL HABITAT</i>	<i>64</i>
Current legal status of the critical habitat.....	64
Current Designation	64
The Physical and Biological Features	65
Conservation Role and Description of Critical Habitat	65
Physical and Biological Features for Bull Trout	66
Current Critical Habitat Condition Rangewide	68
<i>ENVIRONMENTAL BASELINE - BULL TROUT AND BULL TROUT CRITICAL HABITAT</i>	<i>69</i>
Affected Environment	70
<i>EFFECTS OF THE ACTION - BULL TROUT AND BULL TROUT CRITICAL HABITAT</i>	<i>75</i>
Effects to bull trout population indicators	75
Summary of effects to bull trout population characteristics	78
Specific effects to bull trout and bull trout critical habitat	79
Effects to Limiting Factors for Bull Trout.....	96
Effects to Bull Trout from Non-Federal Lands within the Action Area	99
<i>CONCLUSION</i>	<i>99</i>
COOK’S DESERT-PARSLEY	102
<i>STATUS OF THE SPECIES - COOK’S DESERT-PARSLEY</i>	<i>102</i>
Listing Status	102
Population Trends and Distribution for Cook’s Desert-Parsley	102
Habitat Characteristics for Cook’s Desert-Parsley.....	103
Threats/Reasons for Listing for Cook’s Desert-Parsley	104

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Recovery Measures for Cook's Desert-Parsley	105
<i>ENVIRONMENTAL BASELINE – COOK'S DESERT PARSLEY</i>	106
<i>EFFECTS OF THE ACTION – COOK'S DESERT PARSLEY</i>	107
Non-Federal Lands	109
<i>CONCLUSION</i>	110
<i>STATUS OF THE SPECIES - COOK'S DESERT PARSLEY CRITICAL HABITAT</i>	110
Climate Change	111
<i>ENVIRONMENTAL BASELINE – COOK'S DESERT PARSELY CRITICAL HABITAT</i>	112
<i>EFFECTS OF THE ACTION - COOK'S DESERT PARSLEY CRITICAL HABITAT</i>	115
Non-Federal Lands	117
<i>CONCLUSION</i>	118
FENDER'S BLUE BUTTERFLY	119
<i>STATUS OF THE SPECIES - FENDER'S BLUE BUTTERFLY</i>	119
Species listing status	119
Species description	119
Habitat needs and life history	119
Population dynamics.....	120
Reasons for listing and threats.....	122
<i>ENVIRONMENTAL BASELINE – FENDER'S BLUE BUTTERFLY</i>	123
<i>EFFECTS OF THE ACTION - FENDER'S BLUE BUTTERFLY</i>	124
Non-Federal Lands	127
<i>CONCLUSION</i>	127
GENTNER'S FRITILLARY	129
<i>STATUS OF THE SPECIES - GENTNER'S FRITILLARY</i>	129
Listing Status and Locations	129

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Population Trends and Distribution	129
Life History and Ecology	129
Habitat Characteristics	130
Threats/Reasons for Listing	130
Recovery Measures	132
<i>ENVIRONMENTAL BASELINE – GENTNER’S FRITILLARY</i>	<i>132</i>
<i>EFFECTS OF THE ACTION – GENTNER’S FRITILLARY</i>	<i>133</i>
Non-Federal Lands	136
<i>CONCLUSION</i>	<i>137</i>
KINCAID’S LUPINE	138
<i>STATUS OF THE SPECIES – KINCAID’S LUPINE</i>	<i>138</i>
Population Trends and Distribution	138
Life History and Ecology	139
Habitat Characteristics	140
Threats/Reasons for Listing	140
Recovery Measures	142
<i>ENVIRONMENTAL BASELINE – KINCAID’S LUPINE</i>	<i>142</i>
Douglas County	143
Oak Basin	144
<i>EFFECTS OF THE ACTION – KINCAID’S LUPINE</i>	<i>146</i>
Non-Federal Lands	148
<i>CONCLUSION</i>	<i>149</i>
LOST RIVER AND SHORTNOSE SUCKERS	150
<i>STATUS OF THE SPECIES - LOST RIVER AND SHORTNOSE SUCKERS</i>	<i>150</i>
Taxonomy	150
Species Description	150

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Legal Status	151
Life history	152
Population Dynamics	152
Status and Distribution	153
Threats	160
Conservation Needs	165
<i>STATUS OF CRITICAL HABITAT - LOST RIVER AND SHORTNOSE SUCKER</i>	<i>168</i>
The Physical and Biological Features	169
Climate Change/ Potential Effects of Water Temperature Levels to Alteration of the PBFs	170
<i>ENVIRONMENTAL BASELINE - LOST RIVER AND SHORTNOSE SUCKERS AND THEIR CRITICAL HABITATS</i>	<i>171</i>
Role of the Action Area in the Conservation of the Lost River Sucker	172
Current Condition of the Shortnose Sucker in the Action Area	172
Role of the Action Area in the Conservation of the Shortnose Sucker.....	174
Recovery Units	174
Water Quality within Sucker Habitat in the Action Area.....	178
<i>EFFECTS OF THE ACTION - LOST RIVER AND SHORTNOSE SUCKERS AND THEIR CRITICAL HABITATS</i>	<i>181</i>
PBFs for Lost River and shortnose sucker critical habitats:.....	181
Cultural and Paleontological Resources Program	182
<i>CONCLUSION</i>	<i>204</i>
MARBLED MURRELET	206
<i>STATUS OF THE MARBLED MURRELET</i>	<i>206</i>
Species Description	206
Life history	206
Population Dynamics	211
Status and Distribution	221
Conservation	226

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

NWFP Protections	227
Effects of Tree Removal on Murrelets	228
Effects of Associated Disturbance on Murrelets	229
<i>STATUS OF MARBLED MURRELET CRITICAL HABITAT</i>	<i>234</i>
Description	235
Conservation Strategy and Objectives	235
Status and Distribution	236
<i>ENVIRONMENTAL BASELINE – MARBLED MURRELET</i>	<i>237</i>
Coquille Tribe’s Lands	239
State, County and Private Lands	239
BLM Lands within the Action Area	239
Nesting Habitat Classification and Modeling by BLM	239
Occupancy on BLM lands in the Action Area and in Oregon	244
Population trends	247
Nesting habitat trends	248
Conservation Zone 3	248
Conservation Zone 4	250
Potential use of unsurveyed and occupied murrelet habitat	252
NWFP in the Action Area	253
Recovery Plan for the Murrelet	253
Role of the Action Area in the Survival and Recovery of the Murrelet	253
<i>ENVIRONMENTAL BASELINE – MARBLED MURRELET CRITICAL HABITAT</i>	<i>254</i>
Coquille Lands	254
State, County and Private Lands	254
BLM lands within the Action Area	255
Consulted on Effects within Critical habitat	256

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Critical Habitat Units on BLM Lands within the Action Area	256
CHUs only on Non-federal Lands within the Action Area.....	283
<i>EFFECTS OF THE ACTION ON MARBLED MURRELETS.....</i>	<i>284</i>
Effects to Individual Murrelets.....	284
Indirect Effects to Individual Murrelets	298
Summary of effects to individual murrelets.....	301
Consistency of PRMP with Recovery Plan Guidance for the Murrelet.....	303
Combined Effects to the Murrelet Population.....	330
<i>EFFECTS OF THE ACTION ON MARBLED MURRELET CRITICAL HABITAT</i>	<i>340</i>
Overarching protection.....	341
Timber Harvest.....	344
Non-timber Actions.....	355
Indirect Effects from Actions on State, County and Private Lands.....	356
Summary of Effects to Critical Habitat	358
Combined Effects	359
<i>Cumulative Effects.....</i>	<i>425</i>
<i>Conclusion</i>	<i>425</i>
NELSON’S CHECKER-MALLOW	429
<i>STATUS OF THE SPECIES - NELSON’S CHECKER-MALLOW</i>	<i>429</i>
Population Trends and Distribution for Nelson’s Checkermallow	429
Life History and Ecology for Nelson’s Checkermallow	429
Habitat Characteristics for Nelson’s Checkermallow	430
Threats/Reasons for Listing for Nelson’s Checkermallow	431
Recovery Measures for Nelson’s Checkermallow	432
Threats/ Reasons for Listing for Nelson’s Checkermallow	433
Conservation Measures for Nelson’s Checkermallow.....	434

<i>ENVIRONMENTAL BASELINE – NELSON’S CHECKERMALLOW</i>	435
<i>EFFECTS OF THE ACTION TO NELSON’S CHECKER-MALLOW</i>	435
Non-Federal Lands	438
<i>CONCLUSION</i>	438
NORTHERN SPOTTED OWL	439
<i>STATUS OF THE SPECIES - NORTHERN SPOTTED OWL</i>	439
<i>STATUS OF CRITICAL HABITAT – NORTHERN SPOTTED OWL</i>	474
<i>ENVIRONMENTAL BASELINE</i>	483
Analysis Area and Summary of Analytical Methods.....	484
Spotted Owl Occupancy.....	500
Population trends	500
Spotted Owl Habitat.....	501
Spotted Owl Habitat Trends.....	502
Status of Spotted Owl Critical Habitat Within the PRMP	504
<i>EFFECTS OF THE ACTION—NORTHERN SPOTTED OWL</i>	513
Designation of Land Use Allocations	513
Resource Programs	555
Summary of Effects	602
Conclusion – Effects of Proposed Action on Spotted Owls	620
Reinitiation Triggers	625
<i>EFFECTS OF THE ACTION—NORTHERN SPOTTED OWL CRITICAL HABITAT</i>	626
Guidelines for Determining Effects to Critical Habitat	626
Proposed Management Direction	627
Resource Programs	663
Summary of Effects to Critical Habitat	684

<i>JEOPARDY AND ADVERSE MODIFICATION CONCLUSIONS—NORTHERN SPOTTED OWL AND ITS CRITICAL HABITAT</i>	700
Conservation Recommendations	703
Reinitiation Triggers- Spotted Owl	703
OREGON SPOTTED FROG	706
<i>STATUS OF THE SPECIES - OREGON SPOTTED FROG</i>	706
Listing Status	706
Taxonomy	706
Physical description	706
Life history	707
Habitat	708
Distribution	710
Population Dynamics	711
Threats at the Range-wide Level.....	712
<i>ENVIRONMENTAL BASELINE</i>	717
<i>EFFECTS OF THE ACTION - OREGON SPOTTED FROG</i>	718
Non-Federal Lands	721
<i>STATUS OF CRITICAL HABITAT – OREGON SPOTTED FROG</i>	722
Physical or Biological Features	723
Special management considerations	724
<i>ENVIRONMENTAL BASELINE – OREGON SPOTTED FROG CRITICAL HABITAT</i>	724
<i>EFFECTS OF THE ACTION – OREGON SPOTTED FROG CRITICAL HABITAT</i>	725
Non-Federal lands	727
<i>CONCLUSION</i>	728
ROUGH POPCORNFLOWER	729
<i>STATUS OF THE SPECIES – ROUGH POPCORNFLOWER</i>	729

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Listing	729
Population Trends and Distribution	729
Life History and Ecology for Popcornflower	729
Habitat Characteristics for Popcornflower	730
Threats/Reasons for Listing for Popcornflower	730
Recovery Measures for Popcornflower	731
<i>ENVIRONMENTAL BASELINE – ROUGH POPCORNFLOWER</i>	732
<i>EFFECTS OF THE ACTION TO ROUGH POPCORNFLOWER</i>	732
Non-Federal Lands	735
<i>CONCLUSION</i>	735
VERNAL POOL FAIRY SHRIMP	736
<i>STATUS OF THE SPECIES - VERNAL POOL FAIRY SHRIMP</i>	736
Listing	736
Species Description	736
Life History and Habitat Requirements	736
Rangewide Status and Distribution	737
Threats, Reasons for Listing	738
Vernal Pool Conservation Strategy	740
<i>ENVIRONMENTAL BASELINE – VERNAL POOL FAIRY SHRIMP</i>	741
<i>EFFECTS OF THE ACTION - VERNAL POOL FAIRY SHRIMP</i>	741
Non-federal Lands	744
<i>CONCLUSION</i>	744
<i>STATUS OF CRITICAL HABITAT – VERNAL POOL FAIRY SHRIMP</i>	745
<i>ENVIRONMENTAL BASELINE – VERNAL POOL FAIRY SHRIMP CRITICAL HABITAT</i>	749
<i>EFFECTS OF THE ACTION - VERNAL POOL FAIRY SHRIMP CRITICAL HABITAT</i>	749

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

Non-federal Lands	752
<i>CONCLUSION</i>	752
WESTERN SNOWY PLOVER	753
<i>STATUS OF THE SPECIES - WESTERN SNOWY PLOVER</i>	753
Legal Status	753
Species Description	753
Reproductive Biology	754
Population Structure	754
Habitat Description	757
Threats	758
<i>ENVIRONMENTAL BASELINE – WESTERN SNOWY PLOVER</i>	764
Breeding Habitat (Distribution, Amount and Quality)	765
Breeding Population (Numbers, Distribution, and Reproduction)	766
Wintering Habitat and Population	767
The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range Within the Action Area ..	767
Overutilization for commercial, recreational, scientific, or education purposes	769
Predation	769
The inadequacy of existing regulatory mechanisms	770
Other natural or manmade factors affecting their continued existence	770
Role of the Action Area in the Recovery of the Western Snowy Plover	770
<i>EFFECTS OF THE ACTION – WESTERN SNOWY PLOVER</i>	771
Non-Federal Lands	773
<i>CONCLUSION</i>	774
<i>STATUS OF THE SPECIES – WESTERN SNOWY PLOVER CRITICAL HABITAT</i>	774
<i>ENVIRONMENTAL BASELINE – WESTERN SNOWY PLOVER CRITICAL HABITAT</i>	776
CHU OR-10, Coos Bay North Spit	776

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

CHU OR-11, Bandon to New River	777
<i>EFFECTS OF THE ACTION - SNOWY PLOVER CRITICAL HABITAT</i>	778
Non-Federal Lands	780
<i>CONCLUSION</i>	780
OVERALL CONCLUSION	782
INCIDENTAL TAKE STATEMENT	782
FORM AND AMOUNT OR EXTENT OF ANTICIPATED TAKE	783
<i>Sediment-based take</i>	783
<i>Contaminant-based Take</i>	784
<i>Recreational Activity-based Take</i>	784
<i>Use of a surrogate to express the Amount or Extent of Take</i>	785
EFFECT OF THE TAKE	787
REASONABLE AND PRUDENT MEASURES	788
TERMS AND CONDITIONS.....	788
<i>Term and Condition 1</i>	788
<i>Term and Condition 2</i>	789
<i>Term and Condition 3</i>	789
CONSERVATION RECOMMENDATIONS	790
SPOTTED OWL REINITIATION TRIGGERS	791
REINITIATION NOTICE	792
LITERATURE CITED	793
COMMON CITATIONS	793
BULL TROUT	794
<i>Personal Communications</i>	807
COOK’S DESERT PARSLEY	807

<i>Personal Communications</i>	808
FENDER’S BLUE BUTTERFLY.....	809
GENTNER’S FRITILLARY	811
<i>Personal Communications</i>	812
KINCAID’S LUPINE	812
<i>Personal Communication</i>	815
<i>Unpublished Report</i>	815
LOST RIVER AND SHORNOSE SUCKERS	816
<i>Personal Communications</i>	826
MARBLED MURRELET	826
<i>GUIDANCE DOCUMENTS FOR THE MURRELET SECTION</i>	836
<i>PERSONAL COMMUNICATIONS</i>	836
NELSON’S CHECKERMALLOW	837
NORTHERN SPOTTED OWL.....	839
<i>Personal Communications</i>	857
OREGON SPOTTED FROG	858
<i>Personal Communication</i>	862
ROUGH POPCORNFLOWER	862
<i>Personal Communication</i>	863
VERNAL POOL FAIRY SHRIMP	863
<i>Personal Communication</i>	865
WESTERN SNOWY PLOVER.....	866
APPENDIX A – LETTERS OF CONCURRENCE	1
COLUMBIAN WHITE-TAILED DEER.....	1
GRAY WOLF	1

WESTERN LILY	3
<i>Literature Cited</i>	6
COLUMBIAN WHITE-TAILED DEER	6
GRAY WOLF	6
WESTERN LILY	6

APPENDIX B – BLM EFFECTS DETERMINATIONS COMMON TO ALL SPECIES AND CRITICAL HABITATS IN THE TERRESTRIAL BA 1

1. CONGRESSIONALLY RESERVED AND NATIONAL LANDSCAPE CONSERVATION SYSTEM.....	1
2. AIR QUALITY	2
3. CULTURAL RESOURCES	2
4. LANDS, REALTY, AND ROADS	2
<i>a. Right-of-Ways</i>	2
<i>b. Land Disposal and Acquisitions</i>	3
<i>c. Land Tenure Zone Designations</i>	4
<i>d. Leases and Withdrawals</i>	6
5. MINERALS	6
<i>Leasable Minerals: Oil, Gas or Coalbed Natural Gas Resources</i>	7
<i>Salable Minerals</i>	7
<i>Locatable Minerals</i>	8
6. PALEONTOLOGICAL RESOURCES	9
7. SOIL RESOURCES	9
8. SUSTAINABLE ENERGY	10
<i>Sustainable Energy</i>	11
Management Direction	11
<i>Sustainable Energy – Biomass Energy Development</i>	12
Management Direction	12

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

<i>Sustainable Energy – Wind Energy Development</i>	<i>12</i>
Management Direction	12
<i>Sustainable Energy – Geothermal Energy Development.....</i>	<i>13</i>
Management Direction	13
<i>Sustainable Energy – Sustainable Energy Transmission Corridors</i>	<i>13</i>
Management Direction	13
9. VISUAL RESOURCE MANAGEMENT.....	14
10. WILD HORSES	16
CONCLUSION	16
LITERATURE CITED	17
APPENDIX C – AQUATIC ANALYTICAL PROCESS.....	1
<i>Habitat Indicators Used for the Effects Analysis</i>	<i>1</i>
Large and small wood	1
Sediment/Turbidity/Substrate	2
Water temperature.....	3
Peak/base flows	4
Riparian Reserve function and vegetation diversity	5
Chemical contamination/nutrients	6
Roads within Riparian Reserves	6
<i>Bull Trout Population Indicators Used for the Effects Analysis</i>	<i>7</i>
<i>Organization of the Effects Analysis for ESA-listed Fish</i>	<i>8</i>
1. Cultural and Paleontological Resources	8
2. Fire and Fuels.....	11
3. Fisheries, Hydrology, Invasive Species, Soils and Wildlife.....	22
4. Forest Management Program	25

5. <i>Lands and Realty</i>	76
6. <i>Livestock Grazing</i>	83
7. <i>Minerals</i>	93
8. <i>Recreation and Visitors Services</i>	97
9. <i>Special Forest Products</i>	105
10. <i>Sustainable Energy</i>	108
11. <i>Trails and Travel Management</i>	112
12. <i>Wild Horses</i>	122
<i>Summary of habitat indicator analyses by PRMP program</i>	126
LITERATURE CITED	130
APPENDIX D CLIMATE CHANGE	1
GENERAL OVERVIEW	1
Temperature and Precipitation.....	2
Forest Composition	3
Disturbance Patterns	4
Summary	4
LITERATURE CITED	5

LIST OF TABLES

TABLE 1. ACRES AND PERCENTAGES BY LAND USE ALLOCATION FOR THE PROPOSED RESOURCE MANAGEMENT PLAN. BLM’S TABLE II-1, P. 34.	9
TABLE 2. STREAM/ShORELINE DISTANCE AND RESERVOIR/LAKE AREA DESIGNATED AS BULL TROUT CRITICAL HABITAT.	64
TABLE 3. MILES AND PERCENTAGES OF MCKENZIE RIVER BASIN BULL TROUT DISTRIBUTION BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P.205).	71
TABLE 4. MILES, ACRES AND PERCENTAGES OF MCKENZIE RIVER BASIN BULL TROUT DESIGNATED CRITICAL HABITAT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P.210).	71
TABLE 5. ACRES AND PERCENTAGES BY LAND OWNERSHIP FOR THE MCKENZIE RIVER BASIN BULL TROUT ANALYSIS AREA, WITHIN THE PRMP PLANNING AREA (BLM 2016B, P.199).	71
TABLE 6. ACRES AND PERCENTAGES BY PRMP LAND USE ALLOCATION FOR BULL TROUT IN THE MCKENZIE RIVER BASIN (BLM 2016B, P.28).	72
TABLE 7. SUMMARY OF EFFECTS TO BULL TROUT AND BULL TROUT CRITICAL HABITAT.	80
TABLE 8. SUMMARY OF EFFECTS FROM CULTURAL RESOURCES AND PALEONTOLOGICAL RESOURCES PROGRAMS ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	81
TABLE 9. SUMMARY OF EFFECTS FROM FIRE AND FUELS PROGRAM ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	83
TABLE 10. EFFECTS TO PBF’S FROM RESTORATION ACTIVITIES OF ARBO II (AFTER TABLE 26 IN USFWS (2013)).	85
TABLE 11. SUMMARY OF EFFECTS FROM FOREST MANAGEMENT PROGRAM ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	86
TABLE 12. SUMMARY OF EFFECTS FROM LANDS AND REALTY PROGRAM ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	89
TABLE 13. SUMMARY OF EFFECTS FROM RECREATION AND VISITORS SERVICES PROGRAM ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	91
TABLE 14. SUMMARY OF EFFECTS FROM TRAILS AND TRAVEL MANAGEMENT PROGRAM ON THE PBF’S OF BULL TROUT AND THEIR CRITICAL HABITAT.	94
TABLE 15. EFFECTS TO LIMITING FACTORS FOR MCKENZIE RIVER BASIN BULL TROUT.	97
TABLE 16. ANNUAL RANGE-WIDE FENDER’S BLUE BUTTERFLY POPULATION ESTIMATES (FITZPATRICK 2014).	121
TABLE 17. EGG AND ADULT FENDER’S BLUE BUTTERFLY POPULATION DATA FROM 2006-2015 AT OAK BASIN.	124
TABLE 18. KINCAID’S LUPINE POPULATION DATA (TOTAL COVER IN REPORTED IN M ²) FROM 2006-2015 ON BLM LANDS IN DOUGLAS COUNTY (GILES 2015).	143

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 19. KINCAID’S LUPINE POPULATION DATA FROM 2006-2015 AT OAK BASIN (GILES-JOHNSON <i>ET AL.</i> 2010 AND GILES <i>ET AL.</i> 2015)	144
TABLE 20. COMPARATIVE MORPHOLOGY OF KLAMATH LARGESCALE SUCKERS, LOST RIVER SUCKERS, AND SHORTRIVER SUCKERS, BASED ON MARKLE <i>ET AL.</i> (2005, PP. 475-480).	151
TABLE 21. MILES AND PERCENTAGES OF LOST RIVER SUCKER DISTRIBUTION IN THE LOST RIVER RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 206).	174
TABLE 22. MILES AND PERCENTAGES OF SHORTRIVER SUCKER DISTRIBUTION IN THE LOST RIVER RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 206).	175
TABLE 23. MILES, ACRES AND PERCENTAGES OF SHORTRIVER SUCKER DESIGNATED CRITICAL HABITAT IN THE LOST RIVER RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 211).	175
TABLE 24. ACRES AND PERCENTAGES BY LAND OWNERSHIP WITHIN THE LOST RIVER RECOVERY UNIT FOR LOST RIVER AND SHORTRIVER SUCKERS, WITHIN AND OUTSIDE OF THE PRMP PLANNING AREA (BLM 2016B, P. 200).	175
TABLE 25. ACRES AND PERCENTAGES BY LAND OWNERSHIP WITHIN THE UPPER KLAMATH LAKE RECOVERY UNIT FOR LOST RIVER AND SHORTRIVER SUCKERS, WITHIN AND OUTSIDE OF THE PRMP PLANNING AREA (BLM 2016B, P. 200).	175
TABLE 26. MILES AND PERCENTAGES OF LOST RIVER SUCKER DISTRIBUTION IN THE UPPER KLAMATH LAKE RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 210).	176
TABLE 27. MILES AND PERCENTAGES OF SHORTRIVER SUCKER DISTRIBUTION IN THE UPPER KLAMATH LAKE RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 206).	176
TABLE 28. MILES, ACRES AND PERCENTAGES OF LOST RIVER SUCKER DESIGNATED CRITICAL HABITAT IN THE UPPER KLAMATH LAKE RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 210).	176
TABLE 29. MILES, ACRES AND PERCENTAGES OF SHORTRIVER SUCKER DESIGNATED CRITICAL HABITAT IN THE UPPER KLAMATH LAKE RECOVERY UNIT BY LAND OWNERSHIP WITHIN THE PRMP PLANNING AREA (BLM 2016B, P. 211).	176
TABLE 30. ACRES AND PERCENTAGES BY PRMP LAND USE ALLOCATION FOR THE LOST RECOVERY UNIT FOR LOST RIVER AND SHORTRIVER SUCKERS (BLM 2016B, P. 29).	180
TABLE 31. ACRES AND PERCENTAGES BY PRMP LAND USE ALLOCATION FOR THE UPPER KLAMATH LAKE RECOVERY UNIT FOR LOST RIVER AND SHORTRIVER SUCKERS (BLM 2016B, P. 29).	180
TABLE 32. POTENTIAL EFFECTS OF THE CULTURAL RESOURCES AND PALEONTOLOGICAL RESOURCES PROGRAMS ON PBFs FOR THE LOST RIVER AND SHORTRIVER SUCKERS (SEE APPENDIX C, PP. 639-642).	182
TABLE 33. POTENTIAL EFFECTS OF THE FIRES AND FUELS PROGRAM ON PBFs FOR THE LOST RIVER AND SHORTRIVER SUCKERS (SEE APPENDIX C, PP. 643-655).	184
TABLE 34. POTENTIAL EFFECTS OF THE FISHERIES, HYDROLOGY, INVASIVE SPECIES, AND SOILS AND WILDLIFE RESOURCE PROGRAMS ON PBFs FOR THE LOST RIVER AND SHORTRIVER SUCKERS.	186
TABLE 35. POTENTIAL EFFECTS OF THE FOREST MANAGEMENT PROGRAM ON PBFs FOR THE LOST RIVER AND SHORTRIVER SUCKERS (SEE APPENDIX C, PP. 658-711).	188

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 36. POTENTIAL EFFECTS OF THE LAND AND REALTY PROGRAM ON PBFs FOR THE LOST RIVER AND SHORNOSE SUCKERS (SEE APPENDIX C, PP. 712-719).	191
TABLE 37. POTENTIAL EFFECTS OF THE LIVESTOCK GRAZING PROGRAM ON PBFs FOR THE LOST RIVER AND SHORNOSE SUCKERS (SEE APPENDIX C, PP. 719-729).	192
TABLE 38. POTENTIAL EFFECTS OF THE RECREATION AND VISITORS SERVICES PROGRAM ON PBFs FOR THE LOST RIVER AND SHORNOSE SUCKERS (SEE APPENDIX C, PP. 733-741).	195
TABLE 39. POTENTIAL EFFECTS OF THE TRAILS AND TRAVEL MANAGEMENT PROGRAM ON PBFs FOR THE LOST RIVER AND SHORNOSE SUCKERS (SEE APPENDIX C, PP. 749-759).	198
TABLE 40. POTENTIAL EFFECTS OF THE WILD HORSE PROGRAM ON PBFs FOR THE LOST RIVER AND SHORNOSE SUCKERS (SEE APPENDIX C, PP. 759-763).	201
TABLE 41. POTENTIAL EFFECTS OF PRMP PROGRAMS ON LIMITING FACTORS FOR THE LOST RIVER SUCKER AND THE SHORNOSE SUCKER	202
TABLE 42. SUMMARY OF 2001-2015 MURRELET DENSITY AND POPULATION SIZE ESTIMATES (ROUNDED TO NEAREST 100 BIRDS) FOR ALL CONSERVATION ZONES COMBINED.	213
TABLE 43. ESTIMATES OF AVERAGE ANNUAL RATE OF CHANGE BASED ON THE AT-SEA POPULATION SURVEYS.	214
TABLE 44. MURRELET POPULATION ESTIMATES FOR CONSERVATION ZONES AND SAMPLING STRATA WITHIN CONSERVATION ZONES, 2014-2015.	214
TABLE 45. POPULATION ESTIMATES FOR MARBLED MURRELETS IN CENTRAL CALIFORNIA CONSERVATION ZONE 6 BETWEEN 1999 AND 2014; NO SURVEYS WERE CONDUCTED FROM 2004 TO 2006.	215
TABLE 46. DISTRIBUTION OF MURRELET NESTING HABITAT ON ALL LANDS, BY HABITAT SUITABILITY CLASS, FOR THE BASELINE PERIOD (1993) AND FINAL YEAR OF ANALYSIS (2012).	218
TABLE 47. AGGREGATE RESULTS OF ALL SUITABLE HABITAT (ACRES) AFFECTED AS DETERMINED BY SECTION 7 CONSULTATION FOR THE MARBLED MURRELET; SUMMARY OF EFFECTS BY CONSERVATION ZONE AND HABITAT TYPE FROM OCTOBER 1, 2003 TO JULY 19, 2016.	222
TABLE 48. MURRELET DEMOGRAPHIC PARAMETER VALUES BASED ON FOUR STUDIES ALL USING LESLIE MATRIX MODELS.	224
TABLE 49. BREEDING PERIOD USED TO DETERMINE POTENTIAL EFFECTS IN THIS CONSULTATION.	229
TABLE 50. DISTURBANCE AND DISRUPTION DISTANCES FOR MURRELETS DURING THE BREEDING PERIOD FROM THE EDGE OF UNSURVEYED OR KNOWN OCCUPIED STAND OR NEST STRUCTURE IN YOUNGER STANDS.	230
TABLE 51. DISTURBANCE AND DISRUPTION DISTANCES WITH EFFECTS DETERMINATIONS FOR THE MURRELET.	233
TABLE 52. AGGREGATE RESULTS OF ALL CRITICAL HABITAT AFFECTED BY SECTION 7 CONSULTATION FOR THE MURRELET; BASELINE AND SUMMARY OF EFFECTS BY CONSERVATION ZONE AND HABITAT TYPE FROM OCTOBER 1, 2003, TO JULY 19, 2016.	237
TABLE 53. HIGH-QUALITY NESTING HABITAT ON NON-BLM LANDS WITHIN THE ACTION AREA (GLENN 2016A, PERS. COMM.).	239

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 54. STRUCTURAL STAGE DESCRIPTIONS FOR CLASSIFYING MURRELET HABITAT.	241
TABLE 55. CURRENT MURRELET NESTING HABITAT ON BLM LANDS IN THE ACTION AREA AND WITHIN OREGON.....	243
TABLE 56. CURRENT MURRELET NESTING HABITAT PATCH METRICS ON BLM LANDS IN THE ACTION AREA.	243
TABLE 57. KNOWN MURRELET SITES IN OREGON.....	246
TABLE 58. CURRENT MURRELET NESTING HABITAT UNDER THE PRMP ON BLM-ADMINISTERED LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.....	249
TABLE 59. CURRENT HIGH-QUALITY MURRELET NESTING HABITAT UNDER THE PRMP ON BLM-ADMINISTERED LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.....	249
TABLE 60. CURRENT MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.....	250
TABLE 61. CURRENT MURRELET NESTING HABITAT UNDER THE PRMP ON BLM-ADMINISTERED LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.....	251
TABLE 62. CURRENT HIGH-QUALITY MURRELET NESTING HABITAT UNDER THE PRMP ON BLM-ADMINISTERED LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.....	251
TABLE 63. CURRENT MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.....	251
TABLE 64. CURRENT HIGH-QUALITY MURRELET NESTING HABITAT IN THE ACTION AREA AND NON-BLM LANDS WITHIN OREGON.	254
TABLE 65. HIGH-QUALITY NESTING HABITAT WITHIN CRITICAL HABITAT ON NON-BLM LANDS WITHIN THE ACTION AREA (GLENN 2016b, PERS. COMM.).	254
TABLE 66. ACRES OF MURRELET CRITICAL HABITAT ON BLM LANDS IN THE ACTION AREA BY LUA.	255
TABLE 67. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS IN MURRELET CRITICAL HABITAT ON BLM LANDS IN THE ACTION AREA.	256
TABLE 68. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-01-b	257
TABLE 69. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-01-c	258
TABLE 70. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-02-b	259
TABLE 71. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-02-c	260
TABLE 72. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-02-d	261
TABLE 73. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-02-e	262
TABLE 74. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-03-a	263

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 75. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-03-c	264
TABLE 76. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-a	265
TABLE 77. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-b	266
TABLE 78. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-c	267
TABLE 79. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-d	268
TABLE 80. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-e	269
TABLE 81. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-f	270
TABLE 82. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-g	271
TABLE 83. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-i	272
TABLE 84. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-j	273
TABLE 85. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-04-k	274
TABLE 86. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-06-a	275
TABLE 87. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-06-b	276
TABLE 88. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-06-c	277
TABLE 89. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-06-d	278
TABLE 90. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-07-a	279
TABLE 91. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-07-b	280
TABLE 92. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-07-d	281
TABLE 93. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-07-f	282
TABLE 94. LAND USE ALLOCATIONS AND CURRENT MURRELET HABITAT CONDITIONS WITHIN CHU OR-07-g	283
TABLE 95. SUMMARY OF WHERE PROTECTION MEASURES APPLY FOR OCCUPIED STANDS AND UNSURVEYED STANDS	286
TABLE 96. SUMMARY OF WHERE PROTECTION MEASURES APPLY FOR DISRUPTION OF OCCUPIED (INCLUDING UNSURVEYED) STANDS.....	292
TABLE 97. ESTIMATED ACRES OF TIMBER HARVEST, BASED ON BLM WOODSTOCK MODELING (McGraw 2016b, pers. comm.), BY LUA AND DECADE, UNDER THE PRMP WITHIN THE RANGE OF THE MURRELET	293
TABLE 98. DECADAL FORECAST FOR MURRELET NESTING HABITAT POTENTIALLY HARVESTED OVER 50 YEARS (2013-2063) UNDER THE PRMP	294

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 99. MURRELET NESTING HABITAT MODELED FOR HARVEST THAT WOULD NOT BE SUBJECT TO WILDLIFE RESOURCE PROGRAM'S MANAGEMENT DIRECTION FOR MURRELET PROTECTION UNDER THE PRMP (HARVEST LAND BASE BEYOND 35 MILES FROM THE COASTLINE).....	294
TABLE 100. MURRELET NESTING HABITAT MODELED FOR HARVEST THAT WOULD BE SUBJECT TO PROTECTION OF OCCUPIED HABITAT (WILDLIFE RESOURCE PROGRAM'S MANAGEMENT DIRECTION FOR MURRELETS) UNDER THE PRMP.....	295
TABLE 101. DECADAL FORECAST FOR MURRELET OCCUPIED SITES LOST TO TIMBER HARVEST ACTIVITIES OVER 50 YEARS (2013-2063).	295
TABLE 102. RESOURCE PROGRAMS FOR NON-TIMBER ACTIONS THAT MAY AFFECT MURRELETS.	295
TABLE 103. RESOURCE PROGRAMS FOR NON-TIMBER ACTIONS IN THE COQUILLE FOREST THAT MAY AFFECT MURRELETS.	298
TABLE 104. SUMMARY OF DECADAL FORECAST FOR MURRELET NESTING HABITAT POTENTIALLY HARVESTED OVER 50 YEARS (2013-2063) UNDER THE PRMP.	301
TABLE 105. COMPARISON OF NWFP AND PRMP RESERVE SYSTEM USING THE CURRENT BASELINE DATA FOR 0-35 MILES FROM THE COAST. ALL NUMBERS CALCULATED FOR THESE TABLES ARE FROM WITHIN THE RANGE OF THE MURRELET.	304
TABLE 106. COMPARISON OF NWFP AND PRMP RESERVE SYSTEM USING THE CURRENT BASELINE DATA FOR 35-50 MILES FROM THE COAST AND WITHIN MURRELET CRITICAL HABITAT.	306
TABLE 107. COMPARISON OF NWFP AND PRMP RESERVE SYSTEM USING THE CURRENT BASELINE DATA FOR 35-50 MILES FROM THE COAST AND OUTSIDE OF MURRELET CRITICAL HABITAT.	307
TABLE 108. RESOURCE PROGRAMS FOR NON-TIMBER ACTIONS THAT MAY AFFECT MURRELET HABITAT IN THE RESERVE SYSTEM.	315
TABLE 109. DECADAL FORECAST FOR MURRELET OCCUPIED SITES DISCOVERED OVER 50 YEARS (2013-2063) ON BLM LANDS IN THE ACTION AREA.....	318
TABLE 110. DECADAL FORECAST FOR MURRELET OCCUPIED SITES LOST TO TIMBER HARVEST OVER 50 YEARS (2013-2063) ON BLM LANDS IN THE ACTION AREA.	318
TABLE 111. ESTIMATED CHANGES IN THE NUMBER OF MURRELET OCCUPIED SITES ON BLM LANDS IN THE ACTION AREA DURING THE NEXT 50 YEARS (2012 – 2063), BY DECADE, ACCORDING TO THE NO TIMBER HARVEST REFERENCE ANALYSIS AND UNDER THE PRMP.	319
TABLE 112. SUMMARY OF POTENTIAL IMPACTS TO PROJECTED SITES IN AREAS WHERE BLM WILL HARVEST MURRELET HABITAT.	321
TABLE 113. MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM-ADMINISTERED LANDS BETWEEN THE NORTH AND SOUTH BOUNDARIES OF CONSERVATION ZONE 3.	322
TABLE 114. HIGH-QUALITY MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM-ADMINISTERED LANDS BETWEEN THE NORTH AND SOUTH BOUNDARIES OF CONSERVATION ZONE 3.....	323
TABLE 115. MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM-ADMINISTERED LANDS BETWEEN THE NORTH AND SOUTH BOUNDARIES OF CONSERVATION ZONE 4.	324
TABLE 116. HIGH-QUALITY MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM-ADMINISTERED LANDS BETWEEN THE NORTH AND SOUTH BOUNDARIES OF CONSERVATION ZONE 4.....	324

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 117. MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA.	325
TABLE 118. HIGH-QUALITY MURRELET NESTING HABITAT IN LUAS UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA.	325
TABLE 119. MURRELET NESTING HABITAT PATCH METRICS.	326
TABLE 120. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.	331
TABLE 121. TRENDS IN HIGHER-SUITABILITY NESTING MURRELET HABITAT FROM 1993 TO 2012 BY NORTH SOUTH DIVISION OF CONSERVATION ZONES WITHIN THE OREGON NWFP MAPPED INLAND ZONE 1 AREA (FALXA AND RAPHAEL 2015, PP. 118 AND 121).	333
TABLE 122. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON NON-BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.	333
TABLE 123. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON ALL IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.	334
TABLE 124. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.	335
TABLE 125. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON NON-BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.	336
TABLE 126. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON ALL IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.	337
TABLE 127. ESTIMATED CHANGES IN THE NUMBER OF MURRELET OCCUPIED SITES ON BLM LANDS IN THE ACTION AREA DURING THE NEXT 50 YEARS (2012 – 2063), BY DECADE, UNDER THE PRMP.	337
TABLE 128. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON NON-BLM LANDS IN THE ACTION AREA.	338
TABLE 129. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED ON ALL LANDS IN THE ACTION AREA.	339
TABLE 130. SUMMARY OF WHERE PROTECTION MEASURES APPLY FOR CURRENTLY SUPPORTING MURRELET NESTING.	342
TABLE 131. ESTIMATED ACRES OF FOREST TREATMENT, BASED ON BLM WOODSTOCK MODELING, BY LUA AND DECADE, UNDER THE PRMP WITHIN MURRELET CRITICAL HABITAT.	345
TABLE 132. PRMP HARVEST SCENARIO IN MURRELET CRITICAL HABITAT FOR BLM LANDS WITHIN ACTION AREA.	346
TABLE 133. THE ACRES OF REGENERATION HARVEST BY DECADE IN MURRELET CRITICAL HABITAT IN NESTING HABITAT AND IN NON-HABITAT.	346
TABLE 134. RESOURCE PROGRAMS FOR NON-TIMBER ACTIONS THAT MAY AFFECT MURRELET CRITICAL HABITAT.	355
TABLE 135. DECADAL FORECAST (2013-2063) OF HIGH-QUALITY NESTING HABITAT CONTAINING PBFs 1 AND 2 EXPECTED ON NON-BLM LANDS DESIGNATED AS CRITICAL HABITAT IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.	357

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 136. DECADAL FORECAST OF HIGH-QUALITY NESTING HABITAT ON NON-BLM LANDS DESIGNATED CRITICAL HABITAT IN THE ACTION AREA CRITICAL HABITAT UNIT.	357
TABLE 137. PREDICTED FIRE WITHIN MURRELET DESIGNATED CHUs ON BLM-ADMINISTERED LANDS.....	364
TABLE 138. MODELED PRMP REGENERATION HARVEST WITHIN MURRELET CRITICAL HABITAT UNITS.	365
TABLE 139. MURRELET HABITAT DEVELOPMENT IN CHU OR-01-B	366
TABLE 140. PRMP HARVEST SCENARIO IN CHU OR-01-C	368
TABLE 141. MURRELET HABITAT DEVELOPMENT IN CHU OR-01-C	368
TABLE 142. MURRELET HABITAT DEVELOPMENT IN CHU OR-02-A	369
TABLE 143. PRMP HARVEST SCENARIO IN CHU OR-02-B	370
TABLE 144. MURRELET HABITAT DEVELOPMENT IN CHU OR-02-B	371
TABLE 145. PRMP HARVEST SCENARIO IN CHU OR-02-C	373
TABLE 146. MURRELET HABITAT DEVELOPMENT IN CHU OR-02-C	373
TABLE 147. PRMP HARVEST SCENARIO IN CHU OR-02-D	375
TABLE 148. MURRELET HABITAT DEVELOPMENT IN CHU OR-02-D	375
TABLE 149. PRMP HARVEST SCENARIO IN CHU OR-02-E	377
TABLE 150. MURRELET HABITAT DEVELOPMENT IN CHU OR-02-E	377
TABLE 151. PRMP HARVEST SCENARIO IN CHU OR-03-A	378
TABLE 152. MURRELET HABITAT DEVELOPMENT IN CHU OR-03-A	379
TABLE 153. MURRELET HABITAT DEVELOPMENT IN CHU OR-03-B	380
TABLE 154. PRMP HARVEST SCENARIO IN CHU OR-03-C	382
TABLE 155. MURRELET HABITAT DEVELOPMENT IN CHU OR-03-C	382
TABLE 156. PRMP HARVEST SCENARIO IN CHU OR-04-A	384
TABLE 157. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-A	384
TABLE 158. PRMP HARVEST SCENARIO IN CHU OR-04-B	385
TABLE 159. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-B	385

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 160. PRMP HARVEST SCENARIO IN CHU OR-04-c	387
TABLE 161. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-c	387
TABLE 162. PRMP HARVEST SCENARIO IN CHU OR-04-d	389
TABLE 163. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-d	389
TABLE 164. PRMP HARVEST SCENARIO IN CHU OR-04-e	391
TABLE 165. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-e	391
TABLE 166. PRMP HARVEST SCENARIO IN CHU OR-04-f	393
TABLE 167. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-f	393
TABLE 168. PRMP HARVEST SCENARIO IN CHU OR-04-g	395
TABLE 169. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-g	395
TABLE 170. PRMP HARVEST SCENARIO IN CHU OR-04-i	397
TABLE 171. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-i	397
TABLE 172. PRMP HARVEST SCENARIO IN CHU OR-04-j	399
TABLE 173. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-j	399
TABLE 174. PRMP HARVEST SCENARIO IN CHU OR-04-k	401
TABLE 175. MURRELET HABITAT DEVELOPMENT IN CHU OR-04-k	401
TABLE 176. PRMP HARVEST SCENARIO IN CHU OR-06-a	403
TABLE 177. MURRELET HABITAT DEVELOPMENT IN CHU OR-06-a	403
TABLE 178. PRMP HARVEST SCENARIO IN CHU OR-06-b	405
TABLE 179. MURRELET HABITAT DEVELOPMENT IN CHU OR-06-b	405
TABLE 180. PRMP HARVEST SCENARIO IN CHU OR-06-c	407
TABLE 181. MURRELET HABITAT DEVELOPMENT IN CHU OR-06-c	407
TABLE 182. PRMP HARVEST SCENARIO IN CHU OR-06-d	409
TABLE 183. MURRELET HABITAT DEVELOPMENT IN CHU OR-06-d	409
TABLE 184. PRMP HARVEST SCENARIO IN CHU OR-07-a	411

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 185. MURRELET HABITAT DEVELOPMENT IN CHU OR-07-A	411
TABLE 186. PRMP HARVEST SCENARIO IN CHU OR-07-B	413
TABLE 187. MURRELET HABITAT DEVELOPMENT IN CHU OR-07-B	413
TABLE 188. PRMP HARVEST SCENARIO IN CHU OR-07-D	415
TABLE 189. MURRELET HABITAT DEVELOPMENT IN CHU OR-07-D	415
TABLE 190. PRMP HARVEST SCENARIO IN CHU OR-07-F	417
TABLE 191. MURRELET HABITAT DEVELOPMENT IN CHU OR-07-F	417
TABLE 192. PRMP HARVEST SCENARIO IN CHU OR-07-G	419
TABLE 193. MURRELET HABITAT DEVELOPMENT IN CHU OR-07-G	419
TABLE 194. MURRELET HABITAT DEVELOPMENT IN CHUS WITHIN CONSERVATION ZONE 3 THAT OCCUR IN THE ACTION AREA.	422
TABLE 195. MURRELET HABITAT DEVELOPMENT IN CHUS WITHIN CONSERVATION ZONE 4 THAT OCCUR IN THE ACTION AREA.	424
TABLE 196. MURRELET HABITAT DEVELOPMENT IN CHUS THAT OCCUR IN THE ACTION AREA.	425
TABLE 197. RANGE-WIDE AGGREGATE OF CHANGES TO NRF ¹ HABITAT ACRES FROM ACTIVITIES SUBJECT TO SECTION 7 CONSULTATIONS AND FROM OTHER CAUSES. DATA COVERS FROM 1994 TO MAY 11, 2016.....	465
TABLE 198. SUMMARY OF SPOTTED OWL SUITABLE HABITAT (NRF ¹) ACRES REMOVED OR DOWNGRADED AS DOCUMENTED THROUGH SECTION 7 CONSULTATIONS ON ALL FEDERAL LANDS WITHIN THE NORTHWEST FOREST PLAN AREA.	467
TABLE 199. SUMMARY OF SPOTTED OWL SUITABLE HABITAT (NRF ¹) ACRES REMOVED OR DOWNGRADED ON FEDERAL LANDS WITHIN THE NORTHWEST FOREST PLAN AREA THROUGH TIMBER HARVEST, NATURAL DISTURBANCE, OR OTHER MANAGEMENT ACTIONS AS DOCUMENTED THROUGH SECTION 7 CONSULTATION AND TECHNICAL ASSISTANCE.	469
TABLE 200. SUMMARY OF SPOTTED OWL POPULATION TRENDS FROM IN DEMOGRAPHIC STUDY AREAS (DUGGER <i>ET AL.</i> , 2016, TABLE 25, P.97).....	472
TABLE 201. SUMMARY OF SPOTTED OWL CRITICAL HABITAT NRF ¹ ACRES REMOVED OR DOWNGRADED AS DOCUMENTED THROUGH SECTION 7 CONSULTATIONS ON NORTHWEST FOREST PLAN (NWFP) LANDS; ENVIRONMENTAL BASELINE AND SUMMARY OF EFFECTS BY STATE, PHYSIOGRAPHIC PROVINCE AND LAND USE FUNCTION.	478
TABLE 202. METRICS TO IDENTIFY BLOCKS OF NORTHERN SPOTTED OWL NESTING-ROOSTING HABITAT. TABLE III-16 IN BLM (2016A).	487
TABLE 203. ESTIMATED (OBSERVED) AND MODIFIED BARRED OWL ENCOUNTER RATES.	494
TABLE 204. NO TIMBER HARVEST REFERENCE ANALYSIS: NORTHERN SPOTTED OWL RANGE-WIDE POPULATIONS (MEAN OF 500 REPLICATE NON-STOCHASTIC SIMULATIONS) BY YEAR. TABLE III-19 IN (BLM 2016A).	498

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 205. NO TIMBER HARVEST REFERENCE ANALYSIS: SIMULATED NORTHERN SPOTTED OWL POPULATIONS (MEAN OF 500 REPLICATE NON-STOCHASTIC SIMULATIONS), BY MODELING REGION AND YEAR. TABLE III-20 IN BLM (2016A).	499
TABLE 206. NO TIMBER HARVEST REFERENCE ANALYSIS: SIMULATED NORTHERN SPOTTED OWL POPULATIONS (MEAN OF 500 REPLICATE NON-STOCHASTIC SIMULATIONS), BY PHYSIOGRAPHIC PROVINCE AND YEAR. TABLE III-21 IN BLM (2016A).	499
TABLE 207. CURRENT SPOTTED OWL HABITAT ON BLM LANDS IN THE ACTION AREA.	501
TABLE 208. CURRENT SPOTTED OWL HABITAT IN THE ACTION AREA.	502
TABLE 209. ACRES OF SPOTTED OWL CRITICAL HABITAT BY LAND USE ALLOCATION. TABLE II-3 IN BLM (2016A).	504
TABLE 210. ACRES OF NORTHERN SPOTTED OWL DISPERSAL HABITAT ON ALL LAND OWNERSHIPS BY NORTHERN SPOTTED OWL CRITICAL HABITAT SUB-UNIT, AS IN BLM (2016A, TABLE III-28).	505
TABLE 211. ACRES OF NORTHERN SPOTTED OWL NESTING-ROOSTING HABITAT ON ALL LAND OWNERSHIPS BY NORTHERN SPOTTED OWL CRITICAL HABITAT SUB-UNIT, AS IN BLM (2016A, TABLE III-29).	507
TABLE 212. ACRES OF NORTHERN SPOTTED OWL DISPERSAL HABITAT ON BLM-ADMINISTERED LANDS IN THE PLANNING AREA BY NORTHERN SPOTTED OWL CRITICAL HABITAT SUB-UNIT, AS IN BLM (2016A, TABLE III-30).	509
TABLE 213. ACRES OF NORTHERN SPOTTED OWL NESTING-ROOSTING HABITAT ON BLM-ADMINISTERED LANDS IN THE PLANNING AREA BY NORTHERN SPOTTED OWL CRITICAL HABITAT SUB-UNIT, AS IN BLM (2016A, TABLE III-31).	510
TABLE 214. SUMMARY OF NORTHERN SPOTTED OWL CRITICAL HABITAT NRF ¹ ACRES REMOVED OR DOWNGRADED AS DOCUMENTED THROUGH SECTION 7 CONSULTATIONS ON NORTHWEST FOREST PLAN (NWFP) LANDS; ENVIRONMENTAL BASELINE AND SUMMARY OF EFFECTS BY STATE, PHYSIOGRAPHIC PROVINCE AND LAND USE FUNCTION.	511
TABLE 215. SNAG CREATION LEVELS WITHIN THE LATE-SUCCESSIONAL RESERVE AND RIPARIAN RESERVE. TABLE A-3 IN BLM (2016A).	519
TABLE 216. DOWN WOODY MATERIAL RETENTION LEVELS WHEN IMPLEMENTING FUELS REDUCTION OR PRESCRIBED FIRE TREATMENTS WITHIN THE LATE-SUCCESSIONAL RESERVE AND RIPARIAN RESERVE. TABLE A-4 IN BLM (2016A).....	520
TABLE 217. RIPARIAN RESERVE DISTANCE BY WATER FEATURE. TABLE A-5 IN BLM (2016A).....	525
TABLE 218. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS I SUBWATERSHEDS FOR RIPARIAN RESERVE - MOIST. TABLE A-6 IN BLM (2016A).	525
TABLE 219. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS II SUBWATERSHEDS FOR RIPARIAN RESERVE - MOIST. TABLE A-7 IN BLM (2016A).	528
TABLE 220. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS III SUBWATERSHEDS FOR RIPARIAN RESERVE - MOIST. TABLE A-8 IN BLM (2015A).	530
TABLE 221. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS I SUBWATERSHEDS FOR RIPARIAN RESERVE - DRY. TABLE A-10 IN BLM (2016A).	531
TABLE 222. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS II SUBWATERSHEDS FOR RIPARIAN RESERVE - DRY. TABLE A-11 IN BLM (2016A).	533

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 223. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS III SUBWATERSHEDS FOR RIPARIAN RESERVE - DRY. TABLE A-12 IN BLM (2016A).	535
TABLE 224. SNAG CREATION LEVELS WITHIN THE HARVEST LAND BASE. TABLE A-2 IN BLM (2016A).	546
TABLE 225. HABITAT MODIFICATION ACTIVITIES WITH THE POTENTIAL TO ADVERSELY AFFECT SPOTTED OWL HABITAT (BLM 2016A, APPENDIX A, ENTIRE).....	555
TABLE 226. LAND USE ALLOCATIONS IN THE EXAMPLE OF A POTENTIAL BARRED OWL MANAGEMENT DESIGN ON BLM LANDS WITHIN THE PLANNING AREA SHOWN IN FIGURE 28.	591
TABLE 227. DISTURBANCE, DISRUPTION AND/OR PHYSICAL INJURY DISTANCE THRESHOLDS FOR SPOTTED OWLS FROM A VARIETY OF ACTIVITIES.....	597
TABLE 228. ACRES OF SPOTTED OWL HABITAT ESTIMATED TO BE IMPACTED BY TIMBER HARVEST IN THE HARVEST LAND BASE OVER THE NEXT 50 YEARS (ACREAGES FROM BLM 2016A, P.198-201).	602
TABLE 229. SPOTTED OWL ACTIVITY CENTERS, CORE USE AREAS, AND HOME RANGES THAT OVERLAP THE HARVEST LAND BASE, BROKEN OUT BY CRITICAL HABITAT UNIT (WHICH APPROXIMATES PHYSIOGRAPHIC PROVINCES) AND MODERATE INTENSITY, LOW INTENSITY AND UNEVEN-AGED TIMBER MANAGEMENT AREAS.	607
TABLE 230. COMPARISON OF LAND ALLOCATIONS BETWEEN THE NWFP (USFS AND BLM 1994A, B) AND THE PRMP (BLM 2015A).	610
TABLE 231. KNOWN AND HISTORIC SPOTTED OWL TERRITORIES ON THE SIX POTENTIAL BARRED OWL MANAGEMENT AREAS WITH CHANGES IN SPOTTED OWL OCCUPANCY IF BARRED OWL MANAGEMENT IS SUCCESSFULLY IMPLEMENTED.	616
TABLE 232. ANNUAL RATE OF POPULATION CHANGE (Λ) FOR SPOTTED OWLS IN DEMOGRAPHIC STUDY AREAS (DSAs) WITHIN BARRED OWL MANAGEMENT AREAS ON THE SIX POTENTIAL BARRED OWL MANAGEMENT AREAS IF BARRED OWL MANAGEMENT IS SUCCESSFULLY IMPLEMENTED.	626
TABLE 233. ACRES OF SPOTTED OWL CRITICAL HABITAT BY LAND USE ALLOCATION/SUB-ALLOCATION (BLM 2016A, TABLE II-3).	627
TABLE 234. SNAG CREATION LEVELS WITHIN THE LATE-SUCCESSIONAL RESERVE AND RIPARIAN RESERVE. TABLE A-3 IN BLM (2016A).	634
TABLE 235. DOWN WOODY MATERIAL RETENTION LEVELS WHEN IMPLEMENTING FUELS REDUCTION OR PRESCRIBED FIRE TREATMENTS WITHIN THE LATE-SUCCESSIONAL RESERVE AND RIPARIAN RESERVE. TABLE A-4 IN BLM (2016A).....	635
TABLE 236. RIPARIAN RESERVE DISTANCE BY WATER FEATURE. TABLE A-5 IN BLM (2016A).....	640
TABLE 237. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS I SUBWATERSHEDS. TABLE A-6 IN BLM (2016A).	640
TABLE 238. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS II SUBWATERSHEDS. TABLE A-7 IN (BLM 2016A).....	641
TABLE 239. ZONE-SPECIFIC MANAGEMENT DIRECTION FOR STREAMS IN CLASS III SUBWATERSHEDS. TABLE A-8 IN BLM (2016A).	643
TABLE 240. SNAG CREATION LEVELS WITHIN THE HARVEST LAND BASE. TABLE A-2 IN BLM (2016A).	654

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

TABLE 241. HABITAT MODIFICATION ACTIVITIES WITH THE POTENTIAL TO ADVERSELY AFFECT SPOTTED OWL CRITICAL HABITAT (BLM 2016A, APPENDIX A, ENTIRE)	663
TABLE 242. AMOUNT OF SPOTTED OWL DISPERSAL AND NESTING/ROOSTING HABITAT WITHIN DESIGNATED CRITICAL HABITAT IN EACH LAND USE ALLOCATION IN THE PRMP.	684
TABLE 243. AMOUNT OF SPOTTED OWL DISPERSAL AND NESTING/ROOSTING HABITAT WITHIN DESIGNATED CRITICAL HABITAT IN THE HARVEST LAND BASE.	685
TABLE 244. FORECASTED CHANGES UNDER THE PRMP IN THE ACRES OF SPOTTED OWL NESTING-ROOSTING HABITAT (PBF 2) IN CRITICAL HABITAT ON BLM-ADMINISTERED LANDS IN THE ACTION AREA BY SPOTTED OWL CRITICAL HABITAT SUB-UNIT.	694
TABLE 245. FORECASTED CHANGES UNDER THE PRMP IN THE ACRES OF ALL SPOTTED OWL CRITICAL HABITAT INCLUDING DISPERSAL HABITAT (PBF 4) ON BLM-ADMINISTERED LANDS IN THE ACTION AREA BY SPOTTED OWL CRITICAL HABITAT SUB-UNIT.	695
TABLE 246. ANNUAL RATE OF POPULATION CHANGE (λ) FOR SPOTTED OWLS IN DEMOGRAPHIC STUDY AREAS (DSAs) WITHIN BARRED OWL MANAGEMENT AREAS ON THE SIX POTENTIAL BARRED OWL MANAGEMENT AREAS IF BARRED OWL MANAGEMENT IS SUCCESSFULLY IMPLEMENTED.	705
TABLE 247. RANGE-WIDE THREATS TO OREGON SPOTTED FROG OPERATING WITHIN EACH SUB-BASIN (USFWS 2014, P. 51658).	714
TABLE 248. OREGON SPOTTED FROG HABITAT IN THE ACTION AND PLANNING AREAS.	718
TABLE 249. AMOUNT OF VERNAL POOL FAIRY SHRIMP CRITICAL HABITAT RECEIVING PROTECTIVE MEASURES, BY CHU AND TYPE OF PROTECTIVE MEASURE.	748
TABLE 250. ESTIMATED BREEDING ADULT POPULATION OBSERVED IN WASHINGTON AND OREGON (2011 TO 2015) (LAUTEN <i>ET AL.</i> 2015, WDFW UNPUBLISHED DATA).	755
TABLE 251. ESTIMATED NUMBER OF SNOWY PLOVER CHICKS FLEDGED PER ADULT MALE IN WASHINGTON AND OREGON (LAUTEN <i>ET AL.</i> 2014B, P. 26; PEARSON <i>ET AL.</i> 2015, P. 13).	756
TABLE 252. NATIVE AND NON-NATIVE PREDATORS KNOWN TO PREY ON SNOWY PLOVER EGGS, CHICKS, AND ADULTS (USFWS 2007, FANCHER <i>ET AL.</i> 2002, POWELL <i>ET AL.</i> 2002).....	764
TABLE 253. SNOWY PLOVER DESIGNATED CHUS, OREGON (USFWS 2012).	776
TABLE 254. TAKE PATHWAYS FOR LISTED FISH SPECIES RESULTING FROM RECREATION, AND TRAILS AND TRAVEL MANAGEMENT PROGRAMS AUTHORIZED UNDER THE PROPOSED ACTION.	784
TABLE 255. EXTENT OF TAKE INDICATORS BY LISTED SPECIES WITHIN THE ACTION AREA OF THE PROPOSED RMP.	786
TABLE 256. ANNUAL RATE OF POPULATION CHANGE (λ) FOR SPOTTED OWLS IN DEMOGRAPHIC STUDY AREAS (DSAs) WITHIN BARRED OWL MANAGEMENT AREAS ON THE SIX POTENTIAL BARRED OWL MANAGEMENT AREAS IF BARRED OWL MANAGEMENT IS SUCCESSFULLY IMPLEMENTED.	792

LIST OF FIGURES

FIGURE 1. RIPARIAN RESERVE SIZES AND MANAGEMENT BY SUBWATERSHED CLASS. FIGURE 1 IN BLM (2016B).	13
FIGURE 2. MCKENZIE RIVER BASIN BULL TROUT OCCUPANCY, DESIGNATED CRITICAL HABITAT, AND BLM LAND OWNERSHIP WITHIN THE PLANNING AREA (BLM 2016B P. 219).	73
FIGURE 3. MAP OF DESIGNATED COOK’S DESERT PARSLEY CRITICAL HABITAT IN THE AGATE DESERT	113
FIGURE 4. MAP OF DESIGNATED COOK’S DESERT PARSLEY CRITICAL HABITAT IN THE ILLINOIS VALLEY.	114
FIGURE 5. OAK BASIN MANAGEMENT (TREATMENT) POLYGONS INDIVIDUALLY NUMBERED AND OUTLINED IN DARK GRAY (SOURCE: BLM 2011 FIGURE 3).	145
FIGURE 6. MAP OF THE UPPER KLAMATH RIVER BASIN SHOWING PRIMARY WATER BODIES.	155
FIGURE 7. VICINITY MAP FOR THE GERBER RESERVOIR AREA IN KLAMATH COUNTY, OREGON.	158
FIGURE 8. CRITICAL HABITAT UNITS FOR LOST RIVER SUCKERS AND SHORNOSE SUCKERS DESIGNATED IN 2012 (USFWS 2012C, PP. 73764-73768).	169
FIGURE 9. LOST RIVER SUCKER OCCUPANCY, DESIGNATED CRITICAL HABITAT, AND BLM LAND OWNERSHIP IN THE UPPER KLAMATH AND LOST RECOVERY UNITS WITHIN THE PLANNING AREA (BLM 2016B, P. 220).	177
FIGURE 10. SHORNOSE SUCKER OCCUPANCY, DESIGNATED CRITICAL HABITAT, AND BLM LAND OWNERSHIP IN THE UPPER KLAMATH AND LOST RECOVERY UNITS WITHIN THE PLANNING AREA (BLM 2016B, P. 221).	178
FIGURE 11. THE SIX GEOGRAPHIC AREAS IDENTIFIED AS CONSERVATION ZONES IN THE RECOVERY PLAN FOR THE MURRELET (USFWS 1997, P. 114).	212
FIGURE 12. RANGE AND MANAGEMENT ZONES OF THE MURRELET.	238
FIGURE 13. MURRELET OCCUPANCY DETECTION RATES.	244
FIGURE 14. KNOWN, OCCUPIED MURRELET SITES IN THE ACTION AREA.	247
FIGURE 15. FORECAST OF THE NUMBER OCCUPIED MURRELET SITES ON BLM LANDS IN THE ACTION AREA.	319
FIGURE 16. THE BLM LANDS IN THE ACTION AREA ARE DELINEATED BY THE PROPOSED LUAS.	329
FIGURE 17. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 3.	332
FIGURE 18. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA ASSOCIATED WITH NORTH SOUTH DIVISION OF CONSERVATION ZONE 4.	335
FIGURE 19. DECADAL FORECAST (2013-2063) OF MURRELET OCCUPIED SITES EXPECTED UNDER THE PRMP ON BLM LANDS IN THE ACTION AREA.	338

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

FIGURE 20. LOCATION OF HARVEST LAND BASE WITHIN CHUS, 1 OF 4. CHU IS REFERRED TO AS SUB-UNIT IN BLM’S FIGURE (MCGRAW 2016D, PERS. COMM.).	360
FIGURE 21. LOCATION OF HARVEST LAND BASE WITHIN CHUS, 2 OF 4. CHU IS REFERRED TO AS SUB-UNIT IN BLM’S FIGURE (MCGRAW 2016D, PERS. COMM.).	361
FIGURE 22. LOCATION OF HARVEST LAND BASE WITHIN CHUS, 3 OF 4. CHU IS REFERRED TO AS SUB-UNIT IN BLM’S FIGURE AND THE ELLIOT STATE FOREST IS NOT MAPPED (MCGRAW 2016D, PERS. COMM.).	362
FIGURE 23. LOCATION OF HARVEST LAND BASE WITHIN CHUS, 4 OF 4. CHU IS REFERRED TO AS SUB-UNIT IN BLM’S FIGURE (MCGRAW 2016D, PERS. COMM.).	363
FIGURE 24. PHYSIOGRAPHIC PROVINCES WITHIN THE RANGE OF THE NORTHERN SPOTTED OWL.	441
FIGURE 25. ELEVEN REGIONS AND FOUR ZONES OF HABITAT ASSOCIATIONS USED BY SPOTTED OWLS IN WASHINGTON, OREGON, AND CALIFORNIA.	480
FIGURE 26. THE CURRENT (2013) POSITIONS OF NORTHERN SPOTTED OWL HABITAT BLOCKS IN WESTERN OREGON.	488
FIGURE 27. THE NORTHERN SPOTTED OWL DISPERSAL-CAPABLE LANDSCAPE (STIPPLED AREAS) IN 2013, ACCORDING TO THE NO TIMBER HARVEST REFERENCE ANALYSIS. FIGURE III-22 IN BLM (2016A).	489
FIGURE 28. A POTENTIAL BARRED OWL MANAGEMENT DESIGN ON BLM LANDS WITHIN THE PLANNING AREA.	592
FIGURE 29. CHANGE IN THE ACRES OF “STRONGLY-SELECTED-FOR” HABITAT ON BLM-ADMINISTERED LANDS IN WESTERN OREGON UNDER THE PRMP AND THE NO HARVEST SCENARIO.	610
FIGURE 30. CHANGE IN THE ACRES OF MATURE MULTIPLE-CANOPY AND STRUCTURALLY-COMPLEX FOREST ON BLM-ADMINISTERED LANDS IN WESTERN OREGON UNDER THE PRMP AND THE NO HARVEST SCENARIO.	611
FIGURE 31. NORTHERN SPOTTED OWL HABITAT BLOCK LOCATIONS IN 2043 AND 2063 UNDER THE PROPOSED RMP.	612
FIGURE 32. DISPERSAL-CAPABLE LANDS (STIPPLED AREAS), AS THEY WOULD EXIST IN 2043 AND 2063, UNDER THE PROPOSED RMP. FIGURE III-24 IN BLM (2016A).	614
FIGURE 33. PROJECTED TRAJECTORY OF SPOTTED OWL SITE OCCUPANCY ON BLM LANDS THROUGH 2063.	619
FIGURE 34. PROJECTED TRAJECTORY OF SPOTTED OWL SITE OCCUPANCY ON BLM LANDS THROUGH 2063.	621
FIGURE 35. CHANGE IN THE ACRES OF “STRONGLY-SELECTED-FOR” HABITAT ON BLM-ADMINISTERED LANDS IN WESTERN OREGON UNDER THE PRMP AND THE NO HARVEST SCENARIO.	692
FIGURE 36. CHANGE IN THE ACRES OF MATURE MULTIPLE-CANOPY AND STRUCTURALLY-COMPLEX FOREST ON BLM-ADMINISTERED LANDS IN WESTERN OREGON UNDER THE PRMP AND THE NO HARVEST SCENARIO.	693
FIGURE 37. NORTHERN SPOTTED OWL HABITAT BLOCK LOCATIONS IN 2043 AND 2063 UNDER THE PROPOSED RMP.	697

INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service or USFWS) Biological Opinion (BO) on the Bureau of Land Management's (BLM) Proposed Resource Management Plan/Final Environmental Impact Statement (EIS) for Western Oregon (PRMP). This BO is based primarily on our review of the February 1, 2016, Terrestrial Biological Assessment (BA) of the Proposed Resource Management Plan for Western Oregon (BLM 2016a) and the Aquatic Biological Assessment of the Proposed Resource Management Plan for Western Oregon (BLM 2016b). The BLM determined that the approval of the PRMP may affect the endangered Gentner's fritillary (*Fritillaria gentneri*), endangered western lily (*Lilium occidentale*), endangered Cook's desert-parsley (*Lomatium cookii*) (also known as Cook's lomatium), endangered rough popcornflower (*Plagiobothrys hirtus*), endangered Taylor's checkerspot (*Euphydryas editha taylori*), endangered Fender's blue butterfly (*Icaricia icarioides fenderi*), endangered gray wolf (*Canis lupus*), lower Columbia river distinct population segment of the endangered Columbian white-tailed deer (*Odocoileus virginianus leucurus*), threatened Kincaid's lupine (*Lupinus sulphureus ssp. kincaidii*), threatened Nelson's checker-mallow (*Sidalcea nelsoniana*), threatened vernal pool fairy shrimp (*Branchinecta lynchi*), threatened Oregon spotted frog (*Rana pretiosa*), threatened marbled murrelet (*Brachyramphus marmoratus*), threatened western snowy plover (*Charadrius alexandrinus nivosus*), threatened northern spotted owl (*Strix occidentalis caurina*), the endangered Lost river sucker (*Deltistes luxatus*), the endangered shortnose sucker (*Chasmistes brevirostris*), the threatened bull trout (*Salvelinus confluentus*) and the fisher (*Pekania pennanti*) (which was proposed for listing at the time the BLM prepared the BA). In addition, approval of the PRMP may affect the critical habitats of the Cook's desert-parsley, vernal pool fairy shrimp, marbled murrelet, Lost river sucker, shortnose sucker, bull trout, western snowy plover, northern spotted owl and the Oregon spotted frog. This document was prepared in accordance with section 7 of the Endangered Species Act (ESA or Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Overview of How This Document is Organized

Due to the large scope of the proposed action and the large number of listed species and critical habitats which it may affect, this BO is detailed and voluminous. As we prepared the document we made several organizational conventions of which the reader should be aware:

- The Table of Contents displays the organization for how each species is considered in this BO. Note that we evaluated each individual species and their critical habitats together and in alphabetical order, conducting the analysis and providing the biological opinion narrative for one species after the other.
- As described in more detail below, this BO is "programmatic." It does not include incidental take statements, except for several fish species.
- Italicized blocks of text is language taken directly from the PRMP. It is in italics so the reader can distinguish verbiage between the PRMP and the Service's analysis. Where figures or tables occur in text copied from the PRMP, they have been renumbered in accordance with the numbering convention in this BO. Table and Figure numbers

referred to in the BLM text that were not copied into this BO remain as in the original BLM document.

- Literature Cited is generally organized by species and is provided as an appendix. We used standard scientific literature formatting when citing references in the body of the text. However, as a service to the reader, we often provide a specific page number for many of these cites to enable the reader to go directly to the precise location of the citation in the source literature. We have found this convention helpful to readers interested in more precisely documenting the scientific justification for specific statements made in the text.
- We evaluated how the effects of the proposed action might interact with changing conditions associated with climate change in the Pacific Northwest. We provide in an appendix a general overview of this issue as it might affect all species in the BO, and where appropriate we address climate change issues in more detail in individual species sections.

This BO is based on the following major sources of information: The two BAs (BLM 2016a, b); the consultation handbook (USFWS and NMFS 1998); the BLM's Draft Resource Management Plan/Environmental Impact Statement for western Oregon (BLM 2015a); the BLM's proposed Resource Management Plan/Final Environmental Impact Statement for western Oregon (BLM 2016c); current species literature as referenced in species sections; other pertinent reports and documents in our files; and extensive communications between the BLM, Service, and National Marine Fisheries Service (NMFS) staff.

Overview of the Proposed Action

The proposed Resource Management Plans in western Oregon (PRMP, or plan) will provide direction for the management of approximately 2.5 million acres of BLM-administered lands, for the purposes of producing a sustained yield of timber, contributing to the recovery of threatened and endangered species, providing clean water, restoring fire adapted ecosystems, providing for recreation opportunities, and coordinating the management of lands surrounding the Coquille Forest with the Coquille Tribe. The direction provided in this plan will be used to develop and implement specific projects and actions during the life of the plan, which will generally require additional and subsequent evaluation for compliance with NEPA, the ESA, and other appropriate Federal statutes and policies. For the purposes of this consultation, we assume that the BLM will implement actions consistent with the PRMP over an analytical timeframe of 50 years.

Goals and Overview of the Programmatic Section 7 Consultation Process

This PRMP is a Federal action that provides a framework for the development of future BLM actions that will be authorized, funded, or carried out at a later time within the next 50 years. The overall goal of this section 7 consultation process is to evaluate the BLM PRMP for its consistency with the conservation of listed species. This BO uses a programmatic approach to evaluate the PRMP. The analysis in this BO allows for a broad-scale examination of the PRMP's potential impacts on listed species and their designated critical habitats, and examines how the parameters of the BLM PRMP align with the survival and recovery needs of listed species occurring in the action area.

Although the PRMP provides descriptions of program activities and the overall goals for a variety of resource programs (*e.g.*, timber harvest, recreational use, etc.), it does not provide a detailed list of proposed actions that will occur within these programs during the next 50 years. Therefore, the Service is not providing an incidental take statement (ITS) with this BO (with one exception, as noted later). For subsequent actions that will be authorized consistent with this overall program and that may affect listed species, subsequent section 7 consultations under the ESA will occur. During those subsequent consultations, if incidental take is reasonably certain to occur and the proposed action is compliant with the requirements of section 7(a)(2), then an action-specific ITS will be provided that ensures any incidental take from the specific action(s) under the program is addressed. This approach allows for the broad scale evaluation of the BLM's program to ensure that the basic goals and approaches of the program are consistent with the conservation of listed species, while also providing a reliable mechanism for site-specific consultation at the stepped-down, project level scale. In other words, this programmatic view ensures the "big picture" of listed species conservation will be achieved by the program, while also guaranteeing that individual actions occurring on the ground are appropriately evaluated and permitted consistent with this "big picture" when such actions are developed and proposed.

The adequacy of this approach for the conservation of listed species is further sustained by the requirement for the action agency to reinitiate consultation under certain circumstances. Reinitiation of section 7 consultation may occur at any time during the course of program implementation (*i.e.*, the next 50 years) if: (1) new information reveals the effects of the action may affect listed species or critical habitat in manner or to an extent not previously considered; (2) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (3) if a new species is listed or critical habitat designated that may be affected by the identified action. This BO describes some additional specific conditions under which consultation will be reinitiated.

For individual actions that may affect listed species covered by previously completed section 7 consultation under the ESA, the issuance of this biological opinion does not automatically constitute a trigger for re-initiation. If the previously completed section 7 consultation included site-specific project design features that are still applicable (*i.e.*, the extent and scale of effects will not change under the PRMP), then reinitiation is not triggered solely based on issuance of this biological opinion. However, reinitiation for previously completed section 7 consultations may be triggered by this biological opinion where the proposed action(s) were programmatic in nature and the project design features in the previous consultation package relied on the underlying land-use allocation to determine their extent and scale. In such programmatic cases, the previously completed section 7 consultation should be considered for reinitiation.

For actions that may affect listed species but the section 7 consultation is not yet completed (*i.e.*, a letter of concurrence or biological opinion has not been issued to the action agency as of the effective date of this biological opinion), this biological opinion provides the framework for the development of future actions that are authorized, funded, or carried out at a later time and that are subject to future section 7 consultation. The Service assumes such section 7 consultation will be completed consistent with this biological opinion.

Key Considerations Regarding the Northern Spotted Owl in this Section 7 Consultation Process

Although this BO evaluates the potential effects of the PRMP on 17 listed species and nine designated critical habitats, much of the discussion in this document focuses on the potential impacts of the PRMP on the northern spotted owl (spotted owl). Although all 17 listed species treated herein are of conservation concern, the conservation status of the spotted owl is of the greatest concern and presented the most difficult challenge in this analysis. The spotted owl continues to suffer a significant population decline across its range, due primarily to increasing competition during recent years from the invasive and aggressive barred owl. This impact is expected to grow without proactive management. The challenge for the proposed action was to reconcile two potentially competing goals: provide a long term conservation strategy for the spotted owl that complies with the legal requirements of the ESA, while also meeting other statutory requirements to provide sustainable quantities of timber, allow recreational use of BLM lands, and other traditional activities on these public lands.

In the course of this PRMP section 7 consultation process during the last three years, and since publication of the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011; recovery plan), it has become ever clearer that the spotted owl is most threatened by competition with the increasingly common barred owl. Although habitat loss due to timber harvest and wildfire remains an important long term threat to the spotted owl, the Service now believes this threat is secondary in importance to the conservation of the spotted owl. Based on recent scientific information, it is the Service's opinion that spotted owl populations will continue to decline precipitously and be locally extirpated across the range due to barred owl competition regardless of how much habitat is conserved unless the barred owl threat is addressed. In other words, an approach incorporating just the conservation of habitat and avoiding take of spotted owls will not provide for spotted owl recovery as was originally anticipated during the development of the Northwest Forest Plan (NWFP) during the early 1990's.

To address this situation, we continue to work with forest land managers to advance a three-pronged spotted owl recovery approach first outlined in the 2011 recovery plan: (1) minimize short term impacts to extant spotted owls to maximize population recruitment;(2) minimize the long term loss of high quality suitable habitat (currently occupied and unoccupied), and recruit more suitable habitat in large, landscape-level blocks; and (3) evaluate the feasibility of barred owl management and, if feasible, implement actions to address this threat. As discussed later in this BO, the Service and other partners are currently implementing a barred owl removal experiment to assess this feasibility. The long term conservation of the spotted owl will depend on the successful implementation of this three-pronged approach.

The BLM has taken this recovery strategy and incorporated key aspects of it into its PRMP, consistent with their authorities and resources. Important features of this approach include:

- Overall impacts to extant spotted owls are minimized. Take of spotted owl territorial pairs or resident singles from timber harvest will be avoided during the first five to eight years of the PRMP as the barred owl removal experiment is conducted and evaluated, and

implemented. Subsequent effects to spotted owls would be metered out over time in the Harvest Land Base and avoided in other land use allocations.

- If the barred owl removal experiment leads to a longer term barred owl management program, the BLM will support such a program on their ownership. This support will mitigate for the adverse effects associated with the PRMP and will likely result in a net positive impact on the recovery of spotted owls.
- There will be a net increase in suitable habitat for spotted owls during the life of the plan due to an increase in reserve acres and habitat (compared to NWFP reserves) and forest ingrowth outpacing harvest, regardless of barred owl management.
- As individual projects are proposed under this PRMP, the BLM will consult at the project-specific level with the Service, providing a nexus to avoid jeopardy and to further minimize take of spotted owls as on-the-ground actions are implemented.
- The BLM will reinitiate section 7 consultation on the PRMP with the Service if our projections for the spotted owl described in this BO are not realized.

For these reasons, the Service expects an overall net improvement in spotted owl populations on BLM lands under the PRMP when compared to the future declining status quo under the NWFP, including when taking into account any take or adverse impacts to spotted owls due to timber harvest, recreation, and other activities occurring under this plan.

In sum, this BO evaluates the proposed action *in toto* as proposed by BLM, including those aspects of the PRMP that adversely affect the spotted owl as well as those provisions of the plan that mitigate for these impacts and which are expected to provide a net conservation benefit during the life of the program. Although there are some uncertainties regarding both the negative and positive effects of the program on the spotted owl during the next 50 years, this BO uses the best available scientific information to evaluate these effects. As an important safeguard, as discussed above and elsewhere in this BO, the BLM has committed in the proposed action itself to reinitiate consultation with the Service if any of these potential uncertainties manifest themselves in such a manner that the enumerated conservation benchmarks for the spotted owl are not achieved.

CONSULTATION HISTORY

The BLM, the Service and NMFS signed an extensive consultation agreement in May/June of 2013 outlining the process, cooperation and roles and responsibilities for each agency throughout the process of the developing the draft RMP/EIS (BLM 2015a), developing a conservation assessment (BLM 2015b), developing a conservation review (USFWS 2015), and the consultation process. In addition, Service staff participated in a number of technical teams including the Riparian Technical Team, the Cooperating Agencies Advisory Group (CAAG) and the Senior Manager's Group. The process also involved an Attorney's Group whose members included solicitors and general counsel to represent the BLM, the Service and NMFS, and, at times, the Forest Service. Service staff also participated in a number of outreach meetings with interested public and in briefings of our headquarters in Washington, D.C. The administrative

record for the PRMP contains a record of these meetings, processes, and teams which is located within and available from the Oregon State Office of the BLM.

On October 7, 2014, the Service published a proposed rule (USFWS 2014) to list the west coast distinct population segment of the fisher as a threatened species. In light of its listing status as a proposed species, BLM intended to conduct a conference on the fisher and included consideration of this species in their BA (BLM 2016a). However, based on best available scientific and commercial information, the Service subsequently determined that the west coast distinct population segment of the fisher is not currently in danger of extinction or likely to become endangered within the foreseeable future within all or a significant portion of its range. On that basis, the Service withdrew the proposed rule on April 18, 2016 (USFWS 2016). Since this species is no longer proposed for listing under the Act, it is not necessary to complete conferencing or consultation on the species under section 7 of the Act. For that reason, the fisher is not addressed further in this document.

On April 26, 2016, the BLM sent an email to the Service outlining their rationale for a *no effect* determination for the threatened Taylor's checkerspot. Based on the BLM's *no effect* determination, the Taylor's checkerspot is not addressed further in this document.

As part of the consultation process the Service has determined that implementation of the PRMP may affect, but is not likely to adversely affect the Columbian white-tailed deer, the gray wolf, or the western lily. The concurrence letter for these species is included in Appendix A of this BO.

BIOLOGICAL OPINION

Please note that the Incidental Take Statement accompanying this Biological Opinion relies on the revised Incidental Take Statement provisions of the section 7 regulations at 50 CFR 402 that became effective on June 10, 2015 (USFWS and NMFS 2015). The PRMP conforms to a *mixed programmatic action* as defined in section 402.02 of those revised regulations. Pursuant to 402.14(i)(6), an incidental take statement for a mixed programmatic action is required at the programmatic level only for those program actions that are reasonably certain to cause take and are not subject to further section 7 consultation.

If the consultation includes actions that are authorized by the RMP-scale consultation that will not be subject to future consultation, then the action is a "mixed programmatic action." In the case of the BLM's PRMP for western Oregon this consultation includes both actions that will require a future consultation prior to them being implemented, but also includes actions that will be authorized through the signing of the record of decision (ROD). Therefore, we consider this to be a mixed programmatic action.

The vast majority of activities addressed by this consultation fall into the former category and will be evaluated under subsequent section 7 consultations. However, the use of BLM roads for non-commercial use and recreation are activities that will not require future section 7 consultation, but will be authorized through the adoption of the final RMP. Therefore, while this consultation evaluates the effects of all the aspects covered by this RMP, it will only include an incidental take statement for the effects of non-commercial road use and recreation activities on

listed fish. Any incidental take that results from other projects included in, and implemented within the framework of, this RMP will need to be analyzed, addressed and exempted from the prohibitions of section 9 of the Act in future, more project-specific consultations.

DESCRIPTION OF THE PROPOSED ACTION

This Description of the Proposed Action is excerpted from the Overview of the Proposed Action section in the BLM's terrestrial BA (2016a, pp. 26-46), and the Proposed Action section in the BLM's Aquatic BA (2016b, pp. 21-110), which are incorporated herein by reference in their entirety. Some edits have been made for clarity and based on the verbiage of the Final EIS.

The BLM is revising the RMPs for the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District.

The BLM administers the use of a variety of natural resources on approximately 2.5 million acres within an area of approximately 22 million acres, which is the western Oregon planning area. The RMPs define the management direction for specified areas of BLM-administered lands (typically, for individual BLM districts or BLM resource areas). Resource management plans are formally evaluated periodically to determine whether there is a significant cause for amending or revising them.

The primary purpose for managing the approximately 2.1 million acres of what are called the O&C lands that lie within the approximately 2.5 million acres of BLM-administered lands in western Oregon is derived from the statutory authority of the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act). The remaining BLM-administered lands within the western Oregon planning area are public domain lands, and other statutory authorities provide the purposes for managing those lands. The primary direction for the administration of all those lands is the Federal Land Policy and Management Act (FLPMA) of 1976.

The purpose of the RMP revision is to:

- *Provide a sustained yield of timber*
- *Contribute to the conservation and recovery of threatened and endangered species, including:*
 - *maintaining a network of large blocks of forest to be managed for late-successional forests*
 - *maintaining older and more structurally complex multi-layered conifer forests*
- *Provide clean water in watersheds*
- *Restore fire-adapted ecosystems*
- *Provide recreation opportunities*
- *Coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe*

The PRMP components include land use allocations, management objectives, and management direction.

Land use allocations. *Areas where specific activities are allowed, restricted, or excluded in all or part of a planning area.*

Management objectives. *Describe the desired outcomes from the management of particular resources.*

Management direction. *Provide measures that will be applied to planning activities to achieve the management objectives for resources.*

The PRMP would include land use allocations or administrative designations that the BLM would use to manage different resources or groups of resources. These types of allocations or designations include but are not limited to –

- *vegetation and habitat management (Congressionally Reserved, District-Designated Reserves, Late-Successional Reserve, Riparian Reserve, Harvest Land Base, and Eastside Management Area)*
- *land tenure (Zones 1, 2, or 3)*
- *visual resource management (Class I, II, III, or IV)*
- *recreation management (Special Recreation Management Area, Extensive Recreation Management Area, or public lands not designated for recreation management)*
- *off-highway vehicle management (open, limited, or closed)*

Within each allocation or designation, including the examples above, the PRMP would assign each acre within the action area to one, and only one category. For example, in the land tenure designation type, every acre in the action area would be assigned to either the Land Tenure Zone 1, 2, or 3 category. Similarly, for visual resource management, every acre within the action area would be assigned to either the Visual Resource Management Class I, II, III, or IV category. These different types of allocations or designations overlap. For example, an individual acre might be allocated to Riparian Reserve, Land Tenure Zone 2, Visual Resource Management Class IV, Extensive Recreation Management Area, and closed to off-highway vehicle use.

The PRMP includes the following land use allocations categories for vegetation and habitat management: Congressionally Reserved Lands and National Landscape Conservation System, District-Designated Reserves, Late-Successional Reserve, Riparian Reserve, Harvest Land Base, and Eastside Management Area.

Within the PRMP, the land use allocation categories of District-Designated Reserves, Eastside Management Area, Harvest Land Base, Late-Successional Reserve, and Riparian Reserve have been further divided into sub-allocations with different management direction. The Harvest Land Base has three sub-allocations—the Moderate Intensity Timber Area, Low Intensity Timber Area and Uneven-aged Timber Area—with different management direction for forest management. Appendix A of the BAs (BLM 2016a, BLM 2016b) contains full descriptions of the management direction for the sub-allocations of the Harvest Land Base.

In the context of these land use allocations, the term “reserve” indicates that the BLM would reserve, or Congress has reserved, lands within the allocation from sustained-yield timber

production. These reserve land use allocations—Congressionally Reserved Lands, District-Designated Reserves, Late-Successional Reserve, and Riparian Reserve—are in contrast to the Harvest Land Base, which would include management objectives for sustained-yield timber production. This does not mean that the BLM would prohibit active management in these reserve allocations. On the contrary, the PRMP would include management direction to conduct the management actions necessary to achieve the management objectives for reserve allocations.

Table 1. Acres and percentages by land use allocation for the Proposed Resource Management Plan. BLM's Table II-1, p. 34.

Allocation	Acres	Total Acres (%)	Sub-allocation	Acres	Total Acres (%)
Late-Successional Reserve*	948,466	38.3%	Structurally-complex Forest	427,881	17%
			Large Block Forest Reserve (Moist)	250,546	10%
			Large Block Forest Reserve (Dry)	186,949	8%
			Occupied Marbled Murrelet Sites	42,174	2%
			Predicted Marbled Murrelet Sites [†]	31,242	1%
			Occupied Red Tree Vole Sites [#]	128	<1%
			Predicted Red Tree Vole Sites [#]	9,546	<1%
Riparian Reserve [‡]	635,717	25.7%	Riparian Reserve (Class I sub-watersheds)	497,331	20%
			Riparian Reserve (Class II sub-watersheds)	107,453	4%
			Riparian Reserve (Class III sub-watersheds)	30,933	1%
Other Reserves	263,647	10.6%	Congressionally Reserved	40,505	2%
			District Designated Reserves [§]	223,142	9%
Harvest Land Base	469,215	18.9%	Moderate Intensity Timber Area	180,549	7%
			Low Intensity Timber Area	89,126	4%
			Uneven-Aged Timber Area	199,541	8%
Eastside Management Area	161,810	6.5%	Eastside Management Area	149,971	6%
			Eastside Management Area – Riparian Reserve	11,838	<1%
Totals				2,478,856	-

** The acreage of the different components of the Late-Successional Reserve in this table is presented for information. The different components describe areas that are included in the Late-Successional Reserve for different reasons, including analytical projections of areas that the BLM would identify in the future as part of the Late-Successional Reserve. These different components are not sub-allocations, in that they do not have differing management objectives or management direction. The only sub-allocations of the Late-Successional Reserve, as detailed in*

Appendix A of the terrestrial BA – Management Objectives and Direction, are Late-Successional Reserve – Dry and Late-Successional Reserve – Moist.

† For the PRMP, the BLM used updated detection rates to calculate acres of predicted marbled murrelet sites.

‡ The design of the Riparian Reserve – west of Highway 97 varies among three classes of subwatersheds. In addition, the Riparian Reserve – west of Highway 97 includes sub-allocations of Riparian Reserve – Moist and Riparian Reserve – Dry, which overlap the three classes of subwatershed. This table only presents the Riparian Reserve – west of Highway 97 by subwatershed class for simplicity of presentation.

§ District-Designated Reserves include several sub-allocations, as detailed in **Appendix A** of the terrestrial BA, which are grouped together in this table.

|| The acreage for the Eastside Management Area in this table includes both forested and non-forested lands and Eastside Management Area – Riparian Reserve.

Existing Red Tree Vole Sites and Predicted Red Tree Vole Sites means those sites of the North Oregon Coast Distinct Population Segment of the red tree vole north of Highway 20.

Land Use Allocation Overviews

Congressionally Reserved Lands and National Landscape Conservation System

Under the PRMP, the BLM would recommend for inclusion in the National Wild and Scenic River System the eligible Wild and Scenic River segments with recreation identified as an Outstandingly Remarkable Value and the eligible river segments that the BLM found suitable during its administrative process (as outlined in BLM Manual 6400, USDI BLM 2012b).

District-Designated Reserves

District-Designated Reserves include lands that are reserved from sustained-yield timber production for a variety of reasons, including:

- Areas that the BLM has constructed for specific purposes (such as roads, buildings, maintenance yards, seed orchards, and other facilities and infrastructure);
- Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops);
- Areas of Critical Environmental Concern (ACECs) (lands where special management attention is needed to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish, and wildlife resources), including Research Natural Areas (RNAs) and Outstanding Natural Areas (ONAs) that would not overlap the Harvest Land Base; and

- *Other reserves (e.g., Special Recreation Management Areas, areas protected for Bureau sensitive species, and lands managed for their wilderness characteristics).*

Under the PRMP, the BLM would manage roads, maintenance yards, buildings, and other facilities for the purpose for which they were constructed.

Eastside Management Area

The PRMP includes an Eastside Management Area land use allocation, which applies to BLM-administered lands in the Klamath Falls Field Office east of Highway 97.

Harvest Land Base

In the PRMP, the Harvest Land Base is comprised of the Uneven-aged Timber Area, Low Intensity Timber Area, and Moderate Intensity Timber Area.

The Uneven-aged Timber Area is located in —

- *dry and very dry forest types identified by potential vegetation types in the Klamath Falls Field Office,*
- *dry forest types within northern spotted owl critical habitat designated in the 2012 final rule (USFWS 2012) and very dry forest types in the Medford District, and*
- *very dry forest types in the South River Field Office.*

The Low Intensity Timber Area is located in areas within the Harvest Land Base outside of the Uneven-aged Timber Area, in which the BLM identified that higher level of retention within regeneration harvest units would better integrate the management of multiple resources. Timber harvest in the Low Intensity Timber Area includes thinning and regeneration harvest with retention of 15 to 30 percent of the stand. In delineating these areas, the BLM included —

- *northern spotted owl critical habitat designated in the 2012 final rule (USFWS 2012) in the Harvest Land Base outside of the Uneven-aged Timber Area,*
- *dry forest types outside of designated northern spotted owl critical habitat in the Harvest Land Base in the Medford District, and*
- *Special Recreation Management Areas that overlap the Harvest Land Base outside of the Uneven-aged Timber Area where increased tree retention in regeneration harvests would facilitate recreation management.*

The Moderate Intensity Timber Area is located in the remaining portions of the Harvest Land Base.

Timber harvest in the Moderate Intensity Timber Area includes thinning and regeneration harvest with retention of 5 to 15 percent of the stand.

In contrast to Alternative B, the PRMP includes either natural tree regeneration or replanting after timber harvest in both the Low Intensity Timber Area and Moderate Intensity Timber Area.

Late-Successional Reserve

In the PRMP, the Late-Successional Reserve includes, primarily, Structurally-Complex Forest, Large Block Forest Reserves (Late-Successional Reserve - Moist and Late-Successional Reserve - Dry), and much smaller acreages from existing occupied marbled murrelet sites and existing sites of the North Oregon Coast Distinct Population Segment of the red tree vole north of Highway 20. In addition, the PRMP includes requirements for surveys for the marbled murrelet and the North Oregon Coast Distinct Population Segment of the red tree vole, as described below; newly discovered sites would be included in the Late-Successional Reserve. Thus, this description of the Late-Successional Reserve includes predictions of the acreage of newly discovered marbled murrelet and red tree vole sites. Within the Late-Successional Reserve, the BLM would not conduct timber salvage after disturbance, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.

Structurally-Complex Forest

The PRMP includes within the Late-Successional Reserve all stands identified by existing, district-specific information on structurally-complex forests.

Large Block Forest Reserves: Late-Successional Reserve - Moist and Late-Successional Reserve - Dry

The PRMP includes within the Late-Successional Reserve blocks of functional and potential spotted owl habitat, sufficient to meet block size and spacing requirements (Thomas et al. 1990, pp. 24, 28) in all provinces except the Coast Range province, where reserves include blocks of habitat without limitations for size and spacing. In comparison to Alternative B, the PRMP includes additional areas of Late-Successional Reserve in the Eugene and Roseburg Districts to facilitate east-west spotted owl movement and survival between the Coast Range and Cascade Mountains. In moist forests, the BLM would conduct restoration thinning to promote the development of structurally-complex forest, which may include commercial removal of cut trees. In dry forests, the BLM would conduct restoration activities including thinning and prescribed burning to promote the development of structurally-complex forest and to improve resilience to disturbance, which may include commercial removal of cut trees.

Riparian Reserve (west of Highway 97) - Moist

In the PRMP, the Riparian Reserve encompasses lands along streams and other waterbodies. The design of the Riparian Reserve – west of Highway 97 varies among three classes of subwatersheds based on the importance of the subwatershed to the conservation and recovery of listed fish. The BLM evaluated the importance of subwatersheds to the conservation and recovery of listed fish based on designated critical habitat and the abundance of streams with a high intrinsic potential for salmon. Class I subwatersheds are those that include both designated critical habitat and an abundance of high-intrinsic potential streams. Class II subwatersheds are those that include either designated critical habitat or an abundance of high-intrinsic potential streams. Class III subwatersheds are those that include neither designated critical habitat nor an abundance of high-intrinsic potential streams (Figure 1).

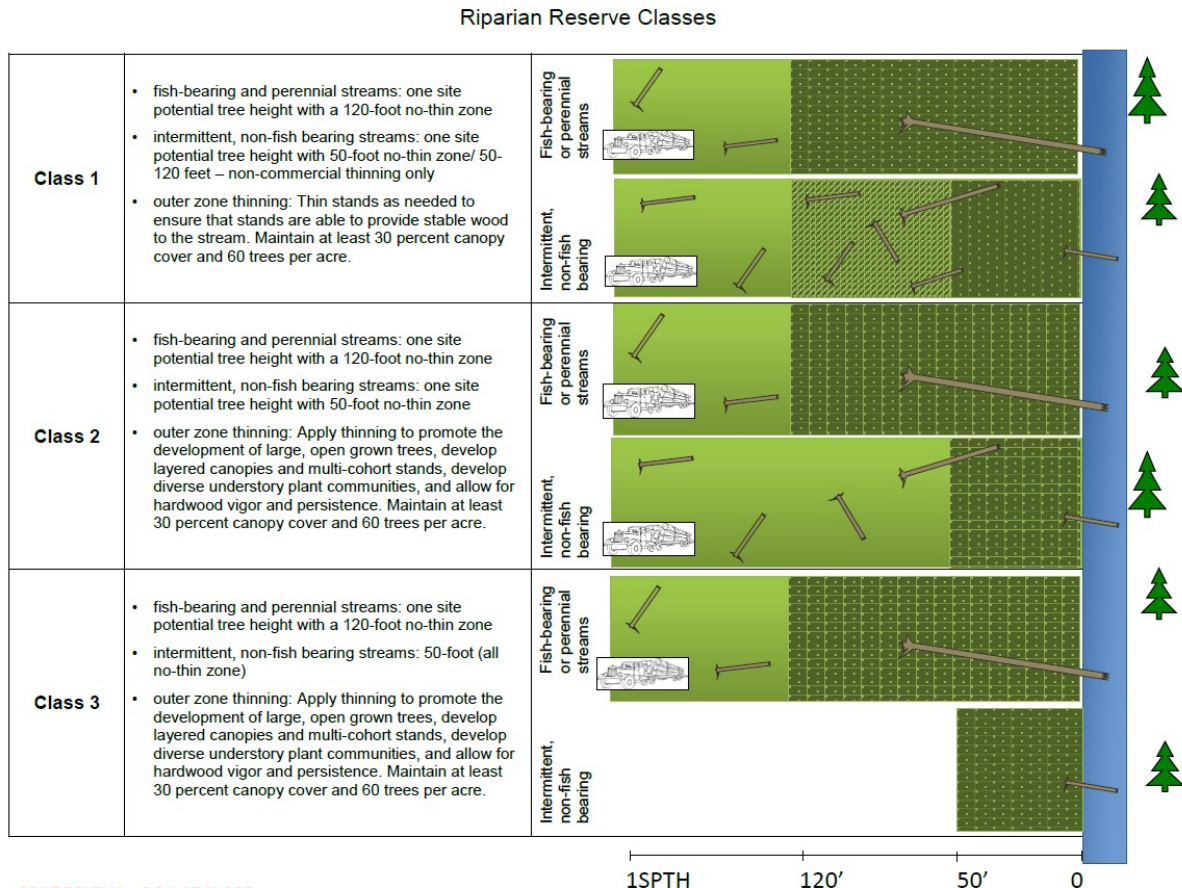


Figure 1. Riparian Reserve sizes and management by subwatershed class. Figure 1 in BLM (2016b).

Class I sub-watersheds

The Riparian Reserve encompasses lands within one site-potential tree height on either side of all streams.

The Riparian Reserve includes an inner zone in which thinning is generally not permitted. Inner zone widths are —

- 120 feet on either side of perennial streams and fish-bearing intermittent streams, and
- 50 feet on either side of non-fish-bearing, intermittent streams.

The Riparian Reserve includes a middle zone of from 50 to 120 feet on either side of non-fish-bearing, intermittent streams. No middle zone is delineated on perennial streams and fish-bearing intermittent streams. In the middle zone, the BLM would conduct restoration thinning as needed to ensure that stands are able to provide trees to form stable instream structures. In the middle zone in moist forests, the BLM would conduct restoration thinning without commercial removal of timber (i.e., coarse woody debris and snag creation only). In the middle zone in

Riparian Reserves - Dry, restoration activities would include prescribed burning and thinning that would include removal of cut trees, including commercial removal, as needed to reduce the risk of stand-replacing, crown fires.

The outer zone of the Riparian Reserve would be from 120 feet to one site-potential tree height on either side of all streams. In the outer zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to ensure that stands are able to provide stable wood to the stream.

Class II sub-watersheds

The Riparian Reserve encompasses lands within one site-potential tree height on either side of all streams.

The Riparian Reserve includes an inner zone in which thinning is generally not permitted. Inner zone widths are —

- 120 feet on either side of perennial streams and fish-bearing intermittent streams, and*
- 50 feet on either side of non-fish-bearing, intermittent streams.*

In the outer zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence and to increase diversity of riparian species and develop structurally-complex stands.

Class III sub-watersheds

The Riparian Reserve encompasses lands within—

- One site-potential tree height on either side of perennial streams and fish-bearing intermittent streams, and*
- 50 feet on either side of non-fish-bearing, intermittent streams.*

The Riparian Reserve includes an inner zone in which thinning is generally not permitted. Inner zone widths are —

- 120 feet on either side of perennial and fish-bearing intermittent streams, and*
- 50 feet on either side of non-fish-bearing, intermittent streams.*

In the outer zone, the BLM would conduct restoration thinning, which may include commercial removal, as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence and to increase diversity of riparian species and develop structurally-complex stands.

See the terrestrial BA (BLM 2016a, pp. A-21 – A31) for a detailed description of the Riparian Reserve widths and allowable management.

Management Objectives by Land Use Allocation

Congressionally Reserved Lands and National Landscape Conservation System

- *Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.*
- *Preserve the wilderness character of designated Wilderness Areas.*
- *Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (USDI BLM Manual 6330), until Congress either designates these lands as wilderness or releases them for other purposes.*

District-Designated Reserves

- *Maintain the values and resources for which the BLM has reserved these areas from sustained-yield timber production.*

Eastside Management Area (forested lands)

- *Manage forested lands on a sustainable basis for multiple uses including wildlife habitat, recreational needs, riparian habitat, cultural resources, community stability, and commodity production, including commercial timber and other forest products.*
- *Promote development of fire-resilient forests. Apply prescribed burns, mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain fire resilient conditions.*
- *Offer for sale the probable sale quantity of 350,000 board feet of timber per year.*

Eastside Management Area (non-forested lands)

- *Manage non-forest lands with the intent of maintaining or improving wildlife habitat and rangeland conditions based on ecological site parameters. Where conditions are currently late seral or potential natural community, maintain these conditions. Where conditions are early or mid-seral, improve conditions towards late seral or potential natural community.*
- *Manage non-forest lands for multiple uses in addition to those listed above including: recreational needs, community stability, and commodity production. Commodities include firewood, logs, biomass, chips, and other products and byproducts from juniper woodlands and rangelands.*
- *Promote development of fire-resilient woodlands and rangelands.*
- *Provide for the conservation of BLM Special Status Species.*

Eastside Management Area - Riparian Reserve

- *Provide for conservation of special status fish and other special status riparian-associated species.*
- *Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood sources, and stream bank stability.*
- *Maintain and restore water quality and hydrologic functions.*
- *Maintain and restore access to stream channels for all life stages of aquatic species.*
- *Maintain and restore the proper functioning condition and ecological site potential of riparian and wetland areas.*

Harvest Land Base

The Harvest Land Base has management objectives to—

- *Manage forests to achieve continual timber production that can be sustained through a balance of growth and harvest;*
- *Offer for sale the declared annual productive capacity of timber (205,000,000 board feet per year);*
- *Recover economic value from timber harvested after disturbance, such as a fire, windstorm, disease, or insect infestation;*
- *Ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth in harvested or disturbed areas; and*
- *Enhance the economic value of timber in forest stands.*

Late-Successional Reserve

The Late-Successional Reserve has management objectives to—

- *Protect stands of older, structurally-complex, conifer forest;*
- *Maintain habitat for the northern spotted owl and marbled murrelet;*
- *Promote development of habitat for the northern spotted owl in stands that do not currently meet suitable habitat criteria; and*
- *Promote development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.*

Riparian Reserve

The Riparian Reserve has management objectives to—

- *Contribute to the conservation and recovery of listed fish species and their habitats and provide for conservation of special status fish and other special status riparian associated species;*
- *Maintain and restore natural channel dynamics and processes and the proper functioning condition of riparian areas, stream channels and wetlands by providing*

- forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates;*
- Maintain water quality and stream flows within the range of natural variability, to protect aquatic biodiversity, and provide quality water for contact recreation and drinking water sources;*
- Meet ODEQ water quality criteria;*
- Maintain high quality water and contribute to the restoration of degraded water quality downstream of BLM-administered lands; and*
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.*

Management Objectives by Resource Program

According to the BLM, all BLM actions that will be implemented under the PRMP fall into one or more “resource programs,” of which there are approximately 20 under consideration in this consultation. Resource programs are logical delineations of the BLM’s land management responsibilities that allow BLM to define and group objectives, direction, staffing and funding.

Air Quality

- Protect air quality related values in Federal mandatory Class I areas.*
- Prevent exceedances of national, state, or local ambient air quality standards.*

Areas of Critical Environmental Concern

- Maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.*
- Under the PRMP, the BLM would designate 108 Areas of Critical Environmental Concern.*

Cultural Resources

- Preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations.*
- Reduce imminent threats and resolve potential conflicts from natural or human-caused deterioration or potential conflict with other resources by ensuring that all authorizations for land and resource use will comply with Section 106 of the National Historic Preservation Act.*

Fire, Fuels, and Wildfire Response

- Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.*

- *Fire management strategies would be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.*
- *Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic, large, high-intensity/high-severity wildfires.*
- *Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.*
- *Participate with communities bordering Federal lands in partnership with local, State, and Federal stakeholders to reduce the risks and threats from wildland fire.*

Fisheries

- *Improve the distribution and quantity of high quality fish habitat across the landscape for all life stages of ESA-listed, BLM Special Status Species, and other fish species.*
- *Maintain and restore access to stream channels for all life stages of aquatic species.*

Forest Management

- *Enhance the health, stability, growth, and vigor of forest stands.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.*
- *Facilitate safe and efficient forestry operations for the BLM, reciprocal right-of-way agreement holders, and permittees.*

Hydrology

- *Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.*

Invasive Species

- *Prevent the introduction of invasive species and the spread of existing invasive species infestations.*
- *Prevent the introduction and the spread of sudden oak death (*Phytophthora ramorum*) infections.*

The PRMP includes treatment at all sudden oak death infection sites.

Lands, Realty, and Roads

- *Make land tenure adjustments to facilitate the management of resources and enhance public resource values.*
- *Provide legal access to BLM-administered lands and facilities to support resource management programs.*

- *Provide needed right-of-ways, permits, leases, and easements over BLM-administered lands in a manner that is consistent with Federal and State laws.*
- *Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.*
- *Provide a road transportation system that serves resource management needs (administrative/commercial) and casual use needs (recreational/domestic) for both BLM-administered lands and adjacent privately-owned lands.*

Under the PRMP, right-of-way avoidance areas would increase from 243,928 acres to 456,801 acres, and right-of-way exclusion areas would increase from 43,590 acres to 107,790 acres. Other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, the PRMP does not contain any affirmative agency actions subject to the ESA regarding rights-of-way. The PRMP does not make any designations or allocations regarding rights-of-way other than the right-of-way avoidance areas and right-of-way exclusion areas. Other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, the PRMP makes no decision in principle about future rights-of-way and does not establish criteria for granting or denying future rights-of-way. Other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, all components of the PRMP regarding rights-of-way state the BLM's existing authorities and responsibilities or are beyond the discretion of the BLM.

Livestock Grazing

- *Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of the public rangelands.*
- *Prevent livestock from causing trampling disturbance to spawning beds where ESA-listed and Bureau Sensitive fish species occur.*

Under the PRMP, the BLM would manage allotments in compliance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). The BLM would adjust grazing levels and management practices when needed to meet or make progress toward meeting the standards for rangeland health. The BLM would make unavailable to grazing those allotments that have generally been vacant or inactive for five years or more, as listed in Appendix D of the terrestrial BA (BLM 2016a).

Minerals

- *Manage the development of leasable (including traditional and non-traditional hydrocarbon resources), locatable, and salable resources in an orderly and efficient manner.*
- *Maintain availability of mineral material sites needed for development and maintenance of access roads for forest management, timber harvest, local communities, rights-of-way for energy production and transmission, and for other uses.*

Under the PRMP, the BLM would recommend for withdrawal from locatable mineral entry 307,312 acres and would close 249,241 acres to salable mineral development.

Paleontological Resources

- *Protect and preserve significant paleontological localities from natural or human-caused deterioration or potential conflict with other resources.*
- *Provide appropriate scientific, educational, and recreational use, such as research and interpretive opportunities for paleontological resources.*

Rare Plants and Fungi

- *Provide for conservation and contribute toward the recovery of plant and fungi species that are listed, or are candidates for listing, under the ESA.*
- *Support the persistence and resilience of natural communities, including those associated with forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands. Support ecological processes and disturbance mechanisms to allow for a range of seral conditions.*
- *Provide for the conservation of Bureau Special Status plant and fungi species.*
- *Support the persistence and resilience of oak species within oak woodlands and within mixed hardwood/conifer communities.*

Under the PRMP, the BLM would manage mixed hardwood/conifer communities to maintain and enhance oak persistence and structure and manage mixed conifer communities to maintain and enhance pine persistence and structure.

Recreation and Visitor Services

- *Provide a diversity of quality recreational opportunities.*
- *Meet legal requirements for visitor health and safety and mitigate resource user conflicts.*
- *Mitigate recreational impacts on natural and cultural resources. In land use allocations where management of other resources is dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.*
- *Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if—*
 - *Recreation development is consistent with interdisciplinary land use plan objectives;*
 - *The BLM has legal public access to the site; and*
 - *The BLM has secured commitments from partners in the form of a cooperative management agreement, adopt a trail agreement, memorandum of understanding, etc.*

The PRMP includes designation of Special Recreation Management Areas at currently developed recreation facilities, and on lands where designation does not conflict with sustained-yield timber harvest. The PRMP includes designation of Extensive Recreation Management Areas where the BLM has developed and currently manages recreation activities outside of developed facilities, primarily where the BLM has authorized motorized and non-motorized trails, and where the BLM currently manages dispersed recreation activities. In addition, the BLM would designate Special Recreation Management Areas and Extensive Recreation Management Areas to address specific recreation demand and scarcity, or where unique opportunities for activity-specific demands exist. In the rest of the action area, the BLM would not manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands.

Soil Resources

- *Maintain or enhance the inherent soil functions of management ecosystems (e.g., ability of soil to take in water, store water, regulate outputs for vegetative growth and stream flow, and resist erosion or compaction).*
- *Provide landscapes that stay within natural soil stability failure rates during and after management activities.*

Sustainable Energy

- *Develop sustainable energy resources to the maximum extent possible without precluding other land uses.*

Trails and Travel Management

- *Maintain a comprehensive travel network that best meets the full range of public use, resource management, and administrative access needs.*
- *Protect fragile and unique resource values from damage by public motorized vehicle use.*
- *Provide public motorized vehicle use opportunities where appropriate.*

Visual Resource Management

- *Protect the quality of the scenic values on public lands where visual resources are an issue or where high-value visual resources exist, and protect areas having high scenic quality, visual sensitivity, and public visibility.*
- *Prohibit activities that would disrupt the existing character of the landscape in Visual Resource Management Class I areas.*
- *Retain the existing character of the landscape in Visual Resource Management Class II areas.*
- *Partially retain the existing character of the landscape in Visual Resource Management Class III areas.*
- *Allow for major modification of the existing character of the landscape in Visual Resource Management Class IV areas.*

Under the PRMP, the BLM would manage Congressionally Reserved Lands where decisions have been made to preserve a natural landscape (e.g., designated Wilderness Areas and the wild sections of Wild and Scenic Rivers) as Visual Resource Management Class I. The BLM would manage the following as VRM II: designated and recommended suitable Wild and Scenic Rivers classified as scenic; National Trail management corridors; District-Designated Reserves- Lands with Wilderness Characteristics; and Special Recreation Management Areas that fall within the primitive and backcountry setting. The BLM would manage the following as VRM III: designated and recommended suitable Wild and Scenic Rivers classified as recreational; and Special and Extensive Recreation Management Areas that fall within the middle country setting. The BLM would manage visual resources on ACECs according to their established Inventory class, except that the BLM would manage ACECs within the Harvest Land Base that are VRI II as VRM III. The BLM would manage all other lands as Visual Resource Management Class IV.

Wild Horses

- *Manage and maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office.*

Wildlife

- *Conserve and recover species that are ESA-listed, proposed, or candidates, and the ecosystems on which they depend.*
- *Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA-listing of these species.*
- *Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.*

Under the PRMP, the BLM would implement the mitigation measure described in the Draft RMP/EIS for BLM participation in barred owl management. As described in the Draft RMP/EIS, the BLM would cooperate with the Service and provide financial support for their experimental removal of barred owls. Further, when the Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl, the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30. Barred owl management actions on BLM-administered lands within the range of the northern spotted owl could include BLM participation in scheduling, funding, and implementing such actions.

The PRMP includes—

- *A requirement to avoid the incidental take of northern spotted owls until implementation of a barred owl management program has begun;*
- *A requirement for surveys for the marbled murrelet prior to management actions in marbled murrelet Zone 1 and protection of habitat within 300 feet around newly discovered occupied sites;*

- *The protection of trees capable of providing marbled murrelet nesting structures in younger stands in marbled murrelet Zone 1; and*
- *A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions north of Highway 20 and protection of habitat areas around newly discovered nest sites north of Highway 20.*

Special Provisions for Spotted Owl Management

BLM Participation in Barred Owl Management

The Service is currently authorizing the removal of barred owls from four study areas in California, Oregon, and Washington to evaluate the feasibility, cost, and effectiveness of barred owl removal and the resulting effects to northern spotted owl populations (USFWS 2013). In the Revised Recovery Plan for the Northern Spotted Owl, Recovery Action 29 describes the design and implementation of large-scale barred owl control experiments to assess the effects on spotted owl site occupancy, reproduction, and survival (USFWS 2011a, p. III-65). Recovery Action 30 calls for management to reduce the negative effects of barred owls on spotted owls so that the recovery criterion for a stable population trend can be achieved. In the Revised Recovery Plan for the Northern Spotted Owl, the Service acknowledges the need for aggressive strategies to address the threat from barred owls in the face of scientific uncertainty, and will employ an active program of adaptive management in order to deal with uncertainty and risk (USFWS 2011a, p. II-6–II-10).

Based on information in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011a), the analysis in the EIS for Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls (USFWS 2013), and preliminary results from experimental removals (Diller 2013, Diller et al. 2014), barred owl management may result in decreased competition between barred owls and northern spotted owls, increased site occupancy by northern spotted owls, and increased northern spotted owl survival and reproduction. These outcomes may increase the likelihood of recovery of the northern spotted owl. As such, the experimental removals represent an inquiry into the best manner in which barred owl management can contribute to the recovery of the northern spotted owl.

The BLM is cooperating with the Service and providing financial support for this experimental removal of barred owls. Further, under the PRMP, when the Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl, the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30. Under the PRMP, barred owl management actions on BLM-administered lands within the range of the northern spotted owl could include BLM participation in scheduling, funding, and implementing such actions. These actions would be implemented pursuant to appropriate NEPA analysis and decision-making. To the extent the BLM funds implementation of the Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls (USFWS 2013), the NEPA analysis for that action is already completed. The EIS prepared by the USFWS describes and evaluates nine alternatives for an experimental removal of barred owls on a scale sufficient to determine if the removal would increase northern spotted site occupancy and improve population trends. Results from these

experiments would be used by the Service to inform future decisions on potential long-term management strategies for barred owls (USFWS 2013). That analysis is hereby incorporated by reference.

When the Service determines the best manner in which barred owl management can contribute to the recovery of the spotted owl, the BLM and the Service will develop a monitoring program that will evaluate whether such a barred owl management program is having the biological benefits to the northern spotted owl assumed by the Biological Opinion on the RMP. The BLM and the Service will meet as necessary, at least annually, to review the results of the monitoring program.

Incidental Take of Northern Spotted Owls

As described in Appendix A of the terrestrial BA (BLM 2106a, p. A-59), the BLM will not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun. Implementation of a barred owl management program includes the existence of a monitoring program that will evaluate whether a barred owl program is having the biological benefits to the northern spotted owl assumed by this Biological Opinion.

Whether a specific timber harvest would result in incidental take will be determined on a case-by-case basis. Until implementation of a barred owl management program has begun, the BLM will not authorize any timber harvest that it determines would cause incidental take of northern spotted owls or is determined to cause incidental take through a section 7 consultation process. The BLM will be authorizing timber harvest that does not result in incidental take of northern spotted owls (e.g., harvest in unoccupied home ranges or harvest within occupied home ranges that does not constitute incidental take), provided that such harvest otherwise meets BLM's obligations under ESA section 7.

As part of the process to determine whether a planned timber harvest would result in take of northern spotted owls, the BLM will establish whether the northern spotted owl is actually present in the area that would be affected by the timber harvest using the best available science at that time, such as through pre-project northern spotted owl surveys consistent with USFWS 2012 Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls (February 2, 2011; revised January 9, 2012). The Service has updated the northern spotted owl survey protocol to account for the influence of barred owl and may update it in the future.

If the BLM and the Service jointly determine that implementation of a barred owl management program has begun, the BLM may proceed with implementation of timber harvest consistent with the ROD/RMP that may include incidental take of northern spotted owl territorial pairs or resident singles. Any proposed timber harvest that may include such incidental take would be implemented only after and consistent with appropriate project-level section 7 consultation and incidental take statement.

After implementation of a barred owl management program has begun, the BLM and Service will meet as necessary, at least annually, to review the results of the monitoring program. If the BLM or the Service concludes that the monitoring program shows that the results of such a barred owl management program are not consistent with the assumptions in its Biological Opinion, the BLM will reinitiate section 7 consultation on the RMP.

If the BLM or the Service concludes that implementation of a barred owl management program consistent with the assumptions contained in this Biological Opinion has not begun after five years from the effective date of the ROD/RMP, the agencies will meet as necessary, at least annually, and evaluate whether implementation of a barred owl management program consistent with the assumptions of the Biological Opinion is reasonably certain to occur. If both the BLM and the Service agree that such a barred owl management program is still reasonably certain to occur, the BLM will continue to not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest. If the BLM or the Service concludes that such a barred owl management program is not reasonably certain to occur, the BLM will reinitiate section 7 consultation on the RMP.

If implementation of a barred owl management program has not begun after eight years of the effective date of the ROD/RMP, the BLM will reinitiate section 7 consultation on the RMP.

If reinitiation of section 7 consultation on the RMP is triggered for any of the reasons above, the BLM will comply with ESA section 7(d) and will not authorize timber harvest that is likely to adversely affect the northern spotted owl or likely to adversely affect its critical habitat until consultation is complete.

After implementation of a barred owl management program has begun, the BLM would continue to seek to avoid or reduce negative impacts to northern spotted owl sites, to the extent consistent with the management objectives and management direction for the Harvest Land Base, as detailed below.

Management of Northern Spotted Owl Known Sites Associated with the Harvest Land Base¹

In 2013, an estimated 175 known sites occurred in what would be the Harvest Land Base under the PRMP. In addition, the Harvest Land Base under the PRMP would contribute to the 500-acre core use areas of an additional estimated 660 known sites located in other land use allocations, and to the median provincial home range areas of another estimated 250 known

¹ This description, which provides background information and explanations of how the BLM will use the completed RMPs, does not constitute additional requirements beyond the management direction described in Appendix A of the biological assessment. This description provides guidance for the timing or order of timber harvest in the Harvest Land Base but does not alter which lands are available for timber harvest. Guidance in this section for avoiding harvest or prioritizing harvest is in the context of those actions that are allowable consistent with the management objectives and management direction for the Harvest Land Base.

sites. Thus, an estimated 1,085 known sites, or 44 percent of the known sites associated with BLM-administered lands, potentially would be affected by BLM management actions in the Harvest Land Base under the PRMP. Given the severe biological stressors currently affecting the northern spotted owl, when designing, locating and implementing actions in the Harvest Land Base, BLM managers would avoid or delay negative impacts to northern spotted owl known sites located in the Harvest Land Base, and avoid causing the abandonment of northern spotted owl known sites located in other land use allocations, to the extent consistent with the management objectives and management direction for the Harvest Land Base, as described below.

This guidance is not intended to prevent all negative effects to known sites associated with the Harvest Land Base or the eventual loss of known sites in the Harvest Land Base. Instead, this guidance is intended to avoid or delay, to the extent consistent with the management objectives and management direction for the Harvest Land Base, near-term negative effects to known sites as northern spotted owl habitat continues to develop in the reserved land use allocations and the Service evaluates options for barred owl management.

The following information is intended to help BLM managers implement this guidance.

Known Sites Located in the Harvest Land Base

With respect to sites currently² occupied by a northern spotted owl territorial pair or resident single at any time during project implementation, to the extent consistent with the management objectives and management direction for the Harvest Land Base, BLM managers would:

- Avoid management actions that would cause the abandonment of more than 10 percent of such sites during the first decade of plan implementation, more than 15 percent of such sites during the second decade of plan implementation, and more than 20 percent of such sites per decade thereafter. These thresholds are intended to reflect site abandonment caused by a BLM action; they are not intended to reflect site abandonment from other causes such as displacement by barred owls or habitat losses on adjacent lands. If the BLM determines that an action would not cause the incidental taking of a territorial pair or resident single, and the Service concurs with that determination, subsequent abandonment of a site associated with the action would not be considered as resulting from the action.*
- Give priority to maintaining existing habitat in the associated nest patch, 500-acre core use area and median provincial home range area, in that order of priority, to support continued site occupancy.*

² For the purpose of this guidance, “sites currently occupied” means northern spotted owl sites that the BLM has determined are occupied at the time of implementation of the management action. The BLM will determine occupancy using the best science available at that time, such as through pre-project northern spotted owl surveys.

With respect to sites not currently occupied but known to have been occupied by a territorial pair or resident single within the prior 5 years, BLM managers would give priority to maintaining existing habitat conditions in the nest patch and 500-acre core use area, and maintaining existing nesting-roosting-foraging habitat in the associated median provincial home range area, to the extent consistent with the management objectives and management direction for the Harvest Land Base. If the BLM cannot maintain all existing nesting-roosting habitat in the median provincial home range area, BLM managers would give priority to maintaining nesting-roosting habitat closest to the 500-acre core use area and maintaining at least 50 percent of the median provincial home range area as nesting-roosting-foraging habitat when all lands are considered.

With respect to sites not currently occupied, but known to have been occupied by a territorial pair or resident single within the prior 10 years, BLM managers would give priority to maintaining existing habitat conditions in the nest patch and maintaining existing nesting-roosting habitat in the 500-acre core use area, or promoting the protection and development of nesting-roosting habitat in the nest patch and 500-acre core use area, to the extent consistent with the management objectives and management direction for the Harvest Land Base.

BLM managers would give priority to implementing management actions that are located outside the median provincial home range area of a site, or would affect sites not known to have been occupied by a territorial pair or resident single within the prior ten years, over actions that would affect sites that have been occupied within the prior ten years.

Known Sites Located Outside the Harvest Land Base

In 2013, approximately 590 known sites in other BLM land use allocations under the PRMP were occupied by a territorial pair or resident single within the prior five years and had portions of the Harvest Land Base within their median provincial home range. In addition, if the Service implements a barred owl management program, the BLM anticipates that northern spotted owls would reoccupy currently unoccupied habitat in areas where barred owls are managed.

As stated above, when designing, locating and implementing actions in the Harvest Land Base, BLM managers would avoid causing the abandonment of northern spotted owl known sites located in other land use allocations, to the extent consistent with the management objectives and management direction for the Harvest Land Base.

BLM managers would give priority to actions that affect sites—

- That are not known to have been occupied by a territorial pair or resident single within the prior 10 years. The longer a site has been unoccupied, the less likely it is to be re-occupied by northern spotted owls.*
- That have less than 50 percent nesting-roosting-foraging habitat within the associated median provincial home range area when all land ownerships are considered. Sites with median provincial home range areas supporting less than 50 percent nesting-roosting-foraging habitat are less likely to be re-occupied by northern spotted owls until habitat conditions recover.*

- *With less than 50 percent of the associated median provincial home range area occurring in the Late-successional Reserve, when all land ownerships and Forest Service reserves are considered. Sites associated with more reserved lands are more likely to be re-occupied by northern spotted owls, resist displacement by barred owls and contribute to species recovery.*

BLM managers would avoid actions that—

- *Occur in the nest patch of a site. Habitat modification in the nest patch will negatively affect re-occupancy of the site by northern spotted owls until habitat conditions recover.*
- *Cause the loss of nesting-roosting-foraging habitat in the 500-acre core use area surrounding a site. Sites with core use areas supporting less than 50 percent nesting-roosting-foraging habitat, when all land ownerships are considered, are less likely to be re-occupied by northern spotted owls until habitat conditions recover.*
- *Cause the amount of nesting-roosting-foraging habitat in the median provincial home range area surrounding a site to decline below 50 percent, when all land ownerships are considered.*

Coordinate Management of Lands Surrounding the Coquille Forest with the Coquille Tribe. The management of the Coquille Forest is subject by law (25 U.S.C. 715c (d)) to the standards and guidelines of forest plans for adjacent or nearby Federal forest lands. Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208) created the Coquille Forest to be held in trust for the benefit of the Coquille Tribe. This Act states that the Coquille Forest shall be managed “under applicable State and Federal forestry and environmental protection laws, and subject to critical habitat designations under the Endangered Species Act and subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future.” This Act also requires the Secretary of the Interior to take the Coquille Forest lands into trust for the benefit of the Coquille Tribe. The purpose of the plan revision includes coordinating the management of BLM-administered lands “adjacent or nearby” the Coquille Forest with the Coquille Tribe.

As noted above under the Description of the Proposed Action, the PRMP conforms to a “mixed programmatic action” as that term is defined in the implementing regulations for section 7 of the ESA at 50 CFR 401.02. A mixed programmatic action includes two categories of actions: (1) authorization of specific actions that are not subject to further section 7 consultation beyond the initial consultation on the programmatic action unless the reinitiation criteria at 50 CFR 402.16 apply; and (2) approval of a framework for the development of future actions that are authorized, funded, or carried out at a later time and that are subject to future section 7 consultation, as appropriate. Both categories of actions are considered in this biological opinion.

Conducting an effects analysis on a framework programmatic action that examines the potential effects of implementing the program is fully consistent with the purposes of a biological opinion.

The analysis in a biological opinion allows for a broadscale examination of a program's potential impacts on listed species and their designated critical habitats—an examination that is not as readily conducted when the later, action-specific consultation occurs on a subsequent action developed under the program framework. The provisions of an incidental take statement, including the amount and extent of take and the terms and conditions, must necessarily be specific to ensure they can be followed and allow for a determination of when they have been exceeded. See 16 U.S.C. 1536(b)(4); 50 CFR 402.14(i). In contrast, a meaningful effects analysis within a framework programmatic biological opinion may appropriately rely upon qualitative analysis to determine whether a program and its set of measures intended to minimize impacts or conserve listed species are adequately protective for purposes of making a jeopardy determination. Framework programmatic biological opinions examine how the parameters of the program align with the survival and recovery of listed species. This approach reflects the different statutory purposes that the two related but separate documents were intended to address.

Description of the Action Area

For the purposes of this BO, the Action Area refers to the subset of lands in the planning area, including subsurface minerals, for which the BLM has authority to make land use and management decisions that are affected directly or indirectly by approval of the PRMP, and all areas affected directly and indirectly by approval of the PRMP (50 CFR §402.02). The Service considers the action area to include the boundary of Federal lands managed by the BLM in the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District. Within the western Oregon districts, three BLM-administered areas are excluded from the action area: the Cascade Siskiyou National Monument (Medford District), the Upper Klamath Basin and Wood River Wetland (Klamath Falls Field Office), and the West Eugene Wetlands (Eugene District). These three areas have independent RMPs/EISs. The Proposed RMP would not alter those independent RMPs/EISs. The BLM lands within the action area cover approximately 2.5 million acres of land (BLM 2016a, p. 34).

Additionally, as noted in the FEIS (BLM 2016c, p. 808), the Coquille Forest managed by the Coquille Tribe is "subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future" per Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208)." The PRMP states that management direction from the resource programs are considered to be synonymous with "standards and guidelines". This means that the Coquille Forest will be subject to the PRMP provisions that apply to the Coos Bay District. Therefore, the Coquille Forest lands are part of the action area. However, the BLM PRMP does not determine which specific land use allocations apply to which specific portions of the Coquille Forest or the rate or extent of timber harvest on the Coquille Forest. Therefore, while we know that the management direction applicable to all land use allocations will apply to the Coquille Forest, at this time we do not know which land allocation-specific management direction will apply. Application of management direction related to land use allocations will be consulted on in subsequent ESA section 7 consultation with BIA. Coquille forest lands cover approximately 5,400 acres of the action area (*in litt.*)

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. It is not possible to precisely determine where actions using BLM roads on non-federal lands will occur during the life of the PRMP although we believe this is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon. Non-federal lands directly adjacent to BLM are more likely to use a road for access that crosses these two ownerships when conducting actions on those lands.

The Service has utilized a ½ mile buffer around the BLM to approximate the extent and size of the action area that would occur on non-federal lands. The likelihood of using a road on BLM to access adjacent lands varies depending on numerous factors, including the extent and density of the road network in the immediate area, and the proximity of a roaded parcel to other BLM lands within the action area. For example, checkerboard areas where a non-federal parcel is completely surrounded by BLM lands are entirely dependent on BLM roads for all but aerial access, whereas an isolated parcel of BLM land is less likely to be used for road access due the amount of land in the proximity that may provide other road access.

The Service believes using a ½ mile buffer around the BLM lands to approximate the extent and size of the action area is a reasonable approach. The action area associated with projects enacted during the life of the PRMP will be described in more detail during project-specific consultation. Based on a GIS query (Glenn 2016, pers. comm.), the non-federal lands within ½ mile of BLM lands that are within the action area cover approximately 1.22 million acres.

Based on this description, the Service estimates that the action area covers approximately 3.7 million acres of land.

Analytical Framework

Effects of the action refer to the permanent or temporary direct and indirect effects of an action on the species and/or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

The Endangered Species Act Consultation Handbook (USFWS & NMFS 1998, p. xvi), states a “*may affect*” determination is required when a proposed action may pose any effects to individuals of a listed species or to its designated critical habitat. When any adverse effects to individuals of a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, a “*may affect, likely to adversely affect*” determination is appropriate. However, when effects to listed species or critical habitat are expected to be discountable or insignificant, “*may affect, is not likely to adversely affect*” is the appropriate conclusion. Insignificant effects relate to the size of the impact and should never reach the level where potential injury to spotted owl would occur. Discountable effects, as described in the consultation handbook, are those extremely unlikely to occur. Based on best judgment, a person

would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Direct and indirect effects: Direct effects are the immediate consequences of the proposed action. Indirect effects are caused by the action, occur later in time and are reasonably certain to occur.

Interrelated and interdependent actions: Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interrelated actions are related to the Federal action, but do not depend on the Federal action. Interdependent actions are those that might occur independently of the larger action, but which have no independent utility apart from the action under consideration. Interdependent actions depend on the Federal action and have no independent utility apart from the Federal action.

Analytical Framework for the Jeopardy Determination

The following analysis relies on four components to support the jeopardy determination for each of the species considered in this BO: (1) the Status of the Species, which evaluates the species' range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species survival and recovery; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated with the aggregate effects of everything that has led to the spotted owl's current status and, for non-federal activities in the action area, those actions likely to affect the spotted owl in the future, to determine if, given the aggregate of all of these effects, implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the species and the role of the action area in meeting those needs as the context for evaluating the effects of the proposed Federal action combined with other relevant effects. In short, a non-jeopardy determination is warranted if the proposed action is consistent with maintaining the role of habitat and the species population in the action area for the species' survival and recovery. The jeopardy determination is made on the range-wide scale of the species.

Analytical Framework for the Adverse Modification Determination

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical

habitat” was published on February 11, 2016 (USFWS and NMFS 2016). The final rule became effective on March 14, 2016. The revised definition states: “Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.”

The destruction or adverse modification analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the range-wide condition of designated critical habitat for a listed species in terms of the key components of the critical habitat that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species; and (4) Cumulative Effects, which evaluate the effects of future non-federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur within the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. As noted above in the Description of the Action Area, the Service has defined the action area based on the anticipated indirect effects that may occur on non-federal lands interspersed with and/or adjacent to the BLM lands within the PRMP. The activities resulting in these indirect effects include the actions of State, Tribal, local or private citizens, which would routinely be considered Cumulative Effects under the definition in 50 CFR §402.02. Because in this BO at the programmatic scale the Service considers these actions to be “caused by or...result from” accessing these lands using BLM roads under the PRMP, the effects of these actions are included as indirect effects instead of Cumulative Effects throughout this BO.

Note: Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical and biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (USFWS and NMFS 2016, p. 7216) discontinue use of the terms "PCEs" or "essential features" and rely exclusively on use of the term PBFs for that purpose because that term is contained in the statute. To be consistent with that shift in terminology and in recognition that the terms PBFs, PCEs, and essential habitat features are synonymous in meaning, we are only referring to PBFs herein. Therefore, if a past critical habitat designation defined essential habitat features or PCEs, they will be referred to as PBFs in this document. This does not change the approach outlined above for conducting the "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features.

Scope of the Analysis

BLM Lands

As noted above under the *Description of the Proposed Action*, the proposed action conforms to a "mixed programmatic action" as that term is defined in the implementing regulations for section 7 of the ESA at 50 CFR 401.02. A mixed programmatic action includes two categories of actions: (1) authorization of specific actions that are not subject to further section 7 consultation beyond the initial consultation on the programmatic action unless the reinitiation criteria at 50 CFR 402.16 apply; and (2) approval of a framework for the development of future actions that are authorized, funded, or carried out at a later time and that are subject to future section 7 consultation, as appropriate. Both categories of actions are considered in this biological opinion.

The PRMP covers a wide variety of potential actions under 20 resource programs. To assist the Service in understanding and analyzing the various aspects of the mixed programmatic action, the BLM prepared the two BAs covering the proposed action (BLM 2016a, BLM 2016b) to include effect determinations for terrestrial and aquatic listed species and designated and proposed critical habitats for each resource program. For 10 of the 20 resource programs covered by the proposed action, the BLM's terrestrial BA (BLM 2016a, pp. 147-152) included a section addressing effect determinations common to all listed and proposed species and critical habitats addressed in that BA (see Appendix B of this document).

Coquille Tribal lands

There are approximately 5,400 acres within the total ownership of the Coquille Indian Tribe Land Ownership in the southern coastal area of Oregon (the Coquille Forest). These lands are interspersed with BLM and other non-federal parcels. The Coquille Tribe manages these lands for a variety of uses and values, including timber harvest to generate revenue for the tribe. The Coquille Tribe conducts section 7 consultation with the Service when implementing timber sales and coordinates through the Bureau of Indian Affairs (BIA). While designation of specific land use allocations on their lands does not result from adoption of the PRMP, the management direction that is not specific to land use allocations are synonymous with "standards and guidelines" and assumed to be applicable to these lands per Title V of the Oregon Resource

Conservation Act of 1996 (Public Law 104-208) (BLM 2016a, pp. 808-809). Adoption and implementation of these management directions are indirect effects of the PRMP, and so those potential effects that are reasonably certain to occur are included in this analysis.

1. Although the PRMP does not determine which specific land use allocations apply to which specific portions of the Coquille Forest, the PRMP also includes management direction that is not specific to land-use allocations. The Coquille Forest is subject to this management direction in the PRMP that is not specific to land-use allocations. On that basis, the Coquille Forest is considered part of the action area, and the potential indirect effects of those components of the PRMP on the Coquille Forest to listed species and critical habitat will be evaluated under the *Effects of the Action* analysis.
2. BLM's adoption of the PRMP will indirectly result in the need for the Coquille Tribe to amend its Forest Management Plan (FMP) for BIA approval.
3. BIA's proposed approval of the amended FMP, which will include specific land-use allocations on the Coquille Forest, will trigger ESA section 7 consultation, as appropriate. If so, the effects of the amended FMP over and above those considered in this consultation on the PRMP will be addressed at that time.

Non-Federal Lands

There are approximately 1.22 million acres of non-federal lands that are not part of the Coquille Forest within the action area. The PRMP resource programs and LUAs do not apply to these lands, but they are included as part of the action because access to those lands generally is considered to require the use of BLM roads making actions on those lands indirect effects of the proposed action.

BULL TROUT

STATUS OF THE SPECIES - BULL TROUT

Taxonomy

The bull trout is a native char found in the coastal and intermountain west of North America. Dolly Varden (*Salvelinus malma*) and bull trout were previously considered a single species and were thought to have coastal and interior forms. However, Cavender (1978) described morphometric, meristic and osteological characteristics of the two forms, and provided evidence of specific distinctions between the two. Despite an overlap in the geographic range of bull trout and Dolly Varden in the Puget Sound area and along the British Columbia coast, there is little evidence of introgression (Haas and McPhail 1991, p. 2191). The Columbia River Basin is considered the region of origin for the bull trout. From the Columbia, dispersal to other drainage systems was accomplished by marine migration and headwater stream capture. Behnke (2002, p. 297) postulated dispersion to drainages east of the continental divide may have occurred through the North and South Saskatchewan Rivers (Hudson Bay drainage) and the Yukon River system. Marine dispersal may have occurred from Puget Sound north to the Fraser, Skeena and Taku Rivers of British Columbia.

Species Description

Bull trout have unusually large heads and mouths for salmonids. Their body colors can vary tremendously depending on their environment, but are often brownish green with lighter (often ranging from pale yellow to crimson) colored spots running along their dorsa and flanks, with spots being absent on the dorsal fin, and light colored to white under bellies. They have white leading edges on their fins, as do other species of char. Bull trout have been measured as large as 103 centimeters (41 inches) in length, with weights as high as 14.5 kilograms (32 pounds) (Fishbase 2015, p. 1). Bull trout may be migratory, moving throughout large river systems, lakes, and even the ocean in coastal populations, or they may be resident, remaining in the same stream their lives (Rieman and McIntyre 1993, p. 2; Brenkman and Corbett 2005, p. 1077). Migratory bull trout are typically larger than resident bull trout (USFWS 1998a, p. 31668).

Legal Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (USFWS 1999a). The threatened bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 715-720).

Throughout its range, the bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and

maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (USFWS 1999a, p. 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin *et al.* 2007; Rieman *et al.* 2007; Porter and Nelitz. 2009, pp. 4-8). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Life History

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989, p. 30; Pratt 1985, pp. 28-34). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982, p. 95).

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 141). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, pp. 15-16; Pratt 1992, pp. 6-7; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, p. 1; Ratliff and Howell 1992, p. 10).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002, p. 9) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding

instream levels of 10 to 11.5 mg/L (Stewart *et al.* 2007, p. 10). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995, Ch. 2 pp. 23-24). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005; McPhail and Baxter 1996, p. i; WDFW *et al.* 1997, p. 16). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz *et al.* 2004, p. 105). For example, multiple life history forms (*e.g.*, resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel *et al.* (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell *et al.* (2003) best summarized genetic information on bull trout population structure. Spruell *et al.* (2003) analyzed 1,847 bull trout from 65 sampling locations, four

located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell *et al.* 2003, p. 17). They were characterized as:

- i. “Coastal”, including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.
- ii. “Snake River”, which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.
- iii. “Upper Columbia River” which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell *et al.* (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell *et al.* (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor *et al.* (1999) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello *et al.* (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell *et al.* (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001). Both Taylor *et al.* (1999, p. 1166) and Spruell *et al.* (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the Service identified additional genetic units within the coastal and interior lineages (Ardren *et al.* 2011, p. 18). Based on a recommendation in the Service’s 5-year review of the species’ status (USFWS 2008a, p. 45), the Service reanalyzed the 27 recovery units identified in the draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren *et al.* 2011). In this examination, the Service applied relevant factors from the joint Service and NMFS Distinct Population Segment (DPS) policy (USFWS 1996) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six draft recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010, p. 63898). The six draft recovery units identified for bull trout in the coterminous United States include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. These six draft recovery units were also identified in the Service’s revised recovery plan (USFWS 2015a, p. vii) and designated as final recovery units.

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, p. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders *et al.* 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989; Burkey 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, p. 15; Dunham and Rieman 1999; Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell *et al.* 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (*e.g.*, a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Recent research (Whiteley *et al.* 2003) does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho.

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 4). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing

substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989, pp. 23, 25; Hoelscher and Bjornn 1989, pp. 19, 25; Howell and Buchanan 1992, pp. 30, 32; Pratt 1992; Rich 1996, p. 17; Rieman and McIntyre 1993, pp. 4-6; Rieman and McIntyre 1995; Sedell and Everest 1991; Watson and Hillman 1997). Watson and Hillman (1997, pp. 247-250) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, pp. 4-6), bull trout should not be expected to simultaneously occupy all available habitats.

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, p. 2). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993, p. 2; Spruell *et al.* 1999). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under “Diet.”

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams, and spawning habitats are generally characterized by temperatures that drop below 9 °C in the fall (Fraley and Shepard 1989, p. 137; Pratt 1992, p. 5; Rieman and McIntyre 1993, p. 2).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, pp 7-8; Rieman and McIntyre 1993, p. 7). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (Buchanan and Gregory 1997, p. 4; Goetz 1989, p. 22). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C, within a temperature gradient of 8 °C to 15 °C. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham *et al.* (2003, p. 900) found that the probability of juvenile bull trout occurrence does not become high (*i.e.*, greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, p. 2; Fraley and Shepard 1989, pp. 133, 135; Rieman and McIntyre 1993, pp. 3-4; Rieman and McIntyre 1995, p. 287). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick 2002, pp. 6 and 13).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, p. 137; Goetz 1989, p. 19; Hoelscher and Bjornn 1989, p. 38; Pratt 1992; Rich 1996, pp. 4-5; Sedell and Everest 1991; Sexauer and James 1997; Thomas 1992, pp. 4-6; Watson and Hillman 1997, p. 238). Maintaining bull trout habitat requires natural stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993, pp. 5-6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, p. 364). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, p. 141; Pratt 1992, p. 6; Pratt and Huston 1993, p. 70). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Fish growth depends on the quantity and quality of food that is eaten, and as fish grow their foraging strategy changes as their food changes, in quantity, size, or other characteristics (Quinn 2005, pp. 195-200). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 242-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout feed on various fish species (Donald and Alger 1993, pp. 241-243; Fraley and Shepard 1989, pp. 135, 138; Leathe and Graham 1982, pp. 13, 50-56). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001, p. 204). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasii*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz *et al.* 2004, p. 105; WDFW *et al.* 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW *et al.* 1997, p. 25). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, pp. 1078-1079; Goetz *et al.* 2004).

Status and Distribution

Distribution and Demography

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-166; Bond 1992, p. 2). To the west, the

bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, pp. 165-166; Brewin *et al.* 1997).

Each of the following recovery units (below) is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. No new local populations have been identified and no local populations have been lost since listing.

Coastal Recovery Unit

The Coastal Recovery Unit is located within western Oregon and Washington. Major geographic regions include the Olympic Peninsula, Puget Sound, and Lower Columbia River basins. The Olympic Peninsula and Puget Sound geographic regions also include their associated marine waters (Puget Sound, Hood Canal, Strait of Juan de Fuca, and Pacific Coast), which are critical in supporting the anadromous³ life history form, unique to the Coastal Recovery Unit. The Coastal Recovery Unit is also the only unit that overlaps with the distribution of Dolly Varden (*Salvelinus malma*) (Ardren *et al.* 2011), another native char species that looks very similar to the bull trout (Haas and McPhail 1991). The two species have likely had some level of historic introgression in this part of their range (Redenbach and Taylor 2002). The Lower Columbia River major geographic region includes the lower mainstem Columbia River, an important migratory waterway essential for providing habitat and population connectivity within this region. In the Coastal Recovery Unit, there are 21 existing bull trout core areas which have been designated, including the recently reintroduced Clackamas River population, and 4 core areas have been identified that could be re-established. Core areas within the recovery unit are distributed among these three major geographic regions (Puget Sound also includes one core area that is actually part of the lower Fraser River system in British Columbia, Canada) (USFWS 2015b, p. A-1).

The current demographic status of bull trout in the Coastal Recovery Unit is variable across the unit. Populations in the Puget Sound region generally tend to have better demographic status, followed by the Olympic Peninsula, and finally the Lower Columbia River region. However, population strongholds do exist across the three regions. The Lower Skagit River and Upper Skagit River core areas in the Puget Sound region likely contain two of the most abundant bull trout populations with some of the most intact habitat within this recovery unit. The Lower Deschutes River core area in the Lower Columbia River region also contains a very abundant bull trout population and has been used as a donor stock for re-establishing the Clackamas River population (USFWS 2015b, p. A-6).

³ 1 Anadromous: Life history pattern of spawning and rearing in fresh water and migrating to salt water areas to mature.

Puget Sound Region

In the Puget Sound region, bull trout populations are concentrated along the eastern side of Puget Sound with most core areas concentrated in central and northern Puget Sound.

Although the Chilliwack River core area is considered part of this region, it is technically connected to the Fraser River system and is transboundary with British Columbia making its distribution unique within the region. Most core areas support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within this region are likely stable overall, although some at depressed abundances. Two core areas (Puyallup River and Stillaguamish River) contain local populations at either very low abundances (Upper Puyallup and Mowich Rivers) or that have likely become locally extirpated (Upper Deer Creek, South Fork Canyon Creek, and Greenwater River). Connectivity among and within core areas of this region is generally intact. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (*e.g.*, North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas) (USFWS 2015b, p. A-7).

Olympic Peninsula Region

In the Olympic Peninsula region, distribution of core areas is somewhat disjunct, with only one located on the west side of Hood Canal on the eastern side of the peninsula, two along the Strait of Juan de Fuca on the northern side of the peninsula, and three along the Pacific Coast on the western side of the peninsula. Most core areas support a mix of anadromous and fluvial life history forms, with at least one core area also supporting a natural adfluvial life history (Quinault River core area [Quinault Lake]). Demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them.

Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas) (USFWS 2015b, p. A-7).

Lower Columbia River Region

In the Lower Columbia River region, the majority of core areas are distributed along the Cascade Crest on the Oregon side of the Columbia River. Only two of the seven core areas in this region are in Washington. Most core areas in the region historically supported a fluvial life history form, but many are now adfluvial due to reservoir construction. However, there is at least one core area supporting a natural adfluvial life history (Odell Lake) and one supporting a natural, isolated, resident⁴ life history (Klickitat River [West Fork Klickitat]). Status is highly variable

across this region, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Although the South Santiam River has been identified as a historic core area, there remains uncertainty as to whether or not historical observations of bull trout represented a self-sustaining population. Current habitat conditions in the South Santiam River are thought to be unable to support bull trout spawning and rearing. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

Most core populations in this region are not only isolated from one another due to dams or natural barriers, but they are internally fragmented as a result of manmade barriers. Local populations are often disconnected from one another or from potential foraging habitat. In the Coastal Recovery Unit, adult abundance may be lowest in the Hood River and Odell Lake core areas, which each contain fewer than 100 adults. Bull trout were reintroduced in the Middle Fork Willamette River in 1990 above Hills Creek Reservoir. Successful reproduction was first documented in 2006, and has occurred each year since (USFWS 2015b, p. A-8). Natural reproducing populations of bull trout are present in the McKenzie River basin (USFWS 2008d, pp. 65-67). Bull trout were more recently reintroduced into the Clackamas River basin in the summer of 2011 after an extensive feasibility analysis (Shively *et al.* 2007, Hudson *et al.* 2015). Bull trout from the Lower Deschutes core area are being utilized for this reintroduction effort (USFWS 2015b, p. A-8).

Klamath Recovery Unit

Bull trout in the Klamath Recovery Unit have been isolated from other bull trout populations for the past 10,000 years and are recognized as evolutionarily and genetically distinct (Minckley *et al.* 1986; Leary *et al.* 1993; Whitesel *et al.* 2004; USFWS 2008a; Ardren *et al.* 2011). As such, there is no opportunity for bull trout in another recovery unit to naturally re-colonize the Klamath Recovery Unit if it were to become extirpated. The Klamath Recovery Unit lies at the southern edge of the species range and occurs in an arid portion of the range of bull trout.

Bull trout were once widespread within the Klamath River basin (Gilbert 1897; Dambacher *et al.* 1992; Ziller 1992; USFWS 2002b), but habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, and past fisheries management practices have greatly reduced their distribution. Bull trout abundance also has been severely reduced, and the remaining populations are highly fragmented and vulnerable to natural or manmade factors that place them at a high risk of extirpation (USFWS 2002b). The presence of nonnative brook trout (*Salvelinus fontinalis*), which compete and hybridize with bull trout, is a particular threat to bull trout persistence throughout the Klamath Recovery Unit (USFWS 2015c, pp. B-3-4).

Upper Klamath Lake Core Area

The Upper Klamath Lake core area comprises two bull trout local populations (Sun Creek and Threemile Creek). These local populations likely face an increased risk of extirpation because they are isolated and not interconnected with each other. Extirpation of other local populations

in the Upper Klamath Lake core area has occurred in recent times (1970s). Populations in this core area are genetically distinct from those in the other two core areas in the Klamath Recovery Unit (USFWS 2008b), and in comparison, genetic variation within this core area is lowest. The two local populations have been isolated by habitat fragmentation and have experienced population bottlenecks. As such, currently unoccupied habitat is needed to restore connectivity between the two local populations and to establish additional populations. This unoccupied habitat includes canals, which now provide the only means of connectivity as migratory corridors. Providing full volitional connectivity for bull trout, however, also introduces the risk of invasion by brook trout, which are abundant in this core area.

Bull trout in the Upper Klamath Lake core area formerly occupied Annie Creek, Sevenmile Creek, Cherry Creek, and Fort Creek, but are now extirpated from these locations. The last remaining local populations, Sun Creek and Threemile Creek, have received focused attention. Brook trout have been removed from bull trout occupied reaches, and these reaches have been intentionally isolated to prevent brook trout reinvasion. As such, over the past few generations these populations have become stable and have increased in distribution and abundance. In 1996, the Threemile Creek population had approximately 50 fish that occupied a 1.4-km (0.9-mile) reach (USFWS 2002b). In 2012, a mark-resight population estimate was completed in Threemile Creek, which indicated an abundance of 577 (95 percent confidence interval = 475 to 679) age-1+ fish (ODFW 2012). In addition, the length of the distribution of bull trout in Threemile Creek had increased to 2.7 km (1.7 miles) by 2012 (USFWS unpublished data). Between 1989 and 2010, bull trout abundance in Sun Creek increased approximately tenfold (from approximately 133 to 1,606 age-1+ fish) and distribution increased from approximately 1.9 km (1.2 miles) to 11.2 km (7.0 miles) (Buktenica *et al.* 2013) (USFWS 2015c, p. B-5).

Sycan River Core Area

The Sycan River core area is comprised of one local population, Long Creek. Long Creek likely faces greater risk of extirpation because it is the only remaining local population due to extirpation of all other historic local populations. Bull trout previously occupied Calahan Creek, Coyote Creek, and the Sycan River, but are now extirpated from these locations (Light *et al.* 1996). This core area's local population is genetically distinct from those in the other two core areas (USFWS 2008b). This core area also is essential for recovery because bull trout in this core area exhibit both resident⁴ and fluvial life histories, which are important for representing diverse life history expression in the Klamath Recovery Unit. Migratory bull trout are able to grow larger than their resident counterparts, resulting in greater fecundity and higher reproductive potential (Rieman and McIntyre 1993). Migratory life history forms also have been shown to be important for population persistence and resilience (Dunham *et al.* 2008).

The last remaining population (Long Creek) has received focused attention in an effort to ensure it is not also extirpated. In 2006, two weirs were removed from Long Creek, which increased the amount of occupied foraging, migratory, and overwintering (FMO) habitat by 3.2 km (2.0 miles).

⁴ Resident: Life history pattern of residing in tributary streams for the fish's entire life without migrating.

Bull trout currently occupy approximately 3.5 km (2.2 mi) of spawning/rearing habitat, including a portion of an unnamed tributary to upper Long Creek, and seasonally use 25.9 km (16.1 mi) of FMO habitat. Brook trout also inhabit Long Creek and have been the focus of periodic removal efforts. No recent statistically rigorous population estimate has been completed for Long Creek; however, the 2002 Draft Bull Trout Recovery Plan reported a population estimate of 842 individuals (USFWS 2002b). Currently unoccupied habitat is needed to establish additional local populations, although brook trout are widespread in this core area and their management will need to be considered in future recovery efforts. In 2014, the Klamath Falls Fish and Wildlife Office of the Service established an agreement with the U.S. Geological Survey to undertake a structured decision making process to assist with recovery planning of bull trout populations in the Sycan River core area (USFWS 2015c, p. B-6).

Upper Sprague River Core Area

The Upper Sprague River core area comprises five bull trout local populations, placing the core area at an intermediate risk of extinction. The five local populations include Boulder Creek, Dixon Creek, Deming Creek, Leonard Creek, and Brownsworth Creek. These local populations may face a higher risk of extirpation because not all are interconnected. Bull trout local populations in this core area are genetically distinct from those in the other two Klamath Recovery Unit core areas (USFWS 2008b). Migratory bull trout have occasionally been observed in the North Fork Sprague River (USFWS 2002b). Therefore, this core area also is essential for recovery in that bull trout here exhibit a resident life history and likely a fluvial life history, which are important for conserving diverse life history expression in the Klamath Recovery Unit as discussed above for the Sycan River core area.

The Upper Sprague River core area population of bull trout has experienced a decline from historic levels, although less is known about historic occupancy in this core area. Bull trout are reported to have historically occupied the South Fork Sprague River, but are now extirpated from this location (Buchanan *et al.* 1997). The remaining five populations have received focused attention. Although brown trout (*Salmo trutta*) co-occur with bull trout and exist in adjacent habitats, brook trout do not overlap with existing bull trout populations. Efforts have been made to increase connectivity of existing bull trout populations by replacing culverts that create barriers. Thus, over the past few generations, these populations have likely been stable and increased in distribution. Population abundance has been estimated recently for Boulder Creek (372 + 62 percent; Hartill and Jacobs 2007), Dixon Creek (20 + 60 percent; Hartill and Jacobs 2007), Deming Creek (1,316 + 342; Moore 2006), and Leonard Creek (363 + 37 percent; Hartill and Jacobs 2007). No statistically rigorous population estimate has been completed for the Brownsworth Creek local population; however, the 2002 Draft Bull Trout Recovery Plan reported a population estimate of 964 individuals (USFWS 2002b). Additional local populations need to be established in currently unoccupied habitat within the Upper Sprague River core area, although brook trout are widespread in this core area and will need to be considered in future recovery efforts (USFWS 2015c, p. B-7).

Mid-Columbia Recovery Unit

The Mid-Columbia Recovery Unit (RU) comprises 24 bull trout core areas, as well as two historically occupied core areas and one research needs area. The Mid-C RU is recognized as an area where bull trout have co-evolved with salmon, steelhead, lamprey, and other fish populations. Reduced fish numbers due to historic overfishing and land management changes have caused changes in nutrient abundance for resident migratory fish like the bull trout. The RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. Major drainages include the Methow River, Wenatchee River, Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Clearwater River, and smaller drainages along the Snake River and Columbia River USFWS 2015d, p. C-1).

The Mid-Columbia RU can be divided into four geographic regions: (1) the Lower Mid-Columbia, which includes all core areas that flow into the Columbia River below its confluence with the Snake River; (2) the Upper Mid-Columbia, which includes all core areas that flow into the Columbia River above its confluence with the Snake River; (3) the Lower Snake, which includes all core areas that flow into the Snake River between its confluence with the Columbia River and Hells Canyon Dam; and (4) the Mid-Snake, which includes all core areas in the Mid-C RU that flow into the Snake River above Hells Canyon Dam. These geographic regions are composed of neighboring core areas that share similar bull trout genetic, geographic (hydrographic), and/or habitat characteristics. Conserving bull trout in geographic regions allows for the maintenance of broad representation of genetic diversity, provides neighboring core areas with potential source populations in the event of local extirpations, and provides a broad array of options among neighboring core areas to contribute recovery under uncertain environmental change USFWS 2015d, pp. C-1-2).

The current demographic status of bull trout in the Mid-Columbia RU is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the recovery unit, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the RU. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin (USFWS 2015d, p. C-5).

Lower Mid-Columbia Region

In the Lower Mid-Columbia Region, core areas are distributed along the western portion of the Blue Mountains in Oregon and Washington. Only one of the six core areas is located completely in Washington. Demographic status is highly variable throughout the region. Status is the poorest in the Umatilla and Middle Fork John Day Core Areas. However, the Walla Walla River core area contains nearly pristine habitats in the headwater spawning areas and supports the most abundant populations in the region. Most core areas support both a resident and fluvial life history; however, recent evidence suggests a significant decline in the resident and fluvial life

history in the Umatilla River and John Day core areas respectively. Connectivity between the core areas of the Lower Mid-Columbia Region is unlikely given conditions in the connecting foraging migration and overwintering (FMO) habitats. Connection between the Umatilla, Walla Walla and Touchet core areas is uncommon but has been documented, and connectivity is possible between core areas in the John Day Basin. Connectivity between the John Day core areas and Umatilla/Walla Walla/Touchet core areas is unlikely (USFWS 2015d, pp. C-5-6).

Upper Mid-Columbia Region

In the Upper Mid-Columbia Region, core areas are distributed along the eastern side of the Cascade Mountains in Central Washington. This area contains four core areas (Yakima, Wenatchee, Entiat, and Methow), the Lake Chelan historic core area, and the Chelan River, Okanogan River, and Columbia River FMO areas. The core area populations are generally considered migratory, though they currently express both migratory (fluvial and adfluvial) and resident forms. Residents are located both above and below natural barriers (*i.e.*, Early Winters Creek above a natural falls; and Ahtanum in the Yakima likely due to long lack of connectivity from irrigation withdrawal). In terms of uniqueness and connectivity, the genetics baseline, radio-telemetry, and PIT tag studies identified unique local populations in all core areas. Movement patterns within the core areas; between the lower river, lakes, and other core areas; and between the Chelan, Okanogan, and Columbia River FMO occurs regularly for some of the Wenatchee, Entiat, and Methow core area populations. This type of connectivity has been displayed by one or more fish, typically in non-spawning movements within FMO. More recently, connectivity has been observed between the Entiat and Yakima core areas by a juvenile bull trout tagged in the Entiat moving in to the Yakima at Prosser Dam and returning at an adult size back to the Entiat. Genetics baselines identify unique populations in all four core areas (USFWS 2015d, p. C-6).

The demographic status is variable in the Upper-Mid Columbia region and ranges from good to very poor. The Service's 2008 5-year Review and Conservation Status Assessment described the Methow and Yakima at risk, with a rapidly declining trend. The Entiat was listed at risk with a stable trend, and the Wenatchee as having a potential risk, and with a stable trend. Currently, the Entiat is considered to be declining rapidly due to much reduced redd counts. The Wenatchee is able to exhibit all freshwater life histories with connectivity to Lake Wenatchee, the Wenatchee River and all its local populations, and to the Columbia River and/or other core areas in the region. In the Yakima core area some populations exhibit life history forms different from what they were historically. Migration between local populations and to and from spawning habitat is generally prevented or impeded by headwater storage dams on irrigation reservoirs, connectivity between tributaries and reservoirs, and within lower portions of spawning and rearing habitat and the mainstem Yakima River due to changed flow patterns, low instream flows, high water temperatures, and other habitat impediments. Currently, the connectivity in the Yakima Core area is truncated to the degree that not all populations are able to contribute gene flow to a functional metapopulation (USFWS 2015d, pp. C-6-7)

Lower Snake Region

Demographic status is variable within the Lower Snake Region. Although trend data are lacking, several core areas in the Grande Ronde Basin and the Imnaha core area are thought to be stable. The upper Grande Ronde Core Area is the exception where population abundance is considered depressed. Wenaha, Little Minam, and Imnaha are strongholds (as mentioned above), as are most core areas in the Clearwater River basin. Most core areas contain populations that express both a resident and fluvial life history strategy. There is potential that some bull trout in the upper Wallowa River are adfluvial. There is potential for connectivity between core areas in the Grande Ronde basin, however conditions in FMO are limiting (USFWS 2015d, p. C-7).

Middle Snake Region

In the Middle Snake Region, core areas are distributed along both sides of the Snake River above Hells Canyon Dam. The Powder River and Pine Creek basins are in Oregon and Indian Creek and Wildhorse Creek are on the Idaho side of the Snake River. Demographic status of the core areas is poorest in the Powder River Core Area where populations are highly fragmented and severely depressed. The East Pine Creek population in the Pine-Indian- Wildhorse core area is likely the most abundant within the region. Populations in both core areas primarily express a resident life history strategy; however, some evidence suggests a migratory life history still exists in the Pine Creek-Indian-Wildhorse core area. Connectivity is severely impaired in the Middle Snake Region. Dams, diversions and temperature barriers prevent movement among populations and between core areas. Brownlee Dam isolates bull trout in Wildhorse Creek from other populations (USFWS 2015d, p. C-7).

Columbia Headwaters Recovery Unit

The Columbia Headwaters RU (CHRU) includes western Montana, northern Idaho, and the northeastern corner of Washington. Major drainages include the Clark Fork River basin and its Flathead River contribution, the Kootenai River basin, and the Coeur d'Alene Lake basin. In this implementation plan for the CHRU we have slightly reorganized the structure from the 2002 Draft Recovery Plan, based on latest available science and fish passage improvements that have rejoined previously fragmented habitats. We now identify 35 bull trout core areas (compared to 47 in 2002) for this RU. Fifteen of the 35 are referred to as “complex” core areas as they represent large interconnected habitats, each containing multiple spawning streams considered to host separate and largely genetically identifiable local populations. The 15 complex core areas contain the majority of individual bull trout and the bulk of the designated critical habitat (USFWS 2010).

However, somewhat unique to this RU is the additional presence of 20 smaller core areas, each represented by a single local population. These “simple” core areas are found in remote glaciated headwater basins, often in Glacier National Park or federally-designated wilderness areas, but occasionally also in headwater valley bottoms. Many simple core areas are upstream of waterfalls or other natural barriers to fish migration. In these simple core areas bull trout have apparently persisted for thousands of years despite small populations and isolated existence. As such, simple core areas meet the criteria for core area designation and continue to be valued for

their uniqueness, despite limitations of size and scope. Collectively, the 20 simple core areas contain less than 3 percent of the total bull trout core area habitat in the CHRU, but represent significant genetic and life history diversity (Meeuwig *et al.* 2010). Throughout this RU Implementation Plan, we often separate our analyses to distinguish between complex and simple core areas, both in respect to threats as well as recovery actions (USFWS 2015e, pp. D-1-2).

In order to effectively manage the RU Implementation Plan structure in this large and diverse landscape, the core areas have been separated into the following five natural geographic assemblages.

Upper Clark Fork Geographic Region

Starting at the Clark Fork River headwaters, the *Upper Clark Fork Geographic Region* comprises seven complex core areas, each of which occupies one or more major watersheds contributing to the Clark Fork basin (*i.e.*, Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Bitterroot River, West Fork Bitterroot River, and Middle Clark Fork River core areas) (USFWS 2015e, p. D-2).

Lower Clark Fork Geographic Region

The seven headwater core areas flow into the *Lower Clark Fork Geographic Region*, which comprises two complex core areas, Lake Pend Oreille and Priest Lake. Because of the systematic and jurisdictional complexity (three States and a Tribal entity) and the current degree of migratory fragmentation caused by five mainstem dams, the threats and recovery actions in the Lake Pend Oreille (LPO) core area are very complex and are described in three parts. The LPO-A is upstream of Cabinet Gorge Dam, almost entirely in Montana, and includes the mainstem Clark Fork River upstream to the confluence of the Flathead River as well as the portions of the lower Flathead River (*e.g.*, Jocko River) on the Flathead Indian Reservation. The LPO-B is the Pend Oreille lake basin proper and its tributaries, extending between Albeni Falls Dam downstream from the outlet of Lake Pend Oreille and Cabinet Gorge Dam just upstream of the lake; almost entirely in Idaho. The LPO-C is the lower basin (*i.e.*, lower Pend Oreille River), downstream of Albeni Falls Dam to Boundary Dam (1 mile upstream from the Canadian border) and bisected by Box Canyon Dam; including portions of Idaho, eastern Washington, and the Kalispel Reservation (USFWS 2015e, p. D-2).

Historically, and for current purposes of bull trout recovery, migratory connectivity among these separate fragments into a single entity remains a primary objective.

Flathead Geographic Region

The *Flathead Geographic Region* includes a major portion of northwestern Montana upstream of Kerr Dam on the outlet of Flathead Lake. The complex core area of Flathead Lake is the hub of this area, but other complex core areas isolated by dams are Hungry Horse Reservoir (formerly South Fork Flathead River) and Swan Lake. Within the glaciated basins of the Flathead River headwaters are 19 simple core areas, many of which lie in Glacier National Park or the Bob

Marshall and Great Bear Wilderness areas and some of which are isolated by natural barriers or other features (USFWS 2015e, p. D-2).

Kootenai Geographic Region

To the northwest of the Flathead, in an entirely separate watershed, lies the *Kootenai Geographic Region*. The Kootenai is a uniquely patterned river system that originates in southeastern British Columbia, Canada. It dips, in a horseshoe configuration, into northwest Montana and north Idaho before turning north again to re-enter British Columbia and eventually join the Columbia River headwaters in British Columbia. The *Kootenai Geographic Region* contains two complex core areas (Lake Koocanusa and the Kootenai River) bisected since the 1970's by Libby Dam, and also a single naturally isolated simple core area (Bull Lake). Bull trout in both of the complex core areas retain strong migratory connections to populations in British Columbia (USFWS 2015e, p. D-3).

Coeur d'Alene Geographic Region

Finally, the *Coeur d'Alene Geographic Region* consists of a single, large complex core area centered on Coeur d'Alene Lake. It is grouped into the CHRU for purposes of physical and ecological similarity (adfluvial bull trout life history and nonanadromous linkage) rather than due to watershed connectivity with the rest of the CHRU, as it flows into the mid-Columbia River far downstream of the Clark Fork and Kootenai systems (USFWS 2015e, p. D-3).

Upper Snake Recovery Unit

The Upper Snake RU includes portions of central Idaho, northern Nevada, and eastern Oregon. Major drainages include the Salmon River, Malheur River, Jarbidge River, Little Lost River, Boise River, Payette River, and the Weiser River. The Upper Snake Recovery Unit contains 22 bull trout core areas within seven geographic regions or major watersheds: Salmon River (10 core areas, 123 local populations), Boise River (2 core areas, 29 local populations), Payette River (5 core areas, 25 local populations), Little Lost River (1 core area, 10 local populations), Malheur River (2 core areas, 8 local populations), Jarbidge River (1 core area, 6 local populations), and Weiser River (1 core area, 5 local populations). The Upper Snake Recovery Unit includes a total of 206 local populations, with almost 60 percent being present in the Salmon River watershed (USFWS 2015f, p. E-1).

Three major bull trout life history expressions are present in the Upper Snake RU, adfluvial⁵, fluvial⁶, and resident populations. Large areas of intact habitat exist primarily in the Salmon drainage, as this is the only drainage in the Upper Snake RU that still flows directly into the Snake River; most other drainages no longer have direct connectivity due to irrigation uses or

⁵ Adfluvial: Life history pattern of spawning and rearing in tributary streams and migrating to lakes or reservoirs to mature.

⁶ Fluvial: Life history pattern of spawning and rearing in tributary streams and migrating to larger rivers to mature.

instream barriers. Bull trout in the Salmon basin share a genetic past with bull trout elsewhere in the Upper Snake RU. Historically, the Upper Snake RU is believed to have largely supported the fluvial life history form; however, many core areas are now isolated or have become fragmented watersheds, resulting in replacement of the fluvial life history with resident or adfluvial forms. The Weiser River, Squaw Creek, Pahsimeroi River, and North Fork Payette River core areas contain only resident populations of bull trout (USFWS 2015f, pp. E-1-2).

Salmon River

The Salmon River basin represents one of the few basins that are still free-flowing down to the Snake River. The core areas in the Salmon River basin do not have any major dams and a large extent (approximately 89 percent) is federally managed, with large portions of the Middle Fork Salmon River and Middle Fork Salmon River - Chamberlain core areas occurring within the Frank Church River of No Return Wilderness. Most core areas in the Salmon River basin contain large populations with many occupied stream segments. The Salmon River basin contains 10 of the 22 core areas in the Upper Snake RU and contains the majority of the occupied habitat. Over 70 percent of occupied habitat in the Upper Snake RU occurs in the Salmon River basin as well as 123 of the 206 local populations. Connectivity between core areas in the Salmon River basin is intact; therefore it is possible for fish in the mainstem Salmon to migrate to almost any Salmon River core area or even the Snake River.

Connectivity within Salmon River basin core areas is mostly intact except for the Pahsimeroi River and portions of the Lemhi River. The Upper Salmon River, Lake Creek, and Opal Lake core areas contain adfluvial populations of bull trout, while most of the remaining core areas contain fluvial populations; only the Pahsimeroi contains strictly resident populations. Most core areas appear to have increasing or stable trends but trends are not known in the Pahsimeroi, Lake Creek, or Opal Lake core areas. The Idaho Department of Fish and Game reported trend data from 7 of the 10 core areas. This trend data indicated that populations were stable or increasing in the Upper Salmon River, Lemhi River, Middle Salmon River-Chamberlain, Little Lost River, and the South Fork Salmon River (IDFG 2005, 2008). Trends were stable or decreasing in the Little-Lower Salmon River, Middle Fork Salmon River, and the Middle Salmon River-Panther (IDFG 2005, 2008).

Boise River

In the Boise River basin, two large dams are impassable barriers to upstream fish movement: Anderson Ranch Dam on the South Fork Boise River, and Arrowrock Dam on the mainstem Boise River. Fish in Anderson Ranch Reservoir have access to the South Fork Boise River upstream of the dam. Fish in Arrowrock Reservoir have access to the North Fork Boise River, Middle Fork Boise River, and lower South Fork Boise River. The Boise River basin contains 2 of the 22 core areas in the Upper Snake RU. The core areas in the Boise River basin account for roughly 12 percent of occupied habitat in the Upper Snake RU and contain 29 of the 206 local populations. Approximately 90 percent of both Arrowrock and Anderson Ranch core areas are federally owned; most lands are managed by the Forest Service, with some portions occurring in designated wilderness areas. Both the Arrowrock core area and the Anderson Ranch core area are isolated from other core areas. Both core areas contain fluvial bull trout that exhibit adfluvial

characteristics and numerous resident populations. The Idaho Department of Fish and Game in 2014 determined that the Anderson Ranch core area had an increasing trend while trends in the Arrowrock core area is unknown (USFWS 2015f).

Payette River

The Payette River basin contains three major dams that are impassable barriers to fish: Deadwood Dam on the Deadwood River, Cascade Dam on the North Fork Payette River, and Black Canyon Reservoir on the Payette River. Only the Upper South Fork Payette River and the Middle Fork Payette River still have connectivity, the remaining core areas are isolated from each other due to dams. Both fluvial and adfluvial life history expression are still present in the Payette River basin but only resident populations are present in the Squaw Creek and North Fork Payette River core areas. The Payette River basin contains 5 of the 22 core areas and 25 of the 206 local populations in the recovery unit. Less than 9 percent of occupied habitat in the recovery unit is in this basin. Approximately 60 percent of the lands in the core areas are federally owned and the majority is managed by the Forest Service. Trend data are lacking and the current condition of the various core areas is unknown, but there is concern due to the current isolation of three (North Fork Payette River, Squaw Creek, Deadwood River) of the five core areas; the presence of only resident local populations in two (North Fork Payette River, Squaw Creek) of the five core areas; and the relatively low numbers present in the North Fork core area (USFWS 2015f, p. E-8).

Jarbidge River

The Jarbidge River core area contains two major fish barriers along the Bruneau River: the Buckaroo diversion and C. J. Strike Reservoir. Bull trout are not known to migrate down to the Snake River. There is one core area in the basin, with populations in the Jarbidge River; this watershed does not contain any barriers. Approximately 89 percent of the Jarbidge core area is federally owned. Most lands are managed by either the Forest Service or BLM. A large portion of the core area is within the Bruneau-Jarbidge Wilderness area. A tracking study has documented bull trout population connectivity among many of the local populations, in particular between West Fork Jarbidge River and Pine Creek. Movement between the East and West Fork Jarbidge River has also been documented; therefore both resident and fluvial populations are present. The core area contains six local populations and 3 percent of the occupied habitat in the RU. Trend data are lacking within this core area (USFWS 2015f, p. E-9).

Little Lost River

The Little Lost River basin is unique in that the watershed is within a naturally occurring hydrologic sink and has no connectivity with other drainages. A small fluvial population of bull trout may still exist, but it appears that most populations are predominantly resident populations. There is one core area in the Little Lost basin, and approximately 89 percent of it is federally owned by either the Forest Service or BLM. The core area contains 10 local populations and less than 3 percent of the occupied habitat in the RU. The current trend condition of this core area is likely stable, with most bull trout residing in Upper Sawmill Canyon (IDFG 2014).

Malheur River

The Malheur River basin contains major dams that are impassable to fish. The largest are Warm Springs Dam, impounding Warm Springs Reservoir on the mainstem Malheur River, and Agency Valley Dam, impounding Beulah Reservoir on the North Fork Malheur. The dams result in two core areas that are isolated from each other and from other core areas. Local populations in the two core areas are limited to habitat in the upper watersheds. The Malheur River basin contains two of the 22 core areas and eight of the 206 local populations in the RU. Fluvial and resident populations are present in both core areas while adfluvial populations are present in the North Fork Malheur. This basin contains less than 3 percent of the occupied habitat in the RU, and approximately 60 percent of lands in the two core areas are federally owned. Trend data indicates that populations are declining in both core areas (USFWS 2015f, p. E-9).

Weiser River

The Weiser River basin contains local populations that are limited to habitat in the upper watersheds. The Weiser River basin contains only a single core area that consists of 5 of the 206 local populations in the RU. Local populations occur in only three stream complexes in the upper watershed: (1) Upper Hornet Creek; (2) East Fork Weiser River; and (3) Upper Little Weiser River. These local populations include only resident life histories. This basin contains less than 2 percent of the occupied habitat in the RU, and approximately 44 percent of lands are federally owned. Trend data from the Idaho Department of Fish and Game indicate that the populations in the Weiser core area are increasing (IDFG 2014), but it is considered vulnerable because local populations are isolated and likely do not express migratory life histories (USFWS 2015f, p.E-10).

St. Mary Recovery Unit

The Saint Mary RU is located in northwest Montana east of the Continental Divide and includes the U.S. portions of the Saint Mary River basin, from its headwaters to the international boundary with Canada at the 49th parallel. The watershed and the bull trout population are linked to downstream aquatic resources in southern Alberta, Canada; the U.S. portion includes headwater spawning and rearing (SR) habitat in the tributaries, and a portion of FMO habitat in the mainstem of the Saint Mary River and Saint Mary lakes (Mogen and Kaeding 2001).

The Saint Mary RU comprises four core areas; only one (Saint Mary River) is a complex core area with five described local bull trout populations (Divide, Boulder, Kennedy, Otatso, and Lee Creeks). Roughly half of the linear extent of available FMO habitat in the mainstem Saint Mary system (between Saint Mary Falls at the upstream end and the downstream Canadian border) is comprised of Saint Mary and Lower Saint Mary Lakes, with the remainder in the Saint Mary River. The other three core areas (Slide Lakes, Cracker Lake, and Red Eagle Lake) are simple core areas. Slide Lakes and Cracker Lake occur upstream of seasonal or permanent barriers and are comprised of genetically isolated single local bull trout populations, wholly within Glacier National Park, Montana. In the case of Red Eagle Lake, physical isolation does not occur, but consistent with other lakes in the adjacent Columbia Headwaters RU, there is likely some degree

of spatial separation from downstream Saint Mary Lake. As noted, the extent of isolation has been identified as a research need (USFWS 2015g, p. F-1).

Bull trout in the Saint Mary River complex core area are documented to exhibit primarily the migratory fluvial life history form (Mogen and Kaeding 2005a, 2005b), but there is doubtless some occupancy (though less well documented) of Saint Mary Lakes, suggesting a partly adfluvial adaptation. Since lake trout and northern pike are both native to the Saint Mary River system (headwaters of the South Saskatchewan River drainage draining to Hudson Bay), the conventional wisdom is that these large piscivores historically outcompeted bull trout in the lacustrine environment (Donald and Alger 1993, Martinez *et al.* 2009), resulting in a primarily fluvial niche and existence for bull trout in this system. This is an untested hypothesis and additional research into this aspect is needed (USFWS 2015g, p. F-3).

Bull trout populations in the simple core areas of the three headwater lake systems (Slide, Cracker, and Red Eagle Lakes) are, by definition, adfluvial; there are also resident life history components in portions of the Saint Mary River system such as Lower Otatso Creek (Mogen and Kaeding 2005a), further exemplifying the overall life history diversity typical of bull trout. Mogen and Kaeding (2001) reported that bull trout continue to inhabit nearly all suitable habitats accessible to them in the Saint Mary River basin in the United States. The possible exception is portions of Divide Creek, which appears to be intermittently occupied despite a lack of permanent migratory barriers, possibly due to low population size and erratic year class production (USFWS 2015g, p. F-3).

It should be noted that bull trout are found in minor portions of two additional U.S. watersheds (Belly and Waterton rivers) that were once included in the original draft recovery plan (USFWS 2002), but are no longer considered core areas in the final recovery plan (USFWS 2015a) and are not addressed in that document. In Alberta, Canada, the Saint Mary River bull trout population is considered at “high risk,” while the Belly River is rated as “at risk” (ACA 2009). In the Belly River drainage, which enters the South Saskatchewan system downstream of the Saint Mary River in Alberta, some bull trout spawning is known to occur on either side of the international boundary. These waters are in the drainage immediately west of the Saint Mary River headwaters. However, the U.S. range of this population constitutes only a minor headwater migratory spawning and rearing segment of an otherwise wholly Canadian population, extending less than 1 mile (0.6 km) into backcountry waters of Glacier National Park. The Belly River population is otherwise totally dependent on management within Canadian jurisdiction, with no natural migratory connection to the Saint Mary (USFWS 2015g, p. F-3).

Current status of bull trout in the Saint Mary River core area (U.S.) is considered strong (Mogen 2013). Migratory bull trout redd counts are conducted annually in the two major spawning and rearing streams, Boulder and Kennedy creeks. Boulder Creek redd counts have ranged from 33 to 66 in the past decade, with the last 4 counts all 53 or higher. Kennedy Creek redd counts are less robust, ranging from 5 to 25 over the last decade, with a 2014 count of 20 (USFWS 2015g, p. F-3).

Generally, the demographic status of the Saint Mary River core area is believed to be good, with the exception of the Divide Creek local population. In this local population, there is evidence

that a combination of ongoing habitat manipulation (Smillie and Ellerbroek 1991, F-5 USDOI 1992) resulting in occasional historical passage issues, combined with low and erratic recruitment (DeHaan *et al.* 2011) has caused concern for the continuing existence of the local population.

While less is known about the demographic status of the three simple cores where redd counts are not conducted, all three appear to be self-sustaining and fluctuating within known historical population demographic bounds. Of the three simple core areas, demographic status in Slide Lakes and Cracker Lake appear to be functioning appropriately, but the demographic status in Red Eagle Lake is less well documented and believed to be less robust (USFWS 2015g, p. F-3).

Reasons for Listing

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992, pp. 2-3; Schill 1992, p. 42; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993, p. 1; Newton and Pribyl 1994, pp. 4-5; McPhail and Baxter 1996, p. 1). Several local extirpations have been documented, beginning in the 1950s (Rode 1990, pp. 26-32; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994, p. 1; Newton and Pribyl 1994, pp. 8-9; Light *et al.* 1996, pp. 6-7; Buchanan *et al.* 1997, p. 15; WDFW 1998, pp. 2-3). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around 1975 (Rode 1990, p. 32). Bull trout have been functionally extirpated (*i.e.*, few individuals may occur there but do not constitute a viable population) in the Coeur d'Alene River basin in Idaho and in the Lake Chelan and Okanogan River basins in Washington (USFWS 1998a, pp. 31651-31652).

These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include the effects of dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta *et al.* 1987; Chamberlain *et al.* 1991; Furniss *et al.* 1991; Meehan 1991; Nehlsen *et al.* 1991; Sedell and Everest 1991; Craig and Wissmar 1993pp, 18-19; Henjum *et al.* 1994, pp. 5-6; McIntosh *et al.* 1994; Wissmar *et al.* 1994; MBTSG 1995a, p. 1; MBTSG 1995b, pp. i-ii; MBTSG 1995c, pp. i-ii; MBTSG 1995d, p. 22; MBTSG 1995e, p. i; MBTSG 1996a, p. i-ii; MBTSG 1996b, p. i; MBTSG 1996c, p. i; MBTSG 1996d, p. i; MBTSG 1996e, p. i; MBTSG 1996f, p. 11; Light *et al.* 1996, pp. 6-7; USDA and USDI 1995, p. 2).

Emerging Threats

Climate Change

Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout recovery plan and RU Implementation Plans summarize the threat of climate change and acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time due to anthropogenic climate change effects, and use of best available information will

ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, p. vii and pp. 17-20; USFWS 2015b-g).

Global climate change and the related warming of global climate have been well documented (IPCC 2007; ISAB 2007; Combes 2003). Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures and accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, p. 253; Battin *et al.* 2007, p. 6720), we can no longer assume that climate conditions in the future will resemble those in the past.

Patterns consistent with changes in climate have already been observed in the range of many species and in a wide range of environmental trends (ISAB 2007; Hari *et al.* 2006; Rieman *et al.* 2007). In the northern hemisphere, the duration of ice cover over lakes and rivers has decreased by almost 20 days since the mid-1800's (Magnuson *et al.* 2000, p. 1743). The range of many species has shifted poleward and elevationally upward. For cold-water associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari *et al.* 2006).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007, pp. 15-17). For example, stream gauge data from western Washington over the past 5 to 25 years indicate a marked increasing trend in water temperatures in most major rivers.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and stream temperature, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson *et al.* 2003, pp 216-217).

All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold water habitat. For example, ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of other chars. Ground water temperature is linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Baxter 1997, p. 82). Increases in air temperature are likely to be reflected in increases in both surface and groundwater temperatures.

Climate change is likely to affect the frequency and magnitude of fires, especially in warmer drier areas such as are found on the eastside of the Cascade Mountains. Bisson *et al.* (2003, pp. 216-217) note that the forest that naturally occurred in a particular area may or may not be the forest that will be responding to the fire regimes of an altered climate. In several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, as stated earlier, the

future may well be different than the past and extreme fire events may have a dramatic effect on bull trout and other aquatic species, especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson *et al.* 2003, pp. 218-219).

Migratory bull trout can be found in lakes, large rivers and marine waters. Effects of climate change on lakes are likely to impact migratory adfluvial bull trout that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes will likely lead to longer periods of thermal stratification and coldwater fish such as adfluvial bull trout will be restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may further reduce the area of suitable temperatures in the bottom layers and intensify competition for food (Shuter and Meisner 1992, p. 11).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin *et al.* 2007, p. 6720). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout and Pacific salmon species. Although lower elevation river reaches are not expected to experience as severe an impact from alterations in stream hydrology, they are unlikely to provide suitably cold temperatures for bull trout spawning, incubation and juvenile rearing.

As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations. Thermal refugia are important for providing bull trout with patches of suitable habitat during migration through or to make feeding forays into areas with greater than optimal temperatures.

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007, p 7) although the scale of that variation may exceed that of States. For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007, p. 13; Battin *et al.* 2007, p. 6722; Rieman *et al.* 2007, pp. 1558-1561). In streams and rivers with temperatures approaching or at the upper limit of allowable water temperatures, there is little if any likelihood that bull trout will be able to adapt to or avoid the effects of climate change/warming. There is little doubt that climate change is and will be an important factor affecting bull trout distribution. As its distribution contracts, patch size decreases and connectivity is truncated, bull trout populations that may be currently connected may face increasing isolation, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman *et al.* 2007, pp. 1559-1560). Due to variations in land form and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

The ability to assign the effects of gradual global climate change to bull trout or to a specific location on the ground is beyond our technical capabilities at this time.

Conservation

Conservation Needs

The 2015 recovery plan for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable¹ in six recovery units; (2) effectively manage and ameliorate the primary threats in each of six recovery units at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information (USFWS 2015a, p. v.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, 2004, 2004a) have served to identify recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation.

The 2015 recovery plan (USFWS 2015a) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the range of the single DPS listed under the Act.

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary (USFWS 2015a, p. 45-46).

To implement the recovery strategy, the 2015 recovery plan establishes categories of recovery actions for each of the six RUs (USFWS 2015a, p. 50-51):

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.

3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biologically-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015a, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015a, p. 33).

Each of the six RUs contain multiple bull trout core areas, 116 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015a, p. 3). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015a, p. 3). Core areas can be further described as complex or simple (USFWS 2015a, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and FMO habitat. Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015a, p. 73). A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (*e.g.*, those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Population Units

The final recovery plan (USFWS 2015a) designates six bull trout RUs as described above. These units replace the 5 interim RUs previously identified (USFWS 1999a). The Service will address the conservation of these final RUs in our section 7(a)(2) analysis for proposed Federal actions. The recovery plan (USFWS 2015a, identified threats and factors affecting the bull trout within these RUs. A detailed description of recovery implementation for each RU is provided in separate RU Implementation Plans (USFWS 2015b-g), which identify conservation actions and recommendations needed for each core area, FMO areas, historical core areas, and research

needs areas. Each of the following RUs (below) is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

Coastal Recovery Unit

The coastal RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the RU (USFWS 2015b). The Coastal RU is located within western Oregon and Washington. The Coastal RU is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This RU contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015a, p. 47; USFWS 2015b, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This RU also contains ten shared FMO habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5). There are four core areas within the Coastal RU that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015a, p.79). These are the most stable and abundant bull trout populations in the RU. The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (*e.g.*, flood control, floodplain disconnection, bank armoring, channel straightening, loss of instream habitat complexity), agriculture (*e.g.*, diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (*e.g.*, dams, culverts, instream flows) residential development, urbanization, forest management practices (*e.g.*, timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species. Conservation measures or recovery actions implemented include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats.

Klamath Recovery Unit

The Klamath RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c). The Klamath RU is located in southern Oregon and northwestern California. The Klamath RU is the most significantly imperiled recovery unit, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural recolonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015a, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015a, p. 47; USFWS 2015c, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS 2015c, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c, p. B-3). The current condition of the bull

trout in this recovery unit is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Conservation measures or recovery actions implemented include removal of nonnative fish (*e.g.*, brook trout, brown trout, and hybrids), acquiring water rights for instream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culver replacement, and habitat restoration.

Mid-Columbia Recovery Unit

The Mid-Columbia RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d). The Mid-Columbia RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia RU is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This RU contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015a, p. 47; USFWS 2015d, p. C-1–4). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, agricultural practices (*e.g.*, irrigation, water withdrawals, livestock grazing), fish passage (*e.g.*, dams, culverts), nonnative species, forest management practices, and mining. Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements.

Columbia Headwaters Recovery Unit

The Columbia headwaters RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e). The Columbia Headwaters Recovery Unit is located in western Montana, northern Idaho, and the northeastern corner of Washington. The Columbia Headwaters RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats, and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the recovery unit have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41). The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of nonnative fish predators and competitors, modified instream flows, migratory barriers (*e.g.*, dams), habitat fragmentation, forest practices (*e.g.*, logging, roads), agriculture practices (*e.g.*, irrigation, livestock grazing),

and residential development. Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

Upper Snake Recovery Unit

The Upper Snake RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the RU (USFWS 2015f). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region. The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (*e.g.*, water diversions, grazing). Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration.

St. Mary Recovery Unit

The St. Mary RU Implementation Plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the RU (USFWS 2015g). The Saint Mary Recovery Unit is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This RU contains four core areas, and seven local populations (USFWS 2015g, p. F-1) in the U.S. Headwaters. The current condition of the bull trout in this recovery unit is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (*e.g.*, entrainment, fish passage, instream flows), and, to a lesser extent habitat impacts from development and nonnative species.

Tribal Conservation Activities

Many Tribes throughout the range of the bull trout are participating on bull trout conservation working groups or recovery teams in their geographic areas of interest. Some tribes are also implementing projects which focus on bull trout or that address anadromous fish but benefit bull trout (*e.g.*, habitat surveys, passage at dams and diversions, habitat improvement, and movement studies).

STATUS OF BULL TROUT CRITICAL HABITAT

Current legal status of the critical habitat

Current Designation

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (USFWS 2010); the rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (<http://www.fws.gov/pacific/bulltrout>). The scope of the designation involved the species' coterminous range, which includes the Coastal, Klamath, Mid-Columbia, Upper Snake, Columbia Headwaters and St. Mary's RU population segments. Rangelwide, the Service designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 2). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migration, and overwintering.

Table 2. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat.

State	Stream/Shoreline Miles	Stream/Shoreline Kilometers	Reservoir /Lake Acres	Reservoir/ Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon ¹	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho ²	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total ³	19,729.0	31,750.8	488,251.7	197,589.2
¹ No shore line is included in Oregon				
² Pine Creek Drainage which falls within Oregon				
³ Total of freshwater streams: 18,975				

The 2010 revision increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs compared to the 2005 designation.

The final rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not

occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower main stem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: 1) waters adjacent to non-federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the ESA, in which bull trout is a covered species on or before the publication of this final rule; 2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or 3) waters where impacts to national security have been identified (USFWS 2010, p. 63903). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant Critical Habitat Unit (CHU) text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

The Physical and Biological Features

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010, p. 63898). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

Thirty-two CHUs within the geographical area occupied by the species at the time of listing are designated under the revised rule. Twenty-nine of the CHUs contain all of the physical or biological features (PBFs) identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the PBFs necessary to support the bull trout's particular use of that habitat, other than those PBFs associated with PBFs 5 and 6, which relate to breeding habitat.

The primary function of individual CHUs is to maintain and support core areas, which: (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat

conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Hard 1995, pp. 314-315; Healey and Prince 1995, p. 182; MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Hard 1995, pp. 321-322; MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

Physical and Biological Features for Bull Trout

Within the designated critical habitat areas, the PBFs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the PBFs, as described within USFWS 2010, are essential for the conservation of bull trout. A summary of those PBFs follows.

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 2 °C to 15 °C, with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of non-native predatory (*e.g.*, lake trout, walleye, northern pike, smallmouth bass); interbreeding (*e.g.*, brook trout); or competing (*e.g.*,

brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The revised PBF's are similar to those previously in effect under the 2005 designation. The most significant modification is the addition of a ninth PBF to address the presence of nonnative predatory or competitive fish species. Although this PBF applies to both the freshwater and marine environments, currently no non-native fish species are of concern in the marine environment, though this could change in the future.

Note that only PBFs 2, 3, 4, 5, and 8 apply to marine nearshore waters identified as critical habitat. Also, lakes and reservoirs within the CHUs also contain most of the PBFs necessary to support bull trout, with the exception of those associated with PBFs 1 and 6. Additionally, all except PBF 6 apply to FMO habitat designated as critical habitat.

Critical habitat includes the stream channels within the designated stream reaches and has a lateral extent as defined by the bankfull elevation on one bank to the bankfull elevation on the opposite bank. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. If bankfull elevation is not evident on either bank, the ordinary high-water line must be used to determine the lateral extent of critical habitat. The lateral extent of designated lakes is defined by the perimeter of the waterbody as mapped on standard 1:24,000 scale topographic maps. The Service assumes in many cases this is the full-pool level of the waterbody. In areas where only one side of the waterbody is designated (where only one side is excluded), the mid-line of the waterbody represents the lateral extent of critical habitat.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high-water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced freshwater heads of estuaries. The MHHW line refers to the average of all the higher high-water heights of the two daily tidal levels. Marine critical habitat extends offshore to the depth of 10 meters (m) (33 ft) relative to the mean low low-water (MLLW) line (zero tidal level or average of all the lower low-water heights of the two daily tidal levels). This area between the MHHW line and minus 10 m MLLW line (the average extent of the photic zone) is considered the habitat most consistently used by bull trout in marine waters based on known use, forage fish availability, and ongoing migration studies and captures geological and ecological processes important to maintaining these habitats. This area contains essential foraging habitat and migration corridors such as estuaries, bays, inlets, shallow subtidal areas, and intertidal flats.

Adjacent shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes, and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on PBFs of the aquatic environment.

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to "destroy or adversely modify" critical habitat by no longer serving the intended

conservation role for the species or retaining those PBFs that relate to the ability of the area to at least periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PBFs to such an extent that the conservation value of critical habitat is appreciably reduced (USFWS 2010, pp. 63898:63943; USFWS 2004a, pp. 140-193; USFWS 2004b, pp. 69-114). The Service's evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998, Ch. 4 p. 39). Thus, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Jarbidge River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments. However, we consider all 32 CHUs to contain features or areas essential to the conservation of the bull trout (USFWS 2010, pp. 63898:63901, 63944). Therefore, if a proposed action would alter the PBFs of critical habitat to an extent that appreciably reduces the conservation function of one or more critical habitat units for bull trout, a finding of adverse modification of the entire designated critical habitat area may be warranted (USFWS 2010, pp. 63898:63943).

Current Critical Habitat Condition Rangewide

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (Ratliff and Howell 1992; Schill 1992, p. 40; Thomas 1992, p. 28; Buchanan *et al.* 1997, p. vii; Rieman *et al.* 1997, pp. 15-16; Quigley and Arbelbide 1997, pp. 1176-1177). This condition reflects the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (USFWS 1998a, pp. 31648-31649; USFWS 1999b, p. 17111).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PBFs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: (1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7); (2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45); (3) the introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary *et al.* 1993, p. 857; Rieman *et al.* 2006, pp. 73-76); (4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and (5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

Climate Change on Bull Trout Critical Habitat

One objective of the final rule was to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential PBFs described in PBFs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (*e.g.*, decreased base flows, increased water temperatures) and biologically (*e.g.*, increased competition with non-native fishes).

Many of the PBFs for bull trout may be affected by the presence of toxics and/or increased water temperatures within the environment. The effects will vary greatly depending on a number of factors which include which toxic substance is present, the amount of temperature increase, the likelihood that critical habitat would be affected (probability), and the severity and intensity of any effects that might occur (magnitude).

The ability to assign the effects of gradual global climate change bull trout critical habitat or to a specific location on the ground is beyond our technical capabilities at this time.

ENVIRONMENTAL BASELINE - BULL TROUT AND BULL TROUT CRITICAL HABITAT

Bull trout exist within two portions of the action area:

Clackamas River Core Area: Bull trout have been extirpated from the Clackamas River since the 1960s (Shively *et al.* 2007, p. 9). A reintroduction under section 10(j) of the ESA was initiated in 2011 and continues today with spawning being documented each year since the reintroduction began (Hudson *et al.* 2015, p. 19). Because of the experimental non-essential designation under 10(j) of the ESA, section 7 consultation requirements are differ from an otherwise listed entity. Populations under 10(j) are treated as “proposed” for listing for the purposes of consultation, so no conference is required unless an action under consultation is “likely to jeopardize” as determined by the action agency. No such determination was made. For this reason the Clackamas River Core Area is not included in this consultation and will not be referred to further in this document.

Upper Willamette River Core Area: The Upper Willamette River Core Area is located in the southern portion of the Willamette River Basin in northwestern Oregon and includes the McKenzie and Middle Fork Willamette rivers, and a short section of the mainstem Willamette River. The Upper Willamette River core area contains four local populations, Trail Bridge, McKenzie River, and South Fork McKenzie, and Middle Fork Willamette River. The Middle Fork Willamette River local population occurs upstream of Hills Creek Dam, and includes Hills Creek Reservoir, the Middle Fork Willamette River, and numerous tributaries and springs. The group of bull trout analyzed in this consultation are individuals who are likely members of the South Fork Mckenzie who have survived entrainment through the dams above the PRMP boundary. No bull trout have been seen within this portion of the McKenzie River since the time

of listing but it is believed that a small population (~5-20 fish) may be present, but the exact number is unknown.

Affected Environment

Upper Willamette River Core Area

The local populations that comprise the Upper Willamette Core Area are part of the Coastal RU (evolutionary lineage). Based on genetic data, Spruell *et al.* (2003, p. 21) suggested that among Coastal lineage populations there is a wide amount of variation relative to that observed among other major evolutionary lineages (Snake and Upper Columbia). This may suggest populations (or core areas) within the Coastal RU may offer greater opportunities for conserving genetic diversity than other recovery units, namely the Snake and Upper Columbia RUs (BLM 2016b, p. 276). The Upper Willamette Core Areas essential to bull trout conservation because it provides significant opportunity for genetic diversity and ensures sufficient redundancy in local populations.

Four local populations exist in the Upper Willamette Core Area, one in the Middle Fork Willamette River Subbasin and three in the McKenzie River Subbasin. Three local populations were identified in this core area in the 2002 draft recovery plan, all in the McKenzie River Subbasin (USFWS 2002a). The revised draft recovery plan for the Upper Willamette Core Area (USFWS 2005) included a “potential local population” in the Middle Fork Willamette based on the existence of fry and juvenile fish from the ongoing rehabilitation program initiated by ODFW and the USFS in 1998 (fry transfer program from the McKenzie River). This “potential local population” was deemed a “local population” in 2006 following the documentation of spawning and successful recruitment (USFWS 2008).

The mainstem McKenzie River local population occurs from the mouth to Trail Bridge Dam and extends into portions of the South Fork McKenzie River, Gate Creek, Blue River, Horse Creek, Separation Creek, Deer Creek, Olallie Creek, and Anderson Creek. A total of 170 kilometers (105.6 miles) of stream habitat has been identified as being used by bull trout in the McKenzie River basin downstream of Trail Bridge Dam (Ziller and Taylor 2000). Most of the population occurs upstream of Leaburg Dam. However, since 1995 when color video equipment was added to the dam, greatly facilitating identification of bull trout, from 4 to 28 bull trout (25.4 centimeters [10 inches] and larger) annually have been observed passing through the fish ladder at this site.

The revised draft recovery plan for the Upper Willamette Core Area (USFWS 2005) clarified that the three local populations in the McKenzie River Subbasin were likely a single fluvial (population that travelled freely, migrating throughout a river) population historically and the only reason for the existence of more than one local population in this subbasin was the isolation of bull trout above two dams (Cougar Dam in the South Fork McKenzie and Trail Bridge Dam in the upper McKenzie River - neither with fish passage). Restoring connectivity between these local populations in the McKenzie River would reduce the number of local populations from three to one (USFWS 2015a, pp.60-61).

Bull trout or bull trout critical habitat are found on the Upper Willamette Field Office of the Eugene BLM. This includes portions of 11 6th field sub-watersheds: three class one and eight class two watersheds, all located on the west side of the Cascades (BLM 2016b, p.46).

The BLM manages land encompassing approximately 0.9 mile of stream in the planning area within the bull trout Coastal RU. The 0.9 mile is entirely within the McKenzie River basin. The BLM does not manage any land containing miles or acres of designated CH within the bull trout Klamath RU within the planning area (BLM 2016b, p.194).

The BLM manages land with 0.6 percent of the designated CH for McKenzie Basin bull trout (Tables 3 through 6). There is no BLM ownership of the 1,443.5 acres of bull trout designated CH in Cougar Reservoir in the McKenzie River basin (BLM 2016b, p.207). BLM ownership of this bull trout CH consists of small portions within sections of land within the checkerboard owner ship (see Figure 2).

Table 3. Miles and percentages of McKenzie River basin bull trout distribution by land ownership within the PRMP planning area (BLM 2016b, p.205).

Ownership	Miles of Distribution	Percentage
Total	157.86	100.0%
Other Ownership	156.99	99.45%
BLM	0.87	0.55%

Table 4. Miles, acres and percentages of McKenzie River basin bull trout designated critical habitat by land ownership within the PRMP planning area (BLM 2016b, p.210).

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	120.15	100.0%	1,443.5	100%
Other Ownership	119.31	99.3%	1,443.5	100%
BLM	0.84	0.7%	0.0	0%

Table 5. Acres and percentages by land ownership for the McKenzie River basin bull trout analysis area, within the PRMP planning area (BLM 2016b, p.199).

McKenzie River Basin Land Ownership	Acres	% Acres in Basin	% Acres w/in PRMP Area
McKenzie River Basin bull trout	856,409	100.0%	100.0%
Within RMP for Western Oregon	856,409	100.0%	100.0%
Other Ownership	804,077	93.9%	93.9%
BLM	52,332	6.1%	6.1%

Table 6. Acres and percentages by PRMP land use allocation for bull trout in the McKenzie River basin (BLM 2016b, p.28).

Land Use Allocation	Total Acres	Percent Basin Acres	Percent PRMP Acres
Total McKenzie River	856,409	100.00%	-
Basin acres			
Total PRMP BLM Acres	51,805	6.05%	100.0%
District-Designated Reserve	734	0.09%	1.4%
Harvest Land Base	23,607	2.76%	45.6%
Land Cover District-Designated Reserve	1,656	0.19%	3.2%
Late-Successional Reserve	8,250	0.96%	15.9%
Riparian Reserves	17,559	2.05%	33.9%

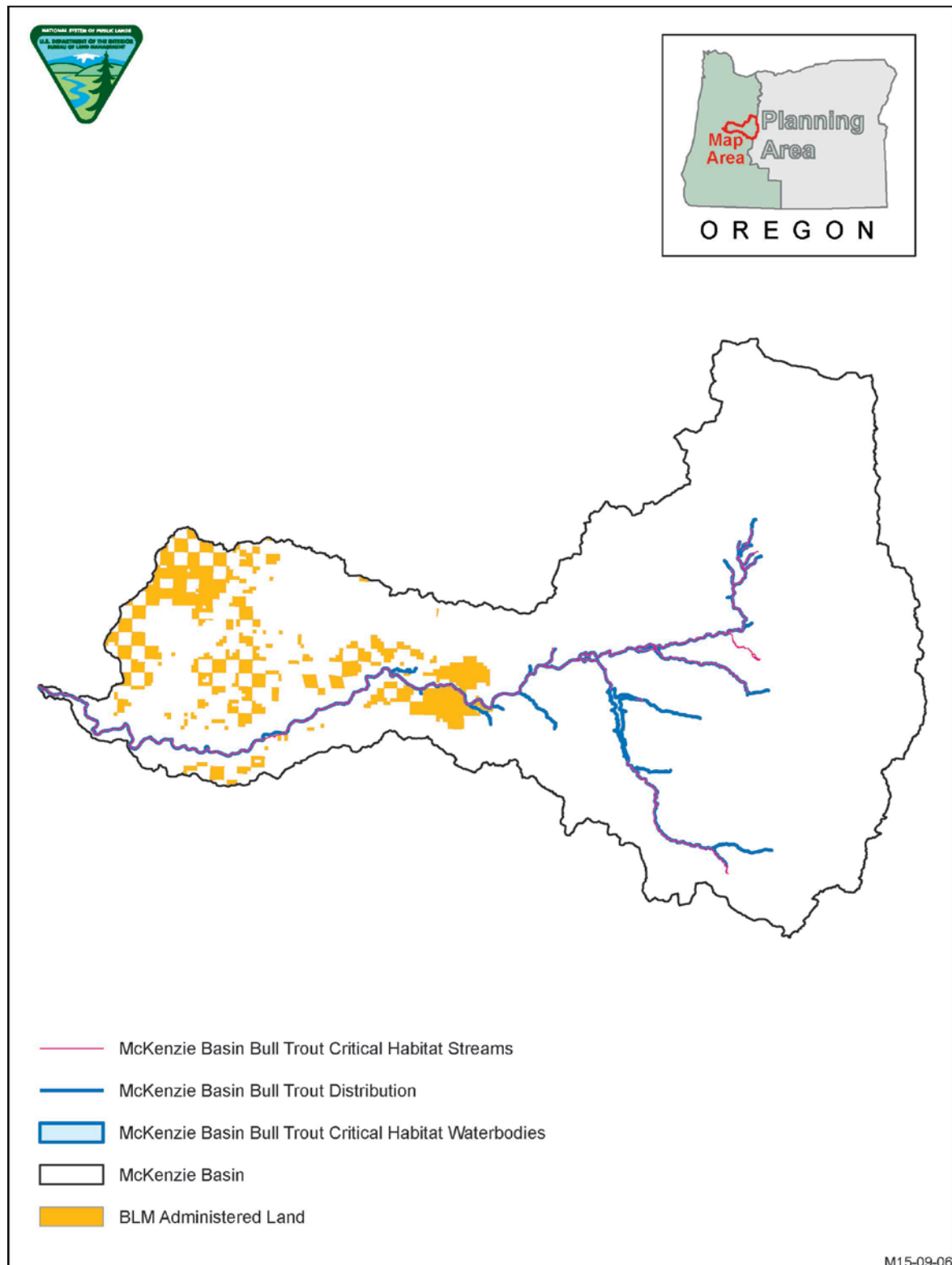


Figure 2. McKenzie River basin bull trout occupancy, designated critical habitat, and BLM land ownership within the planning area (BLM 2016b p. 219).

Existing Condition

Seven-day maximum average water temperatures were generally cooler but did have occasional temperatures that would indicate not properly functioning. However, this may be due to temperatures being taken in a part of the watershed that is outside of bull trout habitat. As such, further site level investigation should be considered. In terms of upslope/riparian conditions, bull trout had the fewest watersheds (37) in the area. Overall scores were above the area average (71 vs 66) and showed a minor increase in the past 20 years (from 69 to 71)(see BLM 2016b, pp. 249-262 for entire habitat analysis).

Within the PRMP planning area, stream physical habitat and upslope/riparian scores were some of the lowest seen in the NWFP area. This is not surprising given the land-use history prevalent to this area prior to the NWFP Aquatic Conservation Strategy (ACS). Initially, the ACS was developed to halt damage in the short-term (0-20 years) and, over the span of several decades (20-100 years), restore ecological process (Reeves *et al.* 2004). Given the diversity of Federal entities, public and private landowners as well as the multiple use mandates of land management agencies, it should be considered successful that these areas have maintained the current condition. So far, the patterns found suggest that the average stream condition physical habitat scores for the PRMP planning area have been largely maintained given that the BLM did not detect a trend in yearly status physical habitat condition (BLM 2016b, p. 262). Further, increases in macroinvertebrate diversity and decreases in water temperatures suggest that we are seeing improvements in these areas. Of the seven aquatic provinces in the NWFP, the WA/OR Coast province showed the largest increase in mean upslope/riparian score over the past 20 years (from 61 to 66). The PRMP planning area results are generally consistent with the larger regional pattern across the entire NWFP area (BLM 2016b, pp. 262-263).

The existing transportation system contributes to a poor environmental baseline condition in several ways. Many miles of roads parallel streams, which has degraded stream bank conditions by encouraging bank armoring with rip rap, degraded floodplain connectivity by adding fill to floodplains, and discharge of untreated or marginally treated stormwater runoff to streams. Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

The McKenzie bull trout basin includes approximately 1,338 square miles and contains 345 road miles (103 miles on BLM land) that fall within 200 feet of a stream. This represents approximately 10 percent of the total road miles (3,503 miles of road), and a road density of about 2.6 miles per square mile within the analysis unit. However, it should be noted that because of the very limited extent of bull trout critical habitat within this basin that most of these miles are quite distant from the bull trout in the McKenzie River.

EFFECTS OF THE ACTION - BULL TROUT AND BULL TROUT CRITICAL HABITAT

Effects to bull trout population indicators

The four bull trout subpopulation indicators (USFWS and NMFS 2004, pp. 19-20) are:

1. Subpopulation Size;
2. Growth and Survival;
3. Life History Diversity and Isolation; and,
4. Persistence and Genetic Integrity.

The distribution of bull trout in the planning area is limited; there are 0.84 miles of bull trout designated critical habitat that occurs adjacent to or within land managed by the BLM, and it is located in the mainstem McKenzie River. The Service has determined that this 0.84 miles is the only occupied bull trout habitat under BLM ownership within the PRMP planning area which is under consultation. The actual number of individual bull trout is unknown, but is considered to be very small; critical habitat in this area is expected to provide for the conservation needs of these localized individuals, but there is no connection from bull trout in this part of critical habitat to any other portion of critical habitat. Any bull trout within this portion of the McKenzie River are fish that have been entrained through the dams above. It represents 0.6 percent of the total bull trout designated critical habitat within the planning area. The proximity of BLM lands to the 0.84 mile of designated occupied habitat does not imply that the effects of BLM activities are restricted to that specific 0.84 mile of designated critical habitat. It is understood that effects may be transmitted downstream for some distance from the initiation point of the effect. The Service typed bull trout occupied habitat associated with BLM lands in the McKenzie River basin as FMO habitat. There is no spawning and rearing habitat.

The summary of the effects to the habitat indicators by PRMP program in Table C33 (Appendix C) reveals that there are adverse effects to several habitat indicators by multiple programs. Effects described below may occur from a sub-set of activities within the PRMP program.

Adverse effects to the Large and Small Wood indicator may occur by implementing actions of the Forest Management, Lands and Realty, Recreation and Visitors Services, and Trails and Travel Management programs. For the Forest Management program, the adverse effect is from yarding corridors and the rare road construction within a Riparian Reserve. For the Lands and Realty program, it is from road construction as a result of a discretionary right-of-way grant. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (BLM 2016b, p. 373). Effects to the Large and Small Wood indicator from the Recreation and Visitors Services program would be from removal of trees from recreation sites and suppression of new trees by trampling, as well as removal of trees from the McKenzie River that are hazardous to boaters. Adverse effects from the Trails and Travel Management program would occur from hiking and public motorized travel trails within Riparian Reserves. Each of these are localized short-term impacts.

Adverse effects to the Sediment/Turbidity/Substrate indicator may occur by implementing actions of 12 PRMP resource programs. The effects of five of the programs (Fisheries, Hydrology, Invasive species, Soil Resources and Wildlife) are from restoration actions that would have localized, short-term adverse effects. With the possible exception of the Wildlife program, there would also be long-term benefits to the indicator that are consistent with the recovery plan for the bull trout. For the remaining six programs (Fire and Fuels, Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, and Trails and Travel Management), effects are anticipated to be localized. Effects would be short-term, and in some cases recurring and short-term (*e.g.*, sediment and turbidity from roads and trails draining to stream channels). Additionally, many programs contain components that may introduce small amounts of sediment, and/or increase turbidity in streams. Many of these cases were determined to be insignificant individually. The Service believes that the overall effects of these actions would remain insignificant even when viewed collectively. This is because these immeasurable changes would take place across a large landscape over a period of many years. Therefore the effects would be separated both spatially and temporally and would be indistinguishable from background influences.

Adverse effects to the Water Temperature indicator may occur by implementing actions of the Fire and Fuels, Recreation and Visitors Services, and Trails and Travel Management Program. These would also be localized effects. Effects from use of pump chances for Fire and Fuels actions would also be short-term.

Adverse effects to the Peak/Base flow indicator may occur by implementing actions of the Fire and Fuels, Forest Management, and the Trails and Travel Management Program. These would be localized effects, as well, and short-term in the case of effects to base flow from use of pump chances.

Adverse effects to the Riparian Reserve Function and Vegetation Diversity indicator may occur by implementing actions of 10 PRMP programs. The effects of five of the programs (Fisheries, Hydrology, Invasive Species, Soil Resources and Wildlife) are from restoration actions that would have localized, short-term adverse effects and long-term benefits that are consistent with the bull trout recovery plan to the indicator. For the remaining five programs (Fire and Fuels, Forest Management, Lands and Realty, Recreation and Visitors Services, and Trails and Travel Management), effects are anticipated to be localized.

Adverse effects to the Chemical Contamination/Nutrients indicator may occur by implementing actions of four PRMP programs in the McKenzie River basin. While Table C21 (Appendix C) indicates an adverse effect from the Mineral Program, it is not applicable to bull trout because the effects are specifically for methylmercury contamination as a result of suction dredge mining, which does not take place within the McKenzie River basin within BLM ownership. The potential effects of the Invasive Species program are from chemicals used to kill invasive plants. Potential effects attributed to Forest Management are from petroleum product contamination from heavy equipment use during culvert replacements in streams. For the Recreation and Visitors Services, and Trails and Travel Management programs, adverse effects may occur from use and maintenance of treated wood on trails and structures. Additionally adverse effects will occur where segments of existing paved roads which are located within 200 feet of a stream

introduce contaminants through stormwater runoff. These effects are localized, and with the exception of effects from treated wood, are short-term. Treated wood products have the potential to leach chemicals into streams especially when exposed to environmental elements such as precipitation. Where treated wood is used adjacent to, or above streams a negative effect to the Chemical Contamination and Nutrient indicator would be anticipated.

Adverse effects to the Roads within Riparian Reserves indicator may occur from implementing the Lands and Realty, and Recreation and Visitors Services programs. Effects would be localized.

Direct effects to the species resulting in injury or death or disturbance may occur when implementing actions for several PRMP programs. The effects include:

- Injury and mortality may occur from increased sediment, turbidity and chemical contamination which are introduced through non-commercial use of the existing BLM road system. Increases in sediment and turbidity are likely to occur from road use particularly on segments of native surface roads that are located within 200 feet of streams. Chemical contamination is likely to occur when segments of paved roads are located within 200 feet of streams and stormwater runoff from these sections are introduced into streams.
- Temporary displacement in response to physical disturbance by recreationists, individuals during surveys for restoration actions, individuals placing salmon carcasses, and during the set-up and use of yarding corridors across streams.
- Temporary displacement due to short-term turbidity from a variety of actions.
- The potential to be injured or killed by: impingement on water drafting pump screens, heavy equipment during instream restoration activities or fish passage culvert replacements, handling during fish salvage in support of instream restoration or fish passage culvert replacements, being stranded when stream reaches are dewatered for a restoration project, when capturing bull trout during projects to remove non-native fish species, stress in response to localized water temperature increases, increased risk of predation because fine sediment has reduced interstitial spaces in substrate, recreationists stepping on gravels containing juveniles. While this potential exists the Management Direction, Project Design Criteria, and Conservation Measures from ARBO II (USFWS 2013, pp. 7-70), which would be implemented under the PRMP, would greatly reduce these risks, some examples include:
 - For the dewatering of a work site to remove or install culverts, bridge abutments etc. if ESA-listed fish may be present, a fish screen must be used on the pump intake to avoid juvenile fish entrainment that meets criteria specified by NMFS (USFWS 2013, p. 19).
 - Bull trout must not be handled when water temperatures exceed 15°. Nets, hands, etc. must be free of insect repellent, sunscreen or any other substance that might harm fish. Ice packs will be used to keep capture water <15°. If using MS 222, the formulation should be buffered (USFWS 2013, p. 18).

There would not be meaningfully measured effects to the Subpopulation Size or Growth and Survival indicators for the following reasons:

- Exposure of bull trout to adverse effects of BLM activities in the basin is very limited. There are only 0.84 miles of designated critical habitat in the mainstem McKenzie River adjacent to BLM land.
- Most of the adverse effects are short-term and localized allowing for populations to recover from the effects in a relatively short time.
- BLM activities will be distributed in time and space, and only a sub-set may affect habitat occupied by bull trout.
- The Service has typed bull trout occupied habitat associated with BLM lands in the McKenzie River basin as FMO habitat. There is no spawning and rearing habitat where impacts could be much more severe because eggs in redds are not able to move away from disturbance.
- While there is the potential for disturbance, injury or death to individual bull trout from a sub-set of actions, the exposure of individual bull trout to these actions is limited because of the small number of fish that are likely to be present and the limited amount of habitat that could potentially be exposed to the proposed actions.

Therefore, the Service does not anticipate that implementation of the PRMP will affect the distribution of the bull trout because we anticipate this stretch of occupied habitat will remain occupied due to the conservation measures included in the PRMP, as noted in Appendix C. The PRMP could affect the numbers in this sub-population, but we do not expect there to be any meaningful reduction in numbers since the occupied habitat is sparsely populated and many of the anticipated effects are expected to be sub-lethal, even in concert with each other. Reproduction will not be affected as we do not believe there is any spawning habitat in the action area to be impacted.

There is no mechanism of the action to affect migratory corridors/connectivity (barriers) between subpopulations, so there would be no effect to the Life History and Isolation, and Persistence and Genetic Integrity indicators.

Summary of effects to bull trout population characteristics

There would be insignificant effects to the Subpopulation Size or Growth and Survival indicators. Exposure of bull trout to these adverse effects to indicators and to direct effects is very limited due to bull trout distribution with respect to BLM land ownership. Most negative effects are short-term and localized allowing for rapid recovery of individuals, actions will be distributed in time and space, and BLM activities will not affect habitat typed as spawning or rearing, the most limiting and vulnerable habitat within the McKenzie River basin. There would be no effect to the Life History and Isolation, and Persistence and Genetic Integrity indicators because there is no (no effect) mechanism of the action to affect migratory corridors/connectivity between subpopulations.

Therefore, we do not expect any reduction in distribution of the species or reproduction. The PRMP could affect the numbers in this sub-population, but we do not expect there to be any meaningful reduction in numbers since the occupied habitat is sparsely populated and many of the anticipated effects are expected to be sub-lethal, even in concert with each other.

Specific effects to bull trout and bull trout critical habitat

For the purposes of consultation only those populations within the McKenzie River are likely to be affected by the proposed action. Direct and indirect effects could occur to individual bull trout from the South Fork McKenzie local population.

To summarize the previous discussion of effects, the Service will display the overall effect determination of implementing the PRMP on bull trout and bull trout critical habitat by program area. The Service chooses to analyze effects to bull trout and their critical habitat by utilizing the PBFs of bull trout critical habitat as the pertinent habitat metrics. These PBF's represent those conditions necessary for bull trout to survive, thrive and recover.

There is no spawning habitat within the action area administered by the BLM. All habitat under management of the PRMP is FMO habitat. Therefore, portions of the PBF's that deal with spawning will not be applicable. Effects of the action are likely limited to juveniles, sub-adults and adults that have entered this habitat through entrainment from the dams system located upstream.

The basic PBF's for bull trout and their critical habitat are listed below. For a more detailed description please see the Status of Bull Trout Critical Habitat section within this BO.

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 36 °F to 59 °F (2 °C to 15 °C), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of non-native predatory (*e.g.*, lake trout, walleye, northern pike, smallmouth bass); interbreeding (*e.g.*, brook trout); or competing (*e.g.*, brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Below is a summary of the effects to bull trout and bull trout critical habitat (Table 7).

Table 7. Summary of effects to bull trout and bull trout critical habitat.

PRMP Program	Indicator Determination from Table C33 (Appendix C)	Effects Determination
1. Cultural Resources and Paleontological Resources	Insignificant	NLAA
2. Fire and Fuels	Adverse	LAA
3. Fisheries, Hydrology, Invasive Species, Soils and Wildlife	Adverse	LAA
4. Forest Management	Adverse	LAA
5. Lands and Realty	Adverse	LAA
6. Livestock grazing ¹	Adverse	No Effect
7. Minerals ²	Adverse	NLAA
8. Paleontological Resources	Insignificant	NLAA
9. Recreation & Visitors Services	Adverse	LAA
10. Special Forest Products	No Effect	No Effect
11. Sustainable Energy ³	Adverse	NLAA
12. Trails & Travel Management	Adverse	LAA
13. Wild Horses	No Effect	No Effect
¹ No livestock grazing occurs on BLM land within the McKenzie basin		
² No mining occurs in the McKenzie basin, insignificant effects from rock quarry operations may occur		

Cultural Resources and Paleontological Resources

Table 8 displays the PBF's for bull trout and their critical habitat within the action area, and summarizes the effects of the Cultural and Paleontological Resources program. The Service has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as FMO habitat. There is no spawning and rearing habitat. The Service evaluates the rearing and migratory PBF's in the context of FMO use. That is the approach taken in the table below.

Table 8. Summary of effects from Cultural Resources and Paleontological Resources programs on the PBF's of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Insignificant. There would be insignificant effects to large wood debris/small woody debris (LWD/SWD) recruitment, and to near stream riparian vegetation. Channel morphology would not be measurably affected. There would be discountable effects to peak/base flows.
	Food base	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Substrate	There will be an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles.
	Water quality	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows. Little to no vegetation that provides shade to stream channels would be removed during site excavations, resulting in immeasurable effects to water temperature.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
	Natural hydrograph	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Migration	Minimal physical, biological or water quality impediments	Insignificant. There is no causal mechanism to affect physical barriers (such as culverts). The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity that would affect bull trout migration. There is no causal mechanism to introduce chemicals or nutrients to stream flows that would cause a water quality impediment. Little to no vegetation that provides shade to stream channels would be removed during site excavations, resulting in immeasurable effects to water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms (no effect) of the action to affect occurrence of non-native predatory fish species or competing fish species.

Based on the matrix displayed above Cultural and Paleontological programs “*may affect, but are not likely to adversely affect*” bull trout or bull trout critical habit. In addition, and by definition, there will be no activities that result in injury, death or disturbance to listed fish. The main effect expected from this program would be minor increases in sediment and turbidity that would not reduce foraging, or measurably reduce habitat quality. The minor increases will be highly localized and would not diminish the conservation value of the critical habitat PBF’s to provide for survival or recovery of bull trout. There would be no direct effects to individual bull trout from these programs.

Fire and Fuels Program

Table 9 displays the PBF’s for bull trout that apply to the action area, and summarizes the effects of the Fire and Fuels Program. The Service evaluates the rearing and migratory PBF’s in the context of FMO use. That is the approach taken in the table below.

Overall, the Fire and Fuels program “*may affect and is likely to adversely affect*” bull trout and bull trout critical habitat. Prescribed burning could increase fine sediment input through overland flows into streams. Fuels treatment could reduce the ability of large and small wood from acting to filter sediments, (PBF 8) and reduce wood recruitment into streams. Meaningful increases in sediment and turbidity (including increased nitrogen and phosphorus) (PBF 8) would reduce foraging opportunities (PBF 3) for bull trout through reduced vision and reductions in prey species. Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout (PBF 3 and PBF 6). Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing significant changes in normal behavior. However, we do not anticipate this resource program would diminish the conservation value of

the critical habitat within the action area because those effects that are adverse are expected to be short-term in nature (as noted in the table). Also, the long term intent of this program is to reduce the risk of catastrophic wildfire which would negatively impact bull trout; thus, this program should provide a long term benefit to bull trout conservation. Direct effects to individual bull trout from pursuit, capture or handling are not anticipated from this program.

Table 9. Summary of effects from Fire and Fuels program on the PBF's of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Insignificant. There would be insignificant effects to LWD/SWD recruitment, and to near stream riparian vegetation. Channel morphology would not be measurably affected. The flow regime would not be measurably affected.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity and nutrients (phosphorus/nitrogen). Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to water temperature.
	Water quantity	Insignificant. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PBF.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Rearing	Natural hydrograph	Discountable. Analysis of peak/base flow indicator determined that It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of 6 th field sub-watersheds or larger.
Migration	Minimal physical, biological or water quality impediments	Insignificant. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration. There would be an immeasurable negative effect to water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PBF's of designated critical habitat are habitat restoration actions. In addition to the short-term negative effects to the PBF's described above, habitat restoration actions have long-term benefits to these PBF's. The ARBO II (USFWS 2013) described effects to PBF's by presenting tables that were cross-walks between the Service's MPI indicators and the elements. The rationale for an overall effect determination of LAA to bull trout and bull trout critical habitat was based upon the outcomes for effects to the MPI indicators and the cross-walk.

The Service's ARBO II (USFWS 2013) listed the bull trout PBF's through identification of the bull trout critical habitat PBFs. A table was used to identify the cross-walk between the elements and pathways/indicators of the Service's MPI (USFWS 1998b)(see Table 10), and also described the effects to the PBF's in a narrative. A modified reproduction of Table 25 from that document follows:

Overall the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs *may affect and are likely to adversely affect* bull trout and bull trout critical habitat. The main negative effect is from increases in sedimentation and turbidity (PBF 8) from construction activities including culvert replacements, tree tipping and terrestrial habitat enhancement. There could be a loss of the ability of some streamside vegetation to filter sediment (PBF 4) in localized areas. Meaningful increases in sediment and turbidity would reduce foraging opportunities (PBF 3) for

bull trout through reduced vision and reductions in prey species. Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout (PBF 3). Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing changes in normal behavior. Best management practices, however, will be implemented so as to minimize these adverse impacts to the PBFs such that we do not anticipate this resource program would diminish the conservation value of the critical habitat within the action area.

Direct effects to individual bull trout would occur during work site isolation through pursuit, capture and handling. Disturbance, physical injury and mortality are all likely to occur to some degree depending on site-specific conditions.

Table 10. Effects to PBF's from restoration activities of ARBO II (after Table 26 in USFWS (2013)).

MPI Indicators	Construction Activities ¹	Instream Activities ²	Vegetation Treatments ³	Other Projects ⁴	Effects Determination
Floodplain connectivity	-S	-I	N	N	LAA
Change in peak/base flows	-S	-I	-S	N	
Physical barriers	B	N	N	N	LAA
Chemical contaminants/ nutrients, temperature	-S	-I	-S	B	
Change in peak/base flows	-S	-I	-S	N	
All	-S	-I	-S	N	LAA
Large wood, pool frequency and quality, large pools, off channel habitat, refugia	N	B	-S	N	LAA
Wetted width/ maximum depth ratio, streambank condition, floodplain connectivity	N	B	N	N	
Temperature	N	N	-I	N	NLAA
Sediment	-S	-I	-S	N	LAA
Substrate embeddedness	-S	-I	-S	N	
Change in peak/base flows	-S	N	-S	N	LAA
Chemical contaminants / nutrients	-S	N	-S	B	LAA

MPI Indicators	Construction Activities ¹	Instream Activities ²	Vegetation Treatments ³	Other Projects ⁴	Effects Determination
Life History Diversity and Isolation, Persistence and Genetic Integrity	B	N	N	N	NLAA
Overall Effects Determination: LAA					

Footnotes for Table 10

Key: -S = negative effects significant magnitude, -I =negative effects insignificant magnitude or duration, N = neutral effect, B = beneficial effect	Overall Effects Determination LAA

Forest Management

Table 11 displays the PBF's for bull trout and their critical habitat that apply to the action area, and summarizes the effects of the Forest Management program.

Table 11. Summary of effects from Forest Management program on the PBF's of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect.
Rearing	Complex aquatic environments and processes	Insignificant. There would be a small but measurable effect to LWD/SWD recruitment from the rare new road construction within Riparian Reserves. However, this would not occur adjacent to streams with designated CH. Channel morphology would not be measurably affected. There would be an insignificant effect to the flow regime from an increase in base flows in some small catchments that may not be detectable where designated CH is present.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Rearing	Water quality	Adverse. There would be short-term, localized increases in turbidity. The risk of chemical contamination from petroleum products use by heavy equipment is extremely low, as there are no culverts that would be replaced in a stream with designated CH. Model results indicate there are no miles of stream susceptible to water temperature increases as a result of thinning or road construction in the outer zone of Riparian Reserves on fish-bearing or perennial streams in the McKenzie River basin.
	Water quantity	Insignificant and positive. Model results indicate that there are no sub-watersheds with BLM land ownership in the McKenzie River basin that are susceptible to a detectable change in peak flow response. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PBF.
	Natural hydrograph	It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of Forest Management actions under the PRMP. This may not be detectable where designated CH is present, but may be a beneficial effect to the PBF. Beneficial. See analysis above for water quantity.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Migration	Minimal physical, biological or water quality impediments	Insignificant. There are no culvert barriers for bull trout on BLM land. Turbidity increases should not measurably affect migration. The risk of chemical contamination from heavy equipment is extremely low, as there are no culverts that would be replaced in a stream with designated CH. Model results indicate there are no miles of stream susceptible to water temperature increases as a result of thinning the outer zone of Riparian Reserves on fish-bearing or perennial streams in the McKenzie River basin. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PBF.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

Based on the matrix displayed above the Forest Management program “*may affect, and is likely to adversely affect*” bull trout and bull trout critical habitat. Many of the suites of Forest Management program activities would increase fine sediment and turbidity to streams (PBF 8). Meaningful increases in sediment and turbidity could reduce foraging opportunities PBF 3 for bull trout through reduced vision and reductions in prey species. Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout (PBF 3). Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing significant changes in normal behavior. There is potential contamination of streams from spills of petroleum products and antifreeze from equipment used in this program that could affect water quality (PBF 8). Direct effects to bull trout from pursuit, capture or handling would not be anticipated from the PE contained within this program. Due to the short-term nature of these effects we do not anticipate this resource program would diminish the conservation value of the critical habitat within the action area.

Lands and Realty

Table 12 displays the PBF’s for bull trout and bull trout critical habitat that apply to the action area, and summarizes the effects of the Lands and Realty program. Note that the PBF’s analysis

below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to an occupied stream or critical habitat. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (BLM 2016b, p.373).

The Service evaluates the rearing and migratory PBF's in the context of FMO use. That is the approach taken in the table below.

Table 12. Summary of effects from Lands and Realty program on the PBF's of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Adverse. There would be measurable negative effects to LWD/SWD recruitment and to near stream riparian vegetation, dependent upon the specific location of the right-of-way. Channel morphology would not be measurably affected. The flow regime would not be measurably affected.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Measurable negative (adverse). It is a result of short-term, localized increases in turbidity). There would be immeasurable negative (insignificant) effects to water temperature and to chemical contamination.
	Water quantity	Insignificant. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6 th field watersheds.
Rearing	Natural hydrograph	Insignificant. Analysis of peak/base flow indicator determined that short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6 th field watersheds.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Migration	Minimal physical, biological or water quality impediments	Insignificant. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration. There would be immeasurable negative (insignificant) effects to water temperature and to chemical contamination.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

Based on the matrix displayed above the Lands and Realty program *may affect, and is likely to adversely affect* bull trout and bull trout critical habitat. Complexity of habitat could be compromised (PBF 4) through the reduction in recruitment of large and small wood into streams. This could reduce the number and frequency of pools in the immediate area affected by the project, and could reduce the ability of bull trout to hide while foraging (PBF 3), or as hiding cover for sub-adults (PBFs 4 and 6). Meaningful increases in sediment and turbidity would reduce foraging opportunities (PBF 3) for bull trout through reduced vision and reductions in prey species. Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout (PBF 3). Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing significant changes in normal behavior. Direct effects to individual bull trout from pursuit, capture or handling are not anticipated from this program. Due to the short-term nature of these effects, we do not anticipate this resource program would diminish the conservation value of the critical habitat within the action area. The reductions in potential large-wood delivered to the streams would be tempered by the management of riparian reserves under the PRMP which is designed to contribute large wood into streams. Any reduction in large wood recruitment would be on an extremely limited scale.

Minerals

There are no mining claims on BLM land in the McKenzie River basin according to a search of a BLM GIS layer. Eugene BLM District Fish biologist Brett Blundon states that he has not seen any suction dredges in the mainstem McKenzie River that has the only bull trout occupied habitat in the basin (Blundon 2016, pers. comm.). Consequently, we do not anticipate any effects to the PBF's for bull trout or their critical habitat from suction dredge gold mining on BLM land in the McKenzie River basin.

The use of rock quarries may occur in the McKenzie basin and could contribute minor amounts of sediment to the occupied bull trout habitat. However, these increases are likely to be very

small and immeasurable because any rock sources are located upland and distant from bull trout or their critical habitat. Thus introduction of sediment from the minerals program is considered insignificant. Therefore the Mineral Program “*may affect, but is not likely to adversely affect*” bull trout or bull trout critical habitat.

Recreation and Visitors Services

Table 13 displays the PBFs for bull trout and bull trout critical habitat that apply to the action area, and summarizes the effects of the Recreation and Visitors Services program. Since there is no spawning and rearing habitat the Service evaluates the rearing and migratory PBF’s in the context of FMO use. That is the approach taken in the table below.

Table 13. Summary of effects from Recreation and Visitors Services program on the PBF’s of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect.
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Adverse. There would be a small, localized adverse effect as a result of removal of in-channel trees that are a hazard to boaters, and hazard trees that may fall into stream channels.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Rearing		Insignificant. There is potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, at the viewing platform at the Silver Creek boat landing Watchable Wildlife site. There is also a small bridge crossing at Silver Creek at that location. However, the mainstem river flow has high volume at that location and the dilution factor would result in immeasurable effects. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to overwintering use and as foraging habitat. There is a discountable probability that vegetation loss at BLM campgrounds, day use sites, boat ramps or trails from vegetation trampling would result in a water temperature increase of the mainstem McKenzie River.
	Water quality	
	Water quantity	Insignificant effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
	Natural hydrograph	Insignificant effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
Migration	Minimal physical, biological or water quality impediments	Insignificant. There is no causal mechanism in the action to create or mitigate physical barriers. Short-term, localized turbidity increases should not measurably affect migration. There is a discountable probability that vegetation loss at BLM campgrounds, day use sites, boat ramps or trails from vegetation trampling would result in a water temperature increase of the mainstem McKenzie River. There is potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, at the viewing platform at the Silver Creek boat landing Watchable Wildlife site. There is also a small bridge crossing at Silver Creek at that location. However, the mainstem river flow has high volume at that location and the dilution factor would result in immeasurable effects.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms (no effect) of the action to affect occurrence of non-native predatory fish species or competing fish species.

Based on the analysis displayed above the Recreation and Visitors Services program “*may affect and is likely to adversely affect*” bull trout and bull trout critical habitat. Complexity of habitat could be compromised (PBF 4) through the removal of logs and root wads from the mainstem McKenzie River that are considered to be hazards to navigations. This would reduce the ability of bull trout to hide while foraging (PBF 3), or as hiding cover for sub-adults (PBFs 4 and 6). Meaningful increases in sediment and turbidity would reduce foraging opportunities (PBF 3) for bull trout through reduced vision and reductions in prey species. Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout. Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing significant changes in normal behavior. Direct effects to individual bull trout from pursuit, capture or handling are not anticipated under this program. As noted in the table, the level of effects and the short-term nature of these effects informs our conclusion that we do not expect this resource program to diminish the conservation value of the critical habitat within the action area.

Swimming, boating and Other Water-Based Activities. Recreationists using streams may interact with rearing or spawning fish when they are in the water, for example, wading, swimming, or boating. Under the proposed action, BLM provides the opportunity for recreationists to access the land and use the streams, and by maintaining recreational facilities the proposed action does concentrate public access at these locations. These locations include campgrounds and boat ramps, as well as other recreation sites. Disturbance by recreationists may cause rearing fish to leave cover and become more susceptible to predation. Disturbance of adults at the spawning sites may delay some spawning. BLM identified recreation facilities within a site-potential tree distance (216 feet) of occupied habitat or critical habitat for ESA-listed species (see Appendix C, p. 733). These facilities concentrate recreationists and represent the likely and most predictable areas where disturbance may occur. Although these sites may concentrate the disturbance, this may limit the disturbance area to the immediate site. These activities are fairly concentrated in the McKenzie bull trout area where several of these facilities occur within a relatively short distance within one site potential tree height of critical habitat. Although the potential for increased predation and spawning delay may occasionally occur, disturbance by recreationists is expected to be of a minor nature due to the limited number of bull trout within the action area.

However, it is possible that some degree of adverse effects (albeit small in number) will occur to bull trout from these activities. However, the very limited number of bull trout likely to be present adjacent to BLM recreational facilities located on the McKenzie River makes it extremely unlikely that these adverse effects would rise to a level that would cause mortality or

injury. The small amount of the McKenzie River under BLM ownership also limits the extent of any adverse effects as any individual bull trout that might be affected can easily flee to areas outside of the recreational influence.

Special Forest Products

The BLM has determined that the Special Forest Products resource program will have no effect on listed fish and their critical habitats (Hardt 2016, pers. comm.). Therefore, we are not consulting on the effects of that program on the listed bull trout and their critical habitats.

Sustainable Energy

Note that the effects analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. Adverse effects are attributed to winter haul.

However, as noted in the BLM's write-up (BLM 2016a, p. 152), the rarity of past requests for biomass feedstock and the lack of biomass processing infrastructure in the planning area, the Service believes this action is extremely unlikely to occur which renders the effects to species and critical habitats discountable, which is *not likely to adversely affect* the species included in this consultation. The Service concurs that the history of this practice and the operational capacity for it to occur are telling for its future likelihood, and so we concur with the BLM's determination.

Trails and Travel Management

Table 14 displays the PBF's for bull trout and their critical habitat that apply to the ESA action area, and summarizes the effects of the Trails and Travel Management program. The Service evaluates the rearing and migratory PBF's in the context of FMO use. That is the approach taken in the table below.

Table 14. Summary of effects from Trails and Travel Management program on the PBF's of bull trout and their critical habitat.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect.

Physical and Biological Features		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Rearing	Complex aquatic environments and processes	Adverse. There would be a small but measurable effect to LWD/SWD recruitment. Channel morphology would not be measurably affected. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use. The BLM does not have any trail crossings with treated wood, so there is no risk of chemical contamination.
	Water quantity	Insignificant. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Natural hydrograph	Insignificant. See above for Water Quantity.
Migration	Minimal physical, biological or water quality impediments	Insignificant. There are no culvert barriers for bull trout on hiking or public motorized travel trails. Slight increases in turbidity should not measurably affect migration. Any water temperature increases for short sections of stream are unlikely to occur in streams that are designated CH.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

Based on the above analysis the Trails and Travel Management program “*may affect and is likely to adversely affect*” bull trout and bull trout critical habitat. Stream complexity (PBF 4) would be reduced by limiting recruitment of large and small wood. Meaningful increases in sediment and turbidity would reduce foraging opportunities (PBF 3) for bull trout through reduced vision and reductions in prey species (PBF 3). Increased sedimentation in interstitial spaces between cobbles would reduce hiding cover for bull trout (PBF 8). Decreased water quality (PBF 8) from this program could cause bull trout to flee the affected area causing significant changes in normal behavior. The Service does not anticipate that direct effects to bull trout will occur from pursuit, capture or handling under this program. However, injury and mortality may occur from increased sediment, turbidity and chemical contamination which are introduced through non-commercial use of the existing BLM road system. Increases in sediment and turbidity are likely to occur from road use particularly on segments of native surface roads that are located within 200 feet of streams. Chemical contamination may occur when segments of paved or hard surfaced aggregate roads are located within 200 feet of streams and stormwater from these sections are introduced into streams.

It is impossible to predict the exact level of road use within the McKenzie bull trout basin. As stated previously, the McKenzie bull trout basin contains approximately 345 miles of road (103 miles on BLM land) that occurs within 200 feet of streams within the action area. The Service does not have information on the exact number of road miles within the entire action area that fall within 200 feet of streams. However, based on the percentages of the miles of BLM roads in the McKenzie bull trout basin compared to the miles of roads on BLM land within the entire action area, this represents approximately 1.7 percent of the total miles of road that are likely to contribute sediment, turbidity or contaminants from road use and stormwater runoff. The Service anticipates this road use within 200 feet of streams within the action area could cause the lethal or sub-lethal injury of bull trout associated with these increasing numbers of visitors by decade. We believe ongoing non-commercial road use will cause sub-lethal effects resulting in decreased fitness to bull trout. Pulses of sediment from roads and increased turbidity from stormwater may disturb bull trout causing them to flee and disrupt normal behavior. This species requires high water quality to thrive. There is very limited distribution of bull trout within the McKenzie basin; only individuals entrained through the dams higher in the system are likely to be present. Even though the extent of habitat is limited and the number of individual bull trout is small, the Service anticipates that use of the existing road system may result in sub-lethal injury of the bull trout in the McKenzie basin from non-commercial road use within the action area.

Effects to Limiting Factors for Bull Trout

McKenzie River basin bull trout

The final bull trout recovery plan (USFWS 2015a) identifies the following habitat threats in the Upper Willamette River Core Area (including the McKenzie River basin): loss of pool habitat, instream structure, cover, and floodplain connectivity and increases in temperature due to historical wood removal and riparian harvest. All have been cited as limiting ecological function and biological productivity. The recovery plan states that restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade, and

diverse allochthonous inputs; and reducing fine sediment and water quality impacts from roads and recreational development. The effects of implementing the PRMP to McKenzie River Basin bull trout Limiting Factors based upon the information above are evaluated in Table 15.

Table 15. Effects to limiting factors for McKenzie River basin bull trout.

Limiting Factor Category	Analysis
Lack of habitat complexity, instream structure and cover resulting from loss of pools, lack of LWD and its recruitment.	There would be a beneficial effect to habitat complexity, instream structure and cover in the short and long-term under the PRMP within habitat occupied by McKenzie River basin bull trout. This is a result of wood recruitment from the tree-tipping requirement of the Forest Management program, the lack of impact to existing trees in the RR outer zone that would qualify at the time of thinning as LWD, the accelerated growth of trees in the RR outer zone after thinning into the LWD category, natural growth of trees in the RR over the next 100 years into the Mature and Structurally complex successional stages and instream large wood placement for habitat restoration projects. The structure and function of Riparian Reserves that results in instream habitat complexity, structure and cover would be protected by the Riparian Reserve designation and its management direction.

Limiting Factor Category	Analysis
Degradation of water quality (including water temperature) and degradation of instream habitat from sediment.	It is unlikely that water temperature may be measurably affected by implementing the PRMP in the McKenzie River basin. Any use of pump changes would not result in a measurable water temperature increase in waters occupied by bull trout or where there is designated critical habitat (in the mainstem McKenzie River). Recreation developments are located on the mainstem McKenzie River where their impacts are minimized due to water volume and shade loss from vegetation at these developments would not result in measurable increases in water temperature. Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Invasive Plant Control (chemical treatments) and Recreation & Visitors Services (use of treated wood under certain conditions). Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management. There would be short-term adverse effects as a result of fine sediments on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable Energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages.

Limiting Factor Category	Analysis
Floodplain connectivity	Floodplain connectivity of the mainstem McKenzie River (where there is the only occupied habitat adjacent to BLM land) would not be affected by PRMP activities. Elsewhere on tributary streams, there is very little occupied bull trout habitat near BLM land. Activities within Riparian Reserves may occur within floodplains for several programs. However, very limited actions would occur within the inner zones. Short-term adverse effects to floodplain connectivity were identified for a sub-set of habitat restoration projects and for possible discretionary right-of-way road construction for the Lands and Realty program.
Diverse allochthonous inputs	PRMP activities are very limited within RR inner zones. There would not be measurable negative effects to allochthonous inputs.

Effects to Bull Trout from Non-Federal Lands within the Action Area

There are non-federal lands within the McKenzie basin that can only be accessed by traveling on a BLM managed road. Because non-federal actions on these parcels are dependent on a BLM road, any future non-federal actions that are reasonably foreseeable on those parcels are considered indirect effects of the proposed action. The McKenzie watershed is accessed by Oregon State Highway 126 which is not managed by the BLM. BLM ownership within the watershed is about 16 percent, with the majority of the checkerboard lands occurring higher up in the watershed and away from the river. Near the river where the bull trout potentially reside, BLM lands are relatively sparse and non-federal lands are generally not dependent on BLM managed roads for access due to land ownership patterns (see Table 3).

As stated in the Description of the Proposed Action, the Service considered all non-federal lands within ½ mile of BLM lands to be within the action area. Any private timber land within the non-federal portion of the action area is likely to be harvested on a 40 year clear-cut harvest rotation (BLM 2015c, p. 31). Timber harvest schedules and rotations are proprietary information and are not disclosed to the BLM or the Service, but these activities often fluctuate along with timber market prices. The historic and current regimen of timber harvest on these private lands has contributed to the existing baseline conditions of the action area, and it is reasonable to expect that the effects of these actions on private land will continue at the same general rate and have the same general effects to bull trout into the future, which includes the conditions that currently support the bull trout population in the action area.

CONCLUSION

Based on the analysis of effects from implementation of the programs described within the PRMP to bull trout, bull trout critical habitat PBF's, and limiting factors to bull trout recovery, combined with the Cumulative Effects, the Service believes that this action will not jeopardize the bull trout, nor will it result in the adverse modification of bull trout habitat. Implementation of the PRMP is expected to have adverse effects to bull trout over the short term and beneficial effects to recovery of bull trout over the long term.

The Service concludes that the implementation of the BLM's PRMP will not jeopardize the continued existence of bull trout because:

- The riparian and aquatic ecosystems managed by BLM under the direction of the PRMP are expected to improve due to increases in stream shading, inputs of large wood and improvements in water quality (both temperature and turbidity). These improvements are expected to result from management of the Riparian Reserves to produce large wood for streams, implementation of aquatic habitat restoration activities such as tree tipping, implementation of ARBOII standards for culverts, crossings and restoration projects, application of BMPs to meet water quality standards, and the potential reduction in road densities within the McKenzie basin due to road decommissioning.
- Although there will be adverse effects to individual bull trout within the McKenzie River basin, these effects will be of short duration, will be limited in scope and magnitude, and will occur over a wide landscape and a long timeframe. Additionally, the number and distribution of bull trout within portions of the McKenzie River that are adjacent to BLM ownership are extremely limited and are not expected to be permanently decreased by the PRMP.
- Although individual programs implemented under the PRMP could cause disturbance, injury, or death to individual bull trout, these individuals are a very small subset of individual bull trout of the larger Southfork McKenzie local population which is predominantly located on Forest Service lands and which will continue to exist upstream of the action area.
- Any individuals that may be adversely affected would be those that have been isolated by the extensive system of dams above the action area, and have been entrained through the dam system and survived. These dams act as a total barrier to upstream passage, and prevent these individuals from contributing to the genetic diversity of the local population. This lower portion of the local population is not self-sustaining because there is no spawning habitat available within the area they occupy.

Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the PBFs essential to the conservation of a species or that preclude or significantly delay development of such features. Based on the analysis of effects from implementation of the programs described within the PRMP to bull trout critical habitat and limiting factors to bull trout recovery, the Service believes that this action will not result in the destruction or adverse modification of bull trout critical habitat. Overall, implementation of the PRMP is expected to have adverse effects to bull trout critical habitat over the short term, and beneficial effects to recovery of bull trout over the long term.

The Service concludes that the implementation of the BLM's PRMP will not result in adverse modification of bull trout critical habitat because:

- The critical habitat PBFs in the riparian and aquatic ecosystems managed by BLM under the direction of the PRMP are expected to improve due to increases in

stream shading, development of large trees, inputs of large wood and improvements in water quality (both temperature and turbidity). These improvements are expected to result from management of the Riparian Reserves to produce large wood for streams, implementation of aquatic habitat restoration activities such as tree tipping, implementation of ARBOII standards for culverts, crossings and restoration projects, application of BMPs to meet water quality standards, and the potential reduction in road densities within the McKenzie basin due to road decommissioning.

- The BLM only owns 0.6 percent of the bull trout critical habitat within the Upper Willamette core area. Even when one extrapolates possible downstream effects of PRMP actions only about 1 percent of the critical habitat within this unit even has the potential to be affected. This represents only a miniscule amount of the critical habitat within the Coastal RU.
- While there will be adverse effects from some activities on certain PBFs of bull trout critical habitat within the McKenzie River basin, these effects will be highly localized, of short duration and widely spaced in both distance and time such that we do not anticipate will be an appreciable diminishment of the value of the critical habitat for the conservation of bull trout in this small portion of the overall critical habitat network. In most instances increases in sediment or turbidity associated with the proposed action would be cleared by high flows and storm events. Many of these effects will last only days to weeks, others may persist from weeks to months, but ultimately habitat conditions should improve over the long-term and benefit recovery of bull trout within the action area.
- When analyzed against the limiting factors for bull trout, implementation of the PRMP will have some short-term adverse effects. However, over the long term the PRMP will improve critical habitat conditions through improvement of the PBFs, and ultimately will contribute to an increased potential for the recovery of the species within the McKenzie River basin.

COOK’S DESERT-PARSLEY

STATUS OF THE SPECIES - COOK’S DESERT-PARSLEY

Listing Status

Cook’s desert-parsley (*Lomatium cookii*) (also known as Cook’s lomatium) was listed as federally endangered on December 7, 2002 (USFWS 2002a). Critical habitat was designated for Cook’s desert-parsley in July 2010 (USFWS 2010). A draft recovery plan for this species was developed on September 22, 2006 (USFWS 2006) and updated in November 2012 (USFWS 2012). This species is on the state of Oregon’s State Endangered Plant list. Cook’s desert-parsley is currently known to occur in Oregon (Jackson and Josephine counties).

Population Trends and Distribution for Cook’s Desert-Parsley

Cook’s desert-parsley was first collected in 1981 and subsequently described from vernal pools in the Agate Desert, Jackson County, Oregon (Kagan 1986). Additional populations were found at French Flat in the Illinois Valley, Josephine County, Oregon in 1988 (ONHIC 2008). Currently, the distribution of Cook’s desert-parsley ranges from the Agate Desert area of the Rogue Valley in Jackson County to the Illinois Valley in Josephine County.

In the Rogue Valley’s Agate Desert, Cook’s desert-parsley in the Rogue Valley is known from 13 occurrences, of which six are extant, six are unknown in current status, and one is extirpated. The populations occur within or adjacent to vernal pool-mounded prairie habitat on Agate-Winlo mapped soils (USFWS 2012). Approximately 40 percent of the population occurs on publicly owned land and 60 percent occurs on privately owned land.

In the Illinois Valley, the 38 occurrences of Cook’s desert-parsley cover 29.5 acres, with an estimated 7,766 acres of potential Cook’s desert-parsley habitat present. Occurrences range from areas north of Selma, Oregon, south to the French Flat area.

Rogue Valley Population Trends

Population census results at the Agate Desert Preserve between 1997 and 2012 indicate a fluctuating but gradual decline in Cook’s desert-parsley numbers, ranging from a high of 5,000 in 1997 to a low of 1,800 in 2002 (Morison 2012, pers. comm.). The most recent *L. cookii* census, in 2011, estimated 1,710 plants, a continuing decline.

Surveys at an Oregon Department of Transportation Special Management Area along Highway 140 have found fluctuating populations that are relatively stable: 200 plants observed in 1992, decreasing to 26 plants in 2000 and 60 plants in 2004, and most recently increasing to 160 plants in 2009 (Sharp 2009, pers. comm.).

On private land in central White City, a population numbering 2,000 individuals was documented in 1992 but was extirpated due to competition with non-native invasive grasses (ONHIC 2008; USFWS 2010).

Several Cook's desert-parsley populations at the Hall Tract of the Denman Wildlife Area decreased in size from an original estimate between 700 and 1,000 plants in 1992 to an estimate of 500 plants in 2000, but were estimated to contain 3,000 plants in 2008 (Perchemliedes 2011, pers. comm.).

The estimated population size at the Rogue Valley International-Medford Airport is approximately 5,000 plants (USFWS 2009) due to consistent airport mowing and thought to give the species a competitive edge. This population is stable (USFWS 2012).

During 2001, roughly 500,000 individuals were estimated in a single population of Cook's desert-parsley on private property in White City (ONHIC 2008). This is the largest population ever recorded; however, the status of this population is currently unknown.

Illinois Valley Population Trends

Annual monitoring of three populations (Indian Hill, Rough and Ready Botanical Wayside, and French Flat ACEC) on BLM lands since 1994 has revealed an overall stable population with increases at some sites and decreases at others (Pfingsten *et al.* 2012). For example, the Indian Hill population increased from 2007 to 2011, and then decreased in 2012. Similarly, the French Flat South population increased each year from 2007 to 2010, and then declined in 2011 and 2012. French Flat Middle, in contrast, has steadily declined since 2009, reaching in 2012 an all-time low since monitoring began in 1993. There have been large variations in population densities and reproduction over time and among the three sites.

A survey along an Oregon Department of Transportation Special Management Area along Highway 46 in 2012 reported approximately 1,095 Cook's desert-parsley plants, which was up from the 1,035 plants observed in 2003 (Sharp 2012, pers. comm.).

A population viability analyses conducted at French Flat South and French Flat Middle populations predict a high probability (98 and 78 percent, respectively) of a 50 percent population decline in the next 20 years (Pfingsten *et al.* 2012).

In summary, Cook's desert-parsley is fairly stable across its range but still at risk; populations are increasing in some areas, but slowly declining in other areas due to competition with native and non-native vegetation recruitment.

Habitat Characteristics for Cook's Desert-Parsley

Cook's desert-parsley in the Illinois Valley grows on seasonally wet soils. For much of its range in the Rogue River Valley, the plant occurs on upland mounds, at the bottom of rocky vernal pools, and on vernal pools flanks. It occurs in either strongly expressed or weakly expressed vernal pool formations and appears to tolerate various types of disturbance.

In the Rogue River Valley, populations of Cook's desert-parsley are found in shallow Agate-Winlo complex in sparse prairie vegetation. Common plant associates include *Lupinus bicolor* (bicolor lupine), *Colinsia sparsiflora* (sparse-flowered collinsia), *Clarkia purpurea* (purple clarkia), *Erodium cicutarium* (filaree), (*Lomatium utriculatum*) foothills desert-parsley, *Achnatherum lemmonii* (Lemmon's needlegrass), *Poa bulbosa* (bulbous bluegrass), *Brodiaea elegans* (elegant brodiaea), *Madia* spp. (tarweed), *Lasthenia californica* (goldfields), *Hemizonia fitchii* (Fitch's tarweed), and *Plagiobothrys* spp. (popcornflower).

In the Illinois Valley, Cook's desert-parsley occurs in open wet meadows and along roadsides adjacent to meadows on Brockman clay loam, Josephine gravelly loam, Pollard loam, Eightlar extremely stony clay, Takilma cobbly loam, Abegg clay loam, and Newberg loam soils. Brockman clay loam soils in the French Flat area average 61 to 89 cm (24 to 35 inches) in depth. These seasonally wet soils have the ability to block water permeability through the soil, similar to the Agate Desert vernal pools, but lack that region's distinctive mound and swale topography.

Soils in the Illinois Valley are partially derived from serpentine formations that occur on surrounding slopes and hilltops. Common species in the Illinois Valley associated with Cook's desert-parsley include *Danthonia californica* (California oatgrass), *Chlorogalum pomeridianum* (soap plant), *Plagiobothrys bracteatus* (bracted popcornflower), *Hesperichiron californica* (hesperichiron), *Horkelia californica* (California horkelia), *Calochortus uniflorus* (short-stemmed mariposa lily), and *Ceanothus cuneatus* (wedge-leaved buckbrush). Two rare plants that may occasionally occur with Cook's desert-parsley in the Illinois Valley are *Senecio hesperius* (western senecio) and *Microseris howellii* (Howell's microseris).

Threats/Reasons for Listing for Cook's Desert-Parsley

Specific threats to Cook's desert-parsley are habitat loss, off-road vehicle use, mining, road construction, logging in surrounding forests and meadows, livestock grazing, woody plant encroachment, invasion of non-native annual grasses and herbs, herbicide spraying, and dredging for gold in surrounding hills (USFWS 2012). Off-road vehicle tires create large ruts and can fracture the clay hardpan layer when soils are moist, which allows water to drain and compromises plant survival. Off-road vehicle use caused the drainage of an estimated 15 acres from French Flat in 2000 (USFWS 2002b) and by 2004 has drained an additional 10 acres (USFWS 2012).

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and result in encroachment to suitable Cook's desert parsley meadow habitat. These potential impacts may affect the environmental baseline for Cook's desert parsley and a general overview of these potential effects is provided in

Appendix D. Although it appears likely that Cook's desert parsley could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of Cook's desert parsley where it occurs on BLM managed land including the four ACECs that will be managed to maintain, enhance or restore Cook's desert-parsley at these locations. For example, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within existing and newly discovered (or established) plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning of trees, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including vernal pools and meadows. These measures will increase the ability of Cook's desert parsley to persist and recover in the face of climate change on BLM lands within the action area.

Recovery Measures for Cook's Desert-Parsley

The Service published the Recovery Plan for Listed Species of the Rogue Valley Vernal Pool and Illinois Valley Wet Meadow Ecosystems (recovery plan) in 2012 (USFWS 2012). The recovery plan sets out specific goals, objectives and tasks to direct recovery efforts for large-flowered woolly meadowfoam, Cook's desert-parsley and vernal pool fairy shrimp. These species are all listed and associated with vernal pool complexes. Nine core areas were identified as focal areas for conservation.

The Service's Conservation Strategy in the Rogue Valley relies on conservation of vernal pool habitat to assist in the recovery of meadowfoam, Cook's desert-parsley, and fairy shrimp (USFWS 2011). The strategy has a goal to conserve up to 2,000 acres of contiguous blocks of vernal pool complexes (USFWS 2011) to meet recovery criteria for the three species. This Conservation Strategy and its biological opinion (USFWS 2011), coupled with the recovery plan are anticipated to provide long-term conservation benefits to meadowfoam, Cook's desert-parsley, and vernal pool fairy shrimp, and streamline projects with the principal purposes of protecting, preserving, restoring, enhancing, or maintaining the habitat and listed species attributes of the vernal pool complex.

Where Cook's desert-parsley occurs on public lands, it receives some form of protection. The BLM protects 34 populations of Cook's desert-parsley in the Illinois Valley by restricting off-road vehicle access, maintaining a long-term population inventory program, and monitoring existing populations. Additionally, the Service signed a Conservation Agreement with the BLM in January 2003 to enable additional protection of the species on Federal lands through cooperative actions (*e.g.*, fencing, monitoring) (BLM and USFWS 2003). Although some trespass and damage problems still exist, the agencies are working cooperatively to address these issues.

Of the four Cook's desert-parsley populations on Oregon Department of Transportation (ODOT) administered land, one has become extirpated. The ODOT maintains the remaining Cook's

desert-parsley populations in both Jackson and Josephine Counties within three roadside Special Management Areas by limiting destructive maintenance activities during the growing season, restricting herbicide use, and performing restorative practices that benefit the plants (Sharp 2012, pers. comm.; ODOT 2013).

The Cook's desert-parsley population on Jackson County land at the Rogue Valley International-Medford Airport appears to be in good condition. Seasonal mowing of the airport fields during dry weather and protection from vehicular disturbance has benefitted Cook's desert-parsley. At the property, the plants appear prolific, relatively densely spaced, and exhibit a high degree of germination (Friedman 2003). Although more detailed studies need to be conducted at the airport property to determine population trends and the long-term health of the population, the current management of the population appears to be successful.

The Nature Conservancy (TNC) has managed two populations of Cook's desert-parsley at two preserves for over 20 years. Although the two populations are protected from development and grazing was eliminated from the preserves, the populations are not very large or robust. Noxious weeds have been greatly reduced from both preserves and prescribed burning has been conducted, but the Cook's desert-parsley population has not responded well. Mowing, grazing, and reintroduction are now used to maintain or restore vernal pool-mounded prairie habitat at the Agate Desert and the Whetstone Savanna preserves in an attempt to bring the populations back to their former robust size (Morison 2011, pers. comm.).

Seeds from three Cook's desert-parsley populations in the Rogue Valley and two locations in Josephine County (French Flat) are stored at the Rae Selling Berry Seed Bank in Portland, Oregon (Portland State Environmental Science and Management 2015). In 2006, the Service funded the Oregon Department of Agriculture (ODA) to develop detailed propagation and reintroduction protocols for the species.

Since 2008 ODOT has been working to establish a Cook's desert-parsley population at the ODOT vernal pool mitigation and conservation bank (bank) in Central Point, Oregon in anticipation of future vernal pool and Cook's desert-parsley impacts. This bank will be owned and co-managed by TNC. In 2011, ODOT collected seed from a 0.4 acre highway expansion project build site to grow out Cook's desert-parsley within the bank (USFWS 2013). They collected over 10,000 seeds from an estimated 3,397 plants and planted these at the Stone Nursery, near Jacksonville, Oregon. The resulting plants had nearly 100 percent successful germination and grew to produce over 20 pounds of seed, which have been sown into the ODOT bank area. Efforts to establish the population have been met by set-backs, but ODOT and TNC are persistently working to improve siting and growing conditions so that the successful re-introduction will be achieved (USFWS 2013; Benton 2015, pers. comm.).

ENVIRONMENTAL BASELINE – COOK'S DESERT PARSLEY

Cook's desert-parsley occurs in the BLM Medford District on 34 known sites in the Illinois Valley of Josephine County. All of the known BLM sites would occur within District-Designated Reserves for Critical Habitat or within ACECs, in Josephine County. ACECs that

include Cook's desert-parsley are French Flat, Waldo Takilma, Rough and Ready, and Reeves Creek.

Habitats in the Illinois Valley include forest edges, in seasonally wet grassy meadows, oak woodlands, serpentine meadow and shrub habitats. The largest populations on BLM-administered lands are in and adjacent to the French Flat ACEC. Rural development, illegal refuse dumping, and recreational use threaten Cook's desert-parsley habitat in the Illinois Valley. Illegal uses such as OHV trespass and refuse dumping occasionally damage sites on BLM-administered lands, although the use of barricades and law enforcement efforts have successfully reduced effects in recent years (BLM 2014). Under the Proposed RMP, the BLM livestock grazing would not be authorized within any habitat containing Cook's desert-parsley.

The BLM would allocate all 3,125 acres of Cook's desert-parsley critical habitat in the action area to District-Designated Reserves for Critical Habitat and manage those reserves for the species and its critical habitat. Approximately 34 of the 48 known Cook's desert-parsley sites are known from BLM lands in the action area. This accounts for 71 percent of the entire species and therefore, the relevance of the PRMP to the species as a whole is significant.

EFFECTS OF THE ACTION – COOK'S DESERT PARSLEY

Although several resource programs under the PRMP have the potential to adversely affect Cook's desert-parsley, the BLM (2016a, pp. 158) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species. The specific measures are:

1. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
 - *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species,*

retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.

- *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
- *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*

2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values*

Absent the above constraints, many resource programs under the PRMP have the potential to adversely affect Cook's desert parsley depending on how the BLM implements the particular program in areas occupied by this species. For example, the forest management program includes fuel reduction activities such as thinning, brush removal or hazard tree removal that have the potential to injure or kill individual plants by dragging or yarding harvested logs over plants; the forest management program also includes fuel reduction activities such as prescribed fire that has the potential to injure or kill individual plants while the plants are above ground; and the Lands and Realty program includes road-building activities that could remove all or portions of Cook's desert-parsley populations within or adjacent to a road bed.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the Cook's desert-parsley to an extent that is compatible with the conservation of this species. This is because the measures described above would require pre-project surveys for Cook's parsley and preclude implementation of future activities under the PRMP that may affect Cook's parsley that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;

- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

The management direction described above has a high potential to protect and restore Cook's desert-parsley habitat, maintain known populations, and facilitate surveys to discover and protect additional populations of this species prior to implementation of PRMP-associated management actions.

There are four proposed designations of ACECs in the PRMP: (1) French Flat; (2) Waldo Takilma; (3) Rough and Ready; and (4) Reeves Creek ACECs. These ACECs would be managed to maintain, enhance or restore Cook's desert-parsley at these locations.

The recovery plan for the Cook's desert parsley provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include: protect known or newly identified species occurrences, potential species occurrences, and their vernal pool, wet meadow, sloped mixed conifer forest, or shrub dominated habitat (USFWS 2010 p. IV-38). This is further defined as permanent reduction or elimination of the threats and application of appropriate and adaptive management to ensure species survival and recovery.

The Service agrees with BLM's assessment that implementation of the PRMP has the potential to adversely affect Cook's desert-parsley populations that have not yet been discovered in certain land-use allocations and where no management projects are implemented under the PRMP. Although the effect on Cook's desert-parsley of such losses has the potential to be adverse, the Service concludes that implementation of the PRMP has a high potential to result in the retention, management, enhancement and augmentation of 34 existing known populations of this species within the action area (which is ~45 percent of the known species' populations), along with the establishment and discovery of new populations. Such potential effects would be consistent with the Cook's desert-parsley recovery plan, and are sufficient to contribute positively to the recovery needs of the species within the BLM portion of the action area.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be "caused by or will result from" the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of western Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

The potential exists for Cook's desert-parsley populations to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon. On timber lands interspersed within the action area the Service is not aware of any Cook's desert-parsley habitat, although it is likely surveys have not been conducted in most or all cases. The Service does not have any information that changes in the management on non-federal lands within the action area is reasonably certain to occur. Therefore, we anticipate that the conditions and the management that has occurred and resulted in the current baseline conditions of the Cook's desert-parsley will continue into the future such that populations in these areas should remain about the same as they currently are.

CONCLUSION

After reviewing the current status of the Cook's desert-parsley, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the Cook's desert-parsley.

The key basis for this conclusion is the two PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on Cook's desert-parsley to an extent that is compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations in Late Successional Reserve, Riparian Reserve allocations and on non-federal lands, if they occur, where habitat conditions may not be maintained. The proposed management of these known populations on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing Cook's desert-parsley's viability without restricting the species' range. The Service expects that improvements in these populations are likely to contribute positively to the recovery needs of the species within the action area. Populations on non-federal lands within the action area are expected to remain about the same as current levels for the reasons mentioned above. This is not likely to jeopardize the species because under the PRMP, the BLM will protect, maintain and enhance all known and newly discovered populations within the action area which is expected to provide a well-distributed and robust meta-population within the 14 recovery core areas in the action area.

STATUS OF THE SPECIES - COOK'S DESERT PARSLEY CRITICAL HABITAT

The Service published the final critical habitat rule for Cook's desert parsley and large-flowered woolly meadowfoam (*Limnanthes pumila* ssp. *grandiflora*) on July 21, 2010 (USFWS 2010, pp. 42490 - 42569). The final rule designates approximately 6,289 acres of Cook's desert parsley critical habitat; all located in Jackson and Josephine counties of Oregon. The critical habitat units for Cook's desert parsley are shown on Figures 3 and 4.

The rule describes the PBFs of the proposed critical habitat as:

- (1) Vernal pools or ephemeral wetlands and the adjacent upland margins of these depressions that hold water for a sufficient length of time to sustain meadowfoam germination, growth, and reproduction, occurring in the Agate Desert vernal pool landscape. These

vernal pools or ephemeral wetlands are seasonally inundated during wet years but do not necessarily fill with water every year due to natural variability in rainfall, and support native plant populations. Areas of sufficient size and quality are likely to have the following characteristics: a) elevations from 1,220 to 1,540 feet, b) association with the dominant native plants; and, c) minimum area of 20 acres to provide intact hydrology and protection from development and weed sources.

- (2) The hydrologically and ecologically functional system of interconnected pools, ephemeral wetlands, or depressions within a matrix of surrounding uplands that together form vernal pool complexes within the greater watershed. The associated features may include the pool basin or depressions; an intact hardpan subsoil underlying the surface soils up to 0.75 m (2.5 ft) in depth; and surrounding uplands, including mound topography and other geographic and edaphic features, that support these systems of hydrologically interconnected pools and other ephemeral wetlands (which may vary in extent depending on site-specific characteristics of pool size and depth, soil type, and hardpan depth).
- (3) Silt, loam, and clay soils that are of alluvial origin, with a 0 to 3 percent slope, primarily classified as Agate–Winlo complex soils, but also including Coker clay, Carney clay, Provig–Agate complex soils, and Winlo very gravelly loam soils.
- (4) No or negligible presence of competitive nonnative invasive plant species. Negligible is defined for the purpose of this rulemaking as a minimal level of nonnative plant species that will still allow Cook’s desert parsley and/or meadowfoam to continue to survive and recover.

The need for space for individual and population growth, germination, seed dispersal, and reproduction is provided by PBFs 1 and 4; the need for soil moisture for growth, germination, reproduction, and seed dispersal is provided by PBF 2 (but not necessarily every year); the need for other nutritional or physiological requirements for the species is met by PBFs 3; habitat free from disturbance that allows for sufficient reproduction and survival opportunities is provided by PBFs 1 and 4. All of the above described PBFs do not have to occur simultaneously within a unit for the unit to constitute critical habitat for Cook’s desert parsley and/or meadowfoam.

Critical habitat is designated for Cook’s desert parsley on 6,289 acres in Jackson and Josephine Counties, Oregon. In Josephine County, 2,153 acres are designated on private lands, 1,781 on Federal lands, and 72 on State lands for a total of 4,006 acres. In Jackson County, there is a total of 2,282 acres designated as critical habitat: 1,413 acres are designated on private lands, 277 acres are designated on municipal lands, 200 acres are designated on county lands, and 392 acres are designated on State lands.

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought, and habitat shifts due to changes in precipitation. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive

plants and result in encroachment to suitable Cook's desert parsley critical habitat. These potential impacts may affect the environmental baseline for Cook's desert parsley critical habitat and a general overview of these potential effects is provided in Appendix D. Although it appears likely that Cook's desert parsley critical habitat could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of Cook's desert parsley critical habitat where it occurs on BLM managed land. For example, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within existing and newly discovered (or established) plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning of trees, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including vernal pools and meadows. These measures will increase the ability of Cook's desert parsley critical habitat to continue to provide the PBFs necessary for the species to persist and recover in the face of climate change on BLM lands within the action area.

ENVIRONMENTAL BASELINE – COOK'S DESERT PARSELY CRITICAL HABITAT

There are 3,125 acres of Cook's desert parsley critical habitat in the BLM Medford District on 34 known sites in the Illinois Valley of Josephine County. All of the designated critical habitat units would occur within District-Designated Reserves for Critical Habitat or within ACECs, in Josephine County. ACECs that include Cook's desert parsley are French Flat, Waldo Takilma, Rough and Ready, and Reeves Creek.

Rural development, illegal refuse dumping, and recreational use threaten Cook's desert parsley habitat in the Illinois Valley. Illegal uses such as OHV trespass and refuse dumping occasionally damage sites on BLM-administered lands, although the use of barricades and law enforcement efforts have successfully reduced effects in recent years (BLM 2014). Under the Proposed RMP, the BLM livestock grazing would not be authorized within any habitat containing Cook's desert parsley.

The BLM would allocate all 3,125 acres of Cook's desert parsley critical habitat in the action area to District-Designated Reserves for Critical Habitat and manage those reserves for the species and its critical habitat. Approximately 3,125 acres of the 6,289 acres designated Cook's desert parsley critical habitat are included in the action area. This accounts for 49 percent of all Cook's desert parsley designated critical habitat and therefore, the relevance of the PRMP to the species as a whole is significant.



Figure 3. Map of designated Cook's desert parsley critical habitat in the Agate Desert

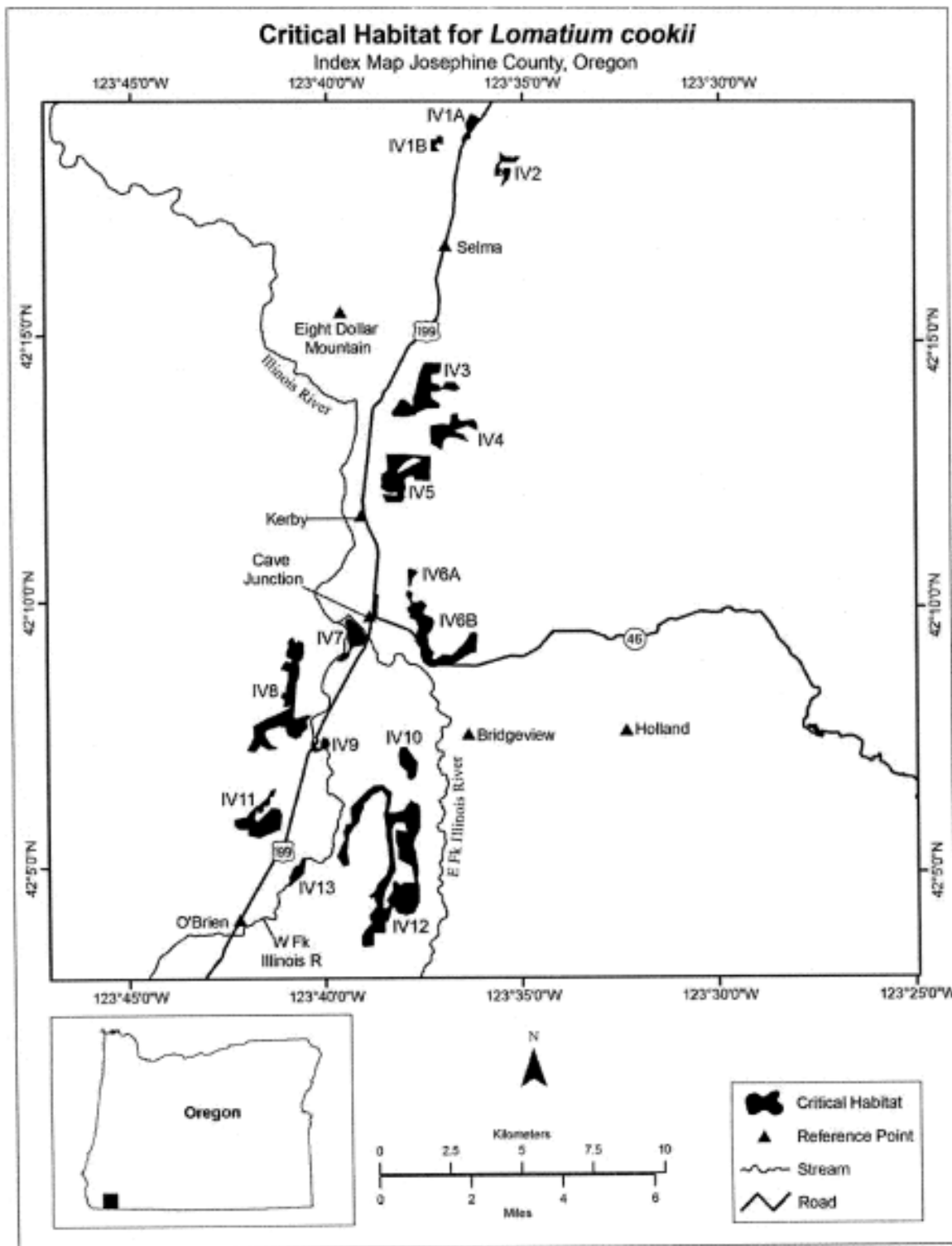


Figure 4. Map of designated Cook's desert parsley critical habitat in the Illinois Valley.

EFFECTS OF THE ACTION - COOK'S DESERT PARSLEY CRITICAL HABITAT

Although several resource programs under the PRMP have the potential to adversely affect the 3,125 acres of Cook's desert parsley critical habitat, the BLM (2016a, pp. 158) has included specific measures to protect this habitat. These measures will apply to all PRMP resource programs and require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species. The specific measures are:

1. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
 - *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
 - *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
 - *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*

2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values*

3. *The District-Designated reserves management direction (BLM 2016a, p. A-3) includes the following management direction:*

- *Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system.*

This management direction would have the potential to adversely affect Cook's desert parsley critical habitat depending on how the BLM implements the particular actions. For example, prescribed fire could directly burn living native plants causing temporary degradation to the Cook's desert parsley habitat's PBFs; following fuel treatments, the potential for noxious weed invasion in critical habitat meadows could degrade the PBF; inappropriate silvicultural activities could also degrade PBFs by planting trees in space that would otherwise be utilized by Cook's desert parsley resulting in encroachment of trees into habitat and allowing seral succession to alter Cook's desert parsley wet meadow habitat.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the Cook's desert parsley critical habitat to an extent that is compatible with the conservation of this species. This is because the measures described above would preclude implementation of future activities under the PRMP that may affect Cook's desert parsley critical habitat that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

Implementation of the management direction described above has the potential to maintain, enhance, and restore Cook's desert parsley critical habitat PBFs on BLM lands within the action area. Such an outcome underlies the basis for which the French Flat, Waldo Takilma, Rough and Ready, and Reeves Creek ACECs will be designated under the PRMP because the PBFs of Cook's desert parsley critical habitat match the habitat needs of the species, which is one of the relevant and important values for which these four ACECs will be designated (BLM 2016c,

p.1279-1283). Implementation of the management direction described above will insure that: Cook's desert parsley habitat will be protected from noxious weed encroachment or inappropriate silvicultural activities; and no actions that would adversely affect the Cook's desert parsley would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule.

The ACEC resource program requires the implementation of "activities as necessary to maintain, enhance, or restore relevant and important values;" such activities can include thinning out encroaching trees and shrubs and using controlled burns to provide more habitat for plants to seed and germinate and grow as necessary to reproduce. Some aspects of these measures, such as burning or mowing, may have the potential to cause adverse effects to Cook's desert parsley critical habitat, but are consistent with the critical habitat rule and recovery plan and are considered necessary for the conservation of the species.

The management direction described above has a high potential to protect and restore Cook's desert parsley critical habitat PBFs. Based on our consideration of the above three programs and their management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the Cook's desert parsley to an extent that is compatible with maintaining the value of critical habitat for the conservation of this species. For example, under the RMP, the BLM would limit the timing of burning and mowing to when Cook's desert parsley is dormant to avoid damage to plants.

The Service has published a recovery plan for the Cook's desert parsley (USFWS 2012). The recovery plan provides recommended actions that the Service believes will result in the conservation and recovery of this species and, in turn, the PBFs of critical habitat. The development of future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include (USFWS 2010, p. IV-38), protect known or newly identified species occurrences, potential species occurrences, and support wet meadows in oak and pine forests, sloped mixed-conifer openings, and shrubby plant communities (PBF 2(A)) and no or negligible presence of competitive, nonnative invasive plant species (PBF 2(D)). This is further defined as permanent reduction or elimination of the threats and application of appropriate and adaptive management to ensure species survival and recovery.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be "caused by or will result from" the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

The potential exists for Cook's desert parsley critical habitat to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon. Management of these lands up until this point has provided the current habitat conditions and PBFs that support those populations. The Service has no information that changes in those management practices into the future are reasonably certain to occur, and so we assume that the conditions of Cook's desert parsley critical habitat PBFs will persist at about the same condition as baseline levels. Therefore, we do not anticipate any significant increases or decreases of Cook's desert parsley critical habitat PBFs, or the value of that critical habitat for the conservation of the species, on non-federal lands within the action area.

CONCLUSION

After reviewing the current status of the Cook's desert parsley critical habitat, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to destroy or adversely modify Cook's desert parsley critical habitat.

The key basis for this conclusion is the three PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on Cook's desert parsley critical habitat to an extent that is compatible with the conservation of this species. The proposed management of critical habitat on BLM lands is expected to improve habitat conditions and in turn will maintain and increase Cook's desert parsley's viability without restricting the species' range. The Service expects that improvements to this habitat are likely to contribute positively to the recovery needs of the species within the BLM portion of the action area. We expect the conservation value of critical habitat on non-federal lands within the action area to remain about the same as the current value. This is not likely to adversely modify Cook's desert parsley critical habitat because under the PRMP the BLM will not cause any diminishment of the value of critical habitat for the conservation of the species.

FENDER'S BLUE BUTTERFLY

STATUS OF THE SPECIES - FENDER'S BLUE BUTTERFLY

Species listing status

Fender's blue butterfly was listed as endangered, without critical habitat, on January 25, 2000 (USFWS 2000). Critical habitat for the butterfly was designated on October 6, 2006 (USFWS 2006). A final recovery plan that includes the Fender's blue butterfly (Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington) was published by the Service in May 2010 (USFWS 2010).

Species description

The Fender's blue butterfly belongs to the group of blue butterflies in the family Lycaenidae. The Fender's blue butterfly is one of about a dozen subspecies of Boisduval's blue butterfly (*Icaricia icarioides*) found only in western North America. Fender's blue butterfly is small, with a wingspan of approximately 25 mm (1 inch). The upper wings of the males are brilliant blue in color and the borders and basal areas are black. The upper wings of the females are completely brown. The undersides of the wings of both sexes are creamish-tan with black spots surrounded by a fine white border or halo. The dark spots on the underwings of male butterflies are small. In contrast, the dark spots on the underwings of the pembina blue butterfly (*Icaricia icarioides pembina*) are surrounded with wide white haloes, and the underside of the hindwings of Boisduval's blue butterfly (*Icaricia icarioides*) is very pale whitish gray with broad haloes around the black spots (Schultz *et al.* 2003).

Habitat needs and life history

Fender's blue butterfly populations occur on upland prairies characterized by native fescue spp. (bunch grasses). The association of Fender's blue butterfly with upland prairie is mostly a result of its dependence on lupine host plants, although the butterfly also uses wet prairies for nectaring and dispersal habitat. Sites occupied by the Fender's blue butterfly are predominantly located on the western side of the Willamette Valley, within 33 km (21 miles) of the Willamette River.

Adult Fender's blue butterfly live approximately 10-15 days and are estimated to travel approximately 2 km (1.2 miles) over their life span (Schultz 1998). Although only limited observations have been made of the early life stages of the butterfly, the life cycle of the species likely is similar to other subspecies of *Icaricia icarioides* (Hammond and Wilson 1993). The life cycle of Fender's blue butterfly may be completed in one year. An adult female butterfly may lay approximately 350 eggs over her 10-15 day lifespan, of which perhaps fewer than two will survive to adulthood (Schultz 1998, Schultz *et al.* 2003). Females lay their eggs on Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), longspur lupine, (*Lupinus arbustus*) or sickle-keeled lupine (*Lupinus albicaulis*), which are the larval food plants, during May and June (Ballmer and Pratt 1988). Newly hatched larvae feed for a short time, reaching their second instar in the early summer, at which point they enter an extended diapause. Diapausing larvae remain in the leaf litter at or near the base of the host plant through the fall and winter when the lupine plant

senesces. Larvae become active again in March or April of the following year. Some larvae may be able to extend diapause for more than one season depending upon the individual and environmental conditions. Once diapause is broken, the larvae feed and grow through three to four additional instars, enter their pupa stage, and after about two weeks emerge as adult butterflies in May and June (Schultz *et al.* 2003).

Fender's blue butterfly is believed to have limited dispersal ability, potentially remaining within 2 km (1.2 miles) of their natal lupine patch (Schultz 1998). However, anecdotal evidence exists of adult butterflies dispersing as far as 5-6 km (3.1-3.7 miles) (Hammond and Wilson 1993, Schultz 1998). Habitat fragmentation makes dispersal of this magnitude less likely to occur so recovery strategies focus on establishing "functioning networks" to ensure connectivity between habitat patches (USFWS 2010). A study at the main area of Willow Creek in Lane County, showed 95 percent of adult Fender's blue butterfly are found within 10 m (33 feet) of large lupine patches (Schultz 1998).

Habitat requirements for Fender's blue butterfly include lupine host plants (Kincaid's lupine, longspur lupine, and sickle-keeled lupine) for larval food and oviposition sites and wildflowers for adult nectar food sources. Documented native nectar sources include species such as: narrowleaved onion (*Allium amplexans*), Tolmie star-tulip (*Calochortus tolmiei*), rose checker-mallow (*Sidalcea malviflora* ssp. *virgata*), common woolly sunflower (*Eriophyllum lanatum*), and Oregon geranium (*Geranium oreganum*) (Wilson *et al.* 1997, York 2002, Schultz *et al.* 2003). Non-native vetches and other flowers are also frequently used as nectar sources, although they are considered inferior to the native nectar sources (Schultz *et al.* 2003). An estimated 2 - 6 ha (5-15 ac) of high density lupine habitat are necessary to support a population of Fender's blue butterfly (Crone and Schultz 2003, Schultz and Hammond 2003). However, most prairie remnants are degraded areas, with very patchy distribution of lupine resources. Therefore, larger prairie patches, with on-going management to improve and maintain habitat quality, are necessary to support a viable Fender's blue butterfly populations.

Kincaid's lupine is the larval host plant at most known Fender's blue butterfly population sites. At two sites, Coburg Ridge and Baskett Butte, the butterfly feeds primarily on longspur lupine, although small amounts of Kincaid's lupine is present (Schultz *et al.* 2003). Sickle-keeled lupine is used by the butterfly where it occurs in poorer quality habitats (Schultz *et al.* 2003). It is interesting to note that Fender's blue butterfly has not been found to use broadleaf lupine (*Lupinus latifolius*), a plant commonly used as a food source by other subspecies of *Icaricia icarioides*, even though it occurs in habitats occupied by the butterfly (Schultz *et al.* 2003).

Population dynamics

The historic distribution of Fender's blue butterfly is not precisely known due to the limited information collected on this species prior to its description in 1931. Although the type specimen for this butterfly was collected in 1929, few collections were made between the time of the subspecies' discovery and Macy's last observation of the butterfly on May 23, 1937, in Benton County, Oregon (Hammond and Wilson 1992). Uncertainty regarding the butterfly's host plant caused researchers to focus their survey efforts on common lupine species known to

occur in the vicinity of Macy's collections. Fifty years passed before the Fender's blue butterfly was found again.

Fender's blue butterfly was rediscovered in 1989 at the McDonald Research Forest, Benton County, Oregon. The species was found to be associated primarily with Kincaid's lupine and occasionally longspur and sickle-keeled lupine (Hammond and Wilson 1993). Past survey efforts have determined that Fender's blue butterfly is endemic to the Willamette Valley and persists at about thirty sites on remnant prairies in Linn, Yamhill, Polk, Benton, and Lane counties (Hammond and Wilson 1993, Schultz 1996, Schultz *et al.* 2003). Extensive survey efforts have resulted in the discovery of several subpopulations and populations that were not known when Fender's blue butterfly was listed as endangered. Most significantly, in 2011, a large Fender's blue butterfly population was found at Hagg Lake in Washington County, Oregon (Hammond 2011). In 2014, FWS introduced Fender's blue butterfly to the William Finley National Wildlife Refuge and intend to augment the population in 2015-2016 (Severns and Fitzpatrick 2015). The status of Fender's blue butterfly has improved since the species was listed as endangered, primarily due to the number of sites that are now actively managed to improve habitat conditions and the discovery of several subpopulations and populations that were not previously known. As of 2014, Fender's blue butterfly was found at an estimated 67 sites in Oregon with a total species abundance estimate of approximately 16,664 adults (Fitzpatrick 2014). A summary of annual, range-wide species abundance is provided in Table 16 below (Fitzpatrick 2014).

Table 16. Annual range-wide Fender's blue butterfly population estimates (Fitzpatrick 2014)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Estimate	3391	1713	3843	4490	5996	2017	3525	5355	2309	6064	4531	3761	13011	15029	16644

It is difficult and costly to assess Fender's blue butterfly annual population abundance due to the short flight season of adults, variable weather conditions, species distribution, and the presence of other blue butterflies (Collins *et al.* 2011). In order to improve the accuracy of range-wide annual population estimates, more intensive and costly monitoring efforts were initiated in 2012 (Collins *et al.* 2011 and Hicks 2012). Specifically, distance sampling is now being implemented at the largest habitat areas supporting the largest Fender's blue butterfly populations and peak count assessments are being conducted at smaller sites. Peak count estimates are less expensive because they only involve a single site visit. However, these surveys have limited accuracy since it is difficult to predict when peak flight will occur and the method assumes 100 percent detection of the individuals which is impossible to obtain. Distance sampling is a method for estimating abundance that takes into account the probability of detection, and is implemented by recording the distance from the observer to each observation (Thomas 2010). Distance sampling transect counts are collected several times throughout the flight season and are processed with Insect Count Analyzer (INCA) to provide a population estimate (Hicks 2011). In 2012, there was significant increase in Fender's blue butterfly abundance estimates (see Table 16, above).

The magnitude of this increase is actually a reflection of the change in abundance estimate methodologies implemented in that year.

Reasons for listing and threats

Habitat loss, encroachment of shrubs and trees into prairie habitats due to fire suppression, fragmentation, invasion by non-native plants, and elimination of natural disturbance regimes all threaten the survival of Fender's blue butterfly. Few populations occur on protected lands. Most occur on private lands which are not managed to maintain native prairie habitats. These populations are at high risk of loss to development or continuing habitat degradation (USFWS 2000).

The prairies of western Oregon and southwestern Washington have been overtaken by non-native plants that shade-out or crowd-out important native species. Fast growing non-native shrubs Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*), non-native grasses such as tall oatgrass (*Arrhenatherum elatius*), and non-native forb, such as meadow knapweed (*Centaurea debeauxii*), can virtually take over the prairies, inhibiting the growth of the lupine host plants and native nectar sources (Hammond 1996, Schultz *et al.* 2003). When these highly invasive non-native plants become dominant, they can effectively preclude Fender's blue butterfly from using the native plant species the butterfly needs to survive and reproduce (Hammond 1996). In the absence of a regular disturbance regime, succession of native trees and shrubs also threaten to alter prairie habitats. Common native species found to encroach on undisturbed prairies include Douglas-fir (*Pseudotsuga menziesii*), Oregon white oak (*Quercus garryana*), Oregon ash (*Fraxinus latifolia*), Douglas' hawthorn (*Crataegus douglasii*) and Pacific poison oak (*Toxicodendron diversilobum*).

Habitat fragmentation has isolated some Fender's blue butterfly populations to such an extent that butterfly movement among suitable habitat patches may now occur only rarely. This reduction in movement is not expected to maintain the population over time (Schultz 1998). The rarity of host lupine patches and fragmentation of habitat are thought to be the major ecological factors limiting reproduction, dispersal, and subsequent colonization of new habitat (Hammond and Wilson 1993, Hammond 1994, Schultz 1997, Schultz and Dlugosch 1999). Extirpation of remaining small populations as a result of localized events and/or probable low genetic diversity associated with small populations is expected (Schultz and Hammond 2003).

Previous population viability analyses determined that the Fender's blue butterfly is at high risk of extinction throughout most of its range (Schultz and Hammond 2003). However, several relatively large populations have been found that were not previously known to occur and methodologies for population estimates have been improved (Collins *et al.* 2011 and Hicks 2012) data quality. Therefore, the Service is currently evaluating options for completing another population viability analysis with more current and improved data.

Climate Change

The Service also believes climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999), which may exacerbate effects due to drought. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and result in encroachment to suitable Fender's blue butterfly habitat. Increases in temperature may also alter the developmental rate of Fender's blue butterflies that becomes out of sync with the cycles of other plants and animals that provide food and shelter. These potential impacts will affect the environmental baseline for Fender's blue butterflies and other listed species in the Pacific Northwest, and we provide a general overview of these potential effects in Appendix D. Although it appears likely that the Fender's blue butterfly will be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of the Fender's blue butterfly and other prairie dependent species on BLM managed land including the Oaks Basin Prairie ACEC. In addition, the Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including upland prairie habitat. Also of benefit is the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within existing and newly discovered (or established) plant population sites are maintained or restored in natural communities through actions such as applying prescribed fire, thinning of trees, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species, all important attributes that will support Fender's blue butterfly populations. These measures, described in detail elsewhere in this BO, will increase the ability of the Fender's blue butterfly to persist and recover in the face of climate change effects on BLM lands within the action area.

ENVIRONMENTAL BASELINE – FENDER'S BLUE BUTTERFLY

Within the planning area, Oak Basin is the only known Fender's blue butterfly population occurring on BLM lands. This site contains some of the few upland prairies that remain in the Willamette Valley and hosts populations of both Fender's blue butterfly and Kincaid's lupine. Oak basin is the only known site in Linn County currently occupied by Fender's blue butterfly and Kincaid's lupine. It is also 1 of 3 upland sites in Coburg Hills currently occupied by both of these species (BLM 2010). The action area does not contain critical habitat for the Fender's blue butterfly.

Population monitoring of Fender's blue butterfly at Oak Basin started in 2006 and has continued through 2015. Egg and adult population data during this time period is shown in Table 17

Fender's blue butterfly populations at Oak Basin are primarily located in two upper meadows (Meadows A and B) (Ross 2010), however in 2014 and 2015, Fender's blue butterflies were also observed in Meadow C (Ross 2015). As a result of recent habitat restoration efforts, the lupine plants in Meadow C appeared healthier and more robust (Ross 2015), which inherently improve

that habitat quality for the Fender's blue butterfly. Based on survey results, it appears the butterfly population has been relatively stable over the last five years (Ross 2015).

Table 17 Fender's blue butterfly populations at Oak Basin are primarily located in two upper meadows (Meadows A and B) (Ross 2010), however in 2014 and 2015, Fender's blue butterflies were also observed in Meadow C (Ross 2015). As a result of recent habitat restoration efforts, the lupine plants in Meadow C appeared healthier and more robust (Ross 2015), which inherently improve that habitat quality for the Fender's blue butterfly. Based on survey results, it appears the butterfly population has been relatively stable over the last five years (Ross 2015).

Table 17. Egg and adult Fender's blue butterfly population data from 2006-2015 at Oak Basin

Life Stage	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Egg ¹	470	1,234	1,104	672	NA	NA	NA	NA	NA	NA
Adult ²	23	NA	45	NA	38	50	49	45	51	56

1 - Thorpe and Massatti 2008, Giles-Johnson *et al.* 2010

2 - Ross 2010 and 2015

An important threat existing in the project area to Fender's blue butterfly is the heavy infestation of competing invasive plant species, including encroaching woody vegetation. This can adversely affect the number of lupine plants available for egg laying and future adult recruitment in the butterfly population. However, the project area does contain a mixture of plant species to support Fender's blue butterfly in all its life stages (BLM 2010).

EFFECTS OF THE ACTION - FENDER'S BLUE BUTTERFLY

Although numerous resource programs under the PRMP have the potential to adversely affect the Fender's blue butterfly, the BLM (2016a, pp. 167-171) has included specific management direction under four resource programs to protect this species. This management direction will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the Fender's blue butterfly under those programs except where necessary for the conservation of the species. These four programs and management direction are as follows:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61), which includes the following management direction:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*

- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*

2. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), applies to the Fender's blue butterfly as it protects its host plant, the Kincaid lupine, which includes the following management direction:*

- *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
- *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
- *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
- *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
- *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and*

applying prescribed fire, to the extent consistent with management direction for the land use allocation.

- *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*

3. *The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values*

4. *Invasive Species (BLM, 2016a, p. A-36), which includes the following management direction:*

- *Implement measures to prevent, detect, and rapidly control new invasive species infestations.*

Absent the above constraints, several resource programs under the PRMP would have the potential to adversely affect Fender's blue butterflies in areas occupied by this species. For example, the forest management program includes fuel reduction activities such as thinning, brush removal or hazard tree removal that have the potential to injure or kill individual butterflies or Kincaid's lupines by dragging or yarding harvested logs over them; the forest management program also includes fuel reduction activities such as prescribed fire that has the potential to injure or kill individual butterflies or Kincaid's lupines while the plants are above ground; and the Lands and Realty program includes road-building activities that could remove all or portions of Kincaid's lupine populations within or adjacent to a road bed. Within the ACEC restoration activities to promote prairie and oak habitats have the potential to adversely affect the butterflies or Kincaid's lupine by implementing actions such as mowing, broadcast burning, and pile burning to manage for invasive species. These types of management actions have the potential to cause mortality to individual butterflies and modify suitable habitat.

However, under the PRMP's management direction, BLM would manage these resource programs to avoid these adverse effects to Fender's blue butterflies unless it was necessary for the conservation of the species. Thus, with the above conservation measures, none of these potential adverse effects would be expected to occur under the PRMP because of the constraints on activities noted in the Wildlife, Rare Plants and Fungi, ACEC, and Invasive Species management direction above unless they were necessary for the conservation of the species.

Implementation of the management direction described above has the potential to maintain, enhance, and restore the Fender's blue butterfly populations on BLM lands within the action area. Such an outcome underlies the basis for which the Oak Basin Prairie ACEC will be managed under the PRMP. Implementation of the management direction described above will insure that no actions that would adversely affect Fender's blue butterflies would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

The ACEC resource program requires the implementation of “activities as necessary to maintain, enhance, or restore relevant and important values” which has the potential to include controlling invasive plant species. The role of a recovery plan is to provide a roadmap of recommended actions the Service believes necessary to conserve and recover the listed species. The Fender’s blue butterfly recovery plan (USFWS 2010) identifies recovery actions to intensively monitor abundance, distribution, survival and productivity; some aspects of these measures have the potential to cause adverse effects to the Fender’s blue butterfly, but they are considered necessary for the conservation of the species. Considering this information and based on the management direction in the PRMP, the Service concludes that all actions to be implemented by the BLM under the PRMP that may have the potential to adversely affect the Fender’s blue butterfly will be consistent with the recovery plan and will be “necessary for the conservation of the species”, and move the species condition closer to recovery.

Based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs Fender’s blue butterflies to an extent that is compatible with the conservation of this species. This is because the measures described above would preclude implementation of future activities under the PRMP that may affect Fender’s blue butterfly that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon. The potential exists for Fender’s blue butterfly populations to occur on non-federal lands that are adjacent to or interspersed with BLM lands within the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon. The Service does not anticipate PRMP management will alter human use patterns on these adjacent lands in a manner that could cause potential indirect effects of the action that are different than the actions that have resulted in the baseline condition on these portions of the action area.

CONCLUSION

After reviewing the current status of the Fender's blue butterfly, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the Fender's blue butterfly.

The key basis for this conclusion is the four PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on Fender's blue butterflies and their host plant, the Kincaid's lupine, to an extent that is compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations in Late Successional Reserve, Riparian Reserve allocations and on non-federal lands, if they occur, where habitat conditions may not be maintained. The proposed management of these known populations on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing Fender's blue butterfly's viability without restricting the species' range. The Service expects that improvements in these populations are likely to contribute to the recovery needs of the species within the action area. This is not likely to jeopardize the species because under the PRMP the BLM will protect, maintain and enhance all known and newly discovered populations within the action area which is expected to provide a well-distributed and robust meta-population within the one recovery zone in the action area (Oak Basin).

GENTNER'S FRITILLARY

STATUS OF THE SPECIES - GENTNER'S FRITILLARY

Listing Status and Locations

Gentner's fritillary was federally listed as endangered on December 10, 1999 (USFWS 1999) without critical habitat designation. The species is also on the State of Oregon's State Endangered Plant list. A recovery plan for the species was published on July 21, 2003 (USFWS 2003). *Fritillaria gentneri* occurs in Jackson and Josephine counties in Oregon and in northern Siskiyou County in California.

Population Trends and Distribution

There are approximately 138 occurrences of Gentner's fritillary. A high number of 1955 flowering plants were observed on 50 BLM monitoring sites lands in 2004, but flower plant counts have been lower since then, even though seven new monitoring sites were added. The lowest years were 2006 and 2007 when less than 1,000 flowering plants were observed on the monitoring sites. In the last six years, flower fritillary counts have remained above 1,100. Eight occurrences contained 100 flowering plants or more in the last ten years, with surveyors recording a high of 602 flowering plants at the Pilot Rock Lower occurrence on the Cascade Siskiyou National Monument in 2013. The rest of the populations have fluctuated between 0 to 96 flowering plants (Siskiyou BioSurvey 2014).

The Pickett Creek population has been the subject of a long-term demography study. In this population both flowering plants and vegetative leaves are documented. Flowering plant counts have steadily declined at this site over the last 13 years. In 2012, the lowest recorded numbers of flowering individuals were recorded (46 flowering individuals). However, the estimated total population size (both vegetative and flowering plants) based on density plots in the upper and below-road subpopulations has not consistently declined, but has fluctuated throughout the course of the study from a low of 6,715 in 2006 to a high of 17,684 in 2003.

New populations have been found during the last 14 years on Medford BLM lands. The majority of the occurrences are small and widely scattered, containing one to five flowering adults and an unknown number of juveniles. Of 58 monitored plant populations in 2014 by BLM contractors, 54 had less than 100 flowering individuals and 32 had zero to two flowering plants (Siskiyou BioSurvey LLC 2014).

Life History and Ecology

Gentner's fritillary is a perennial herb arising from a fleshy bulb producing numerous small rice-grained bulblets. The plant also produces several large scales surrounded by 10 to 150 small rice-grained bulblets per plant (USFWS 2003). Gentner's fritillary forms large maroon to bright reddish flowers with yellow mottles that are easily observed in the early spring. The flowers are solitary, or in bracted racemes, 1 to 7 (rarely more) on long slender pedicels. The 2.5 to 4.0 cm

bell-shaped flower has segments that bend more or less outward, at times straight, but are not strongly recurved like the common scarlet fritillary (*Fritillaria recurva*).

Gentner's fritillary emerges from the ground in early February, flowers from mid-April to early June, and is dormant from mid-August to mid-January. Non-flowering fritillaries greatly outnumber flowering plants in natural populations, and are recognizable only by their single ovate to lanceolate basal leaf, indistinguishable from several other common related fritillaries. Due to poor and erratic seed production, bulblet production and disbursement are the principal means of Gentner's fritillary propagation.

Although older research (Amsberry and Meinke 2002) documented erratic, extremely low seed production, and poor viability in the species (2.3 percent seed production), indicating that the plant is largely reproducing asexually. However, inter-population fruit-set of Gentner's fritillary x Gentner's fritillary crosses was much higher, with 48.9 percent seed production and with good seed viability (Amsberry and Meinke 2007).

A population of fritillaries consists of plants at three different life stages: flowering plants, vegetative mature plants, and vegetative juvenile plants. Using data provided by Brock and Knapp (2000), it is estimated that each flowering fritillary located in a population represents an estimated 40 plants from all three life stages (USFWS 2003).

Habitat Characteristics

Gentner's fritillary occurs in a variety of forested habitats including oak woodlands dominated by Oregon white oak (*Quercus garryana*), mixed hardwood forest dominated by California black oak (*Quercus kelloggii*), Oregon white oak, and madrone (*Arbutus menziesii*), and coniferous forests dominated by madrone and Douglas-fir (*Pseudotsuga menziesii*). The plant is thought to be adapted to a fire or disturbance ecology. Gentner's fritillary has been documented in responding positively to wildfire due to increased light and moisture from the loss of overtopping and competing vegetation, and an increase in available nutrients.

The 25 soil types that the plant has been known to occur on are Abegg, Beckman-Colestine complex, Brader-Debenger complex, Caris-Offenbacher complex, Cornutt-Dubakelia complex, Dubakella-Pearsoll complex, Farva, Heppsie, Heppsie-McMullin complex, Holland, Langellain, Langellain-Brader complex, Manita, McNull-Medico complex, McMullin-Rockoutcrop complex, McNull, McNull-Medco complex, McNull-McMullin complex, Ruch, Tallowbox, Tatouche, Vannoy, Vannoy-Voorhies complex, Woodseye-rockoutcrop complex and Xerothents-Dumps complex (USFWS 2003). The soil types most commonly supporting the plant are Vannoy and Vannoy-Voorhies complex.

Threats/Reasons for Listing

Habitat loss is the main threat to this species. Gentner's fritillary populations are often directly impacted by development in the form of housing construction, cemetery expansion, trail maintenance, road widening, landfill expansion, power line maintenance, water system construction, and agricultural conversions (USFWS, 1999). These activities primarily occur on

private lands. Between 1941 and the present, eight known occurrences have been extirpated due to developmental expansion.

Recreational collection of plants could adversely affect the species, especially along roads, where the plant is more observable and most vulnerable. Because the species occurs in small, isolated clusters, an entire patch could be decimated in one gathering, extirpating the plant from that area.

Fritillaries appear to be a strongly preferred food choice by deer, which go to great lengths to eat flower stalks. Predation could conceivably reduce plant numbers and productivity. Many plant flowers are browsed before producing mature fruit. Many of the plants that were tagged for seed collection by Wayne Rolle, in 1988, had the capsules eaten by wildlife before the seed capsules matured (USFWS 1999). Since the species does not appear to produce viable seeds, floral and/or upper stem herbivory may yield little impact. Intensive grazing (including trampling) by livestock at some sites may pose a much greater threat than browsing by deer (USFWS 2003).

Private land owners are not required to protect State or federally listed plant species, except where projects are associated with Federal funds or permits. As a result the plant receives little protection from its State or Federal status as endangered on private lands.

Fire exclusion has altered suitable habitat for the plant by permitting open oak woodland habitats to become more thickly wooded and less grassy. This transition can result in partial to total exclusion of plants. At the same time, the increase of homes in the area makes prescribed burning difficult. This has reduced suitable habitat for the plant while a less-than-optimal habitat condition is achieved that is also susceptible to catastrophic fire.

The threat of extinction due to naturally occurring demographic and environmental events reduces the viability of the species as a whole. Because most plant sites occupy small areas, naturally occurring environmental events could also play a role in extirpation. Small clusters can disappear with one environmental event, such as erosion. Gentner's fritillary sites are small and isolated from each other due to habitat fragmentation. This isolation could inhibit re-colonization to other suitable areas and could result in a permanent loss of localized occurrences once they fall below a critical level.

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought, and habitat shifts due to changes in precipitation. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and result in encroachment to suitable Gentner's fritillary oak woodland habitat. These potential impacts have the potential to affect the environmental baseline for Gentner's fritillary and a general overview of these potential effects is provided in Appendix D. Although it appears likely that Gentner's fritillary could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the

species. However, the PRMP provides measures that are designed to ameliorate these impacts and which should provide for the long term persistence of Gentner's fritillary on BLM managed land including the three ACECs that will be managed to maintain, enhance or restore Gentner's fritillary at these locations. In addition, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, and planting or seeding native species. These measures, described in detail elsewhere in this BO, will increase the ability of Gentner's fritillary to persist and recover in the face of climate change effects on BLM lands.

Recovery Measures

Most Gentner's fritillary populations occur on Federal lands and are protected from development. The Medford BLM manages the majority of known Gentner's fritillary sites by performing annual monitoring, funding research to determine life history dynamics and funding recovery actions such as habitat restoration and population augmentation. All ground disturbing activities that are carried out or permitted on BLM lands are surveyed for *Fritillaria gentneri*. The BLM will protect or conserve any listed plants that are located on BLM administered land. On July 13, 2015, the Service and BLM signed a conservation agreement establishing eight *Fritillaria* Management Areas (FMA) (USFWS and BLM 2015) which are areas that are managed specifically for the purpose of conserving the plants. Establishment of FMAs are one of the prime criteria for downlisting the species and will greatly contribute to recovery.

ODOT also manages two Gentner's fritillary sites on highway right-of-ways and has designated Special Management Areas (SMA) at the two locations. Management under the SMAs calls for annual or biennial monitoring and suspension of spraying, ditching, disking, or mowing activities to conserve the populations. ODOT also surveys suitable habitat for Gentner's fritillary for presence of new populations prior to ground disturbing activities.

Recent recovery group meetings were held that began to chart a course for downlisting the species from an endangered to threatened status in the next ten years. Some of the actions that will be undertaken will include signing a conservation agreement between BLM, the Service and ODA to manage federal lands across most of the range of Gentner's fritillary and developing best management practices for managing habitat.

The City of Jacksonville has developed a management plan to address restoration of a Gentner's fritillary population due to accidental construction of a road through the middle of a population and subsequent infestation of the noxious weed, *Centaurea solstitialis* (yellow starthistle). Currently the yellow starthistle is nearly under control and the population is carefully monitored.

ENVIRONMENTAL BASELINE – GENTNER'S FRITILLARY

Gentner's fritillary occurs in scattered locations throughout the Rogue and Illinois River watersheds within the BLM Medford District. Potential habitat also occurs in the Klamath Falls Resource Area of the BLM Lakeview District. Habitat is diverse, ranging from Oregon white

oak woodlands, moist riparian areas, Douglas-fir forests, and serpentine areas. Where the species occurs within forested communities, it generally occurs on the edge or in openings.

The Medford District has surveyed an average of 40,000 acres of suitable habitat per year during 2008 – 2013. On average, the surveyors found one new Gentner's fritillary site for every 4,400 acres surveyed. Most sites are very small – less than 12 individuals. However, a few sites contain several hundred flowering plants with many more bulbs producing only vegetative leaves. The Medford District has augmented sites by outplanting bulblets since 2002.

There are 162 known sites in the action area. There are an additional 36 sites on BLM-administered lands within the Cascade-Siskiyou National Monument, which is outside the action area, and 12 sites or more occur on private, county, and state lands. Because approximately 77 percent of all known Gentner's fritillary sites occur on BLM land that are within the action area, the proposed management direction will have great relevance for the species as a whole.

Gentner's fritillary occurs within eight active livestock grazing allotments. The Medford District has surveyed all suitable habitats within grazing allotments, and populations generally occur on steeper slopes outside of riparian areas, where cattle use is light. Botanists monitor the effects of grazing on Gentner's fritillary, and there is little evidence of direct grazing or trampling by cattle (BLM 2014). Currently, 62 Gentner's fritillary known sites, ranging in size from one plant to approximately 30 plants, occur in eight active grazing allotments. Another 55 Gentner's fritillary known sites occur within eight vacant grazing allotments. Of the active allotments with Gentner's fritillary sites, all are in the Improve Management category, meaning that the current resource condition does not meet Rangeland Standards and Guidelines. While cattle are not known to directly affect Gentner's fritillary, removing cattle might improve adjacent habitat for the species and allow for expansion.

Forty-six Gentner's fritillary known sites would occur in reserve land use allocations under the PRMP. No known sites occur in the Harvest Land Base, although the species potentially could occur in that land use allocation.

EFFECTS OF THE ACTION – GENTNER'S FRITILLARY

Although numerous resource programs under the PRMP have the potential to adversely affect Gentner's fritillary, the BLM (2016a, pp. 153-157) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species. The specific measures are:

2. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and*

intensity of actions, and implementing other strategies designed to recover populations of the species.

- *Manage ESA candidate and Bureau Sensitive species consistent with any conservation agreements or strategies including the protection and restoration of habitat, alteration of the type, timing, and intensity of actions, and other strategies designed to conserve populations of the species.*
- *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
- *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
- *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
- *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives; and*

2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

Implement activities as necessary to maintain, enhance, or restore relevant and important values.

Absent the above constraints, many resource programs under the PRMP would have the potential to adversely affect Gentner's fritillary depending on how the BLM implements the particular program in areas occupied by this species. For example, livestock grazing has the potential to trample, injure, and kill individual plants; the forest management program includes fuel reduction activities such as thinning, brush removal or hazard tree removal that have the

potential to injure or kill individual plants by dragging or yarding harvested logs over plants; the forest management program also includes fuel reduction activities such as prescribed fire that has the potential to injure or kill individual plants while the plants are above ground; and the Lands and Realty program includes road-building activities that could remove all or portions of Gentner's fritillary populations within or adjacent to a road bed.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the Gentner's fritillary to an extent that is compatible with the conservation of this species. This is because the measures described above would require pre-project surveys for Gentner's fritillary and preclude implementation of future activities under the PRMP that may affect Gentner's fritillary that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

The management direction described above has a high potential to protect and restore Gentner's fritillary habitat, maintain known populations, and facilitate surveys to discover and protect additional populations of this species prior to implementation of PRMP-associated management actions.

In addition, there are three proposed designations of ACECs in the PRMP: (1) Cobleigh Road; (2) Dakubetede Creek; and (3) Pickett Creek. These ACECs would be managed to maintain, enhance, or restore Gentner's fritillary at these locations.

The Service has published a recovery plan for Gentner's fritillary (USFWS 2003). The recovery plan provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. Provisions of the recovery plan include (USFWS 2003, p. 52) reducing encroachment by trees and shrubs through prescribed fire, mowing, etc.; curtailing new roads in suitable habitat; control and prevent invasive weeds; and reducing deer grazing through fencing.

Notwithstanding the above information, the BLM also acknowledges (BLM 2016a, p. 19) that implementation of the PRMP has the potential to adversely affect Gentner's fritillary populations that have not yet been discovered in certain land-use allocations and where no management projects are implemented under the PRMP. Gentner's fritillary grows in hardwood and coniferous forested areas with an open canopy cover, which is primarily the result of stands that have developed with the influence of frequent, low to moderate severity fires. In the Late-

successional Reserve and the Riparian Reserve land allocations, there are many acres where the BLM will not be conducting management actions, but instead will let the forest develop and grow. Many of these areas have already been surveyed for Gentner's fritillary, though complete surveys have not been conducted (Friedman 2016, pers. comm.). Barring wildfire, those forest canopies are expected to grow denser over time. This has the potential to result in the loss of these undiscovered Gentner's fritillary populations. If the BLM were to conduct a potential action in these land-use allocations, they would survey for the Gentner's fritillary and protect and manage any discovered populations as they would all other known populations. There are currently 46 known Gentner's fritillary locations in the Late-successional Reserve and the Riparian Reserve land-use allocations that will be managed for retention and enhancement, so there is good reason to expect there are unknown populations that may also occur in these land-use allocations. Some of these currently unknown populations could potentially be located and protected as the management direction provides for conducting "additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations."

The Service agrees with BLM's assessment that implementation of the PRMP has the potential to adversely affect Gentner's fritillary populations that have not yet been discovered in certain land-use allocations and where no management projects are implemented under the PRMP. Although the effect of such loss of unknown populations has the potential to be adverse, for Gentner's fritillary, the Service concludes that implementation of the PRMP will provide for the retention, management, and enhancement the 162 existing known populations of this species within the action area (which is ~80 percent of the known species' populations), along with the establishment of new populations. The loss of these unknown populations is not expected to significantly affect the distribution and reproduction of Gentner's fritillary because it is a widespread species throughout BLM lands in southern Oregon in known populations and in practice, few populations, if any, are systematically managed to prevent seral succession. While overall numbers would be reduced if these unknown populations were to be lost, BLM lands contain significant populations so we do not expect a significant impact to the species from such a loss. These actions will be consistent with Gentner's fritillary recovery plan (USFWS 2003) and are sufficient to contribute positively to the recovery needs of the species within the action area. The recovery criteria of the species can be met by conserving and enhancing just the known populations on BLM lands without any population contribution from non-federal lands within the action area.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be "caused by or will result from" the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

The potential exists for Gentner's fritillary populations to occur on non-federal lands that are interspersed with BLM lands within the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon. There are known populations on state lands, Josephine county lands, and on lands managed by ODOT. These lands are not interspersed with BLM lands in a manner such that they are within the action area although they are managed for retention of Gentner's fritillary. On non-federal timber lands interspersed within BLM lands the Service is not aware of any Gentner's fritillary populations, although it is likely surveys have not been conducted in most or all cases. Since these lands are generally managed for timber harvest they are also managed for closed canopy forests which yield a higher return per acre. Because these lands are managed for closed canopy conditions, the Service anticipates there are few, if any, extant populations within the action area on non-federal lands. Any potential populations on private lands would not be expected to be significantly large because of the forest structural conditions managed for on commercial timber lands are not conducive to the Gentner's fritillary growing conditions. Timber harvest activities on these lands could potentially impact those non-federal populations through crushing by heavy machinery use and logging operations, and they could be lost. Fire exclusion could result in more closed canopy stands which have the potential to create conditions that are not conducive to Gentner's fritillary retention. The loss of any unknown Gentner's fritillary populations on non-federal lands within the action area are expected to be small and to not significantly influence the overall population numbers, distribution or reproduction of Gentner's fritillary given populations on BLM lands in southern Oregon.

CONCLUSION

After reviewing the current status of Gentner's fritillary, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the Gentner's fritillary.

The key basis for this conclusion is the two PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species, constraining potential adverse effects of PRMP-associated resource programs on Gentner's fritillary that are not compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations in Late Successional Reserve, Riparian Reserve allocations and on non-federal lands, if they occur, where habitat conditions may not be maintained. The proposed management of these known populations on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing the species' viability without restricting the species' range. The Service expects that maintenance and improvements in these populations on BLM lands is likely to positively contribute to the recovery needs of the species within the action area. Taking into consideration the potential effects associated with unknown populations and cumulative effects, the PRMP is not likely to jeopardize the species because under the PRMP the BLM will protect, maintain and enhance all known and newly discovered populations on BLM lands within the action area which is expected to provide a well-distributed and robust meta-population within the three recovery units within the action area. The recovery criteria of the species can be met by conserving and enhancing just the known populations on BLM lands without any population contribution from non-federal lands within the action area.

KINCAID'S LUPINE

STATUS OF THE SPECIES – KINCAID'S LUPINE

Kincaid's lupine was listed as threatened, on January 25, 2000 (USFWS 2000). Critical habitat was designated on October 6, 2006 (USFWS 2006a). A recovery plan was finalized for this species on May 20, 2010 (USFWS 2010). This species is found in Oregon (Benton, Lane, Polk Yamhill and Washington counties) and Washington (Lewis County). This species is on the state of Oregon's Threatened Plant list; in Washington it is classified by the Washington Natural Heritage Program as endangered (USFWS 2010).

Population Trends and Distribution

Kincaid's lupine is found in dry upland prairies from Lewis County, Washington, in the north, south to the foothills of Douglas County, Oregon; however, most of the known and historical populations are found in the Willamette Valley (USFWS 2010). Historically, the species was documented from Vancouver Island, British Columbia, Canada (Dunn and Gillet 1966), but has not been located in that region since the 1920s (Kaye 2000). Before Euro-American settlement of the region, Kincaid's lupine was likely well distributed throughout the prairies of western Oregon and southwestern Washington; today, habitat fragmentation has resulted in existing populations that are widely separated by expanses of unsuitable habitat.

Range-wide, Kincaid's lupine is known at about 164 sites, comprising about 246 ha (608 acres) of total coverage (USFWS 2010). In Oregon, the ONHIC (2014) reported Kincaid's lupine over 100 sites. From these locations, at least 43 populations are considered potential populations that could contribute to recovery (USFWS 2014, unpublished data); and 25 of those populations have protection in place specifically for the plant. When the Service listed the Fender's blue butterfly as endangered and Kincaid's lupine as threatened in 2000 (USFWS 2000), Washington County was not listed as part of the range of either species' because no previous populations had been identified in this County. In 2011 however, a population of Fender's blue butterfly and Kincaid's lupine was discovered on the north side of Hagg Lake, on Bureau of Reclamation, in Washington County, Oregon.

Until the summer of 2004, Kincaid's lupine was known from just two extant populations in Washington, in the Boistfort Valley in Lewis County, more than 160 km (100 miles) from the nearest population in the Willamette Valley (USFWS 2010). Arnett (2014) reported a total of five populations across nine sites of Kincaid's lupine in 2014. At two sites, Kincaid's lupine covered more than 1,000 m² (1,196 square yards) each (Boistfort and Cowlitz Prairie); only one plant was observed at Drew's Prairie in 2013. Only one location (Lozier Preserve within the Cowlitz Prairie population) has protection for Kincaid's lupine; all other locations are privately owned with no formal protections.

Monitoring the size of Kincaid's lupine populations is challenging because its pattern of vegetative growth renders it difficult to distinguish individuals (Wilson *et al.* 2003). Instead of counting plants, most monitoring for this species relies on counting the number of leaves per unit area, partly because there is a strong correlation between Fender's blue butterfly egg numbers

and lupine leaf density (Schultz 1998, Kaye and Thorpe 2006). Leaf counts are time consuming, however, recent evaluations have shown that lupine cover estimates are highly correlated with leaf counts, much faster to perform, and useful for detecting population trends (Kaye and Benfield 2005).

Life History and Ecology

Kincaid's lupine is a long-lived perennial species that can survive for several decades (Wilson *et al.* 2003). Individual plants are capable of spreading by rhizomes, producing clumps of plants exceeding 20 m (33 feet) in diameter. Population counts are thus unreliable, and apparently large populations may consist of few genetic individuals. Leaves are oval-palmate, with very narrow leaflets. The small, purplish-blue pea flowers grow in loose racemes that are 15.2 to 20.3 cm (6 to 8 inches) tall.

Flowering begins in April and extends through June (USFWS 2010). As the summer dry season arrives, Kincaid's lupine becomes dormant, and is completely senescent by mid-August (Wilson *et al.* 2003). Pollination is largely accomplished by small native bumblebees (*Bombus mixtus* and *B. californicus*), solitary bees (*Osmia lignaria*, *Anthophora furcata*, *Habropoda* spp., *Andrena* spp., and *Dialictus* spp.) and occasionally, European honey bees (*Apis mellifera*) (Wilson *et al.* 2003). Insect pollination appears to be critical for successful seed production (Wilson *et al.* 2003).

Kincaid's lupine reproduces by seed and vegetative spread. It is able to spread extensively through underground growth. Individual clones can be several centuries old (Wilson *et al.* 2003), and become quite large with age, producing many flowering stems. As part of a genetic evaluation, collections taken from small populations of Kincaid's lupine at the Baskett Slough National Wildlife Refuge were found to be genetically identical, indicating that the population consists of one or a few large clones (Liston *et al.* 1995). Reproduction by seed is common in large populations where inbreeding depression is minimized and ample numbers of seeds are produced. In small populations, seed production is reduced and this appears to be due, at least in part, to inbreeding depression (Severns 2003).

Kincaid's lupine is vulnerable to seed, fruit and flower predation by insects, which may limit the production of seeds. Seed predation by bruchid beetles and weevils and larvae of other insects has been documented, and may result in substantially reduced production of viable seed (Kaye and Kuykendall 1993, Kuykendall and Kaye 1993). Floral and fruit herbivory by larvae of the silvery blue butterfly (*Glaucopsyche lygdamus columbia*) has also been reported (Kuykendall and Kaye 1993). The vegetative structures of Kincaid's lupine support a variety of insect herbivores, including root borers, sap suckers and defoliators (Wilson *et al.* 2003).

Kincaid's lupine is the primary larval host plant of the endangered Fender's blue butterfly (Wilson *et al.* 2003). Female Fender's blue butterflies lay their eggs on the underside of Kincaid's lupine leaves in May and June; the larvae hatch several weeks later and feed on the plant for a short time before entering an extended diapause, which lasts until the following spring (Schultz *et al.* 2003). Kincaid's lupine, like other members of the genus *Lupinus*, is unpalatable to vertebrate grazers.

Habitat Characteristics

In the Willamette Valley and southwestern Washington, Kincaid's lupine is found on upland prairie remnants where the species occurs in small populations at widely scattered sites (USFWS 2010). A number of populations are found in road rights-of-way, between the road shoulder and adjacent fence line, where they have survived because of a lack of agricultural disturbance. Some of the populations in Washington occur in pastures and appear to benefit from light grazing by livestock, which reduces the cover of competing shrubs and grasses (Joe Arnett, Washington Department of Natural Resources, in litt. 2008). Common native species typically associated with Kincaid's lupine include: Roemer's fescue, California oatgrass, Tolmie star-tulip (*Calochortus tolmiei*), Oregon sunshine (*Eriophyllum lanatum*), and wild strawberry (*Fragaria virginiana*). The species appears to prefer heavier, generally well-drained soils and has been found on 48 soil types, typically Ultic Haploxerolls, Ultic Argixerolls, and Xeric Palehumults (Wilson *et al.* 2003).

In Douglas County, Oregon, Kincaid's lupine appears to tolerate more shaded conditions, where it occurs at sites with canopy cover of 50 to 80 percent (Barnes 2004). In contrast to the open prairie habitats of the more northerly populations, in Douglas County, tree and shrub species dominate the sites, including Douglas-fir (*Pseudotsuga menziesii*), California black oak (*Quercus kelloggii*), Pacific madrone (*Arbutus menziesii*), ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), hairy manzanita (*Arctostaphylos columbiana*), and Pacific poison oak (*Toxicodendron diversilobum*).

In contrast to historical ecosystem composition, invasive non-native species are a significant component of Kincaid's lupine habitat today (USFWS 2010). Common invasive species include: tall oatgrass, false brome, orchard grass, tall fescue, Himalayan blackberry and Scotch broom (Wilson *et al.* 2003). In the absence of fire, some native species, such as Pacific poison oak and bracken fern (*Pteridium aquilinum*), invade prairies and compete with Kincaid's lupine.

Threats/Reasons for Listing

A serious long-term threat to all Willamette Valley prairie species is the change in community structure due to plant succession. The vast majority of Willamette Valley prairies would likely be forested if left undisturbed. The natural transition of prairie to forest in the absence of disturbance such as fire will lead to the eventual loss of these prairie sites unless they are actively managed (Johannessen *et al.* 1971; Kuykendall and Kaye 1993).

The three major threats to Kincaid's lupine populations are habitat loss, competition from non-native plants and elimination of historical disturbance regimes (Wilson *et al.* 2003, USFWS 2010). Habitat loss from a wide variety of causes (*e.g.*, urbanization, agriculture, silvicultural practices and roadside maintenance) has been the single largest factor in the decline of Kincaid's lupine (USFWS 2000). Land development and alteration in the prairies of western Oregon and southwestern Washington have been so extensive that the remaining populations are essentially relegated to small, isolated patches of habitat. Habitat loss is likely to continue as private lands are developed. At least 49 of 54 sites occupied by Kincaid's lupine in 2000, at the time of

listing, were on private lands and are at risk of being lost unless conservation actions are implemented (USFWS 2000).

Habitat fragmentation and isolation of small populations may be causing inbreeding depression in Kincaid's lupine. The subspecies was likely wide-spread historically, frequently outcrossing throughout much of its range, until habitat destruction and fragmentation severely isolated the remaining populations (Liston *et al.* 1995). There is some evidence of inbreeding depression, which may result in lower seed set (Severns 2003). Hybridization between Kincaid's lupine and sickle-keeled lupine has been detected at Baskett Slough National Wildlife Refuge (Liston *et al.* 1995).

Before settlement by Euro-Americans, the regular occurrence of fire maintained the open prairie habitats essential to Kincaid's lupine (USFWS 2010). The loss of a regular disturbance regime, primarily fire, has resulted in the decline of prairie habitats through succession by native trees and shrubs, and has allowed the establishment of numerous non-native grasses and forbs. Some aggressive non-native plants form dense monocultures, which compete for space, water and nutrients with the native prairie species, and ultimately inhibit the growth and reproduction of Kincaid's lupine by shading out the plants (Wilson *et al.* 2003). When Kincaid's lupine was listed, we estimated that 83 percent of upland prairie sites within its range were succeeding to forest (USFWS 2000).

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and result in encroachment to suitable Kincaid's lupine meadow for mixed forest habitat. These potential impacts may affect the environmental baseline for Kincaid's lupine and a general overview of these potential effects is provided in Appendix D. Although it appears likely that Kincaid's lupine could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of Kincaid's lupine where it occurs on BLM managed land including the two ACECs that will be managed to maintain, enhance or restore Kincaid's lupine at these locations. In addition, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within existing and newly discovered (or established) plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning of trees, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including natural meadows and oak/savannah woodlands. These measures will increase the ability of Kincaid's lupine to persist and recover in the face of climate change on BLM lands within the action area.

Recovery Measures

Active research efforts have focused on restoring the essential components of Kincaid's lupine habitat by mimicking the historical disturbance regime with the application of prescribed fire, mowing and manual vegetation removal to set back succession and reduce competition from non-native invasive plants (USFWS 2010). Research and habitat management programs for Kincaid's lupine have been implemented at several sites, including Baskett Slough National Wildlife Refuge, BLM Fir Butte site, and TNC's Willow Creek Preserve (Wilson *et al.* 2003, Kaye and Benfield 2005). Prescribed fire and mowing before or after the growing season have been effective in reducing the cover of invasive non-native plants; following treatments, Kincaid's lupine has responded with increased leaf and flower production (Wilson *et al.* 2003). Research has also been conducted on seed germination, propagation and reintroduction of Kincaid's lupine (Kaye and Kuykendall 2001a, 2001b, Kaye and Cramer 2003, Kaye *et al.* 2003a). Seeds of this species have been banked at the Rae Selling Berry Seed Bank in Portland, Oregon (Portland State Environmental Science and Management 2015).

The BLM, Umpqua National Forest and the Service completed a programmatic conservation agreement for Kincaid's lupine in Douglas County, Oregon, in April 2006 (BLM *et al.* 2006). The objectives of the agreement are: (1) to maintain stable populations of the species in Douglas County by protecting and restoring habitats; (2) to reduce threats to the species on BLM and Forest Service lands; (3) to promote larger functioning metapopulations, with increased population size and genetic diversity; and (4) to meet the recovery criteria in the Recovery Outline for the species (USFWS 2006b).

Populations of Kincaid's lupine that occur on public lands or lands that are managed by a conservation organization are at the Service's William L. Finley National Wildlife Refuge and Baskett Slough National Wildlife Refuge, the U.S. Army Corps of Engineer's Fern Ridge Reservoir, BLM units in Lane and Douglas Counties, the Umpqua National Forest, TNC's Willow Creek Preserve, and at a small portion of Oregon State University's Butterfly Meadows in the McDonald State Forest (USFWS 2010). All of these parcels have some level of management for native prairie habitat values. For additional information on recovery goals, objectives, and criteria for Kincaid's lupine is available in the Recovery Plan for *Lupinus sulphureus* ssp. *kincaidii* (USFWS 2010).

ENVIRONMENTAL BASELINE – KINCAID'S LUPINE

Within the planning area, the primary habitat is open woodland and meadow edges, often near roadsides, associated with Pacific madrone, incense cedar, and Douglas-fir trees with a relatively open canopy cover. Seven Kincaid's lupine populations are known in the action area, of which six occur in openings within woodland or forest communities. In addition, there are five sites on BLM-administered land within the West Eugene Wetlands, which is outside of the action area.

The primary threats to Kincaid's lupine in the planning area are forest succession and resulting canopy shading, encroachment by non-native invasive plants, and road maintenance. In addition, the populations in the planning area are generally small and isolated from each other. This

isolation limits the likelihood of cross-pollination between populations, which could result in inbreeding depression.

Douglas County

Fifteen populations of Kincaid's lupine exist in Douglas County, six are located on the Roseburg District of BLM (Table 18), eight are found on private lands and one population is managed by the Forest Service. Douglas County is the southernmost range of Kincaid's lupine. As noted in the BA (BLM 2016a, p. 49), "In April 2006, the Roseburg District, U.S. Fish and Wildlife Service, and the Umpqua National Forest completed a programmatic conservation agreement for Kincaid's lupine in Douglas County (USDI BLM, USDI FWS, and USDA FS 2006). The three cooperating agencies completed the "Management Plan for Kincaid's Lupine in Douglas County, Oregon" in March 2008 (USDI BLM, USDI FWS, and USDA FS 2008). The management actions specified in the management plan tier to the management goals and objectives for the recovery of Kincaid's lupine (USFWS 2010). The management plan proposes a goal of 5,000 m² of occupied habitat consisting of at least two meta-populations in Douglas County.

In 2015, the Institute for Applied Ecology (IAE) completed a document for the Roseburg District BLM reporting on population monitoring and restoration of Kincaid's lupine for the six populations within the Roseburg District (Giles *et al.* 2015). The document provides preliminary findings and summarizes monitoring by assessing foliar cover, raceme count, and fruit production. The six sites include Loose Laces, Letitia Creek, Callahan Meadow, China Ditch, Dickerson Heights, and Stout's Creek (Table 18). Most of these sites have been monitored since 2003. Since 2007, cover has been the only measure of abundance of Kincaid's lupine at these sites, as is the standard throughout the species range (USFWS 2010).

Table 18. Kincaid's lupine population data (total cover in reported in m²) from 2006-2015 on BLM lands in Douglas County (Giles 2015).

Population	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Callahan Meadows	8.5	10.41	8.36	9.43	13.12	9.07	15.74	13.23	13.38	14.27
China Ditch	21.22	18.27	17.98	19.18	40.63	25.02	53.03	64.17	77.75	44.14
Dickerson Heights	17.26	14.9	15.53	20.65	24.32	31.38	47.42	45.6	49.89	48.49
Letitia Creek	8.12	5.57	4.99	5.25	2.98	1.17	1.54	*	2.8	2.92
Loose Laces	25.48	11.55	15.8	19.1	17.55	19.3	26.29	40.13	34.83	44.57
Stout's Creek	21.24	13.38	7.64	11	17.72	7.58	19.32	27.81	23.93	**

* Monitoring not possible

** No access for monitoring

Specific information regarding abundance, raceme count, and fruit production of the six sites located in Roseburg District can be found in Giles *et al.* (2015), and is incorporated here by reference. According to the IAE report, there is significant variability in the measured cover,

raceme, and fruit production at the six populations monitored in the Roseburg BLM District and overall, all of the sites have had a decrease in seed set and raceme count in 2015 (Giles *et al.* 2015). Foliar cover did not decrease as dramatically, or remained relatively stable as compared to 2014 values, however, at Letitia Creek, Loose Laces, Stout's Creek and portions of Callahan Meadows, there has been a general decline in foliar cover ever since monitoring began (Giles *et al.* 2015).

Of the three sites (Loose Laces, Dickerson Heights, and China Ditch) monitored in 2015 for fruit racemes, the numbers indicate a decrease in fruit production from 2014 to 2015. As in previous years, no viable fruits were produced at Callahan Meadows, so this site was not monitored for reproductive effort. Additionally, reproductive effort at Letitia Creek was not monitored in 2014 or 2015 because no racemes were noted at the time of foliar monitoring (Giles *et al.* 2015).

In 2015, a fire broke out around Stout's Creek and some plants along Stout's Creek Road were damaged during the post clean-up and hazardous tree removal. However, the population is overall intact (Friedman 2016, pers. comm.).

Giles *et al.* (2015) recommends continued surveys of Kincaid's lupine and additional characterization of soils at Kincaid's lupine sites. Reintroduction efforts of Kincaid's lupine at select sites in Douglas County by IAE will begin in 2017, with seed collection and site selection in 2016 (Giles *et al.* 2015).

Oak Basin

This Kincaid's lupine population is located in remnant south and west facing upland prairies ranging from 1630 to 2140 feet in elevation. The lupine population occurs on both Oak Basin Tree Farm (OBTF) and BLM lands, with the majority of the population occurring on BLM land in the ACEC (BLM 2010).

The current population of Kincaid's lupine at Oak Basin is over 2000 individual plants (BLM 2010). Since the start of lupine monitoring at the basin in 2006, the total lupine cover area and number of inflorescences has shown a 25 percent and 322 percent increase, respectively (Table 19) (Giles-Johnson *et al.* 2010). The largest number of Kincaid's lupine patches, cover, and inflorescences are found in the two upper meadows (*i.e.*, coinciding with the occupied area shown on Figure 5 for the lupine).

Table 19. Kincaid's lupine population data from 2006-2015 at Oak Basin (Giles-Johnson *et al.* 2010 and Giles *et al.* 2015)

Measure	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Cover (m²)¹	102	94	102	110	127	158	165	74	150	92
No. of Inflorescences	864	3,105	2,350	1,467	3,646	4,168	2,408	195	2,046	460

¹ - Total cover rounded to the nearest whole number

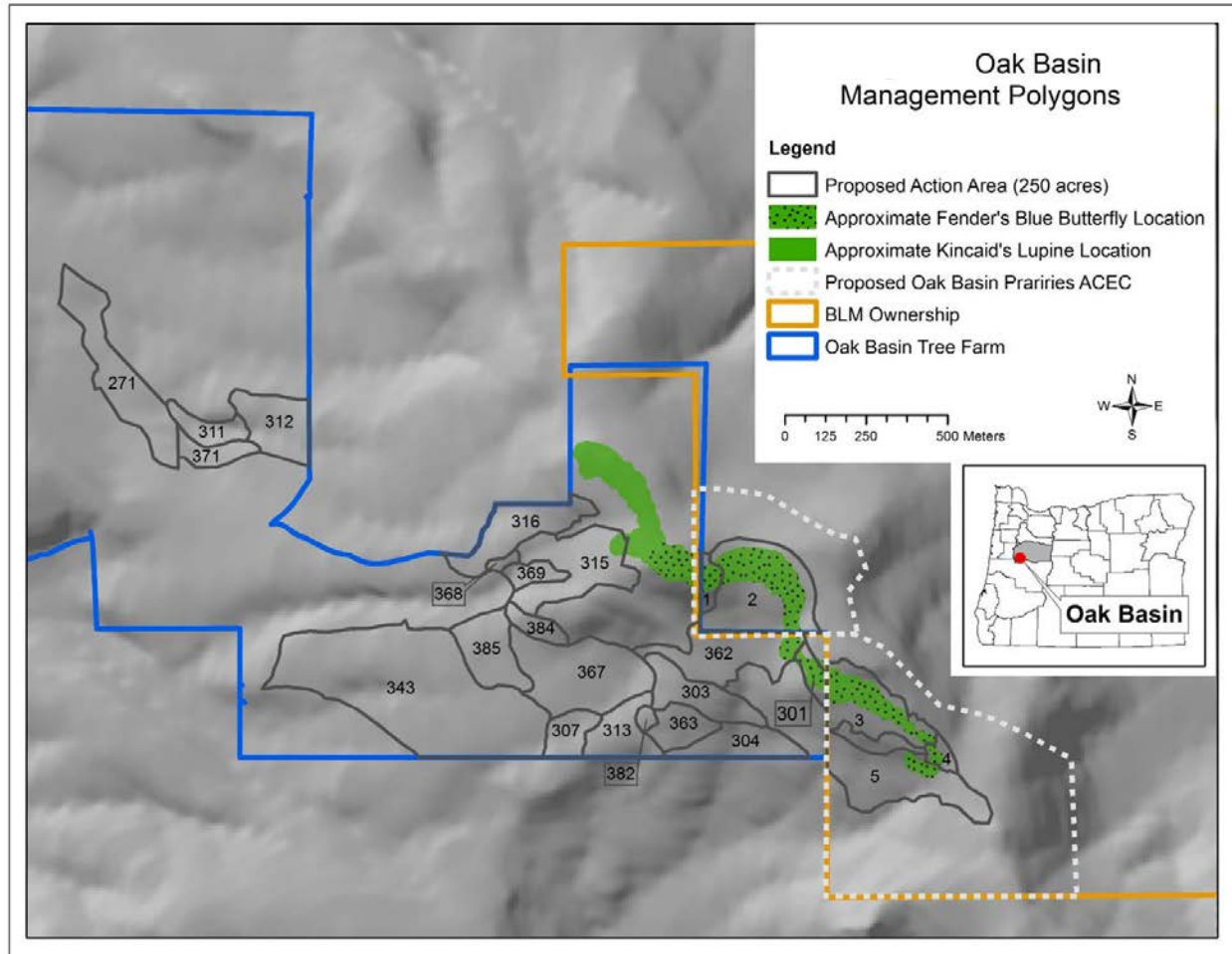


Figure 5. Oak Basin management (treatment) polygons individually numbered and outlined in dark gray (Source: BLM 2011 Figure 3).

Total lupine cover area on the OBTF (*i.e.*, private land portions of the basin) in 2009 and 2010 was 25 and 18 m², respectively. The number of inflorescences in these same years on the OBTF was 79 and 51, respectively. Kincaid's lupine seed collection on the private land in 2009-2010 resulted in very little viable seed (Jancaitis 2011, pers. comm.). BLM also noted an overall low basin seed set in Kincaid's lupine since the start of lupine monitoring in 2006 (BLM 2010).

The Kincaid's lupine population provides for Fender's blue butterfly connectivity to other known and potential butterfly sits in the Coburg Hills area. Habitat quality at Oak Basin for Kincaid's lupine is poor-to-moderate with a heavy infestation of invasive plant species (Giles-Johnson *et al.* 2010). The greatest threat to Kincaid's lupine at Oak Basin is competition with invasive plant species such as: Himalayan blackberry (*Rubus armeniacus*), oxeye daisy (*Leucanthemum vulgare*), crested dogstail grass (*Cynosurus cristatus*), tall fescue (*Festuca arundinacea*), and tall oat grass (*Arrhenatherum elatius*). The Oak Basin meadows are also being invaded by the Scotch broom (*Cytisus scoparius*) (Thorpe and Massatti 2008, Giles-Johnson *et al.* 2010).

EFFECTS OF THE ACTION – KINCAID’S LUPINE

Although several resource programs under the PRMP have the potential to adversely affect Kincaid’s lupine, the BLM (2016a, pp. 160) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species. The specific measures are:

1. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
 - *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
 - *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
 - *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*

2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

Implement activities as necessary to maintain, enhance, or restore relevant and important values.

Absent the above constraints, several resource programs under the PRMP would have the potential to adversely affect Kincaid's lupine depending on how the BLM implements the particular program in areas occupied by this species. For example, the forest management program includes fuel reduction activities such as thinning, brush removal or hazard tree removal that have the potential to injure or kill individual plants by dragging or yarding harvested logs over plants; the forest management program also includes fuel reduction activities such as prescribed fire that has the potential to injure or kill individual plants while the plants are above ground; and the Lands and Realty program includes road-building activities that could remove all or portions of Kincaid's lupine populations within or adjacent to a road bed. Within the ACECs, restoration activities to promote prairie and oak habitats have the potential to adversely affect the Kincaid's lupine by implementing actions such as mowing, broadcast burning, and pile burning to manage for invasive species. These types of management actions have the potential to cause mortality to individual plants, reduction in seed dispersal throughout the greater population, and modify suitable habitat. Indirect negative effects could be a potential short term reduction in the population amount or size in the following year(s).

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the Kincaid's lupine to an extent that is compatible with the conservation of this species. This is because the measures described above would require pre-project surveys for Kincaid's lupine and preclude implementation of future activities under the PRMP that may affect Kincaid's lupine that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

The management direction described above has a high potential to protect and restore Kincaid's lupine habitat, maintain known populations, and facilitate surveys to discover and protect additional populations of this species prior to implementation of PRMP-associated management actions.

There are two proposed designations of ACECs in the PRMP: Oaks Basin 1, 2, 3, and Callahan Meadows ACECs. These ACECs would be managed to maintain, enhance or restore Kincaid's lupine at these locations.

The Service has published a recovery plan for the Kincaid's lupine (USFWS 2010). The recovery plan provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include the preservation, restoration and management of existing populations and habitat. This is further defined as permanent reduction or elimination of the threats and application of appropriate and adaptive management to ensure species survival and recovery.

The Service agrees with BLM's assessment that implementation of the PRMP has the potential to adversely affect Kincaid's lupine populations that have not yet been discovered in certain land-use allocations and where no management projects are implemented under the PRMP. Although the effect on Kincaid's lupine of such losses has the potential to be adverse, the Service concludes that implementation of the PRMP has a high potential to result in the retention, management, enhancement and augmentation of 10 existing, known population sites of this species within the action area (which is approximately 6 percent of the known species' populations), along with the establishment and discovery of new populations. Such potential effects would be consistent with the Kincaid's lupine recovery plan and are sufficient to contribute positively to the recovery needs of the species within the action area.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be "caused by or will result from" the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

The potential exists for Kincaid's lupine populations to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon. There are eight Kincaid's lupine sites known to occur on private lands in Douglas County where Kincaid's lupine tolerates more shaded conditions (USFWS 2010, p. II-24). If these sites are not actively managed for prairie habitat, they will likely not persist into the future because of forest successional changes. Other than these sites, the Service is not aware of any Kincaid's lupine habitat on non-federal lands interspersed with BLM lands within the action area, although it is likely surveys have not been conducted in most or all cases. Since these lands are generally managed for timber harvest they are also managed for closed canopy forests which yield a higher return per acre. Because these lands are managed for closed canopy conditions, the Service anticipates there are currently few populations in the action area on non-federal lands. Any potential populations on private lands would not be expected to be significantly large because of the forest structural conditions managed for on commercial timber lands are not conducive to the Kincaid's lupine growing conditions. However, some private and State lands may manage to benefit the species with mowing, burning, and grazing. On these lands the Service expects these populations to persist. On other private lands habitat is grazed, managed

for other reasons such as fuels control, or left unmanaged. Threats present at these private areas include nonnative, invasive forbs; alteration in hydrology caused by roadside maintenance; competition from invasive, nonnative plant species; and natural succession. Prairie habitats on private lands are expected to become more fragmented as land is converted to other uses, and are likely to continue to be invaded by non-native plants (USFWS 2010, p. II-23). While the potential loss of these eight privately owned sites may reduce the overall numbers of the Kincaid's lupine, it will not affect the well-distributed and robust meta-populations that currently occur on BLM lands within the action area.

CONCLUSION

After reviewing the current status of the Kincaid's lupine, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the Kincaid's lupine.

The key basis for this conclusion is the two PRMP resource programs and their associated conservation measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on Kincaid's lupine to an extent that is compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations in Late Successional Reserve, Riparian Reserve allocations and on non-federal lands, if they occur, where habitat conditions may not be maintained. The proposed management of these known populations on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing Kincaid's lupine's viability without restricting the species' range. The Service expects that improvements in these populations are likely to contribute positively to the recovery needs of the species within the action area. This is not likely to jeopardize the species because under the PRMP, the BLM will protect, maintain and enhance all known and newly discovered populations within the BLM portion of the action area which is expected to contribute to a well-distributed and robust meta-population within the seven recovery zones in the action area. Much of the recovery criteria of the species can be met by conserving and enhancing the known populations on BLM lands without any population contribution from non-federal lands within the action area.

LOST RIVER AND SHORTNOSE SUCKERS

STATUS OF THE SPECIES - LOST RIVER AND SHORTNOSE SUCKERS

Due to the similarities of these species (Family *Catostomidae*), their habitat needs, and overlap in habitat utilization, we combined the discussions for these two species and their critical habitat.

Taxonomy

The Lost River sucker was first described by Cope in 1879, as *Chasmistes luxatus*, based on specimens collected in Upper Klamath Lake. Shortly afterward, *Catostomus rex* was described from the Lost River and Tule Lake, in south-central Oregon and northern California, but has been regarded as a synonym of *D. luxatus*. Other authors have placed the Lost River sucker either in the genus *Deltistes* or *Catostomus*, but currently *Deltistes* is the generic epithet most widely used by fish taxonomists, and it is the name accepted by the American Fisheries Society and USFWS (Andreasen 1975, pp 1-3; Markle *et al.* 2005, p. 473; Miller and Smith 1981, p. 43; USFWS 1988, p. 5017).

The shortnose sucker was described by Cope in 1879 as *Chasmistes brevirostris*, based on specimens collected from Upper Klamath Lake. Fowler (1913, pp. 53-54) suggested that *C. brevirostris* should be transferred to the genus *Lipomyzon*, but this has not been adopted by later workers. Two additional nominal taxa, *C. stomias* and *C. copei*, were later described from Upper Klamath Lake and vicinity, but were synonymized with *C. brevirostris* by Miller and Smith (1981, p. 22). Molecular genetic evidence suggests that the genus *Chasmistes* is artificial and should be synonymized under *Catostomus* (Wagman and Markle 2000, p. 15), but no formal revision has been published.

Species Description

Upper Klamath River Basin suckers can be difficult to identify owing to considerable phenotypic variability, effects of hybridization, and to growth- and gender-related morphological changes (Markle *et al.* 2005, p. 473). The three upper Klamath Basin sucker species (the two aforementioned suckers and the Klamath largescale sucker (*Catostomus snyderi*)) are best distinguished based on multiple characters, since no one character is fully diagnostic. Diagnostic characters include: lip morphology, vertebral number, gill-raker number, and head shape (Andreasen 1975, p. iii; Markle and Simon 1993, p. iii; Markle *et al.* 2005, p. 475). Markle *et al.* (2005, pp. 475-480) recently provided a diagnostic key for the three upper Klamath River basin sucker species which is summarized below in Table 20.

The greatest difficulty in identification of upper Klamath Basin suckers is separating the shortnose sucker from the Klamath largescale sucker, with which it most often interbreeds. However; Markle *et al.* (2005, p. 480), state that they can be “readily distinguished” by lip morphology and gill-raker counts. Other information can be helpful in separating these species as well and Markle *et al.* (2005, entire) point to some differences in local distributions, for example Klamath largescale sucker is less common in Upper Klamath Lake than the shortnose suckers, but is the only sucker found in the upper Williamson River. Also, spawning-run time

and location is somewhat different in the Sprague River with Klamath largescale sucker running mid-March to early April and many spawning upstream of Chiloquin, whereas the shortnose suckers run mid-April to early May and mostly spawn below Chiloquin.

Table 20. Comparative morphology of Klamath largescale suckers, Lost River suckers, and shortnose suckers, based on Markle *et al.* (2005, pp. 475-480).

Species	Maximum Body Length (cm)	Body Shape	Snout Shape	Lip Shape	Number of Gill Rakers	Number of Vertebrae
Klamath Largescale Sucker	55	Deep	Short & rounded	Large & papillose, no gap	29-40	40-46
Lost River Sucker	100	Elongate	Long & angular	Small with a gap	23-37	44-48
Shortnose Suckers	64	Elongate	Short & rounded	Small with a gap	30-45	41-45

Field identification of individual suckers can be problematic due to the high degree of morphological variability expressed by each species and the “mixing” of phenotypes caused by hybridization. Therefore, identification is frequently dependent on the experience of the observer, but is not accurate in every case, thus many specimens are reported as, “species uncertain.” In an effort to ensure Klamath sucker identifications are as accurate and consistent as possible, Oregon State University (OSU), U.S. Geological Survey (USGS), Klamath Tribes, U.S. Bureau of Reclamation, and Service biologists have participated in informal sucker identification workshops.

Legal Status

The Lost River sucker and shortnose sucker were listed as endangered on July 18, 1988 (USFWS 1988). Both species are also listed as endangered by the States of Oregon and California. A recovery plan for Lost River sucker and shortnose sucker was finalized on March 17, 1993 (USFWS 1993, p. i). Five-year reviews for the Lost River sucker and shortnose sucker were most-recently completed in 2012 (USFWS 2012a, entire, b, entire). A considerable amount of scientific information had been collected since the 1993 recovery plan and an updated, revised recovery plan for the Lost River sucker and shortnose sucker was released in 2013 (USFWS 2013a, entire).

On September 9, 1991, the Service received a 60-day notice of intent to sue from the Oregon Natural Resources Council (ONRC) for failure to prepare a recovery plan and to designate critical habitat for the Lost River sucker and shortnose sucker. On December 1, 1994, we

published proposed critical habitat for Lost River sucker and shortnose sucker (USFWS 1994); that proposal was never finalized. A settlement agreement was reached requiring the Service to submit a final rule designating critical habitat for the Lost River sucker and the shortnose sucker to the Federal Register no later than November 30, 2012 (Wood *et al.* v. Thorson *et al.*, No. 91–cv–6496– TC [D. Or.]). Critical habitat for the Lost River sucker and shortnose sucker was designated on December 11, 2012 (USFWS 2012c, entire).

Life history

Both sucker species spawn from February through May over gravel substrates in streams and rivers (Buettner and Scopettone 1990, pp. 19-20, 44-46). The Lost River sucker also spawns over rock and gravel substrates associated with shallow, spring-influenced areas along the eastern shore of Upper Klamath Lake (Barry *et al.* 2007a, pp. 18-19). Females broadcast their eggs where they fall into crevices between gravel or they are buried slightly (Buettner and Scopettone 1990, p. 19).

Both sucker species grow rapidly in their first five to six years, reaching sexual maturity sometime between years four and six for shortnose sucker and four and nine for Lost River sucker (Perkins *et al.* 2000b, p. 21). Lost River sucker and shortnose sucker have been aged to 55 and 33 years, respectively. Females produce a large number of eggs, 44,000 to 200,000 per year for Lost River sucker and 18,000 to 70,000 per year for shortnose sucker when they spawn (Buettner and Scopettone 1990, pp. 20, 47). Larger, older females produce substantially more eggs and, therefore, can contribute relatively more to recruitment than a recently matured female. However, only a small percentage of the eggs survive to become larvae. Because adults are potentially long-lived and fecund, these life history traits should make the species less sensitive to larval and juvenile mortality, but under current conditions adult survival is low and there is inadequate recruitment, as will be discussed later (USFWS 2013a, p. v). Lost River sucker and shortnose sucker do not normally die after spawning and can spawn many times during their lifetime.

Population Dynamics

Population Structure

The Lost River sucker population in the Upper Klamath Lake appears to consist of two distinct stocks: (1) several thousand Lost River sucker and a few shortnose sucker that spawn along shoreline springs; and (2) tens of thousands Lost River suckers that spawn in the Williamson and Sprague Rivers (Perkins *et al.* 2000b, p. 33). Mark-recapture data show that the two stocks maintain a high degree of fidelity to spawning areas and therefore seldom interbreed (Hayes *et al.* 2002, p. 39; Barry *et al.* 2007b, p. 41, b, p. 23). Shortnose sucker spawning is primarily confined to the Williamson River system, so there is only one substantial population or stock in Upper Klamath Lake (USFWS 2013a, p. 6).

Ecological Habitat Characteristics

The Lost River sucker and shortnose sucker have complex life histories that include stream/river, lake, marsh, and shoreline spring habitats and both species use a number of different aquatic habitats through their lives (USFWS 2013a, pp. 13-14). Adults primarily occupy open-water habitats with depths of 3 feet to 15 feet, but appear to prefer depths from 5 feet to 10 feet (Peck 2000, p. 3; Reiser *et al.* 2001, ch. 5 pp. 28-30; Banish *et al.* 2009, pp. 163-164). Lost River sucker and shortnose sucker are generally limited to lake habitats when not spawning, although river-resident fish have been documented, especially in the Lost River system (Buettner and Scoppettone 1991, pp. 14, 20).

Soon after hatching, when larvae reach about 0.2 to 0.6 inches total length (TL) and are mostly transparent with a small yolk sac, they move out of the gravel and into the water column (Buettner and Scoppettone 1990, pp. 101-102). Larval suckers spend relatively little time in rivers/streams before drifting downstream to the lakes by mid-July (Cooperman and Markle 2003, pp. 1147, 1149; 2004 p. 366; Ellsworth *et al.* 2009, p. 27); however, some instream rearing has been observed in the Sprague River and elsewhere. Larval habitat is generally in shallow water along the shoreline in both vegetated and unvegetated habitats (Buettner and Scoppettone 1990, pp. 30, 51; Cooperman and Markle 2004, p. 375; Crandall *et al.* 2008, p. 403). Juvenile suckers also occupy a wide variety of near and off-shores habitat in Upper Klamath Lake including emergent wetlands and non-vegetated areas with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990, pp. 33, 51; Simon and Markle 2001, p. 12, 2004, p. 12; Simon *et al.* 1996, p. 14, 1998, p. 7; Hendrixson *et al.* 2007, p. 2, b, entire; Burdick *et al.* 2008, entire) and move offshore into the lake as they grow. Water quality, especially dissolved oxygen concentrations are likely to affect distributions (Burdick *et al.* 2009, p. 2; Burdick and VanderKooi 2010, p. 13; Rasmussen 2011, p. 450; USFWS 2013a, p. 14).

Status and Distribution

Historical status and distribution

Prior to Anglo-European settlement, Lost River suckers and shortnose suckers occurred in Upper Klamath Lake, Tule Lake, Lower Klamath Lake, and presumably Clear Lake, as well as their tributaries. However, at the time of listing, these species were known from Upper Klamath Lake and its tributaries and outlet (Klamath Co., Oregon), including a “substantial population” of shortnose sucker in Copco Reservoir (Siskiyou Co., California), as well as collections of both species from Iron Gate Reservoir (Siskiyou Co., California) and J.C. Boyle Reservoir (Klamath Co., Oregon), and Lost River sucker from Sheepy Lake and Lower Klamath Lake (Siskiyou Co., California; USFWS 1988, 2013a). Remnants or highly hybridized populations were also stated to occur in the Lost River system (Klamath Co., Oregon, and Modoc and Siskiyou Co., California) including both species in Clear Lake Reservoir (Modoc Co., California) and Lost River sucker in Tule Lake (Siskiyou Co., California; USFWS 1988, p. 5017).

Although not stated explicitly, the reference in the listing document to “highly hybridized populations” in the Lost River Basin probably refers to shortnose suckers within Gerber Reservoir (Klamath Co., Oregon). Spawning likely occurred throughout the Upper Klamath

Lake drainage in both rivers and springs along shoreline of the lake (Andreasen 1975, pp. 38-39; Stine 1982, p. 9; NRC 2004, p. 194). Spawning also occurred in significant numbers in the Lost River system (Bendire 1889, p. 444; Howe 1969, p. 156), some of which occurred in the Big Springs area at Bonanza, Oregon.

These two fishes were once very abundant and were important seasonal foods of Native Americans and white settlers in the upper Klamath River basin prior to about 1900 (Cope 1879, p. 785; Gilbert 1898, p. 6; Stern 1965, pp. 11-12; Howe 1969, p. 134). Sucker spawning migrations occurred in the spring at a critical time when winter food stores had been exhausted (Stern 1965, p. 11). The Klamath and Modoc Indians dried suckers for later use. It was estimated that the aboriginal harvest at one site on the Lost River may have been 50 tons annually (Stern 1965, p. 11). Settlers built a cannery on the Lost River and suckers were also processed into oil and salted for shipment. In 1900, the Klamath Republican newspaper reported that “mullet,” as suckers were referred to, were so thick in the Lost River that a man with a pitch fork could throw out a wagon load in an hour. The first reference to sport fishing of “mullet” appears to be a 1909 reference to sportsmen snagging “mullet” in the Link River at Klamath Falls (Klamath Republican, 1909).

In 1959, suckers were made a game species under Oregon State law and snagging suckers in the Williamson and Sprague River was popular with locals and out-of-town sportsmen (Bragg 2001, entire, Markle and Cooperman 2002, p. 98). In the 1960s, Oregon Department of Fish and Wildlife (ODFW) estimated 100,000 pounds of suckers per year (approximately 12,500 fish) were harvested (Eugene Register-Guard, 1967). ODFW data indicated from 1966 through 1978, an approximate 50 percent decline in catches (from 3.5-5.6 suckers per angler-day before the 1969 bag limit, to 1.5-3.0 afterwards, Markle and Cooperman 2002, p. 98). More than 3,000 suckers were taken in the snag fishery in 1968 (Golden 1969, p. 9). Numbers of harvested suckers from spawning runs in the Sprague and lower Williamson Rivers increased from 1.2 fish per hour in 1966 to 4.7 fish/hour in 1969 and then, from 1969 on, there was a steady decline to 0.8 fish/hour in 1974 (Andreasen 1975, p. 36). Average weight of suckers caught in the fishery declined about 40 percent from 1966 to 1974 (from 7.5 to 4.9 pounds), and declines continued to the time of listing. By 1985, Bienz and Ziller (1987) estimated the harvest had dropped by about 95 percent, and based on this information, the game fishery was terminated in 1987, just prior to federal listing in 1988 (USFWS 1988, p. 5017).

Current status and distribution

At the time of listing, Lost River sucker and shortnose sucker were known from Upper Klamath Lake and its tributaries (Klamath Co., Oregon), the Lost River (Klamath Co. Oregon, and Modoc and Siskiyou Co., California), Clear Lake (Modoc Co., California), the Klamath River above Keno (Klamath Co., Oregon), and Klamath Rivers below Keno (Klamath Co., Oregon, and Siskiyou Co., California; USFWS 1988, p. 5017; 2013a, p. 12 Figure 6). The largest populations occur in Upper Klamath Lake and Clear Lake and their tributaries.

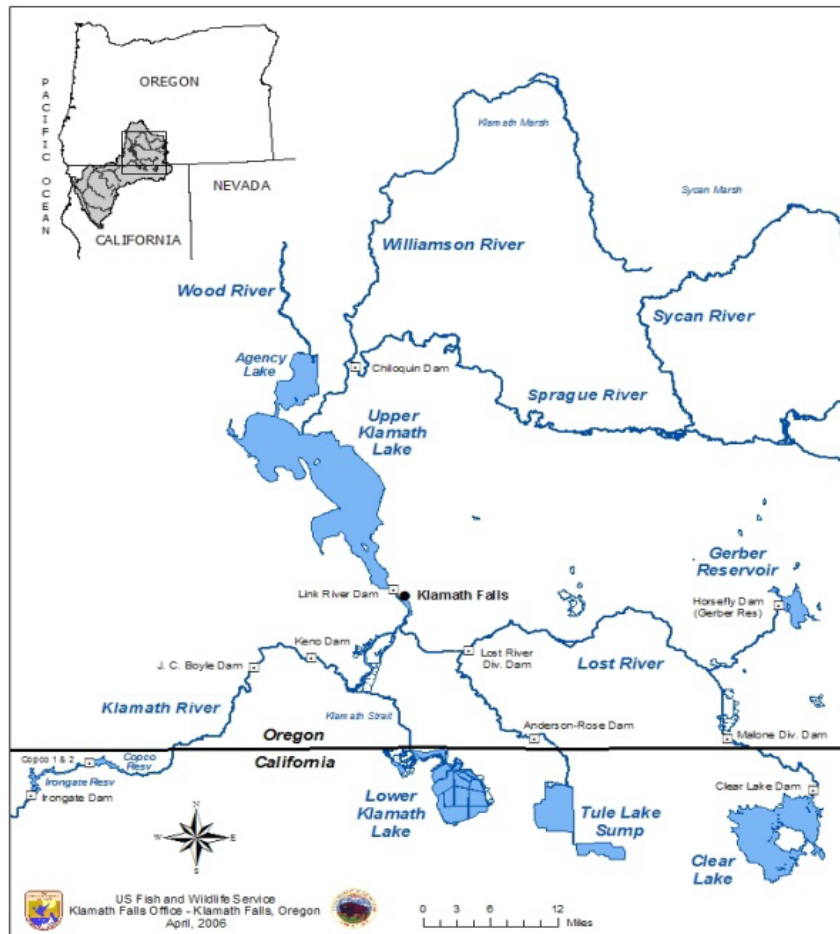


Figure 6. Map of the Upper Klamath River Basin showing primary water bodies.

Currently the total area of occupied lake habitat for Lost River sucker and shortnose sucker is about 118,000 acres, of which approximately 65 percent is in Upper Klamath Lake, which covers approximately 77,000 acres at full pool (Rasmussen 2011, p. 445; USFWS 2013a, pp. 3-4). The remaining habitat is in Clear Lake (25,000 acres); Tule Lake sump 1A (9,000 acres); Gerber Reservoir (4,000 acres); and Keno Reservoir (2,500 acres). Disjunct ‘populations’ also occupy areas outside of their historic distribution in Copco, Iron Gate, and J.C. Boyle Reservoirs on the Klamath River (NRC 2004, p. 192). Additional information about the distribution of the Lost River sucker and shortnose sucker is presented in the recent 5-year status reviews (USFWS 2012a, pp. 5-6, b, pp. 5-6), the revised recovery plan for the Lost River sucker and shortnose sucker (USFWS 2013a, entire), and the 2013 Klamath Project biological opinion (NMFS and USFWS 2013, entire).

Upper Klamath Lake and Tributaries

Upper Klamath Lake, in Klamath County, at 77,000 acres, is the largest natural lake in Oregon. Adult Lost River and shortnose suckers are widely distributed in Upper Klamath Lake during the fall and winter (NRC 2004, pp. 26-27, 189-193). In the spring months, they congregate in the

north end of the lake near Goose Bay and Modoc Point prior to moving into tributaries or shoreline areas for spawning (Hendrixson *et al.* 2003, p. 100). During summer months, adults are primarily found in the northern portion of the lake north of Bare Island (Peck 2000, pp. 6-7; Banish *et al.* 2009, p. 159). Reasons for this summer distribution appear to be related to better water quality near spring-fed Pelican Bay and the Williamson River (Reiser *et al.* 2001, ch. 6 p. 38; Banish *et al.* 2009, pp. 163-164). During the summer and early fall, Upper Klamath Lake water quality conditions periodically deteriorate to stressful and even lethal levels for suckers as a result of decomposition of massive algae blooms and resultant low levels of dissolved oxygen (Perkins *et al.* 2000b, p. 4; Loftus 2001, ch.1 p. 3; Wood *et al.* 2006, p. 3; Morace 2007, p. 2). Multi-year radio telemetry studies have documented Lost River and shortnose suckers concentrating in or near Pelican Bay during periods of deteriorating water quality, presumably to seek refuge at areas of better water quality (Peck 2000, p. 2; Banish *et al.* 2009, p. 163).

A discrete group of Lost River and shortnose suckers are known to spawn at sites along the eastern shoreline of Upper Klamath Lake below Modoc Rim, a prominent fault scarp (Andreasen 1975, p. 39; Buettner and Scopettone 1990, p. 19; Hayes and Shively 2001, p. 43; Shively *et al.* 2000, entire, Barry *et al.* 2007b, p. 18). All of the sites are associated with spring seeps that affect water temperature, which is warmer than the adjacent lake during the spawning season. Current spawning populations at the shoreline springs of Upper Klamath Lake are likely to number in the thousands of Lost River suckers and less than 100 shortnose suckers (Barry *et al.* 2007b, p. 21; USFWS 2013a, pp. 2, 6).

Known areas of concentrated Lost River sucker spawning in the Williamson and Sprague Rivers include the lower Williamson River from River Mile (RM) 6 to the confluence of the Sprague River (RM 11), lower Sprague River below Chiloquin Dam, and in the Beatty Gap area of the upper Sprague River (RM 75) (Buettner and Scopettone 1990, p. 19; Tyler *et al.* 2007, pp. 10-11; Ellsworth *et al.* 2008, p. 3). Removal of the Chiloquin Dam unblocks approximately 75 miles for spawning and migrations, but it is too early to assess the overall impact to the Lost River sucker (USFWS 2012a, p. 17). Other areas in the Sprague River watershed where Lost River suckers may spawn include the lower Sycan River and in the Sprague River near the Nine Mile area (Ellsworth *et al.* 2008, p. 15). Shortnose suckers from Upper Klamath Lake currently spawn in the lower Williamson and Sprague Rivers (Tyler *et al.* 2007, pp. 12-13; Ellsworth *et al.* 2008, p. 3). The few adult shortnose suckers captured at shoreline spawning areas in Upper Klamath Lake indicate that some shortnose sucker spawning is likely to still occur at these locations (Hayes *et al.* 2002, p. 39; Barry *et al.* 2007a, pp. 1-3, b, p. 21). Although species identification is not clear, a small number of suckers presumed to be shortnose sucker may spawn in the Wood River (USFWS 2012b, p. 5). It is possible that sucker spawning may occur in other tributaries to Upper Klamath Lake; however, recent investigations have not located suckers in tributaries other than the Williamson, Sprague, and Wood Rivers.

In the Williamson River, larval out-migration begins in April and is generally completed by July (USFWS 2013a, p. 13). Downstream movement takes place mostly at night and near the water surface (Klamath Tribes 1996, pp. 5-6; Cooperman 2004, p. 7; Ellsworth *et al.* 2008, pp. 11-12, 2009, p. 15), but movement does occur along the river margin during the day, at least in the lower river. Once in the lake, larvae disperse to near-shore areas where they move into shallow,

near-shore, vegetated and unvegetated habitats (Cooperman 2004, p. 7; Cooperman and Markle 2004, pp. 365-366; Crandall *et al.* 2008, p. 403; Erdman and Hendrixson 2009, p. iii, 2010, p. 6).

In Upper Klamath Lake, larval suckers are first captured by researchers in early April during most years, with peak catches occurring in late May to early July (Cooperman and Markle 2000, pp. 8-10; Crandall *et al.* 2008, p. 407; Erdman and Hendrixson 2009, p. 9, 2010, pp. 7, 12). Larval habitat is generally along the shoreline, in water 0.5-3 feet deep (Buettner and Scopettone 1990, p. 30; Cooperman and Markle 2004, p. 373). Larval density in near-shore habitats is usually low (less than 10/m²), but densities as high as 120 larvae/m² have been documented (Buettner and Scopettone 1990, p. 30; Markle and Simon 1993, p. iv; Simon and Markle 2001, p. 32, 2004, p. 20; Simon *et al.* 1995, pp. 11-12, 1996, pp. 10-11).

Keno Reservoir

Keno Reservoir is the first of five reservoirs on the Klamath River and is located just downstream of Upper Klamath Lake, near Klamath Falls, Oregon. Fisheries surveys in Keno Reservoir have been conducted infrequently and have generally been short in duration (Hummel 1993, p. 1; Piaskowski 2003, p. 1). The only intensive monitoring effort was conducted by Terwilliger *et al.* (2004, entire). Larvae and age-0 suckers were generally most abundant in the upper part of Keno Reservoir and decreased downstream. Juvenile, sub-adult and adult suckers are less common; although, U.S. Bureau of Reclamation (USBR) biologists have captured small numbers of adult suckers in Lake Ewauna, which is located at the upper end of the Keno Reservoir, indicating that a population numbering several thousand resides there (Kyger and Wilkens 2011, p. 3).

The relatively low number of adult suckers residing in Keno Reservoir appears to be related primarily to poor water quality in the summer (Piaskowski 2003, p. 7). Keno Reservoir is listed by the State of Oregon for not meeting Clean Water Act Section 303(d) water quality standards for pH, chlorophyll-a, dissolved oxygen and dissolved oxygen concentrations (Piaskowski 2003, p. 1). The reservoir regularly reaches stressful and lethal levels for suckers during July and August (Piaskowski 2003, p. 7; Deas and Vaughn 2006, p. i; USBR 2007, p. 109; Kirk *et al.* 2010, ch. 3 p. 11; Sullivan *et al.* 2011, p. 4). Fish die-offs, including juvenile suckers, have been a regular occurrence in the reservoir (Tinniswood w006, entire)

Gerber Reservoir

Gerber Reservoir is a small reservoir with a surface area of approximately 4,000 acres and is located in southeastern Klamath County, Oregon (Figure 7). Monitoring in Gerber Reservoir has documented a substantial shortnose sucker population (or shortnose sucker x Klamath largescale suckers [*Catostomus snyderi*]) exhibiting multiple size classes and presumably multiple age classes. Data from 2004 to 2006 indicate a lower frequency of larger adults compared to those from 2000 (Piaskowski and Buettner 2003, pp. 15-16; Leeseberg *et al.* 2007, pp. 7-8; Barry *et al.* 2007c, pp. 6-8). Such a change in length frequency suggests relatively good recruitment but low adult survivorship (USFWS 2002, p. 34). Lost River suckers do not occur in Gerber Reservoir probably because none were upstream of dam when it was constructed (Piaskowski and Buettner 2003, p. 4; Leeseberg *et al.* 2007, p. 4; Barry *et al.* 2007c, p. 3).

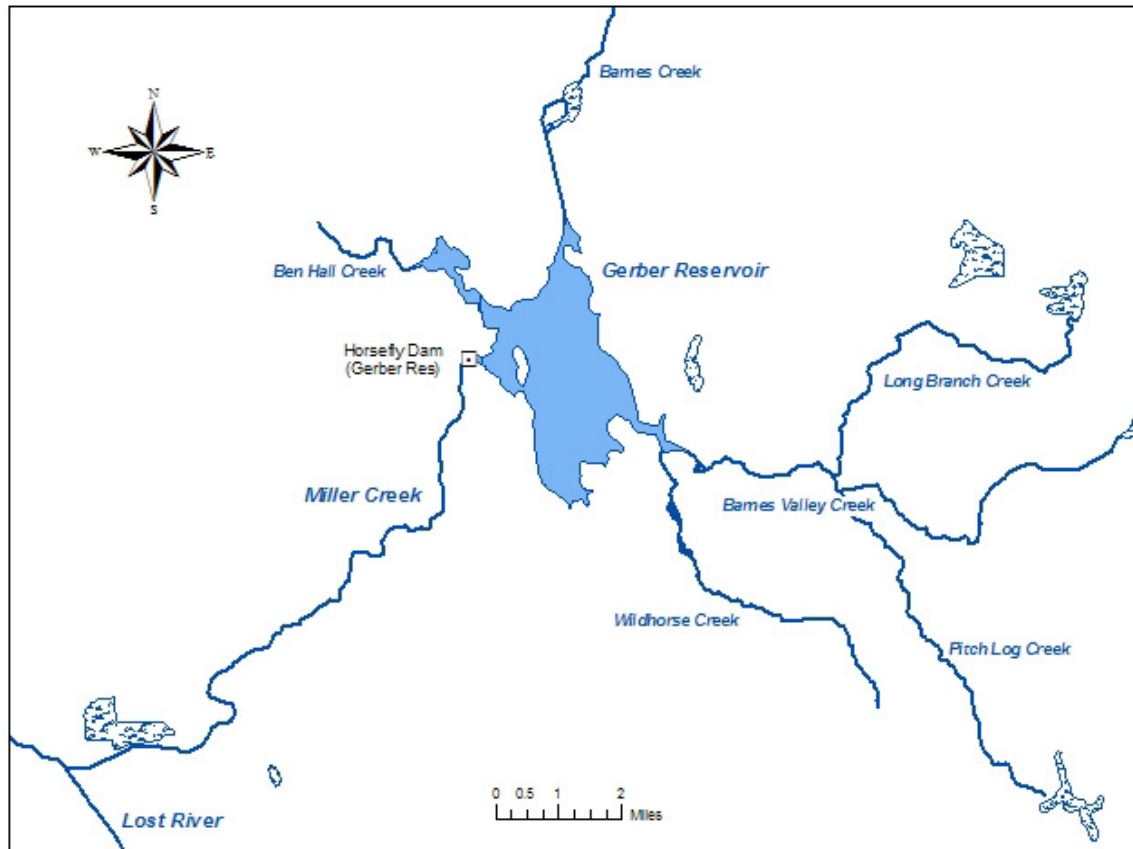


Figure 7. Vicinity map for the Gerber Reservoir area in Klamath County, Oregon.

While the population of shortnose sucker in Gerber Reservoir appears to have more frequent recruitment than some other populations, the problems of restricted distribution and lack of genetic connectivity with other populations still exist (USFWS 2012b, p. 15). A high degree of hybridization between shortnose and Klamath largescale suckers are thought to occur in Gerber Reservoir (Markle *et al.* 2005, p. 486). However, until the taxonomic status of these fish has been resolved, USFWS considers the Gerber Reservoir and tributary sucker population to be shortnose sucker.

Adult Demography and Population Trends in Upper Klamath Lake

The size of Upper Klamath Lake and the scarcity of Lost River and shortnose suckers make it difficult to accurately estimate their abundance in the lake. Lost River and shortnose sucker demography has been monitored since the mid-1990s using mark-recapture methods and PIT tags. It is also difficult to determine the age of Lost River and shortnose suckers. The length of fish is often used to estimate age of individuals, and the distribution of fish in various age classes is often estimated by assessing the number of fish of various lengths.

Lost River sucker and shortnose sucker populations transformed from ones dominated by old fish with little size diversity and consistently poor recruitment in the late 1980s and early to mid-1990s, to populations dominated by smaller young adult fish and very few remaining large

individuals by the late 1990s (Janney *et al.* 2008, p. 1812; USFWS 2012a, p. 4). This marked shift in size structure to smaller individuals suggests that substantial recruitment in these populations occurred sometime during the mid-1990s from fish born in the early 1990s. In recent years, populations of both species exhibited a slightly increasing trend in length (*i.e.*, 1 to 1.5 cm increase in median fork length per year) while the number of age classes in the population decreased (Janney and Shively 2007, p. 5; Janney *et al.* 2008, pp. 1818-1820; USFWS 2012a, p. 4, b, p. 4). Decreasing relative abundance of younger fish suggests that populations are comprised mostly of similarly-aged, older individuals, and that recent substantial recruitment is lacking.

One way ecologists determine if a population is increasing or decreasing is by evaluating survival, mortality, and recruitment, and calculating a variable called lambda (λ) over time. When λ is greater than 1, the population is increasing, and when it is less than 1 the population is decreasing. Several sources of information can be used to derive λ , such as regular counts of individuals, recruitment rates, and survival rates. This information can be determined from regular sampling, but it must be quantified several times before accurate assessments of trends in abundance can be made. When λ is known from a number of samplings conducted over a long period of time, the relative change in the size of a population can be determined, which is a variable known as Δt .

When the USGS Lost River and shortnose sucker capture-recapture program began in 1995, few fish were captured and tagged and mean estimates of survival and λ had little precision or statistical rigor, and Δt could not be accurately calculated. As the number of tagged fish increased each year, precision of these estimates improved and in 2001 (for Williamson-Sprague River spawning shortnose suckers) and 2002 (for shoreline-spawning Lost River suckers) information became adequately precise to accurately calculate λ ; relatively accurate estimates of Δt also became possible (USFWS 2012a, p. 8, b, p. 8).

Results from PIT tag studies in Upper Klamath Lake from 2002 to 2007 show that annual survival probabilities of shoreline springs spawning Lost River sucker ranged from 0.80 to 0.95, with a mean of 0.90, and Δt over the period was 0.56 for males and 0.75 for females (USFWS 2012a, p. 10). These Δt s show that the abundance of male and female, shoreline-spring-spawning Lost River sucker in 2007 was 56 percent and 75 percent, respectively, of their 2002 abundance (USFWS 2012a, p. 10). Estimates for river-spawning shortnose sucker show that annual survival probabilities were lower for this subpopulation. Over this period, Δt s of male and female, river-spawning shortnose sucker were 0.42 and 0.49, respectively (USFWS 2012b, p. 10). Similar data are not currently available for Upper Klamath Lake Lost River sucker river-spawning fish or for Clear Lake Lost River sucker and shortnose sucker populations. This information will be forthcoming in the future when the number of tagged fish is sufficiently large to provide relatively precise, statistically rigorous estimates.

Demography of Lost River sucker and shortnose sucker Populations in Clear Lake

Historically, large Lost River sucker and shortnose sucker spawning migrations occurred from Tule Lake up the Lost River to near Olene and Big Springs near Bonanza, both in Oregon (Howe 1969, pp. 156-158, USFWS 2002, p. 35). Clear Lake currently supports the only substantial

populations of shortnose sucker and Lost River sucker in the Lost River sub-basin. Less is known about shortnose suckers and Lost River suckers in Clear Lake than those in Upper Klamath Lake because monitoring studies have been sporadic over the past 35 years, and studies similar those conducted by Janney *et al.* (2008, entire) in Upper Klamath Lake were not initiated in Clear Lake until 2006 (Barry *et al.* 2009, entire). Data collected by Koch *et al.* (1973 entire) and Andreasen (1975, p. ii) suggested both populations were in decline; however, monitoring from 1989-2000 indicated that populations were relatively large and had diverse age structures (Buettner and Scopettone 1991, pp. 44-48; USBR 1994, pp. 10-13; Scopettone *et al.* 1995, pp. 10-11). In Upper Klamath Lake, 15 age classes were documented in the shortnose sucker population during 1989 and nine during 1993. Similar data are not available for Lost River sucker in Clear Lake, because they appear to be less abundant than shortnose sucker.

Summarizing historical and recently collected data, Barry *et al.* (2009, p. 9) observed that populations of both species in Clear Lake have undergone major demographic changes during the past 15 years. Populations in the mid-1990s showed little evidence of recruitment and consisted mostly of large and presumably older suckers. The abundance of large suckers decreased in the late 1990s and early 2000s, and current populations are mostly ones recruited into the adult population in the late 1990s (Barry *et al.* 2009, p. 9). Length-frequencies from 2005 – 2009 studies found little evidence of shortnose sucker recruitment and that recruitment into the Lost River sucker population had been relatively consistent over the period. Variability in age class structure, longevity, and abundance of Lost River sucker and shortnose sucker in Clear Lake is poorly understood in comparison with populations in Upper Klamath Lake. Several more years of sampling and analysis are needed before data are sufficient to discern current status of these populations and their demographic health.

Threats

The reasons for listing as well as threats to the continued survival of Lost River sucker and shortnose sucker are well reviewed in a number of reports and peer reviewed articles (USFWS 1988, p. 5017, 2012a, pp. 15-25, b, pp. 15-25, 2013a, pp. v-vi; Markle and Cooperman 2002, entire; NRC 2004, pp. 200-209; ISRP 2005, entire; Rasmussen 2011, entire; NMFS and USFWS 2013, pp. 24-34). The major threats are discussed below.

Effects of Habitat Loss and Alteration

Loss and alteration of habitats (including spawning and rearing habitats) were major factors leading to the listing of both species (USFWS 1988, p. 5017) and continue to be significant threats to recovery. As noted above, both species use the spectrum of aquatic habitats during some stage of the life cycle, including river or stream habitats, open-water lake habitats, and the wetlands areas along banks and shores. However, negative impacts and alterations to each of these different habitats have occurred, and continue to threaten the recovery of these species. Suitable habitat has drastically declined due to conversion of wetlands to agricultural use and construction of irrigation and hydroelectric facilities, both of which drained lakes and wetlands, created barriers preventing access to spawning habitat, and caused mortality by entraining fish.

Effects of Nonnative Fishes

Nonnative fishes were identified as a potential threat at the time of listing through predation or as sources of exotic diseases/parasites, although no direct evidence was cited. Since then, controlled experiments have demonstrated that adult fathead minnows prey on sucker larvae (Markle and Dunsmoor 2007, p. 567). In Upper Klamath Lake negative relationships between fathead minnow population size and larval sucker survival rates (*i.e.*, higher fathead minnow populations are associated with lower sucker survival rates) have been observed (Markle and Dunsmoor 2007, p. 567). Likewise, as indirect evidence, higher larval survival rates were also associated with greater water depth and shoreline vegetative cover, habitat which help larvae avoid predation (Markle and Dunsmoor 2007, p. 575). These data suggest that predation by highly-abundant fathead minnows may be an important threat to larval sucker survival, and that loss of emergent wetland habitat may exacerbate this. Other nonnative fishes may also pose a threat to Lost River sucker and shortnose sucker; however, little quantitative information exists to indicate their influence on sucker abundance and distribution.

Effects of Adverse Water Quality

Most water bodies currently occupied by Lost River and shortnose suckers do not meet water quality standards for nutrients, dissolved oxygen, temperature, and pH set by the States of Oregon and California (Boyd *et al.* 2002, p. i; Kirk *et al.* 2010, ch. 1 p. 5). Lost River and shortnose suckers are relatively tolerant of degraded water quality conditions in comparison to species like trout and salmon. Suckers tolerate higher pH, temperature, and un-ionized ammonia concentrations, and lower dissolved oxygen concentrations than many other fishes (Saiki *et al.* 1999, pp. 41-43; Meyer and Hansen 2002, entire; NRC 2004, p. 200). Nevertheless, both species are regularly adversely affected by poor summer water quality in Upper Klamath Lake, Keno Reservoir, Lost River sub-basin, and the hydropower reservoirs downstream in the Klamath River (NRC 2004, pp. 201-202). Adverse water-quality conditions, which have primarily occurred in summer, have caused multiple incidents of mass adult mortality (Perkins *et al.* 2000b, pp. 6-23). The primary cause of water-quality-related mortality appears to be caused by hypoxia (*i.e.*, low levels of dissolved oxygen), but high concentrations of un-ionized ammonia resulting from elevated total ammonia concentrations and high pH, could also be a contributing factor (Perkins *et al.* 2000b, pp. 26-27). Additionally, in the fish die-offs that occurred in Upper Klamath Lake in the 1990s, disease outbreaks contributed to mortality and continued to affect suckers after the adverse water conditions had abated (Perkins *et al.* 2000b, pp. 28-29; NRC 2004, p. 238).

Adverse water quality conditions in Upper Klamath Lake are attributed to high nutrient loading, especially phosphorus, and the presence of blue-green algae, *Aphanizomenon flos-aquae*. This alga (actually categorized as a “cyanobacterium”) now dominates the algal community from June to November, and because of the high concentrations of nutrients, especially phosphorus, available, is able to reach seasonally high biomass levels that can lead to highly degraded water quality (Boyd *et al.* 2002, p. 31; NRC 2004, pp. 5-6; Wood *et al.* 2006, p. 46; Morace 2007, pp. 9, 39). These conditions affect Lost River and shortnose suckers because rapid algal decay depletes dissolved oxygen levels and can create toxic conditions for suckers, especially when

water temperatures are high and wind speeds low (Perkins *et al.* 2000b, p. 19; Boyd *et al.* 2002, p. 135; NRC 2004, p. 6; Wood *et al.* 2006, p. 47; Morace 2007, pp. 44-49).

Water quality remains one of the most important, if not the most important, proximate factor threatening sucker existence; however, the uncertainty surrounding many of the potential ultimate factors (*i.e.*, the complex interactions of factors causing poor water quality), including wetland reduction, natural nutrient loads, nonpoint sources, and water management, also make it one of the most difficult threats to address.

Effects of Algal Toxins

Some cyanobacteria, such as *Microcystis aeruginosa*, which is also present in Upper Klamath Lake, produce toxins that may directly result in mortality or may indirectly cause mortality through a combination of disease and stress produced by hypoxia (low dissolved oxygen), high pH, and high ammonia concentrations. Recent studies by USGS provide preliminary support for a hypothesis that juvenile suckers in Upper Klamath Lake are at risk from biotoxins produced by *M. aeruginosa* (VanderKooi *et al.* 2010, entire, <http://pubs.usgs.gov/fs/2009/3111/>). The toxin, microcystin, attacks liver cells. Up to 50 percent of juveniles sampled showed evidence of liver damage, some severe enough that death would likely result. Microcystin levels in the water samples in 2008 were up to 17x higher than is considered safe for drinking water. Microcystin is an algal toxin that affects the liver and can lead to death. In a 2007 survey in Upper Klamath Lake, 49 percent of a sample of juvenile suckers collected at 11 shoreline sites exhibited indications of microcystin exposure (VanderKooi *et al.* 2010, entire). However, these data are preliminary and further investigations are required to determine the extent of microcystin exposure and of the effects. Additionally, the means by which the toxin is introduced into the body remains unknown, but there is some evidence suggesting that the toxin is indirectly ingested when suckers consume midge larvae, which feed on the algae.

Effects of Pathogens and Parasites

Degraded water quality conditions may weaken fish and increase their susceptibility to disease and parasites (Holt 1997, p. i; Perkins *et al.* 2000a, p. 29). Parasites and pathogens were not identified as important threats at the time of listing; however, new information indicates that pathogens and parasites likely contribute to low rates of sucker survival, especially during adverse water quality events (USFWS 2012a, p. 19, b, p. 19, 2013a, p. 30). A number of pathogens have been identified from moribund (dying) suckers, but Columnaris disease or “gill rot” seems to be the primary organism involved (Foott 1997, pp. 1-2; Holt 1997, p. i). It is caused by the bacterium *Flavobacterium columnare*, which can damage gills and produce body lesions, which leads to respiratory problems and an imbalance of internal salt concentrations, which provides an entry route for lethal systemic pathogens.

Anchor worm, an external, copepod parasite affects suckers and other fish in Upper Klamath Lake and its incidence on age-0 suckers appears to be increasing (ISRP 2005, p. 167). From 1994-1996, the percent of age-0 suckers parasitized by anchor worms ranged from 0 percent to 7 percent, but by 1997-2000 it had increased to between 9 percent and 40 percent. Anchor worms now infect about half of age-0 shortnose suckers. Recently Markle *et al.* (2013, p. 1) stated that

mortality of juvenile shortnose suckers had occurred in Upper Klamath Lake as a result of infections from black spot disease, a type of trematode flatworm or fluke. Parasites like anchor worm may not directly cause death to suckers, but they can provide a route for pathogens to enter fish, since they create a wound, or can make fish more susceptible to predation (Robinson *et al.* 1998, p. 599). To determine the degree to which parasites threaten sucker survival and productivity requires further study.

Effects of Fish-eating Birds

Fish-eating birds, such as the American white pelican (*Pelecanus erythrorhynchos*), could have substantial negative impacts on adult sucker populations, especially those in Clear Lake where the suckers are exposed to pelican predation during the spawning migration in Willow Creek. Early data indicate that American white pelican predation rates on sub-adult or adult suckers in Clear Lake Reservoir may be as high as 20 percent in some years; however, additional research is needed to clarify the magnitude of this threat (Roby and Collis 2011, pp. 64-65; NMFS and USFWS 2013a, p. 52).

Effects of Entrainment Losses

Movement of fish into irrigation systems through unscreened diversions was identified as a threat to the suckers at the time of listing (USFWS 1988, p. 5017). At that time thousands of suckers, including some adults, were entrained into the A-Canal, the largest diversion in the upper basin located near the Link River Dam. Although some of these fish were salvaged, many likely died (NRC 2004, pp. 24, 231). The impact of entrainment into the irrigation system of the Klamath Project was reduced by construction of screening facilities over the A-Canal; although larvae are still at risk. Fish screened from entering the A-Canal are returned via pipeline to the Link River above the dam (Marine and Gorman 2005, p. 1). Further investigations are needed to determine the overall effects and stress on transferred fish and if fish expelled through the pipeline remain in Upper Klamath Lake or are subsequently entrained by flows through the Link River Dam (NMFS and USFWS 2013, p. 102).

Substantial entrainment occurs at the river gates of the Link River Dam. Currently these gates have no structures to prevent drawing fish downstream. During the late summer of 2006, over 3,500 age-0 juvenile suckers were collected in the Link River just below the dam with intermittent sampling of a small fraction of the channel (Tyler 2007, p. 4). The Committee on Endangered and Threatened Fishes in the Klamath River Basin of the National Research Council recommended screening to prevent downstream losses at Link River Dam (NRC 2004, p. 7). Efforts to assess the impacts of this operation found significantly lower numbers of suckers were entrained during surface spill versus bottom spill experiments (Marine and Lappe 2009, ch. 4 p. 1). Gutermuth *et al.* (2000, p. 33) also documented tens of thousands of young suckers entrained at the PacifiCorp hydropower canals and turbines associated with the Link River Dam. Nonetheless, further research is required to better quantify the threats these structures pose to recovery.

Most suckers that pass through the gates at Link River Dam, or that survive passage through the hydroelectric facilities, are believed to be lost from the breeding population in Upper Klamath

Lake. Most likely, these fish either die in poor summer water quality conditions in Keno Reservoir, or pass further downstream into reservoirs along the Klamath River, from which upstream passage is blocked. A fish ladder was constructed at Link River Dam in 2004 through which PIT tagged adult suckers have been documented in low numbers moving upstream through Link River (Korson *et al.* 2008, p. 2; Kyger and Wilkens 2011, p. 2); additional untagged suckers likely also passed upstream through the ladder undetected.

In addition to major diversion point in the Keno Reservoir, the Lost River Diversion Channel, several hundred small, typically unscreened diversions in tributary streams and rivers and the lakes proper may also affect Lost River sucker and shortnose sucker. The influence of these diversions on sucker abundance and recovery is unknown.

Climate Change

Climate variability, such as fluctuations between wet and dry periods, is part of natural processes; however, climatic models and other information suggest that much of the recent trends is driven by anthropogenic pollutants, primarily CO₂ (Barnett *et al.* 2008, p. 1080). Since the 1950s, western North America generally has exhibited trends toward less snowfall, earlier snowmelt, and earlier peak spring runoff, much of which cannot be attributed to natural fluctuations (Hamlet *et al.* 2005, entire; Stewart *et al.* 2005, entire; Knowles *et al.* 2006, entire). Furthermore, models indicate that these trends are likely to continue (Barnett *et al.* 2008, p. 1082). Perhaps the greatest foreseeable concern related to climate change is more intense summer heat waves that have the potential to create especially severe water-quality conditions in Upper Klamath Lake.

It is difficult to predict how such climatic changes will affect these species (Matthews and Marsh-Matthews 2003). Certainly these species have evolved under variable climates, sometimes with severe dry periods (Negrini 2002, entire; Malevich *et al.* 2013, p. 13); however, given the current lack of recruitment, lack of population connectivity even in wet years when it should be higher, degraded habitat including poor water quality, the overall low number of individuals, and other threats, we consider populations of these species to be highly vulnerable to negative impacts from climate change, either from distinct droughts or from extended periods of declining trends. If current trends continue into the future, important changes, which may threaten the continued existence of these species, (*e.g.*, further reductions in water quality, water-quality refuge availability, food-web alterations, and spawning run timing) are likely to occur (Dahm *et al.* 2003, pp. 1224-1229; Magoulick and Kobza 2003, entire). Further reductions in water quality and reduced inflows as a result of climate change, if they occur, could be a serious threat to the survival and recovery of the Lost River and shortnose suckers, especially for populations in Upper Klamath Lake.

The ability to assign the effects of gradual global climate change to Lost River sucker and shortnose suckers or to a specific location on the ground is beyond our technical capabilities at this time. A general overview of potential effects of climate change is provided in Appendix D.

Conservation Needs

The following eight conservation needs or recovery actions were identified in the revised recovery plan (USFWS 2013a, pp. 49-51).

1. Restore or enhance spawning and nursery habitat in the Upper Klamath Lake and Lost River Recovery Units

The relationship between spawning and nursery habitat with healthy population demography is critical. Given the extensive losses of habitat in general, including loss of connectivity, it is vital that such habitats be restored to functionality. The primary components of this recovery action are to: (1) develop and implement a range wide spawning and rearing enhancement plan; (2) conduct and apply research on how to best manage lake levels to protect spawning habitat; (3) reestablish stream and river connectivity; (4) conserve and restore wetland and riparian areas; (5) improve habitat quantity and quality of eastern shoreline springs in Upper Klamath Lake (Lost River sucker specific); and (6) identify and assess the feasibility of potential habitat improvements for suckers in Lake Ewauna/Keno Reservoir (USFWS 2013a, pp. 52-55).

2. Reduce negative impacts of poor water quality

Lost River sucker and shortnose sucker are able to tolerate relatively harsh conditions, but periodic die-offs show that they are susceptible to poor water quality that occurs primarily during summer. Actions to reduce these effects by providing sufficient habitat that provides refuge and minimizes the occurrence of poor water quality events should occur. Specifically, these include: (1) ensure continued connectivity and access to refugial areas; (2) conduct and apply research on the dynamics of algal cycles within Upper Klamath Lake and their effects on sucker populations; (3) conserve and restore riparian and wetland areas along the Wood, Williamson, and Sprague Rivers; and (4) improve water quality in the Upper Klamath Lake (USFWS 2013a, pp. 55-56).

3. Clarify and reduce the effects of introduced species on all life stages by conducting and applying appropriate scientific investigations

Approximately 85 percent of the fish biomass in Upper Klamath Lake when the suckers were listed was comprised of non-native species. The fathead minnow and yellow perch are most likely to affect Lost River sucker and shortnose sucker through predation on and competition for food and space with young suckers. Additional work is needed to clarify these experiments and their effects on trends, distribution and demography of suckers (USFWS 2013a, pp. 56-57).

4. Reduce loss of individuals to entrainment

Entrainment of individuals, especially larvae and juveniles, can remove significant numbers of individuals from populations. It is critical that a reduction in the number of individuals lost to entrainment occur. The primary components of this recovery action include: (1) develop and implement an entrainment reduction plan; (2) assure the efficacy of A-canal bypass; and (3) improve the efficacy of the Link River Dam fish ladder (USFWS 2013a, pp. 56-57).

5. Establish a redundancy and resiliency enhancement program

The purpose of this program will be to support and enhance effort to improve *in situ* conditions through creation or maintenance of populations that provide redundancy and potentially produce individuals for augmentation to increase resiliency of the most important populations for the species, Upper Klamath Lake and Clear Lake Reservoir. The primary components of this recovery action include: (1) develop and implement a Genetics Assessment and Management Plan; (2) prepare emergency response protocols for Upper Klamath Lake, Clear Lake Reservoir, Gerber Reservoir, and Tule Lake populations; (3) establish at least two auxiliary populations; and (4) develop a controlled propagation program (USFWS 2013a, pp. 57-59).

6. Increase juvenile survival and recruitment to spawning populations

Relatively little is known about the ecology and demography of these species as juveniles. Therefore, this recovery action consists of the following components: (1) develop and implement a plan to assess, monitor, and improve juvenile and sub-adult vital rates and demography; and (2) improve understanding of juvenile life history and ecology through study of Clear Lake Reservoir populations (USFWS 2013a, pp. 60).

7. Maintain and increase the number of recurring, successful spawning populations

The number of total spawning aggregations has decreased dramatically for both Lost River sucker and shortnose sucker. Successful establishment of additional spawning aggregations will likely increase the species' ability to overcome many threats. Specific components of this recovery action include: (1) increase the number of spawning sub-populations in Upper Klamath Lake; (2) facilitate successful spawning for the Tule Lake population; (3) continue monitoring of adult populations; and (4) determine the status of shortnose sucker in Gerber Reservoir (USFWS 2013a, pp. 60-62).

8. Establish a Klamath Basin Sucker Recovery Program

The recovery implementation program was formally established in 2014 and consists of several focused "teams" that coordinate public outreach, scientific collaboration, and assessment of current program direction (USFWS 2013a, pp. 62-63).

Current Actions

The Service has worked with other agencies and stakeholders to recover the endangered suckers since 1994 (USFWS 2013a, p. 34). Important cooperators include U.S. Bureau of Reclamation (USBR), National Resources Conservation Service (NRCS), TNC, Oregon Division of Environmental Quality (ODEQ), National Fish and Wildlife Conservation Fund, Klamath Water Users, and Modoc Irrigation District. Approximately 300 on-the-ground restoration projects, including 90 wetland, 130 riparian, 45 in-stream, 25 upland, and 15 fish passage projects have been funded and implemented in the Upper Klamath River Basin that directly or indirectly benefit Lost River and shortnose suckers since 2009. Many of the projects included elements of more than one category of restoration project type. These projects have had significant cost

share from multiple sources, including Federal programs such as Partners for Fish and Wildlife, Hatfield, Jobs in the Woods, and Oregon Resources Conservation Act programs, as well as state and private grants, and contributions from landowners.

Major sucker recovery oriented projects completed include: screening of the main irrigation diversion on the Klamath Project (A-Canal) in 2002 and the outlet to Clear Lake Dam in 2003; screening of Modoc Irrigation District's diversion on the Williamson River (2007); screening the Geary Canal diversion in Howard Bay on Upper Klamath Lake in 2009; construction of a new fish ladder at Link River Dam (2004); restoration of Williamson River Delta approximately 6,000 acres between 2000 and 2008; restoration of the lower three miles of the Wood River in 1999; and removal of Chiloquin Dam in 2008, a major impediment to upstream migration of listed suckers. Removal of Chiloquin Dam provides improved upstream passage to spawning areas.

It is too early to assess the efficacy of these projects to support recovery, and some project modification may be required for the full benefit of each program to be realized. This is particularly true with the project screening the A-Canal. Under present design, fish screened from entering the A-Canal are delivered via pipeline to Upper Klamath Lake at a point that is upstream of the Link River Dam. Investigations are needed to determine if these suckers remain in Upper Klamath Lake or pass downstream into Lake Ewauna and possibly are lost to the spawning population because of poor water quality conditions in the lake during the summer and/or because suckers are having difficulties moving upstream past the dam.

The NRCS completed a large number of projects under the 2002 Farm Bill to improve water quality and water conservation. This has resulted in restoration of over 2,200 acres of wetland habitat and conservation of over 6,700 acre-feet of on-farm water. Conservation systems on over 70,000 acres have been planned, and practices have been applied to over 30,000 acres to manage soil, water, air, plants, and animals on private lands.

The Sprague River, the primary spawning habitat for suckers in Upper Klamath Lake and the largest tributary to the Williamson River, is listed as water quality impaired for nutrients, temperature, sediment, and dissolved oxygen (DO) under the Section 303(d) of the Clean Water Act. In 2002, ODEQ completed a Total Maximum Daily Load (TMDL) process for the Sprague River and Upper Klamath Lake (Boyd *et al.* 2002, entire), and in 2010 it was followed by a TMDL for the Lost and Klamath Rivers in Oregon (Kirk *et al.* 2010, entire). Water quality management plans were developed which provide targets and guidance on improving water quality in the Sprague River and Upper Klamath Lake. Many wetland and riparian restoration projects are now designed to address TMDL issues.

In 2004, Oregon State University Agricultural Extension Service and the Klamath Watershed Council (now called the Klamath Watershed Partnership) began a series of monthly meetings with rural landowners in the Sprague River Valley to discuss watershed restoration goals. With the help of USFWS, NRCS and the Klamath Soil & Water Conservation District, this effort has effectively connected landowners with appropriate state and federal resource conservation programs. As a result, more than 70 percent of the private lands within the Sprague River Valley are partnering with local, state and federal agencies on land conservation and natural resource

actions. The efforts of the Klamath Watershed Partnership have brought additional fiscal partners (*e.g.*, Oregon Department of Agriculture, Klamath County, and Oregon Watershed Enhancement Board) into the conservation partnership. These partnership-forming actions will continue and build on themselves and enable more restoration to be done in the future.

The tributaries in the Wood River Valley supply a large portion of the inflow to Upper Klamath Lake. This valley also supports about half of the livestock in the Upper Basin and is responsible for approximately one-third of the external phosphorus loading to the lake. Because of this, it was identified by ODEQ as a priority water quality impaired area. The Klamath Basin Rangeland Trust has been active in the Wood River Valley encouraging landowners to adopt sustainable land and water management practices. Since 2002, the number of landowners who partner with this trust on conservation and restoration activities has increased to include approximately 50 percent of the agricultural lands in the watershed.

Klamath River Basin stakeholders signed the Klamath Basin Restoration Agreement (KBRA) in February 2010. The agreement is intended to result in effective and durable solutions which will restore native fishes throughout the Klamath Basin including listed suckers; establish reliable water and power supplies which sustain agricultural uses, communities, and National Wildlife Refuges; and contribute to the public welfare and the sustainability of all Klamath Basin communities. The KBRA has not yet been authorized by congress; however, with authorization and appropriation of funds from Federal and State governments and subsequent implementation of the Agreement, substantial progress should be made toward the recovery of Lost River sucker and shortnose sucker.

STATUS OF CRITICAL HABITAT - LOST RIVER AND SHORNOSE SUCKER

Two critical habitat units are designated for each species, as described below.

- The Upper Klamath Lake Unit 1 (Figure 8), situated in Klamath County, Oregon, includes Upper Klamath Lake and Agency Lake, the Link River and upper Klamath River downstream to Keno Dam (known as the Keno Reservoir), as well as portions of the Williamson and Sprague Rivers, for a total of 90,415 acres and 119 RM. This unit is the same for both species with the following exceptions: (1) for Lost River suckers the unit extends upstream in the Sprague River to the Beatty Gap east of Beatty (near RM 75); and (2) for shortnose suckers the unit extends upstream to near RM 8 in the Sprague River.
- The Lost River Basin Unit 2 (Figure 8) is situated in Klamath and Lake Counties, Oregon and Modoc County, California. It includes Clear Lake and its main tributary, Willow Creek, for both the Lost River sucker and shortnose sucker, and Gerber Reservoir and its main tributaries for the shortnose sucker only, for a total of approximately 33,000 acres and 88 RMs. Additionally there are differences in the amount of upstream critical habitat in Willow Creek for the two species. For the Lost River sucker, critical habitat includes Willow Creek and its tributary Boles Creek upstream to Avanzino Reservoir in California. For shortnose suckers, critical habitat extends up Willow Creek to Boles

Creek and upstream past Fletcher Creek and includes Fourmile and Wildhorse Creeks in California and also includes Willow Creek to its East Fork in Oregon.

In total, approximately 146 miles of streams and 118,000 acres of lakes and reservoirs for Lost River sucker and approximately 136 miles of streams and 124,000 acres of lakes and reservoirs for shortnose sucker in Klamath and Lake Counties, Oregon, and Modoc County, California, fall within the boundaries of the critical habitat designation.

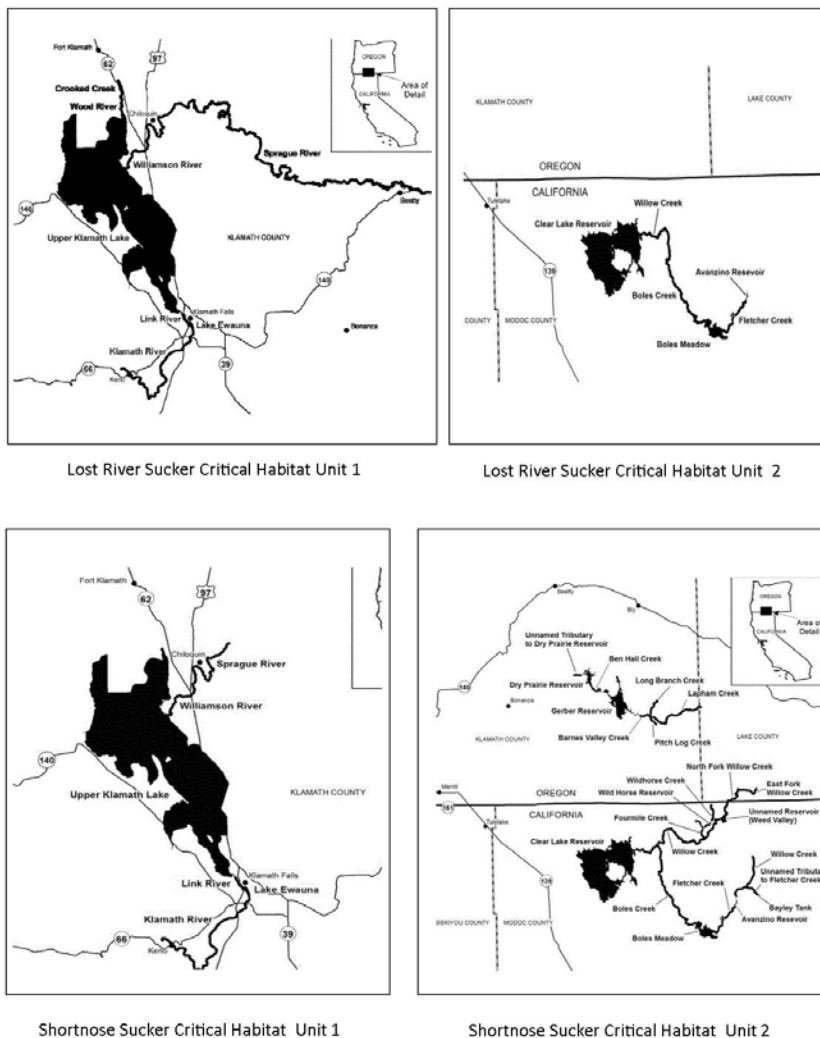


Figure 8. Critical habitat units for Lost River suckers and shortnose suckers designated in 2012 (USFWS 2012c, pp. 73764-73768).

The Physical and Biological Features

Based on our current knowledge of the habitat characteristics required to sustain the species' life-history processes, the PBFs specific to self-sustaining Lost River sucker and shortnose sucker populations are:

- PBF 1—*Water*. Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and water-quality refuge habitats with minimal physical, biological, or chemical impediments to connectivity. Water must have varied depths to accommodate each life stage: shallow water (up to 3.3 feet for larval life stage, and deeper water (up to 14.8 feet) for older life stages. The water quality characteristics should include water temperatures of less than 28.0 °C; pH less than 9.75; dissolved oxygen levels greater than 4.0 mg/L; low levels of microcystin (a liver toxin produced by cyanobacteria); and un-ionized ammonia less than 0.5 mg/L. Elements also include natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph.
- PBF 2—*Spawning and Rearing Habitat*. Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 feet with adequate stream velocity to allow spawning to occur. Areas containing emergent vegetation adjacent to open water provides habitat for rearing and facilitates growth and survival of suckers, as well as protection from predation and protection from currents and turbulence.
- PBF 3—*Food*. Areas that contain abundant forage base, including a broad array of chironomids, crustaceans, and other aquatic macroinvertebrates.

Special management considerations include the following:

- Protect and improve water quality by reducing sediment and nutrient loading
- Manage water bodies so that there is minimal departure from a natural hydrograph
- Maintain, improve, or reestablish instream flows to improve the quantity of water available
- Manage groundwater use to ensure it does not affect surface waters
- Address water level fluctuations in reservoirs
- Maintain appropriate depths in water quality refuge areas for access and maintaining buffers around refuge areas
- Maintain habitat in reservoirs; the timing and volume of water diverted needs to be addressed
- Improve access to spawning and rearing habitats
- Manage exotic fishes by restoring habitats for native fishes

These are discussed in greater detail in the final critical habitat rule (USFWS 2012c, pp. 73750-73752).

Climate Change/ Potential Effects of Water Temperature Levels to Alteration of the PBFs

Potentially all of the PBFs for both of the listed suckers may be affected by higher water temperatures within designated critical habitat. The effects will vary greatly and are difficult to predict because the effect would likely depend on a number of factors, including the amount (*i.e.*, magnitude or intensity), geographical extent (*i.e.*, where it occurs or how large an area is affected), timing (*i.e.*, what season), the duration of the temperature increase, and what other environmental stressors might also be present. For example, any increase in water temperature in mid-summer, when temperatures are already high and dissolved oxygen concentrations are

low, would likely have a much greater effect on the ability of critical habitat to support suckers, than a similar temperature increase at other times of the year when temperatures are lower and dissolved oxygen concentrations higher. Because temperature change can affect both biological and physical processes simultaneously and in ways that are not fully understood, caution must be used in predicting its effects on critical habitat.

The threat of climate change on Lost River suckers and shortnose sucker habitat is discussed below under Threats. Though, the ability to assign the effects of gradual global climate change to Lost River suckers and shortnose sucker critical habitat or to a specific location on the ground is beyond our technical capabilities at this time. A general overview of the potential effects of climate change is provided in Appendix D.

ENVIRONMENTAL BASELINE - LOST RIVER AND SHORTRIVER SUCKERS AND THEIR CRITICAL HABITATS

The current condition of the Lost River sucker and its habitat are primarily influenced by ongoing effects caused by the USBR Klamath Project. The USBR operates the Klamath Project's numerous dams, canals, diversion channels, drains, and reservoirs to store and deliver irrigation water to variety of agricultural water users and irrigation districts in southern central Oregon and northern California.

Klamath Project operations are described geographically as westside and eastside operations and encompass most of the designated critical habitat and occupied habitat for both the Lost River and shortnose sucker. Westside operations affect water elevations in the Upper Klamath Basin, specifically Agency Lake, Upper Klamath Lake, Keno Reservoir (also called Lake Ewauna), and discharge volumes through the Link and Klamath Rivers. Eastside operations affect water elevations in the Lost River drainage including Gerber Reservoir, and discharge volumes in the Lost River including Miller Creek, including portions of these in the action area. The primary effects of the Klamath Project to the Lost River sucker are entrainment of larval, juveniles, and adults through Klamath Project facilities (dams, fish screens, canals) and the manipulation of water elevations that can impact access to spawning and water quality refugial areas. Water quality is further discussed below. The effects of these water control structures influence Lost River suckers populations in the action area because natural flows are reduced, thus reducing water quantities and water quality downstream."

There are approximately 3,027,038 acres within the two Lost River sucker Recovery units that fall within the PRMP planning area boundary. Of these, approximately 230,858 acres fall under BLM ownership. This represents less than 8 percent of the total land ownership within the recovery units. Likewise, there are over 252 stream miles that are considered to be occupied by Lost River suckers within the PRMP planning area, but only 13.2 of these stream miles are under BLM ownership (around 5 percent). None of the occupied stream habitat under management of the BLM is designated critical habitat for Lost River suckers.

The Recovery Plan (USFWS 2012 SUCKERS) states, "Populations in Klamath River below Keno Dam and in the Lost River drainage below Clear Lake Dam are comprised mostly of adults. These populations are probably functioning as sink populations, as they are not likely

self-sustaining because of low recruitment due to the lack of access to spawning habitats (Moyle 2002).” Lost River suckers are found in the Lost River, Miller Creek and the Klamath River on BLM lands.

Most abundance studies have been conducted within the Upper Klamath Lake area, which is outside the action area for the PRMP. It is unclear how many Lost River suckers actually reside within the action area, but results from studies in Upper Klamath Lake show a steady decline in the population from 2001 through 2007 (USFWS 2012). While populations of suckers below Keno Reservoir provide some redundancy to populations in the other more important areas, they are sink populations that likely will never be viable, and therefore will not be actively managed for recovery (USFWS 2012, p. viii). While there may be small populations of Lost River suckers may occur in other portions of the action area these few individuals are not likely contributing to recovery in any meaningful way.

By far the greatest threat to Lost River suckers throughout its range, including the action area, is the destruction, modification, or curtailment of its habitat. The areas of greatest concern occur in Upper Klamath Lake and Clear Lake Reservoir (USFWS 2012, p. 43) where important spawning and nursery habitat have been diminished through changes in water quality and loss of native vegetation. Neither of these areas is within the action area. The effects of these water control structures influence Lost River suckers populations in the action area because natural flows are reduced, thus reducing water quantities and water quality downstream. There is very little spawning and nursery habitat on BLM lands within the action area.

Threats from predation exist from introduced fish such as the fathead minnows (*Pimephales promelas*) and yellow perch (*Perca flavescens*) (USFWS 2012, p. 15). American white pelican (*Pelecanus erythrorhynchus*), double-crested cormorant (*Phalacrocorax auritus*), and great blue heron (*Ardea herodias*) may also prey on Lost River suckers (USFWS 2012, p. 28).

Role of the Action Area in the Conservation of the Lost River Sucker

While all remaining habitat for Lost River suckers is important, the portion of that habitat in the action area is very small in area in relation to the rest of the population. Because there appears to be low reproductive potential, the action area appears to presently contain a sink population. The limited amount of Lost River sucker habitat within the action area plays only a minor role in species conservation. The vast majority of habitat contributing to conservation occurs outside of the action area in Upper Klamath Lake and Clear Lake Reservoir.

Current Condition of the Shortnose Sucker in the Action Area

The USBR operates the Klamath Project’s numerous dams, canals, diversion channels, drains, and reservoirs to store and deliver irrigation water to variety of agricultural water users and irrigation districts in southern central Oregon and northern California.

Klamath Project operations are described geographically as westside and eastside operations and encompass most of the designated critical habitat and occupied habitat for both the Lost River and shortnose sucker. Westside operations affect water elevations in the Upper Klamath Basin,

specifically Agency Lake, Upper Klamath Lake, Keno Reservoir (also called Lake Ewauna), and discharge volumes through the Link and Klamath Rivers. Eastside operations affect water elevations in the Lost River drainage including Gerber Reservoir, and discharge volumes in the Lost River including Miller Creek, including portions in the action area. The primary effects of the Klamath Project to the shortnose sucker are entrainment of larval, juveniles, and adults through Klamath Project facilities (dams, fish screens, canals) and the manipulation of water elevations that can impact access to spawning and water quality refugial areas. The effects of these water control structures influence shortnose sucker populations in the action area because natural flows are reduced, thus reducing water quantities and water quality downstream. Water quality is further discussed below.

There are approximately 3,027,038 acres within the two shortnose sucker Recovery units that fall within the PRMP boundary. Of these, approximately 230,858 acres fall under BLM ownership. This represents less than 8 percent of the total land ownership. Likewise, there are approximately 209 stream miles that are considered to be occupied by shortnose suckers within the PRMP planning area, but only 23 of these stream miles are under BLM ownership (around 11 percent). Of the 39 stream miles of shortnose sucker critical habitat within the PRMP planning area, nine miles (23 percent) are under BLM ownership.

The Recovery Plan (USFWS 2012) states, “Populations in Klamath River below Keno Dam and in the Lost River drainage below Clear Lake Dam are comprised mostly of adults. These populations are probably functioning as sink populations, as they are not likely self-sustaining because of low recruitment due to the lack of access to spawning habitats (Moyle 2002).” Shortnose suckers are found in the Lost River, Miller Creek, Gerber Reservoir and the Klamath River within the action area.

Most abundance studies have been conducted within the Upper Klamath Lake area, which is outside the action area for the PRMP. It is unclear how many shortnose suckers actually reside within the action area, but results from studies in Upper Klamath Lake show a steady decline in the population from 2001 through 2007 (USFWS 2012). While populations of suckers below Keno Reservoir provide some redundancy to populations in the other more important areas (Upper Klamath Lake and Clear Lake Reservoir), they are sink populations that likely will never be viable, and therefore will not be actively managed for recovery (USFWS 2012, p. viii). While there may be small populations of shortnose suckers that may occur in other portions of the action area, these few individuals are not likely contributing to recovery in any meaningful way other than those in Gerber Reservoir where shortnose suckers are likely to persist.

By far the greatest threat to Lost River suckers throughout its range, including the action area is the destruction, modification, or curtailment of its habitat. The areas of greatest concern occur in Upper Klamath Lake and Clear Lake Reservoir (USFWS 2012, p. 43) where important spawning and nursery habitat have been diminished through changes in water quality and loss of native vegetation. Neither of these areas are within the action area. The effects of these water control structures influence Lost River suckers populations in the action area because natural flows are reduced, thus reducing water quantities and water quality downstream. There is very little spawning and nursery habitat on BLM lands within the action area.

Threats from predation exist from introduced fish such as the fathead minnows (*Pimephales promelas*) and yellow perch (*Perca flavescens*) (USFWS 2012, p. 15). American white pelican (*Pelecanus erythrorhynchus*), double-crested cormorant (*Phalacrocorax auritus*), and great blue heron (*Ardea herodias*) may also prey on Lost River suckers (USFWS 2012, p. 28).

In the action area, Shortnose sucker within Gerber Reservoir (Klamath Co., Oregon) were likely part of the “highly hybridized populations” in the Lost River Basin referenced in the listing (USFWS 1988)(USFWS 2012, p. 5).

Gerber Reservoir and its tributaries serve as spawning area for shortnose suckers. The BLM Klamath Falls Resource Area has been monitoring sucker spawning in the Gerber Reservoir tributaries from 1993-2011, and has documented spawning in Barnes Valley Creek, Long Branch Creek, Pitchlog Creek, and Ben Hall Creek. Surveys of spawning areas during the spring of 2006 detected more than 1,700 suckers ascending Ben Hall Creek and Barnes Valley Creek (Barry *et al.* 2007a) (USFWS 2012, p. 7).

Role of the Action Area in the Conservation of the Shortnose Sucker

Much of the occupied shortnose sucker habitat in the action area has limited conservation value because it is isolated and has both poor water quality and seasonally low water quantity. Gerber Reservoir serves as spawning habitat for shortnose suckers; however, it is not known if the levels of recruitment are high enough to classify the area as a self-sustaining population (USFWS 2012, p. 61).

Recovery Units

Two recovery units (Lost River and Upper Klamath Lake) have been designated in the final recovery plan for the Lost River and Shortnose suckers (USFWS 2012, pp. 40-41). The BLM portion of the action area encompass a small portion of the Lost River and Upper Klamath Lake recovery units: approximately 4.3 miles (3.6 percent) of occupied Lost River Sucker habitat, and 14.1 miles (9.2 percent) of occupied shortnose sucker habitat occur on BLM lands within the Lost River Recovery Unit; 8.9 miles (6.6 percent) of occupied Lost River sucker habitat, and 8.9 miles (16.1 percent) of occupied shortnose sucker habitat occur on BLM lands within the Upper Klamath Lake Recovery Unit. See also Tables 21-31 and Figures 9 and 10 below.

Lost River Recovery Unit:

Table 21. Miles and percentages of Lost River sucker distribution in the Lost River Recovery Unit by land ownership within the PRMP Planning area (BLM 2016b, p. 206).

Ownership	Miles of Distribution	Percentage
Total	117.6	100.0%
Other Ownership	113.3	96.4%
BLM	4.3	3.6%

Table 22. Miles and percentages of shortnose sucker distribution in the Lost River Recovery Unit by land ownership within the PRMP planning area (BLM 2016b, p. 206).

Ownership	Miles of Distribution	Percentage
Total	153.4	100.0%
Other Ownership	139.3	90.8%
BLM	14.1	9.2%

Table 23. Miles, acres and percentages of shortnose sucker designated critical habitat in the Lost River Recovery Unit by land ownership within the PRMP planning area (BLM 2016b, p. 211).

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	39.0	100.0%	5,382	100.0%
Other Ownership	30.0	77%	4,344	80.7%
BLM	9.0	23%	1,038	19.3%

Table 24. Acres and percentages by land ownership within the Lost River Recovery Unit for Lost River and shortnose suckers, within and outside of the PRMP planning area (BLM 2016b, p. 200).

Land Ownership	Acres	% Acres in RU	% Acres w/in PRMP Area
Lost Recovery Unit	1,921,537	100.0%	-
Outside RMP for Western Oregon	1,127,897	58.7%	-
Within RMP for Western Oregon	793,640	41.3%	100.0%
Other Ownership	634,580	33.0%	80.0%
BLM	159,060	8.3%	20.0%

Upper Klamath Lake Recovery Unit

Table 25. Acres and Percentages by land ownership within the Upper Klamath Lake Recovery Unit for Lost River and shortnose suckers, within and outside of the PRMP planning area (BLM 2016b, p. 200).

Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Upper Klamath Lake Recovery Unit	2,940,423	100.0%	-
Outside RMP for Western Oregon	707,025	24.0%	-
Within RMP for Western Oregon	2,233,398	76.0%	100.0%
Other Ownership	2,161,599	73.5%	96.8%
BLM	71,798	2.5%	3.2%

Table 26. Miles and percentages of Lost River sucker distribution in the Upper Klamath Lake Recovery Unit by land ownership within the PRMP Planning area (BLM 2016b, p. 210).

Ownership	Miles of Distribution	Percentage
Total	134.5	100.0%
Other Ownership	125.6	93.4%
BLM	8.9	6.6%

Table 27. Miles and percentages of shortnose sucker distribution in the Upper Klamath Lake Recovery Unit by land ownership with the PRMP planning area (BLM 2016b, p. 206).

Ownership	Miles of Distribution	Percentage
Total	55.3	100.0%
Other Ownership	46.4	83.9%
BLM	8.9	16.1%

Table 28. Miles, acres and percentages of Lost River sucker designated critical habitat in the Upper Klamath Lake Recovery Unit by land ownership within the PRMP planning area (BLM 2016b, p. 210).

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	99.2	100.0%	89,732.2	100.00%
Other Ownership	99.2	100%	89,693.8	99.96%
BLM	0.0	0%	38.4	0.04%

Table 29. Miles, acres and percentages of shortnose sucker designated critical habitat in the Upper Klamath Lake Recovery unit by land ownership within the PRMP planning area (BLM 2016b, p. 211).

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	27.1	100.0%	89,732.2	100.00%
Other Ownership	27.1	100.0%	89,693.8	99.96%
BLM	0.0	0.0%	38.4	0.04%

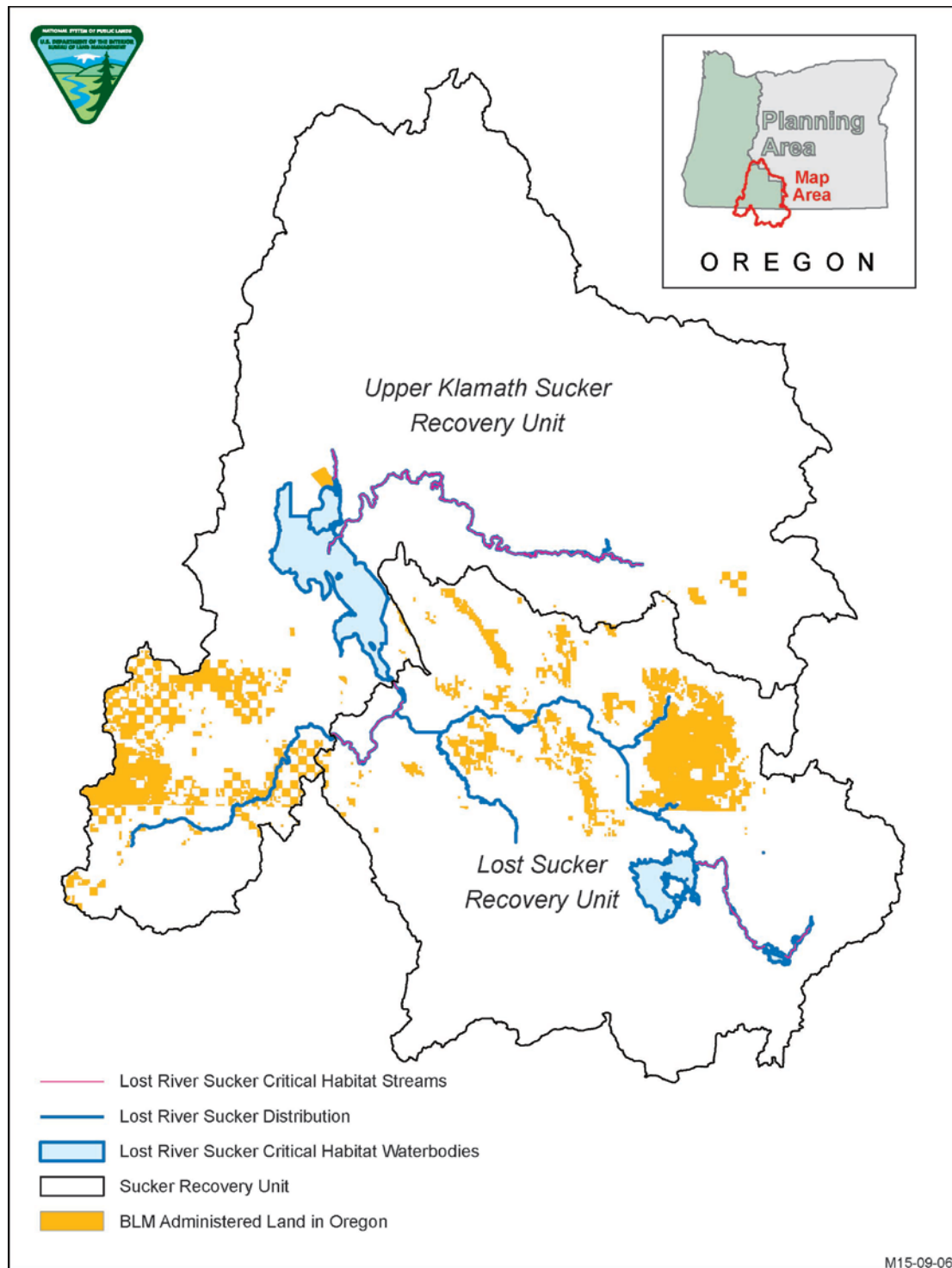


Figure 9. Lost River sucker occupancy, designated critical habitat, and BLM land ownership in the Upper Klamath and Lost Recovery Units within the planning area (BLM 2016b, p. 220).

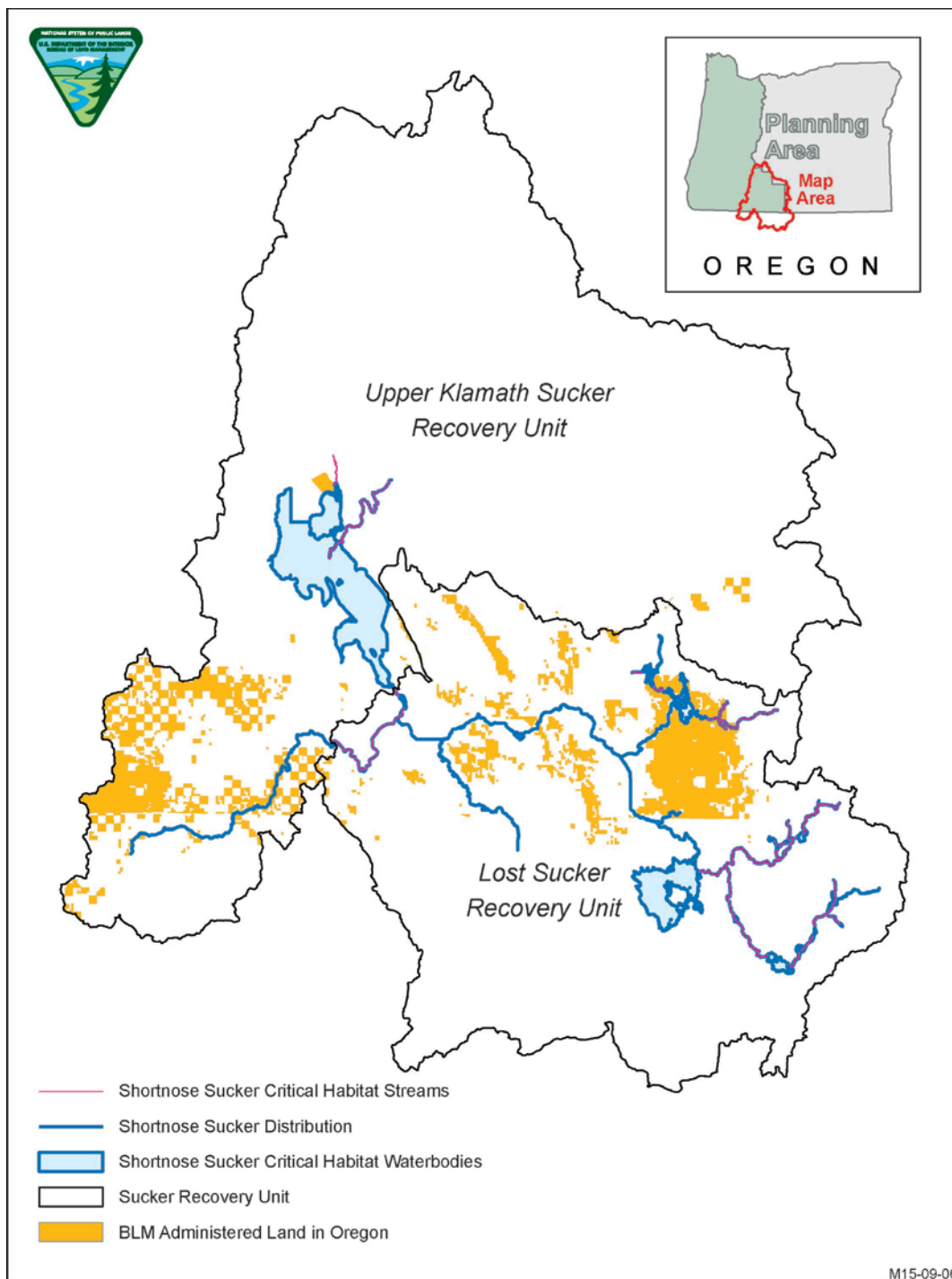


Figure 10. Shortnose sucker occupancy, designated critical habitat, and BLM land ownership in the Upper Klamath and Lost Recovery Units within the planning area (BLM 2016b, p. 221).

Water Quality within Sucker Habitat in the Action Area

Lost River and shortnose suckers are relatively tolerant of degraded water quality conditions in comparison to species like trout and salmon. Suckers tolerate higher pH, temperature, and un-

ionized ammonia concentrations, and lower dissolved oxygen concentrations than many other fishes (Saiki *et al.* 1999, pp. 41-43; Meyer and Hansen 2002, entire; NRC 2004, p. 200). Nevertheless, both species are regularly adversely affected by poor summer water quality in Upper Klamath Lake, Keno Reservoir, Lost River sub-basin, and the hydropower reservoirs downstream in the Klamath River (NRC 2004, pp. 201-202). Adverse water-quality conditions, which have primarily occurred in summer, have caused multiple incidents of mass adult mortality (Perkins *et al.* 2000b, pp. 6-23).

The primary cause of water-quality-related mortality appears to be caused by hypoxia (*i.e.*, low levels of dissolved oxygen), although high concentrations of un-ionized ammonia resulting from elevated total ammonia concentrations and high pH, could also be a contributing factor (Perkins *et al.* 2000b, pp. 26-27). Additionally, in the fish die-offs that occurred in Upper Klamath Lake in the 1990s, disease outbreaks contributed to mortality and continued to affect suckers after the adverse water conditions had abated (Perkins *et al.* 2000b, pp. 28-29; NRC 2004, p. 238).

Adverse water quality conditions in Upper Klamath Lake are attributed to high nutrient loading, especially phosphorus, and the presence of the blue-green algae, *Aphanizomenon flos-aquae*. This alga (actually categorized as a “cyanobacterium”) now dominates the algal community from June to November, and because of the high concentrations of nutrients available, especially phosphorus, is able to reach seasonally high biomass levels that can lead to highly degraded water quality (Boyd *et al.* 2002, p. 31; NRC 2004, pp. 5-6; Wood *et al.* 2006, p. 46; Morace 2007, pp. 9, 39). These conditions affect Lost River and shortnose suckers because rapid algal decay depletes dissolved oxygen levels and can create toxic conditions for suckers, especially when water temperatures are high and wind speeds low (Perkins *et al.* 2000b, p. 19; Boyd *et al.* 2002, p. 135; NRC 2004, p. 6; Wood *et al.* 2006, p. 47; Morace 2007, pp. 44-49). Since 2001, the abundance of Lost River suckers has declined by at least 40 percent in Upper Klamath Lake and the abundance of shortnose suckers may have declined more than 80 percent in Upper Klamath Lake. Given the history of mass mortality events and population trends since 2001, it's reasonable to assume poor water quality will continue to adversely affect sucker survival.

Water quality remains one of the most important, if not *the* most important, proximate factor threatening sucker existence; however, the uncertainty surrounding many of the potential ultimate factors (*i.e.*, the complex interactions of factors causing poor water quality), including wetland reduction, natural nutrient loads, nonpoint sources, and water management, also make it one of the most difficult threats to address.

The Sprague River, the primary spawning habitat for suckers in Upper Klamath Lake and the largest tributary to the Williamson River, is listed as water quality impaired for nutrients, temperature, sediment, and dissolved oxygen under Section 303(d) of the Clean Water Act. In 2002, ODEQ completed a TMDL process for the Sprague River and Upper Klamath Lake (Boyd *et al.* 2002, entire), and in 2010 it was followed by a TMDL for the Lost and Klamath Rivers in Oregon (Kirk *et al.* 2010, entire). Water quality management plans were developed which provide targets and guidance on improving water quality in the Sprague River and Upper Klamath Lake. Many wetland and riparian restoration projects are now designed to address TMDL issues.

The existing transportation system contributes to a poor environmental baseline condition in several ways. Many miles of roads parallel streams, which has degraded stream bank conditions by encouraging bank armoring with rip rap, degraded floodplain connectivity by adding fill to floodplains, and discharge of untreated or marginally treated stormwater runoff to streams. Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

The Upper Klamath Recovery Unit includes approximately 3,591 square miles and contains approximately 277 road miles (99 miles on BLM) that fall within 200 feet of a stream within the action area. This represents about 2.3 percent of the total road miles within the recovery unit (11,704 miles), which has a road density of about 3.3 miles of road per square mile within the unit.

The Lost River Recovery Unit includes approximately 1,240 square miles and contains about 228 road miles (76 miles on BLM) that fall within 200 feet of a stream within the action area. This represents about 7 percent of the total road miles within the recovery unit (3,134 miles of road), which has a road density of about 2.5 miles of road per square mile within the unit.

Table 30. Acres and percentages by PRMP land use allocation for the Lost Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 29).

Land Use Allocation	Total Acres	Percent Recovery Unit Acres	Percent PRMP Acres
Total Recovery Unit acres	1,921,537	100.00%	-
Total PRMP BLM Acres	158,534	8.25%	100.00%
Eastside Management Area	149,971	7.52%	91.1%
Harvest Land Base	41,751	0.07%	0.9%
Land Cover District-Designated Reserve	8,674	0.05%	0.6%
Riparian Reserves	15,788	0.61%	7.3%

Table 31. Acres and percentages by PRMP land use allocation for the Upper Klamath Lake Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 29).

Land Use Allocation	Total Acres	Percent Recovery Unit Acres	Percent PRMP Acres
Total Recovery Unit acres	2,940,423	100.00%	-
Total PRMP BLM Acres	71,292	2.4%	100.00%
Congressionally Reserved	2,633	0.09%	1.1%
District-Designated Reserve	1,046	0.04%	0.5%
Eastside Management Area	5,515	0.19%	65.3%
Harvest Land Base	40,336	1.37%	18.2%

Land Use Allocation	Total Acres	Percent Recovery Unit Acres	Percent PRMP Acres
Land Cover District-Designated Reserve	7,654	0.26%	3.8%
Late-Successional Reserve	9,961	0.34%	4.3%
Riparian Reserves	4,147	0.14%	6.9%

EFFECTS OF THE ACTION - LOST RIVER AND SHORTRIVER SUCKERS AND THEIR CRITICAL HABITATS

Based on the *Status of the Species* assessments above for the Lost River and shortnose suckers, these two species have similar life histories, conservation needs, and population status within the action area. For those reasons, the following analysis considers the effects of the PRMP on both listed suckers rather than presenting a separate analysis for each species.

The potential effects of implementing the proposed PRMP on the suckers are assessed below in terms of the potential effects of each of 12 resource programs on the PBFs of critical habitat for both sucker species. These PBFs reflect the habitat elements required by each sucker species for successful breeding, feeding and sheltering, and that affect their reproduction, numbers, and distribution. Based on the *Status of Critical Habitat* assessments above for the Lost River and shortnose suckers, these critical habitats overlap extensively and have the same PBFs. For those reasons, the Service will rely on following analysis of effects to serve as the analysis of effects of the PRMP on sucker critical habitat as well as on the suckers.

PBFs for Lost River and shortnose sucker critical habitats:

PBF 1—Water. Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and water-quality refuge habitats with minimal physical, biological, or chemical impediments to connectivity. Water must have varied depths to accommodate each life stage: shallow water (up to 3.3 feet for larval life stage, and deeper water (up to 14.8 feet) for older life stages. The water quality characteristics should include water temperatures of less than 28.0 °C; pH less than 9.75; dissolved oxygen levels greater than 4.0 mg/L; low levels of microcystin (a liver toxin produced by cyanobacteria); and un-ionized ammonia less than 0.5 mg/L. Elements also include natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph.

PBF 2—Spawning and Rearing Habitat. Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 feet with adequate stream velocity to allow spawning to occur. Areas containing emergent vegetation adjacent to open water provides habitat for rearing and facilitates growth and survival of suckers, as well as protection from predation and protection from currents and turbulence.

PBF 3—Food. Areas that contain abundant forage base, including a broad array of chironomids, crustaceans, and other aquatic macroinvertebrates.

Cultural and Paleontological Resources Program

Based on the findings presented in Table 32, the Cultural Resources and the Paleontological Resources programs are not likely to have a potential to adversely affect the suckers and their critical habitat.

Table 32. Potential effects of the Cultural Resources and Paleontological Resources programs on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 639-642).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the quality of spawning gravels.
	Water quality and depth	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no causal mechanism in the action to affect emergent vegetation.
	Forage base	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Substrate	There will be an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).
	Water quality	Insignificant. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity and depth	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected. Water depths are not affected by the action.
	Natural flow regimes	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Connectivity	Minimal physical, biological or water quality impediments	No effect. There is no causal mechanism to affect physical barriers (such as culverts). The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity that would affect sucker migration. There is no mechanism to introduce chemicals or nutrients to stream flows that would cause a water quality impediment.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way and, so, the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same as they currently are. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Fire and Fuels Program

Based on the findings presented in Table 33, the Fire and Fuels program has the potential to adversely affect the suckers and their critical habitat. There is a potential for the program to cause measurable increases in fine sediment that would reduce macro-invertebrate production and decrease foraging opportunities for suckers. As noted above, many areas occupied by the suckers are limited by water quantity and quality, therefore reductions in flow or water level from the use of pump changes could reduce habitat quality and quantity and cause individual suckers to move away from affected areas, thereby significantly disrupting normal behavior.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way and, so, the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same as they currently are. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Table 33. Potential effects of the Fires and Fuels program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 643-655).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by spring run-off.
Spawning		Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species, including bull trout. There would be very small increases in nutrients delivered to streams as a result of the action that would not measurably affect the water quality/spawning PBF. There would be an insignificant effect to water temperature from the minimal loss of shade vegetation during fuels treatments. The Western Oregon Programmatic BO (USFWS 2008) stated that effects to water temperature would be negligible because of localized removal of vegetation at pump chance sites. The risk of chemical contamination from pumper trucks was not determined to result in adverse effects in the Western Oregon Programmatic BO. Water depths are not affected by the action.
	Water quality and depth	
	Stream velocity	Discountable. The only change in water velocity would occur during use of a pump chance. It is extremely unlikely that spawning Lost River or shortnose suckers would be affected as they are large enough to avoid the pump nozzle and screen.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant. Management direction would not allow ignition of fuels within 60 feet of fish-bearing streams or perennial streams. Any fire that backs into emergent vegetation at the water's edge would not have a measurable impact on the PBF. Typically, fuels treatment within riparian areas results in patchy burning of fuels progressively towards the water's edge.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Effects to zooplankton are difficult to determine. It is possible that phosphorus and nitrogen entering the water column may result in increased primary production that would increase zooplankton availability.
	Substrate	Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect rearing habitat for the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Rearing	Water quality	Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PBF. Suckers are more tolerant to turbidity than other fish species. There would be very small increases in nutrients delivered to streams as a result of the action that would not measurably affect the water quality/rearing PBF. There would be an insignificant effect to water temperature from the minimal loss of shade vegetation during fuels treatments. The Western Oregon Programmatic BO (USFWS 2008) stated that effects to water temperature would be negligible because of localized removal of vegetation at pump chance sites. The risk of chemical contamination from pumper trucks was not determined to result in adverse effects in the Western Oregon Programmatic BO. Water depths are not affected by the action.
Rearing	Water quantity and depth	Adverse. A short-term effect may occur when water is withdrawn at pump chances in occupied areas. No more than 10 percent of the stream flow at a pump chance may be removed.
	Natural flow regimes	Discountable. Analysis of the peak/base flow indicator determined that It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of 6 th field sub-watersheds or larger.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration

Fisheries, Hydrology, Invasive Species, Soils and Wildlife Programs

The potential effects of implementing these programs on the suckers are informed by a previous analysis prepared by the Service. The Service's ARBO II biological opinion (USFWS 2013b) presented a table cross-walking these Lost River sucker and shortnose sucker critical habitat PBFs to the Service's Matrix of Pathways and Indicators (MPI)(USFWS 1998), and also described the effects of habitat restoration activities on these PBFs in a narrative. A modified version of Table 26 in the ARBO II opinion is presented as Table 34 below. The reader is also referred to pp. 283-286 and Table 26 of the ARBO II biological opinion (USFWS 2013b) for additional information.

Based on the findings presented in Table 34, these programs have the potential to cause short-term adverse effects and long-term beneficial effects to the suckers and their critical habitat in conjunction with habitat restoration activities. These potential effects include measurable increases in sediment and turbidity from construction activities such as culvert replacement, and habitat improvement projects like the placement of natural materials within the high water mark. These increases could reduce macro-invertebrate production and limit foraging opportunities for suckers. Fine sediments may invade interstitial areas between gravel temporarily reducing sucker spawning opportunities. These programs have the potential to remove and/or treat streamside vegetation temporarily reducing the ability of the system to filter nutrients and

chemicals, thus leading to decreased water quality. If work area isolation is needed, direct effects to listed suckers could potentially occur through pursuit, capture and handling to move them out of harm's way; those activities have the potential to disturb, stress, injure, or kill suckers. However, these programs apply project-design criteria (PDC) to avoid and minimize the above adverse effects. Those PDCs are discussed the ARBO II (USFWS 2013b pp. 17-18) and include very specific direction for work area isolation, capture and release, electrofishing, and dewatering.

Table 34. Potential effects of the Fisheries, Hydrology, Invasive Species, and Soils and Wildlife Resource Programs on PBFs for the Lost River and shortnose suckers. Adapted from Table 26 in USFWS (2013b)(see Appendix C, pp. 655-658).

MPI Indicators	Construction Activities¹	Instream Activities²	Vegetation Treatments³	Other Projects⁴	Effects Determination
Physical barriers	-I	N	N	N	LAA
Change in peak/base flows	-S	-I	-S	N	
All PBFs indicators	-S	-I	-S	B	LAA
Chemical contaminants/nutrients, temperature	-S	-I	-S	B	
Refugia	-S	-I	-S	N	LAA
Large pools, off-channel habitat, refugia	-S	-I	-S	N	LAA
Wetted width/maximum depth ratio, streambank condition, floodplain connectivity	-S	-I	N	N	
Disturbance history, disturbance regime	B	N	N	N	NLAA
Key: -S = negative effects significant magnitude, -I = negative effects insignificant magnitude or duration, N = neutral effect, B = beneficial effect			Overall Effects Determination LAA		

Notes for Table 34:

¹ Construction activities includes categories:

1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation and Screen Installation/Replacement),
3. Dam, Tide gate, and Legacy Structure Removal
4. Channel Reconstruction/Relocation
5. Off- and Side-Channel Habitat Restoration
6. Streambank Restoration
7. Set-back or Removal of Existing Berms, Dikes, and Levees
8. Reduction/Relocation of Recreation Impacts
9. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering facilities
10. Piling and other Structure Removal
12. Road and Trail Erosion Control and Decommissioning

² Instream activities includes categories:

2. Large Wood (LW), Boulder, and Gravel Placement (LW and Boulder Projects; Engineered Logjams; Porous Boulder Weirs and Vanes, Gravel Augmentation; Tree Removal for LW Projects)
17. Bull Trout Protection

³ Vegetation treatments includes categories:

13. Non-native Invasive Plant Control
14. Juniper Removal
15. Riparian Vegetation Treatment (controlled burning)
16. Riparian Vegetative Planting
18. Beaver Habitat Restoration
19. Sudden Oak Death (SOD) Treatments

⁴ Other projects includes categories:

11. In-channel Nutrient Enhancement
20. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way and, so, the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same as they currently are. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-Federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

4. Forest Management Program

Based on the findings presented in Table 35, the Forest Management program has the potential to adversely affect the suckers and their critical habitat. There is a potential for the program to cause measurable increases in fine sediment that would reduce macro-invertebrate production and decrease foraging opportunities for suckers. As noted above, many areas occupied by the

suckers are limited by water quantity and quality, therefore reductions in flow or water level from the use of pump chances could further reduce habitat quality and quantity and cause individual suckers to move away from affected areas, thereby significantly disrupting normal behavior. BMP R 60, which will be implemented as part of the proposed action, only allows drawing a maximum of 10 percent of stream flow in or within 1,500 feet of listed fish habitat would help to reduce effects to the species. These potential effects would be expected to be short-term in nature and would not be expected to cause any long-lasting changes in the numbers, reproduction or distribution of either sucker species.

Table 35. Potential effects of the Forest Management program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 658-711).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter storm flows.
	Water quality and depth	Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there are no BLM culverts on occupied streams that would be replaced. There would be no effect to water temperature in occupied habitat west of Highway 97, as analysis determined there are no sub-watersheds with BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following management direction: “Retain and promote long-term site-potential shade conditions.” Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no mechanism in the action to affect emergent vegetation.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Substrate	Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Rearing	Water quality	Insignificant. There may be short-term, localized increases in turbidity that may be undetectable against background levels. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there are no BLM culverts on occupied streams that would be replaced. There would be no effect to water temperature in occupied habitat west of Highway 97, as analysis determined there are no sub-watersheds with BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following Management Direction: “Retain and promote long-term site-potential shade conditions.”
	Water quantity and depth	Adverse. The short-term adverse effect is solely from the use of pump chances to draw water from occupied streams. This is anticipated to be a relatively rare occurrence, as there are alternative water sources than selecting from an occupied stream, and there is a disincentive in BMP R 60 (it allows drawing a maximum of 10 percent of stream flow in or within 1,500 feet of listed fish habitat, while allowing a maximum of 50 percent of flow elsewhere) that would further reduce effects to the species. Model results indicate that there are no sub-watersheds with BLM land ownership in the Lost River RU that that are susceptible to a detectable change in peak flow response. There is one sub-watershed in the Upper Klamath RU (Fall Creek-Klamath River, 180102060502) that is susceptible to a detectable change in peak flow response but does not have occupied habitat. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of Forest Management actions under the PRMP. This may not be detectable in occupied habitat, but may be a beneficial effect to the PBF. There is no causal mechanism of the action to affect water depth.
	Natural flow regimes	Insignificant. A short-term reduction in flow due to use of pump chances would not have a meaningfully measurable effect to the natural flow regiment.

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Connectivity	Minimal physical, biological or water quality impediments	Insignificant. There may be short-term, localized increases in turbidity that may be undetectable against background levels. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there are no BLM culverts on occupied streams that would be replaced. There would be no effect to water temperature in occupied habitat west of Highway 97, as analysis determined there are no sub-watersheds with BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following Management Direction: “Retain and promote long-term site-potential shade conditions.” The only potential negative effect to connectivity would be turbidity, but suckers are relatively tolerant of turbidity.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way, and the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Lands and Realty Program

Table 36 summarizes the potential effects of the Lands and Realty program on the PBFs for the Lost River sucker and the shortnose sucker that apply to the action area. Note that the PBFs analysis below is specific to discretionary road right-of-way actions within a Riparian Reserve adjacent to a stream occupied by listed suckers. While possible, this scenario would be a rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (BLM 2016b, p. 393).

Based on the findings presented in Table 36, the Land and Realty program has the potential to adversely affect the suckers and their critical habitat. There is a potential for the program to cause measurable increases in fine sediment that would reduce macro-invertebrate production and decrease foraging opportunities for suckers. As noted above, many areas occupied by the suckers are limited by water quantity and quality, therefore reductions in flow or water level from the use of pump chances could reduce habitat quality and quantity and cause individual suckers to move away from affected areas, thereby significantly disrupting normal behavior. These potential effects would be expected to be short-term in nature and would not be expected

to cause any long-lasting changes in the numbers, reproduction or distribution of either sucker species.

Table 36. Potential effects of the Land and Realty program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 712-719).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter stormflows.
	Water quality and depth	Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. The two sucker species are more tolerant to turbidity than other fish species. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism of the action that would affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no causal mechanism in the action to affect emergent vegetation.
	Forage base	Adverse. Short-term (days to weeks), localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Effects to zooplankton are difficult to determine.
	Substrate	Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain whether this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).
	Water quality	Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PBF.
	Water quantity and depth	Insignificant. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6 th field watersheds. There is no causal mechanism to affect water depth.
	Natural flow regimes	Insignificant. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6 th field watersheds.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way and, so, the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore,

we expect the habitat conditions of these stretches of occupied habitat to remain about the same as they currently are. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Livestock Grazing Program

The findings presented in Table 37 below rely, in part, on an analysis of the effects of livestock grazing on the shortnose sucker on the BLM Lakeview District of the Klamath Falls Resource Area (USFWS 2014 Suckers).

Table 37. Potential effects of the Livestock Grazing program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 719-729).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Adverse effects could occur to the shortnose sucker (SNS) every 3 rd year within a 0.05 mile reach of Ben Hall Creek when the rotation allows use of Dry Prairie Pasture during the sucker spawning period in May. It should be noted that although Ben Hall Creek has had past riparian problems, grazing management changes made over the last 10-20 years, including upland/riparian pasture fencing and using a rest-rotation grazing system, have allowed this riparian area to improve significantly and maintain upward trends (USFWS 2014 p. 21).
		Lost River Sucker (LRS): Insignificant effects. Distance and topography preclude the likelihood of measurable effects.
	Water quality and depth	Insignificant. Short-term, localized increases in turbidity may be undetectable against background levels and would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species. Increases in nutrients from cattle urine/feces would be diluted at flows typically found during the spawning period. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism of livestock grazing to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	SNS: Adverse. A measurable negative effect occurs to emergent vegetation when drawdown of Dry Prairie Reservoir allows grazing by livestock. Thus reducing effective vegetation cover needed for hiding and foraging suckers.
		LRS: Discountable. It is remotely possible that livestock could enter the Klamath River canyon, but very unlikely.
	Forage base	SNS: Insignificant. The 2014 Service BO (USFWS 2014, p. 45) states that food availability is probably not a limiting factor for shortnose sucker in Ben Hall Creek or Dry Prairie Reservoir.
		LRS: No effect. Distance and topography preclude the possibility of effects to this indicator.

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
	Substrate	SNS: Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles in Ben Hall Creek. However, the 2014 Service BO (USFWS 2014, p. 44) states that excess sediment is expected to be flushed away during spring run-off. It is uncertain how this would affect rearing habitat for the shortnose sucker. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).
		LRS: Insignificant. Distance and topography from most livestock grazing will limit the amount of fine sediment delivered to LRS to immeasurable quantities. Any effects would be extremely localized.
	Water quality	SNS: Insignificant. Short-term, localized increases in turbidity may be undetectable against background levels. Suckers are more tolerant to turbidity than other fish species. The 2014 Service BO states that no specific data exists concerning nutrient concentrations (from cattle urine or feces) in Dry Prairie Reservoir or Ben Hall Creek. However, the Service believes this is probably not a limiting factor for the shortnose sucker since populations are viable and there is no information to indicate that it is limiting the recovery function of the water PBF.
		LRS: Insignificant. Immeasurable increases in turbidity and ammonia could occur, but because of the distance and topography any effects would be highly localized and quickly diffused once entering LRS habitat.
	Water quantity and depth	SNS: Adverse. The 2014 Service BO states that there is the potential that cattle drinking from Dry Prairie Reservoir and Ben Hall Creek during low water years, particularly when the reservoir is greatly reduced in size, would measurably affect water quantity. Reductions in reservoir water depths are known to reduce larval survival rates
		LRS: Discountable. Because of the distance and topography the likelihood that livestock could affect water depths is highly unlikely to occur.
	Natural flow regimes	SNS: Adverse, due to cattle drinking from Ben Hall Creek during low water years. There would be a measurable negative effect to base flow.
		LRS: Insignificant (immeasurable). The only mechanism that would exist is through livestock drinking from streams that flow into LRS habitat or through an occasional animal that somehow entered the Klamath River corridor. This consumption of water would be so small that the effects could not be measured.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration for either species.

Based on the findings presented in Table 37, the Livestock Grazing program has the potential to adversely affect the shortnose sucker and its critical habitat. There is a potential for the program to cause measurable adverse effects to emergent vegetation that could limit hiding and spawning cover for shortnose suckers. Additionally, substrate will be negatively affected by sediment accumulations caused by the presence of livestock on banks and in streams. Water quality could be reduced by livestock watering within occupied shortnose sucker habitat; this activity could reduce available habitat and cause shortnose suckers to move in response to the presence of livestock, thus significantly disrupting their normal behavior. However, these potential effects would be expected to be localized and short-term in nature and would not be expected to cause any long-lasting changes in the numbers, reproduction or distribution of either sucker species.

Based on the findings presented in Table 37, the Livestock Grazing program does not have the potential to adversely affect the Lost River sucker because the little Lost River sucker habitat that is located within the action area has very steep terrain which prevents all direct access by livestock to occupied habitat most of the time. Some potential for minor increases in sediment and turbidity within occupied habitat is possible as a result of upslope grazing by livestock, but these adverse effects would be immeasurable and insignificant because the intensity of that grazing is expected to be low due to the steep terrain.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way, and the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Minerals Program

There are no mining claims on BLM land in waters occupied by the Lost River sucker or the shortnose sucker, based on the Service's review of a BLM GIS layer. The BLM Klamath Falls Resource Area Fish Biologist, Rob Roninger, states that he has not seen any suction dredge mining in critical habitat for the suckers (BLM 2016b, p. 499); the extent of that critical habitat conforms to the extent of sucker-occupied habitat on BLM lands within the action area. There are no BLM rock quarries that drain to occupied habitat for either sucker species. The BLM has concluded that there is no effect to these species or their critical habitat from use of rock quarries or from suction dredge gold mining (BLM 2016b, p. 503).

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way and, so, the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same

as they currently are. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Recreation and Visitors Services Program

Based on the findings presented in Table 38, the Recreation and Visitors Services program has the potential to adversely affect the suckers and their critical habitat. There is a potential for the program to cause measurable increases in fine sediment that would reduce macro-invertebrate production and decrease foraging opportunities for suckers. Water quality could be degraded by the leaching of chemical contaminants from treated wood in site-specific areas. As noted above, many areas occupied by the suckers are limited by water quantity and quality, therefore reductions in flow or water level from the use of pump chances could reduce habitat quality and quantity and cause individual suckers to move away from affected areas, thereby significantly disrupting normal behavior. The combined effects from activities under this program would reduce habitat quality to some degree for both spawning and rearing of suckers. There would be localized effects to reproduction and distribution. However these effects would be minor when evaluated against the range of species, and would not have measurable effects on the overall population.

Table 38. Potential effects of the Recreation and Visitors Services program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 733-741).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by spring run-off.
	Water quality and depth	Adverse. Potential for chemical contamination from legacy treated wood (leaching of chemicals), and maintenance activities on that wood, on trail bridges and walkways. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species. Loss of vegetation at streamside campgrounds is unlikely to affect water temperatures during spawning periods when flows are typically higher and water temperatures are lower. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism of the action that would affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant. There may be some trampling of emergent vegetation adjacent to heavily used recreation areas, but the reduction of vegetation would be slight and would not remove cover needed by suckers for foraging and hiding from predators.

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Rearing	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources, but dissipate within days to weeks. Effects to zooplankton are difficult to determine, but likely minor.
	Substrate	Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect rearing habitat for the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).
	Water quality	Adverse. Potential for continued baseline amounts of chemical contamination from legacy treated wood and maintenance activities on that wood, on trail bridges and walkways. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PBF. Suckers are more tolerant to turbidity than other fish species.
	Water quantity and depth	Insignificant effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels would cause only minor increases that would not be measurable. Water depths are not affected by the action.
	Natural flow regimes	Insignificant. The effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels could not be meaningfully measured.
Connectivity	Minimal physical, biological or water quality impediments	Adverse. Potential for chemical continued baseline amounts of contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways may negatively affect water quality during migration periods. In the context of migration corridors, slight increases in turbidity against background levels would not affect the utility of migration habitat. Suckers are more tolerant of turbidity than salmonids. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction. This would have the potential to adversely affect the PBF.

Swimming, Boating and Other Water-Based Activities. Recreationists using streams may interact with rearing or spawning fish when they are in the water, for example, wading, swimming, or boating. Under the proposed action, BLM provides the opportunity for recreationists to access the land and use the streams, and by maintaining recreational facilities the proposed action does concentrate public access at these locations. These locations include campgrounds and boat ramps, as well as other recreation sites. Disturbance by recreationists may cause rearing fish to leave cover and become more susceptible to predation. Disturbance of adults at the spawning sites may delay some spawning. BLM identified recreation facilities within a site-potential tree distance (216 feet) of occupied habitat or critical habitat for ESA-listed species (see Appendix C, p. 733). These facilities concentrate recreationists and represent the likely and most predictable areas where disturbance may occur. Although these sites may concentrate the disturbance, this

may limit the disturbance area to the immediate site. The two sucker recovery units have recreational facilities that are widely distributed throughout the units. Although the potential for increased predation and spawning delay may occasionally occur, disturbance by recreationists is expected to be of a minor nature due to the limited number of sites within most the analysis units.

However, it is possible that some degree of adverse effects (albeit small in number) will occur to Listed suckers from these activities. Direct mortality or injury may occur from boat strikes, or fishing. Disturbance from swimming, wading and similar activities may cause disturbance causing fish to flee and thus disrupt their normal behaviors.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way, and the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Sustainable Energy Program

Note that this program is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. The potential for this program to adversely affect the suckers is associated with the winter haul of this slash. However, as noted in the BLM's write-up (BLM 2016a, p. 152), the rarity of past requests for biomass feedstock and the lack of biomass processing infrastructure in the planning area, the Service believes this action is extremely unlikely to occur which renders the effects to species and critical habitats discountable, which is not likely to adversely affect the species included in this consultation. The Service concurs that the history of this practice and the operational capacity for it to occur are telling for its future likelihood, and so we concur with the BLM's determination.

Given the lack of infrastructure for biomass processing the Service does not anticipate there will be any effects on non-federal lands within the action area from this activity, either.

Trails and Travel Management Program

Based on the findings presented in Table 39, the Trails and Travel Management program (including existing non-commercial road use) has the potential to adversely affect the suckers and their critical habitat. There is a potential for the program to cause measurable increases in fine sediment that would reduce macro-invertebrate production and decrease foraging opportunities for suckers. Water quality could be degraded by the leaching of chemical

contaminates from treated wood in site-specific areas. Chemical contamination from stormwater originating on paved roads could reduce water quality. Such reductions in habitat quality could cause affected suckers to move away from affected areas, thereby potentially causing a significant disruption of their normal behavior. These potential effects would be expected to be short-term in nature and would not be expected to cause any long-lasting changes in the numbers, reproduction or distribution of either sucker species.

Table 39. Potential effects of the Trails and Travel Management program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 749-759).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter stormflows. Because higher flows occur during this time most sediment or contaminants arising from roads would be flushed from the system.
	Water quality and depth	Insignificant. Slight increases in turbidity against background levels are unlikely to affect the utility of migration habitat. Any water temperature increases for short sections of stream are unlikely to occur during the spawning period. Chemical contamination may occur downstream from a few crossings where treated wood is used, but it would be very diluted with higher flows during the spawning period, and is unlikely to measurably affect spawning. Water depths are not affected by the action. Limited road use during the spawning season would not result in measurable increases in sediment or contaminants.
	Stream velocity	No effect. There is no causal mechanism to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no mechanism in the action to affect emergent vegetation adjacent to open water areas.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Thus reducing the availability of prey causing an increase in the expenditure of energy on foraging activities.
	Substrate	Insignificant. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Rearing	Water quality	Adverse. There may be short-term, localized increases in turbidity that may be undetectable against background levels. Suckers are more tolerant to turbidity than other fish species. Chemical contamination may occur at small stream segments where treated (potential leaching of chemicals into the system) wood is used at trail crossings, or anywhere stormwater from paved roads are located within 200 feet of sucker habitat. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use.
	Water quantity and depth	Insignificant. Trails and roads may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in occupied areas. Base flows are not affected by the action. There is no causal mechanism of the action to affect water depth.
	Natural flow regimes	Insignificant. See analysis above for the effects to rearing Water Quantity and Depth.
Connectivity	Minimal physical, biological or water quality impediments	Adverse. This is a conservative effect determination. Chemical contamination may occur at small stream segments where treated wood is used at trail crossings, or anywhere stormwater from paved roads are located within 200 feet of sucker habitat. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration.

Injury and mortality may occur from increased sediment, turbidity and chemical contamination which are introduced through non-commercial use of the existing BLM road system. Increases in sediment and turbidity are likely to occur from road use particularly on segments of native surface roads that are located within 200 feet of streams (see Appendix C, pp. 752-757). Chemical contamination is likely to occur when segments of paved roads are located within 200 feet of streams and stormwater from these sections are introduced into streams.

It is impossible to predict the exact level of road use within the two sucker recovery units. As stated previously, the action area within the Upper Klamath Lake Recovery Unit contains approximately 277 miles of road (99 miles on BLM) that occur within 200 feet of streams, and the action area within the Lost River Recovery Unit contains approximately 228 miles of road (76 miles on BLM) that occur within 200 feet of streams. The Service does not know the exact number of road miles within the entire PRMP action area that fall within 200 feet of streams. However, based on the percentages of the miles of BLM roads in these two recovery units compared to the miles of roads on BLM land within the entire action area, this represents approximately 1.6 and 1.3 percent, respectively, of the total miles of road that are likely to contribute sediment, turbidity or contaminants from road use and stormwater runoff. The Service believes that these percentages are representative of road miles of the overall action area.

The Service anticipates that non-commercial road use within 200 feet of streams in the action area will cause the lethal or sub-lethal injury of suckers. We believe non-commercial road use

will cause sub-lethal effects resulting in decreased fitness of listed suckers. Pulses of sediment from roads and increased turbidity from stormwater may disturb list suckers causing them to flee and disrupt normal behavior. These species are able to tolerate degraded aquatic conditions and are less sensitive to sediment loading and turbidity than salmonids. However the Service anticipates that use of the existing road system may result in sub-lethal injury and mortality of suckers in both the Upper Klamath Sucker Recovery Unit and the Lost River Sucker Recovery Unit.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way, and the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Wild Horse Program

Based on the findings presented in Table 40, the Wild Horse program does not have a potential to adversely affect the suckers and their critical habitat. Small additions of sediment and increased turbidity could occur with implementation of this program, as proposed, but these habitat changes would be far too small, far too distant and far too infrequent to measurably affect suckers. In addition, as noted in the terrestrial BA (BLM 2016a, p. 25) management direction for the management of the Pokegama herd of wild horses was developed by the BLM to be consistent with the existing Pokegama Wild Horse Herd Management Area Plan NEPA decision and consultation that are currently in place. Because BLM complied with ESA section 7 consultation on these actions prior to signing the records of decision and is not taking any affirmative action regarding them in the PRMP, the BLM is not requesting further ESA consultation on these projects (Hardt 2016, pers. comm.). We include these effects here because they were included in aquatic BA (BLM 2016b, pp. 105-106) out of an abundance of caution.

The activities on non-federal activities within the action area in these two sucker recovery units are not reasonably certain to change in any predictable way, and the effects to the species are expected to remain similar to the effects this area has experienced in recent history. Therefore, we expect the habitat conditions of these stretches of occupied habitat to remain about the same. Because the baseline condition of these riverine habitats and the sucker populations it supports are not expected to change in the foreseeable future, we do not expect the existing numbers of suckers, the distribution of suckers or sucker reproduction in the action area to change as a result of non-federal land actions within the action area. We expect that any actions on these non-federal lands within the action area that have a Federal nexus and that may affect either of these two suckers will undergo the appropriate NEPA and section 7 consultation when specific activities are designed and proposed.

Table 40. Potential effects of the Wild Horse program on PBFs for the Lost River and shortnose suckers (see Appendix C, pp. 759-763).

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Spawning	Substrate	Insignificant. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in fine sediment on spawning substrate.
	Water quality and depth	Insignificant overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in turbidity. Suckers are more tolerant of turbidity than other fish species. Urine and fecal matter should be widely distributed and would not lead to meaningfully measurable affects to water quality of the Klamath River. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism to affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant. There would be very limited grazing by wild horses on emergent vegetation of the Klamath River that could serve as habitat for juvenile suckers. This would not result in a meaningfully measured effect to the PBF.
	Forage base	Insignificant. The very small amount of sediment delivery to stream channels, if any, from wild horse activity would not result in a measurable effect to the production of macroinvertebrates that serve as food sources in the Klamath River. Zooplankton availability should not be affected.
	Substrate	There will an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles of the Klamath River. Even if it were meaningfully measurable, it is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scopettone 1990).
	Water quality	Insignificant overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in turbidity. Suckers are more tolerant to turbidity than other fish species. Urine and fecal matter should be widely distributed and would not lead to meaningfully measurable affects to water quality of the Klamath River.
	Water quantity and depth	Insignificant. The only mechanism of wild horse use to affect water quantity would be horses drinking from the Klamath River, and that level of use in the winter (when they are most likely to be in the canyon) would not result in a meaningfully measurable effect to water quantity. Water depths are not affected.
	Natural flow regimes	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that the small amount of vegetation eaten would affect peak or base flows.

PBF		Effects of the Proposed Action
Site Type	Site Attribute	
Connectivity	Minimal physical, biological or water quality impediments	Insignificant overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse use would not result in a measurable increase in turbidity that would affect sucker migration. Suckers are more tolerant to turbidity than other fish species. There is no mechanism to affect physical barriers such as culverts (No Effect). There is no mechanism for chemical contamination that would be a water quality barrier to migration.

Effects of the Proposed Action on Limiting Factors for Lost River and Shortnose Suckers

The revised recovery plan for the suckers identifies habitat-limiting factors as loss or degradation of spawning, rearing or adult habitat (USFWS 2012 Suckers). Connectivity of these habitats is a concern, as well as reductions in habitat quality, including poor water quality. The potential effects of implementing the PRMP on these limiting factors are discussed in Table 41.

Table 41. Potential effects of PRMP programs on limiting factors for the Lost River sucker and the shortnose sucker

Limiting Factor	Analysis of Potential Effects
Loss of spawning, rearing or adult habitat.	There is no causal mechanism for the proposed action to affect this limiting factor. There is no potential to reduce such habitat for either sucker species by implementing the PRMP.
Degradation of spawning, rearing or adult habitat, including water quality.	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances), Livestock Grazing (trampling and eating shade vegetation), and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites). Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Forest Management (petroleum products from heavy equipment replacing culverts), Invasive Plant Control (chemical treatments) and Recreation & Visitors Services (use of treated wood under certain conditions).

Limiting Factor	Analysis of Potential Effects
Degradation of spawning, rearing or adult habitat, including water quality (cont.).	Water quantity may be measurably decreased in the short-term by use of pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management. There would be short-term adverse effects as a result of fine sediments on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable Energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Livestock grazing would have a short-term (recovery before next grazing season) adverse effect. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages.
Habitat connectivity	There is no causal mechanism of the proposed action to affect the limiting factor. There are no opportunities to improve fish passage on BLM land.

Effects to non-federal lands within the action area

There are non-federal lands within these two recovery units that can only be accessed by traveling on a BLM managed road. Because non-federal actions on these parcels are dependent on a BLM road, any future non-federal actions that are reasonably foreseeable on those parcels are considered indirect effects of the proposed action. As stated in the Description of the Proposed Action, the Service considered all non-federal lands within ½ mile of BLM lands to be within the action area.

The major activities on non-federal lands within the action area that could affect suckers in these two recovery units are grazing, forage production, and the continued modification of the river courses where these suckers reside. Grazing has the potential to introduce sediments and nutrients into the aquatic system, can disturb fish or crush fry or redds when cattle are in the wetted stream channel, and can alter aquatic vegetation through grazing and erosion. Forage production and similar agricultural activities often requires irrigation withdrawals from streams reducing water quantity in streams and ponds and reservoirs. Irrigation returns increase sediment levels, increase turbidity and introduce nutrients into the aquatic system from fertilizers and pesticides. The river systems, including associated impoundments and reservoirs that Lost River and shortnose suckers inhabit within the action area have previously been significantly altered from their natural state. They have been straightened, channelized and simplified. Water levels

in streams, impoundments and reservoirs have been reduced and natural flow regimes altered from agricultural diversions. The Service has no information that changes to activities on non-federal lands within the action area are reasonably certain to occur. Therefore, the effects from non-federal activities within this portion of the action area are expected to remain about the same as the effects this area has experienced in recent history that have produced the existing baseline conditions. The Service does not anticipate those conditions, and the effects they have on the species or population sizes, to change.

CONCLUSION

After reviewing the current status of the Lost River and shortnose suckers, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the suckers.

The Service reached these conclusions for the Lost River and shortnose suckers because:

- Overall, implementation of the PRMP on BLM lands is expected to have short-term adverse effects and long-term beneficial effects to a small portion of the listed species' populations occurring in the action area, particularly as a result of Management Direction (BLM 2016b, Appendix A) and BMPs (BLM 2016b, Appendix B) that would reduce adverse effects to the suckers and improve their habitat conditions over time. Potential adverse effects to the suckers arising from implementation of the PRMP on BLM lands are likely to be of short duration, limited in scope and magnitude, and occur over a wide landscape and a long timeframe. Because these adverse effects are expected to be of short duration and small magnitude, and many of the actions within the PRMP will result in habitat improvements over time, the Service anticipates the potential implementation of the PRMP will result in long-term improvements in habitat conditions from BLM actions, which are expected to result in increases in the Lost River and shortnose sucker numbers, reproduction and, potentially, distribution.
- On non-federal lands within the action area, we anticipate that current practices will continue at rates similar to current rates. Grazing and agricultural practices will continue to be an important aspect of the economy in this part of the action area. These practices that have helped develop the current baseline conditions and population levels and are not expected to cease. Therefore, we expect the contribution to conditions from those lands to be similar to current contributions. Given that actions implemented by BLM will provide a net benefit to baseline and these actions on non-federal lands are expected to continue to contribute to baseline conditions as they have, we anticipate there will be a net positive impact from implementation of the PRMP on habitat conditions, fish health and sucker populations.

After reviewing the current status of the Lost River and shortnose suckers critical habitats, the environmental baseline for their critical habitats within the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to destroy or adversely modify either Lost river or shortnose sucker critical habitat. The Service reached these conclusions for the Lost River and shortnose sucker critical habitats because:

- Implementation of the PRMP on BLM lands is expected to have some short-term adverse effects to critical habitat PBFs and result in long-term benefits to a small portion of the listed species' critical habitat PBFs. We anticipate these effects will be a result of implementation of Management Direction (BLM 2016b, Appendix A) and BMPs (BLM 2016b, Appendix B) that would reduce adverse effects to sucker critical habitat and improve conditions of the PBFs over time. Potential adverse effects to their critical habitats arising from implementation of the PRMP on BLM lands are likely to be of short duration, limited in scope and magnitude, and occur over a wide landscape and a long timeframe. Because any adverse effects are expected to be of short duration and small magnitude, and many of the actions within the PRMP will result in habitat improvements over time, the Service anticipates the potential implementation of the PRMP will result in any long-term improvement of Lost River and shortnose sucker critical habitat PBFs.
- On non-federal lands within the action area we anticipate that current practices will continue at rates similar to current rates. Grazing and agricultural practices will continue to be an important aspect of the economy in this part of the action area. These practices that have helped develop the current baseline conditions for the Lost River or shortnose sucker critical habitat PBFs on non-federal lands within the action area, and these practices are not expected to cease. Therefore, we expect the contribution to conditions from those lands to be similar to current contributions. Given that actions implemented by BLM will provide a net benefit to the baseline and these actions on non-federal lands are expected to continue to contribute to baseline conditions as they have, we anticipate there will be a net positive impact from implementation of the PRMP on the PBFs of critical habitat for these two species.

MARBLED MURRELET

STATUS OF THE MARBLED MURRELET

Species Description

The murrelet is a small diving seabird that nests mainly in coniferous forests and forages in near-shore marine habitats. Males and females have sooty-brown upperparts with dark bars. Underparts are light, mottled brown. Winter adults have brownish-gray upperparts and white scapulars. The plumage of fledged young is similar to that of adults in winter. Chicks are downy and tan colored with dark speckling.

Legal Status

The murrelet was listed as a threatened species on September 28, 1992, in Washington, Oregon, and northern California (USFWS 1992). Since the species' listing, the Service has completed two 5-yr status reviews of the species: September 1, 2004 (USFWS 2004) and June 12, 2009 (USFWS 2009). The 2004 5-year review determined that the California, Oregon, and Washington distinct population segment of the murrelet did not meet the criteria outlined in the Service's 1996 Distinct Population Segment (DPS) policy (USFWS and USDC NMFS 1996, USFWS 2004). However, the 2009 5-year review concluded the 2004 analysis of the DPS question was based on a flawed assumption regarding discreteness at the international border with Canada, and that the three-state population did, in fact, constitute a valid DPS (USFWS 2009, pp. 3-12). In 2010, the Service denied a petition to delist the marbled murrelet, and the U.S. Court of Appeals for the D.C. Circuit upheld the Service's decision. American Forest Resource Council v. Ashe, 601 Fed. Appx. 1 (D.C. Cir. 2015). The legal status of the murrelet remains unchanged from the original designation.

Life history

Murrelets produce one egg per nest and usually only nest once a year, however re-nesting has been documented after nest failure. Nests are not built, but rather the egg is placed in a small depression or cup made in moss or other debris on the limb. Incubation lasts about 30 days, and chicks fledge after about 28 days after hatching. Both sexes incubate the egg in alternating 24-hour shifts. The chick is fed up to eight times daily, and is usually fed only one fish at a time. The young are semiprecocial, capable of walking but not leaving the nest. Fledglings fly directly from the nest to the ocean. If a fledgling is grounded before reaching the ocean, they usually die from predation or dehydration, as murrelets need to take off from an elevated site to obtain flight.

Ecology/Habitat Characteristics

Murrelets spend most of their life in the marine environment, but use old-growth forests for nesting. Courtship, foraging, loafing, molting, and preening occur in near-shore marine waters. Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in near-shore marine waters although they have also been detected on rivers and inland lakes.

In their terrestrial environment, the presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat. Murrelet habitat use during the breeding season is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, proximity to the marine environment, and forests that are increasing in stand age and height. Additional information on murrelet taxonomy, biology, and ecology can be found in Ralph *et al.* (1995), McShane *et al.* (2004), and Piatt *et al.* (2007).

Aquatic Habitat Use

Birds occur off shore in Conservation Zones 1-6 year round and also occur in small numbers off southern California in the winter. Murrelets are usually found within 5 miles (8 km) from shore, and in water less than 60 meters deep (Ainley *et al.* 1995; Burger 1995; Strachan *et al.* 1995; Nelson 1997; Day and Nigro 2000; Raphael *et al.* 2007a). In general, birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (Nelson 1997). Courtship, foraging, loafing, molting, and preening occur in marine waters.

Murrelets are wing-propelled pursuit divers that forage both during the day and at night (Carter and Sealy 1986; Henkel *et al.* 2003; Kuletz 2005). Murrelets can make substantial changes in foraging sites within the breeding season, but many birds routinely forage in the same general areas and at productive foraging sites, as evidenced by repeated use over a period of time throughout the breeding season (Carter and Sealy 1990, Whitworth *et al.* 2000; Becker 2001; Hull *et al.* 2001; Mason *et al.* 2002; Piatt *et al.* 2007). Murrelets are also known to forage in freshwater lakes (Nelson 1997). Activity patterns and foraging locations are influenced by biological and physical processes that concentrate prey, such as weather, climate, time of day, season, light intensity, up-wellings, tidal rips, narrow passages between island, shallow banks, and kelp (*Nereocystis* spp.) beds (Ainley *et al.* 1995; Burger 1995; Strong *et al.* 1995; Speckman 1996; Nelson 1997).

Juveniles are generally found closer to shore than adults (Beissinger 1995) and forage without the assistance of adults (Strachan *et al.* 1995). Kuletz and Piatt (1999) found that in Alaska, juvenile murrelets congregated in kelp beds. Kelp beds are often associated with productive waters and may provide protection from avian predators (Kuletz and Piatt 1999). McAllister (in Strachan *et al.* 1995) found that juveniles were more common within 328 feet (100 m) of shorelines, particularly where bull kelp was present.

Within the area of use, murrelets usually concentrate feedings in shallow, near-shore water less than 98 feet (30 m) deep (Huff *et al.* 2006), but are thought to be able to dive up to depths of 157 feet (47 m) (Mathews and Burger 1998). During the non-breeding season, murrelets disperse and can be found farther from shore (Strachan *et al.* 1995). Although little information is available outside of the nesting season, limited information on winter distribution also suggests they do move further offshore (Strachan *et al.* 1995, p. 247). In areas with protective waters, there may be a general opportunistic shift from exposed outer coasts into more protected waters during the winter (Nelson 1997); for example, many murrelets breeding on the exposed outer coast of Vancouver Island appear to congregate in the more sheltered waters within the Puget Sound and the Strait of Georgia in fall and winter (Burger 1995). In many areas, murrelets also

undertake occasional trips to inland nesting habitat during the winter months (Carter and Erickson 1992). Throughout the listed range, murrelets do not appear to disperse long distances, indicating they are year-round residents (McShane *et al.* 2004).

Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986; USFWS 1992). In general, small schooling fish and large pelagic crustaceans are the main prey items. Pacific sand lance (*Ammodytes hexapterus*), northern anchovy (*Engraulis mordax*), immature Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), Pacific sardine (*Sardinops sagax*), juvenile rockfishes (*Sebastes* spp.), and surf smelt (*Osmeridae*) are the most common fish species taken. Squid (*Loligo* spp.), euphausiids, mysid shrimp, and large pelagic amphipods are the main invertebrate prey. Murrelets are able to shift their diet throughout the year and over years in response to prey availability (Becker *et al.* 2007). However, long-term adjustment to less energetically-rich prey resources (such as invertebrates) appears to be partly responsible for poor murrelet reproduction in California (Becker and Beissinger 2006).

Breeding adults exercise more specific foraging strategies when feeding chicks, usually carrying a single, relatively large (relative to body size) energy-rich fish to their chicks (Burkett 1995; Nelson 1997), primarily around dawn and dusk (Nelson 1997, Kuletz 2005). Freshwater prey appears to be important to some individuals during several weeks in summer and may facilitate more frequent chick feedings, especially for those that nest far inland (Hobson 1990). Becker *et al.* (2007) found murrelet reproductive success in California was strongly correlated with the abundance of mid-trophic level prey (*e.g.*, sand lance, juvenile rockfish) during the breeding and postbreeding seasons. Prey types are not equal in the energy they provide; for example parents delivering fish other than age-1 herring may have to increase deliveries by up to 4.2 times to deliver the same energy value (Kuletz 2005). Therefore, nesting murrelets that are returning to their nest at least once per day must balance the energetic costs of foraging trips with the benefits for themselves and their young. This may result in murrelets preferring to forage in marine areas in close proximity to their nesting habitat. However, if adequate or appropriate foraging resources (*i.e.*, “enough” prey, and/or prey with the optimum nutritional value for themselves or their young) are unavailable in close proximity to their nesting areas, murrelets may be forced to forage at greater distances or to abandon their nests (Huff *et al.* 2006). Consequently, the distribution and abundance of prey suitable for feeding chicks may greatly influence the overall foraging behavior and location(s) during the nesting season, may affect reproductive success (Becker *et al.* 2007), and may significantly affect the energy demand on adults by influencing both the foraging time and number of trips inland required to feed nestlings (Kuletz 2005).

Nesting Biology

Incubation is shared by both sexes, and incubation shifts are generally one day, with nest exchanges occurring at dawn (Nelson 1997, Bradley 2002). Hatchlings appear to be brooded by a parent for one or two days and then left alone at the nest for the remainder of the chick period (from hatching until fledging) while both parents spend most of their time foraging at sea. Both parents feed the chick (usually a single fish carried in the bill) and the chick typically receives 1-8 meals per day (mean 3.2) (Nelson 1997). About two-thirds of feedings occur early in the

morning, usually before sunrise, and about one-third occur at dusk. Feedings are sometimes scattered throughout the day (Hamer and Nelson 1995a). Chicks fledge 27-40 days after hatching, at 58-71 percent of adult mass (Nelson 1997). Fledging has seldom been documented, but it typically appears to occur at dusk (Nelson 1997).

Nest Tree Characteristics

Lank *et al.* (2003) states that murrelets “occur during the breeding season in near-shore waters along the north Pacific coastline from Bristol Bay in Alaska to central California”, nesting in single platform trees generally within 20 miles of the coast and older forest stands generally within 50 miles of the coast. Unlike most auks, murrelets nest solitarily on mossy platforms of large branches in old-forest trees (Lank *et al.* 2003). Suitable murrelet habitat may include contiguous forested areas with conditions that contain potential nesting structure. These forests are generally characterized by large trees greater than 18 inches dbh, multi-storied canopies with moderate canopy closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and protective cover from ambient conditions and potential avian predators (Manley 1999, Burger 2002, Nelson and Wilson 2002). Over 95 percent of measured nest limbs were ≥ 15 cm diameter, with limb diameter ranges from 7-74 cm diameter (Burger 2002). Nelson and Wilson (2002) found that all 37 nest cups identified were in trees containing at least seven platforms. All trees in their study were climbed, however, and ground-based estimates of platforms per tree in the study were not analyzed. Lank *et al.* (2003) emphasizes that murrelets do not select nest sites based on tree species, but rather they select those individual trees that offer suitable nest platforms. Nest cups have been found in deciduous trees, albeit rarely and nest trees may be scattered or clumped throughout a forest stand.

A tree with potential nesting structure in Oregon typically has the following characteristics;

1. It occurs within 50 miles (81 km) of the coast (USFWS 1997, p. 32);
2. It is a conifer tree (USFWS 1997, p. 18, Burger 2002, p. 39);
3. It is ≥ 19.1 in. (49 cm) (dbh) in diameter and > 107 ft. (33 m) in height (Nelson and Wilson 2002, p 32), although smaller trees have been documented in Alaska (Nelson 1997, p. 30);
4. It has $\geq$ one platform with the following characteristics
 - a. It is ≥ 4 in. (10 cm) wide (Nelson 1997, p. 30);
 - b. It has nesting substrate (*e.g.*, moss, epiphytes, duff) (Burger 2002, p. 42; Nelson and Wilson 2002, pp. 24, 100),
 - c. It is in the live crown of the tree, either on the tree with nesting structure or on an adjacent tree (Nelson 1997, p. 16; Nelson and Wilson 2002, pp. 24, 98 & 99);
 - d. It is located ≥ 32.5 ft. (9.9 m) above the ground (Nelson and Wilson 2002, p. 28); and
5. It has an access route through the canopy that a murrelet could use to approach and land on the platform (Nelson and Wilson 2002, p. 103). Because access should be viewed from above the canopy and we are assessing habitat from below the canopy, this aspect of nesting habitat may not be visible. Nelson and Wilson (2002, p. vii)

suggests assessing access by looking for canopy layering, either natural (streams, gaps) or man-made edges and gaps as measures of access.

Nest Stand Characteristics

Nest stands are typically composed of low elevation conifer species. In California, nest sites have been located in stands containing old-growth redwood and Douglas-fir, while nests in Oregon and Washington have been located in stands dominated by Douglas-fir, western hemlock and Sitka spruce. Murrelets appear to select forest stands greater than 123.6 acres (50 ha) (Burger 2002), but will use small patches of habitat surrounded by larger patches of unsuitable habitat (Nelson and Wilson 2002, p. 104). In surveys of mature or younger second-growth forests in California, murrelets were only found in forests where there were nearby old-growth stands or where residual older trees remained (USFWS 1992, Singer *et al.* 1995).

At the stand level, vertical complexity is correlated with nest sites (Meekins and Hamer 1998, Manley 1999, Waterhouse *et al.* 2002, Nelson and Wilson 2002), and flight accessibility is probably a necessary component of suitable habitat (Burger 2002). Some studies have shown higher murrelet activity near stands of old-forest blocks over fragmented or unsuitable forest areas (Paton *et al.* 1992, Rodway *et al.* 1993, Burger 1995, Deschesne and Smith 1997, Rodway and Regehr 2002), but this correlation may be confounded by ocean conditions, distance inland, elevation, survey bias and disproportionately available habitat. Nelson and Wilson (2002) found that potential nest platforms per acre were a strong correlate for nest stand selection by murrelets in Oregon.

Adjacent forests can contribute to the conservation of the murrelet by reducing the potential for windthrow during storms by providing area buffers and creating a landscape with a higher probability of occupancy by murrelets (USFWS 1996, Burger 2001, Meyer *et al.* 2002, and Raphael *et al.* 2002). Trees surrounding and within the vicinity of a potential nest tree(s) may provide protection to the nest platform and potentially reduce gradations in microclimate (Chen *et al.* 1993).

Landscape Characteristics

Studies have determined the characteristics of murrelet nesting habitat at a landscape-scale using a variety of methods, including predictive models, radio telemetry, audio-visual surveys (Evans Mack *et al.* 2003), and radar. McShane *et al.* (2004, p. 4-103) reported, “At the landscape level, areas with evidence of occupancy tended to have higher proportions of large, old-growth forest, larger stands and greater habitat complexity, but distance to the ocean (up to about 37 miles [60 km]) did not seem important.” Raphael *et al.* (2015a, pp. 156 and 171) found that among the factors they investigated, nesting habitat factors (amounts and pattern, large contiguous patches) were the best predictors of murrelet population distribution and trends at sea. Elevation had a negative association in some studies with murrelet habitat occupancy (Burger 2002). Hamer and Nelson (1995b) sampled 45 nest trees in British Columbia, Washington, Oregon, and California and found the mean elevation to be 1,089 feet (332 m).

Multiple radar studies (*e.g.*, Burger 2001, Cullen 2002, Raphael *et al.* 2002, Steventon and Holmes 2002) in British Columbia and Washington have shown that radar counts of murrelets are positively associated with total watershed area, increasing amounts of late-seral forests, and with increasing age and height class of associated forests. Murrelet radar counts are also negatively associated with increasing forest edge and areas of logged and immature forests (McShane *et al.* 2004). Several studies have concluded that murrelets do not pack into higher densities within remaining habitat when nesting habitat is removed (Burger 2001, Manley *et al.* 2001, Cullen 2002).

There is a relationship between proximity of human-modified habitat and increased avian predator abundance. However, increased numbers of avian predators does not always result in increased predation on murrelet nests. For example, Luginbuhl *et al.* (2001, p. 565) report, in a study using simulated murrelet nests, that “Corvid numbers were poorly correlated with the rate of predation within each forested plot”. Luginbuhl *et al.* (2001, p. 569), conclude, “that using measurements of corvid abundance to assess nest predation risk is not possible at the typical scale of homogenous plots (0.5-1.0 km² in our study). Rather this approach should be considered useful only at a broader, landscape scale on the order of 5-50 km² (based on the scale of our fragmentation and human-use measures).”

Artificial murrelet nest depredation rates were highest in western conifer forests where stand edges were close to human development (Luginbuhl *et al.* 2001), and Bradley (2002) found increased corvid densities within three miles of an urban interface, probably due to supplemental feeding opportunities from anthropogenic activities. Golightly *et al.* (2002) found extremely low reproductive success for murrelets nesting in large old-growth blocks of redwoods in the California Redwoods National and State Parks. Artificially high corvid densities from adjacent urbanization and park campgrounds are suspected to be a direct cause of the high nesting failure rates for murrelets in the redwoods parks.

If the surrounding landscape has been permanently modified to change the predators’ numbers or densities through, for example, agriculture, urbanization, or recreation, and predators are causing unnaturally high nest failures, murrelet reproductive success may remain depressed. Because corvids account for the majority of depredations on murrelet nests and corvid density can increase with human development, corvid predation on murrelet habitat is a primary impact consideration. The threat of predation on murrelet populations (both nests and adults) appears to be greater than previously anticipated (McShane *et al.* 2004).

Population Dynamics

Population Status

Current population and distribution of the listed species

Based on the results from the NWFP Effectiveness Monitoring Program, the 2014 murrelet population for Conservation Zones 1-5 is estimated at 21,305 birds (Figure 11 and Table 42). Recovery zones are the functional equivalent of recovery units as defined by Service policy

(USFWS 1997, p. 115). Conservation Zone 3 and part of 4 occur in Oregon and cover the action area.

The data no longer demonstrate a significant murrelet population decline within the range of the NWFP, but the decline is still significant in WA (Table 43). This lack of a demonstrated NWFP-wide decline may be due to sample size or statistical power of the sampling design (see Table 43 for confidence intervals). Conservation Zones 3 and 4 support greater than 75 percent of the murrelet population within the U.S. (Table 44), and consistently have the highest – at-sea densities during the nesting season. Murrelets continue to occur in the lowest abundance in Conservation Zones 5 and 6.

At-sea surveys are also conducted in Conservation Zone 6, independent of the NWFP Effectiveness Monitoring Program, using similar survey methods. The 2014, marbled murrelet population for Conservation Zone 6 is estimated at about 437 birds (95 percent confidence limit [CL]: 306 – 622; Table 45).

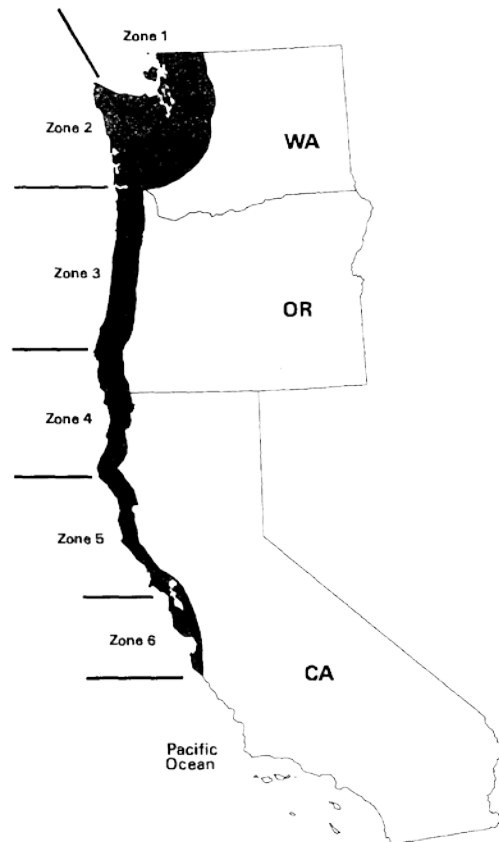


Figure 11. The six geographic areas identified as Conservation Zones in the recovery plan for the murrelet (USFWS 1997, p. 114). Critical habitat beyond these mapped areas is considered part of the conservation zone (USFWS 1997, p. 127).

Table 42. Summary of 2001-2015 murrelet density and population size estimates (rounded to nearest 100 birds) for all conservation zones combined. Numbers may differ slightly from those in previous summary reports, as a result of additional data quality reviews performed in 2014 (Falxa *et al.* 2015, p7). No estimates are available for “All Zones” in 2015, due to implementation of reduced-effort survey design. (Falxa *et al.* 2016, p. 8)

Year	Density(birds/ km ²)	Bootstrap Standard Error (birds/km ²)	Coefficient of Variation of Density (%)	Birds	Birds Lower 95% CL	Birds Upper 95% CL
2001	2.47	0.25	10.1%	21,800	17,500	26,100
2002	2.56	0.31	11.9%	22,500	17,300	27,800
2003	2.60	0.25	9.6%	22,800	18,500	27,100
2004	2.46	0.26	10.5%	21,600	17,100	26,000
2005	2.30	0.25	10.7%	20,200	16,000	24,400
2006	2.08	0.17	8.2%	18,300	15,300	21,200
2007	1.97	0.27	13.7%	17,300	12,700	22,000
2008	2.06	0.18	8.9%	18,100	15,000	21,300
2009	1.96	0.21	10.6%	17,300	13,700	20,900
2010	1.89	0.21	11.1%	16,600	13,000	20,300
2011	2.50	0.31	12.6%	22,000	16,600	27,400
2012	2.40	0.27	11.4%	21,100	16,400	25,700
2013	2.24	0.25	11.1%	19,700	15,400	23,900
2014	2.43	0.22	9.1%	21,305	17,492	25,118
2015	Not all Zones were surveyed, do not have an all zones estimate					

Table 43. Estimates of average annual rate of change based on the at-sea population surveys. Results that included 2014 data are presented first, at scales of conservation zone and state. Confidence limits are for the estimates of percent annual change. The P-value is based on a 1-tailed test for whether the annual rate of change is less than zero (Falxa *et al.* 2015, p15).

Zone or State	Period of Analysis	Annual Rate of Change (%)	95% Conf. Limits		Adjusted R ²	P-value
			Lower	Upper		
inland zone 1	2001-2014	-5.4	-9.1	-1.6	0.398	0.009
inland zone 2	2001-2014	-5.0	-9.5	-0.2	0.239	0.044
Zone 3	2000-2014	1.3	-1.1	3.8	0.021	0.274
WA	2001-2014	-5.1	-7.7	-2.5	0.557	0.001
Zone 4	2000-2013	1.5	-0.9	4.0	0.064	0.195
Zone 5	2000-2013	-1.0	-8.2	6.9	0.000	0.785
OR	2000-2013	0.3	-1.8	2.5	0.000	0.756
CA	2000-2013	2.5	-1.1	6.2	0.092	0.154
All Zones	2001-2013	-1.2	-2.9	0.5	0.099	0.156

Table 44. Murrelet population estimates for conservation zones and sampling strata within conservation zones, 2014-2015. Based on at-sea surveys (Falxa *et al.* 2016, p. 13).

Year	Zone	Stratum	Density	% Standard Error	Birds	Lower 95% CI	Upper 95% CI	Area (km)
2014	All	All	2.425	9.1%	21,305	17,492	25,118	8,784.69
2014	1	All	0.807	19.3%	2,822	1,668	3,836	3,497.13
2014	1	1	1.258	26.7%	1,063	580	1,631	845.20
2014	1	2	1.274	26.4%	1,521	570	2,176	1,193.69
2014	1	3	0.163	69.6%	238	-	533	1,458.24
2014	2	All	1.318	30.7%	2,176	1, 38	3,574	1,650.40
2014	2	1	2.879	31.5%	2,086	925	3,466	724.47
2014	2	2	0.098	65.6%	90	-	214	925.93
2014	3	All	5.541	12.4%	8,841	6,819	11,276	1,595.43
2014	3	1	1.477	34.1%	976	286	1,587	660.89

Year	Zone	Stratum	Density	% Standard Error	Birds	Lower 95% CI	Upper 95% CI	Area (km)
2014	3	2	8.415	13.1%	7,864	6,156	10,240	934.55
2014	4	All	Not surveyed					
2014	5	All	Not surveyed					
2015	All	All	No estimates produced					
2015	1	All	1.227	22.8%	4,290	2,783	6,492	3,497.13
2015	1	1	2.218	33.5%	1,875	956	3,334	845.20
2015	1	2	1.945	28.2%	2,321	1,250	3,683	1,193.69
2015	1	3	0.064	91.7%	94	-	261	1,458.24
2015	2	All	1.941	30.4%	3,204	1,883	5,609	1,650.40
2015	2	1	2.849	27.9%	2,064	1,176	3,316	724.47
2015	2	2	1.231	71.2%	1,140	144	3,290	925.93
2015	3	All	Not surveyed					
2015	4	All	7.542	16.8%	8,743	7,409	13,125	1,159.15
2015	4	1	9.897	17.3%	7,262	5,906	10,692	733.73
2015	4	2	3.480	48.9%	1,481	859	3,713	425.42
2015	5	All	Not surveyed					

Table 45. Population estimates for marbled murrelets in central California Conservation Zone 6 between 1999 and 2014; no surveys were conducted from 2004 to 2006. Surveys conducted using transects delineated from the north and south are presented separately because surveys from the south typically yield greater population estimates (Henry and Tyler 2014).

Year	Both Directions			North			South		
	N	95% CL	n	N	95% CL	n	N	95% CL	n
1999		N/A		487	333-713	5		No surveys	
2000		N/A		496	338-728	8		No surveys	
2001	661	556-786	15	637	441-809	8	733	583-922	7
2002	683	561-832	15	628	487-809	9	729	494-1075	6
2003	699	567-860	12	615	463-815	6	782	570-1074	6
2004		No surveys			No surveys			No surveys	
2005		No surveys			No surveys			No surveys	
2006		No surveys			No surveys			No surveys	
2007	378	238-518	4	269	109-429	2	488	349-626	2
2008	174	91-256	4	122	61-184	1	225	131-319	3
2009	631	449-885	8	495	232-1054	4	789	522-1193	4

Year	Both Directions				North				South		
	N	95% CL	n		N	95% CL	n		N	95% CL	n
2010	446	340-585	7		366	240-559	4		560	343-925	3
2011	433	339-553	6		320	225-454	2		452	331-618	4
2012	487	403-588	6		475	373-605	3		501	359-699	3
2013	628	386-1022	6		428	227-806	3		556	126-2456	3
2014	437	306-622	9		386	232-644	5		543	330-893	4

The at-sea distribution also exhibits discontinuity within Conservation Zones 1, 2, 5, and 6, where five areas of discontinuity are noted: a segment of the border region between British Columbia, Canada and Washington, southern Puget Sound, WA, Destruction Island, WA to Tillamook Head, OR, Humboldt County, CA to Half Moon Bay, CA, and the entire southern end of the breeding range in the vicinity of Santa Cruz and Monterey Counties, CA (McShane *et al.* 2004, p. 3-70).

Current Nesting Habitat

McShane *et al.* (2004, p. 4-2), reviewed and summarized habitat estimates from 16 sources and estimated the amount of murrelet nesting habitat at 2,223,048 acres distributed throughout Washington, Oregon, and California (McShane *et al.* 2004, p. 4-5). Washington State contains almost half of all remaining nesting habitat with an estimated 1,022,695 acres or 48 percent of the total. Approximately 93 percent (2,000,000 acres) are reported to occur on Federal lands (McShane *et al.* 2004, p. 4-10).

In another effort, Raphael *et al.* (2006, in Huff *et al.* 2006) produced two spatial models for the NWFP Effectiveness Monitoring program to predict the amount, location, and distribution of murrelet nesting habitat. Combining vegetation-based maps derived from satellite imagery and prior estimates of habitat on State and private lands from 1994 to 2003, (Raphael *et al.* 2006, p. 109 in Huff *et al.* 2006) used a panel of experts to reclassify 22 old-growth forest classes into four classes of murrelet habitat based upon nesting suitability. Referred to as the Expert Judgment Model, the model classifies existing forest structure, based upon percent conifer cover, canopy structure, quadratic mean diameter, and forest patch size, into four classes of suitability 4 for nesting murrelets. Raphael *et al.* (2006, p. 116-123 in Huff *et al.* 2006) found that across the murrelet range, most habitat-capable land (52 percent) is unsuitable nesting habitat (Class 1) and 18 percent is classified as Class 4 habitat (highest suitability), with an estimated 41 percent of the Class 4 habitat (1,620,800 acres) occurring on non-Federal lands.

The second habitat model developed by Raphael *et al.* (2006 in Huff *et al.* 2006) used the Biomapper Ecological Niche-Factor Analysis methodology developed by Hirzel *et al.* (2002). The resulting murrelet habitat suitability maps are based on both the physical and vegetative attributes adjacent to known murrelet occupied polygons or nest locations for each NWFP province. The maps provide a range of habitat suitability values, each with acreage estimates. In Washington, 2.1 million acres of habitat were rated with a habitat suitability (HS) greater than 60 and captured 82 percent of the stands documented as occupied, while 440,700 acres of habitat were rated as HS >80 habitat and captured 36 percent of the known occupied stands.

More recently, (Falxa and Raphael 2015) used habitat modeling to estimate habitat within the NWFP. Because the modeling was improved (updated data, models, and methods) from the previous modeling effort, results, including the 1993 baseline, are different (Falxa and Raphael 2015, p. 96). Results are displayed in Table 46. Class 3 and 4 were classified as higher suitable murrelet habitat (Falxa and Raphael 2015, p. 90).

The Service believes the Raphael *et al.* (2015) model, which relates known (occupied) murrelet nest stands to habitat abundance, distribution, and quality, represents the best available information on the subject. While not necessarily the best means to describe suitable habitat at the site scale, the Service expects this model to have higher reliability for provincial-scale analysis compared to previous efforts.

Table 46. Distribution of murrelet nesting habitat on all lands, by habitat suitability class, for the baseline period (1993) and final year of analysis (2012). Table from Ralph *et al.* 2015, p. 118.

All Lands – 1993 (1000s of acres)						All Lands – 2012 (1000s of acres)				
State/Province	Class 1	Class 2	Class 3	Class 4	Habitat Capable Total	Class 1	Class 2	Class 3	Class 4	Habitat Capable Total
Washington										
(Maxent score)	0–0.06	0.06–0.21	0.21–0.53	0.53–1		0–0.06	0.06–0.21	0.21–0.53	0.53–1	
Olympic Peninsula	902.9	960.5	623.3	235.4	2,722.1	971.2	994.0	549.7	207.2	2,722.1
Western Lowlands	2,817.7	1,173.3	236.0	32.9	4,259.9	3,182.9	889.2	167.4	20.4	4,259.9
Western Cascades	2,001.8	1,190.3	377.2	25.9	3,595.3	2,077.2	1,139.6	357.8	20.6	3,595.3
Eastern Cascades	158.6	97.0	16.7	1.5	273.8	141.1	112.7	18.5	1.5	273.8
Total	5,881.0	3,421.1	1,253.3	295.7	10,851.0	6,372.4	3,135.5	1,093.4	249.8	10,851.0
Oregon:										
(Maxent score)	0–0.04	0.04–0.18	0.18–0.51	0.51–1		0–0.04	0.04–0.18	0.18–0.51	0.51–1	
Coast Range	2,803.6	1,303.7	567.5	121.6	4,796.5	3,007.8	1,153.4	514.5	120.8	4,796.5
Willamette Valley	98.7	5.7	0.0	0.0	104.5	101.5	3.0	0.0	0.0	104.5
Western Cascades	4.2	0.6	0.0	0.0	4.8	4.4	0.4	0.0	0.0	4.8
Klamath	938.5	601.9	147.3	16.9	1,704.5	1,066.3	498.8	122.3	17.2	1,704.5
Total	3,845.0	1,912.0	714.8	138.6	6,610.4	4,180.0	1,655.6	636.8	137.9	6,610.4
California:										
(Maxent score)	0–0.01	0.01–0.17	0.17–0.57	0.57–1		0–0.01	0.01–0.17	0.17–0.57	0.57–1	
Coast Range	1,418.4	687.5	108.2	22.5	2,236.5	1,385.9	743.7	87.3	19.7	2,236.5

Biological Opinion—2016 Bureau of Land Management Western Oregon Resource Management Plan

All Lands – 1993 (1000s of acres)						All Lands – 2012 (1000s of acres)				
State/Province	Class 1	Class 2	Class 3	Class 4	Habitat Capable Total	Class 1	Class 2	Class 3	Class 4	Habitat Capable Total
Klamath	961.6	50.2	1.8	0.1	1,013.6	959.7	51.9	1.9	0.1	1,013.6
Total	2,379.9	737.6	110.0	22.6	3,250.1	2,345.6	795.6	89.2	19.7	3,250.1
Plan area total	12,106.0	6,070.7	2,078.0	456.8	20,711.5	12,897.9	5,586.7	1,819.5	407.4	20,711.5

^a Numbers rounded to nearest 100; total computed prior to rounding

Population structure

Murrelets are long-lived seabirds that spend most of their life in the marine environment, with breeding adult birds, usually age 3 or greater, annually nesting in the forest canopy of mature and old-growth forests from about March 24 through September 15. Murrelets have a naturally low reproductive rate, with pair's reproduction limited to one young per year.

Recovery Zones

The Recovery Plan identified six Conservation Zones (Figure 11) throughout the listed range of the species: Puget Sound (Conservation inland zone 1), Western Washington Coast Range (Conservation inland zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6). Recovery zones are the functional equivalent of recovery units as defined by Service policy (USFWS 1997, p. 115). Conservation Zones 3 and the northern part of 4 occur in Oregon and these conservation zones includes all lands within 35 miles of the coast and any lands designated as critical habitat beyond 35 miles of the coast (USFWS 1997, p. 127).

Reproductive estimates

Generally, estimates of murrelet fecundity are directed at measures of breeding success, either from direct assessments of nest success in the terrestrial environment, marine counts of hatch-year birds, or computer models. Telemetry estimates are typically preferred over marine counts for estimating breeding success due to fewer biases (McShane *et al.* 2004, p. 3-2). However, because of the challenges of conducting telemetry studies, estimating murrelet reproductive rates with an index of reproduction, referred to as the juvenile ratio ($\hat{R}$), continues to be important, despite the debate over use of this index (see discussion in Beissinger and Peery 2007, p. 296).

Although difficult to obtain, nest success rates are available from telemetry studies conducted in California (Hebert and Golightly 2006; Peery *et al.* 2004) and Washington (Bloxtton and Raphael 2006). In northwestern Washington, Bloxtton and Raphael (2005, p. 5) documented a nest success rate of 0.20 (2 chicks fledging from 10 nest starts). In central California, murrelet nest success is 0.16 (Peery *et al.* 2004, p. 1098) and in northern California it is 0.31 to 0.56 (Hebert and Golightly 2006, p. 95). No studies or published reports from Oregon are available.

Unadjusted and adjusted values for annual estimates of murrelet juvenile ratios at sea suggest extremely low breeding success in all parts of the listed range, including Conservation Zone 4 (mean ratio for 2000-2011 of 0.046, range 0.01 to 0.1, CCR 2012, p. 11), northern California (0.003 to 0.029 - Long *et al.* 2008, pp. 18-19; CCR 2012, p. 11), central California (0.035 and 0.032 - Beissinger and Peery 2007, pp. 299, 300), and in Oregon (0.0254 - 0.0598 - CCR 2008, p. 13). Estimates for $\hat{R}$ (adjusted) in the San Juan Islands in Washington have been below 0.15 every year since surveys began in 1995, with three of those years below 0.05 (Raphael *et al.* 2007b, p. 16).

These current estimates of $\hat{R}$ are assumed to be below the level necessary to maintain or increase the murrelet population within the listed range. Demographic modeling suggests murrelet population stability requires a minimum reproductive rate of 0.2 to 0.3 chicks per pair per year (Beissinger and Peery 2007, p. 302; USFWS 1997, p. B-35; Beissinger 1995, p. 390). The estimates for $\hat{R}$ discussed above from individual studies, as well as $\hat{R}$ estimates for the listed range (0.02 to 0.13) are all below the

lowest estimated $\bar{R}$ value (0.2) identified as required for population stability (Beissinger and Peery 2007, p. 302).

The current estimates for $\bar{R}$ also appear to be well below what may have occurred prior to the murrelet population decline. Beissinger and Peery (2007, p. 298) performed a comparative analysis using historic data from 29 bird species to predict the historic $\bar{R}$ for murrelets in central California, resulting in an estimate of 0.27 (95 percent CI: 0.15 - 0.65). Therefore, the best available scientific information of current murrelet fecundity from model predictions, and from juvenile ratios and trend analyses based on population survey data appear to align well; both indicate that the murrelet reproductive rate is generally insufficient to maintain stable population numbers throughout all or portions of the species' listed range.

Status and Distribution

Historical status and distribution

Murrelet abundance during the early 1990s in Washington, Oregon, and California was estimated at 18,550 to 32,000 birds (Ralph *et al.* 1995).

The historical breeding range of the murrelet extends from Bristol Bay, Alaska, south to the Aleutian Archipelago, northeast to Cook Inlet, Kodiak Island, Kenai Peninsula and Prince William Sound, south coastally throughout the Alexander Archipelago of Alaska, and through British Columbia, Washington, Oregon, to northern Monterey Bay in central California. Birds winter throughout the breeding range and also occur in small numbers off southern California.

At the time of listing, the distribution of active nests in nesting habitat was described as non-continuous (USFWS 1997, p. 14). The at-sea extent of the species currently encompasses an area similar in size to the species' historic distribution, but with the extremely low density of murrelets in Conservation Zone 5, and the small population in Conservation Zone 6, the southern end of the murrelet distribution is sparsely populated compared to Conservation Zones 1-4 (Table 42).

Status of Nesting Habitat Lost Since 1992

The Service has determined that the rate of habitat loss has declined since listing, particularly on Federal lands due to implementation of the NWFP (USFWS 2004, pp. 11 and 13). Between 1992 and 2003, the estimated loss of suitable murrelet habitat totaled 22,398 acres in Washington, Oregon, and California combined, of which 5,364 acres resulted from timber harvest and 17,034 acres resulted from natural events (McShane *et al.* 2004, pp. 4-64). Those data primarily represented losses on Federal lands, and did not include data for most private or State lands within the murrelet's range.

More recently, (Falxa and Raphael 2015, p. 66) used habitat modeling to estimate losses of potential murrelet habitat for the period from 1993 to 2012 on both Federal and non-federal lands within the five Conservation Zones in the NWFP area. They estimated there were 2.53 million acres of potential nesting habitat over all lands in the murrelet's range in Washington, Oregon, and California at the start of the NWFP (1993). Of this, 0.46 million acres were identified as the highest quality habitat. Ninety percent of the 1993 potential nesting habitat on federally-administered lands occurred within reserved-land allocations. Forty one percent of potential nesting habitat occurred on non-federal lands, including 44 percent of the highest quality habitat.

Raphael *et al.* (2015b, p. 66) found a net loss of 12 percent of potential nesting habitat from 1993 to 2012. Loss on Federal lands was about 2 percent of the potential nesting habitat from 1993 to 2012, and on non-federal lands the loss was about 27 percent of the potential nesting habitat from 1993 to 2012. Fire was the major cause of nesting habitat loss on Federal lands since 1993; timber harvest was the primary cause of loss on non-federal lands. Raphael *et al.* (2015b, p. 66) concluded that the NWFP has been successful in conserving murrelet habitat on Federal lands and that losses of habitat on Federal lands will continue due to fires and other disturbance events, but they expect those losses to be exceeded by recovery of currently unsuitable habitat within reserves as forests mature.

Consulted on effects from October 1, 2003 to July 19, 2016 that impact nest stands are summarized in Table 47.

Table 47. Aggregate results of all suitable habitat (acres) affected as determined by section 7 consultation for the marbled murrelet; summary of effects by Conservation Zone and habitat type from October 1, 2003 to July 19, 2016.

Conservation Zone ¹	Consulted On Habitat Effects		Reported Habitat Effects in Acres ²	
	In Acres ²			
	Stands ³	Remnants ⁴	Stands ³	Remnants ⁴
1: Puget Sound	-112	0	-1	0
2: Western Washington	-2,845	0	-12	0
Outside CZ Area in WA	0	0	0	0
3: Oregon Coast Range	-3,226	-1,050	-2,352	0
4: Siskiyou Coast Range	-3,830	0	-138	0
Outside CZ Area in OR	-2	0	0	0
5: Mendocino	0	0	0	0
6: Santa Cruz Mountains	0	0	0	0
Outside CZ Area in CA	0	0	0	0
Total	-10,015	-1,050	-2,503	0

Notes:

1. Conservation Zones (CZ) six zones were established by the 1997 Recovery Plan to guide terrestrial and marine management planning and monitoring for the Murrelet. Marbled Murrelet Recovery Plan, September, 1997
2. Habitat includes all known occupied sites, as well as other suitable habitat, though it is not necessarily occupied. Importantly, there is no single definition of suitable habitat, though the Murrelet Effectiveness Monitoring Module is in the process. Some useable working definitions include the Primary Constituent Elements as defined in the Critical Habitat Final Rule, or the criteria used for Washington State by Raphael *et al.* (2002).
3. Stand: A patch of older forest in an area with potential platform trees.
4. Remnants: A residual/remnant stand is an area with scattered potential platform trees within a younger forest that lacks, overall, the structures for murrelet nesting.

Population Trend

There are two general approaches that researchers use to assess murrelet population trend: at-sea surveys and population modeling based on demographic data. In general, the Service assigns greater weight to population trend and status information derived from at-sea surveys than estimates derived from population models because survey information generally provides more reliable estimates of trend and abundance.

The annual rate of population change between 2000 and 2013 was -1.2 percent, based on at-sea surveys (Falxa *et al.* 2015, p15). However, these results are inconclusive because the confidence interval for the rate of population change overlap zero.

The lack of a conclusive trend in murrelet populations described above is different from previous reports. Previously, Miller *et al.* (2012) reported that the murrelet population was declining throughout its range (estimated at 29 percent decline for the listed population from 2001 to 2010). The annual population decline during 2001 to 2010 was 3.7 percent. It is unknown what is driving recent population levels. According to Falxa and Raphael (2015b, p. 29), the increase in the murrelet population between 2011 and 2013 is too rapid to be attributable to habitat change, because nesting habitat takes many decades to several centuries to develop and is too slow a process to account for the rate of population change. Data does suggest that the habitat loss is likely contributing to variation in trends across the listed range of the murrelet (Falxa and Raphael 2015, p. 26).

Population Models

Prior to the use of survey data to estimate trend, demographic models were more heavily relied upon to generate predictions of trends and extinction probabilities for the murrelet population (Beissinger 1995; Cam *et al.* 2003; McShane *et al.* 2004; USFWS 1997). However, murrelet population models remain useful because they provide insights into the demographic parameters and environmental factors that govern population stability and future extinction risk, including stochastic factors that may alter survival, reproductive, and immigration/emigration rates.

In a report developed for the 5-year Status Review of the Murrelet in Washington, Oregon, and California (McShane *et al.* 2004, pp. 3-27 to 3-60), computer models were used to forecast 40-year murrelet population trends. A series of female-only, multi-aged, discrete-time stochastic Leslie Matrix population models were developed for each conservation zone to forecast decadal population trends over a 40-year period and extinction probabilities beyond 40 years (to 2100). The authors incorporated available demographic parameters (Table 48) for each conservation zone to describe population trends and evaluate extinction probabilities (McShane *et al.* 2004, p. 3-49).

McShane *et al.* (2004) used mark-recapture studies conducted in British Columbia by Cam *et al.* (2003) and Bradley *et al.* (2004) to estimate annual adult survival and telemetry studies or at-sea survey data to estimate fecundity. Model outputs predicted 3.1 to 4.6 percent mean annual rates of population decline per decade the first 20 years of model simulations in murrelet Conservation Zones 1 through 5 (McShane *et al.* 2004, p. 3-52). Simulations for all zone populations predicted declines during the 20 to 40-year forecast, with mean annual rates of 2.1 to 6.2 percent decline per decade (McShane *et al.* 2004, p. 3-52). These reported rates of decline are similar to the estimates of 4 to 7 percent per year decline reported in the Recovery Plan (USFWS 1997, p. 5).

Table 48. Murrelet demographic parameter values based on four studies all using Leslie Matrix models.

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery (2007)	McShane <i>et al.</i> 2004
Juvenile Ratio (R)	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	-
Nest Success	-	-	0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85 % – 90%	85 % – 88 %	82 % - 90 %	83 % – 92 %

*In USFWS (1997).

McShane *et al.* (2004, pp. 3-54 to 3-60) modeled population extinction probabilities beyond 40 years under different scenarios for immigration and mortality risk from oil spills and gill nets. Modeled results forecast different times and probabilities for local extirpations, with an extinction risk of 16 percent and mean population size of 45 individuals in 100 years in the listed range of the species (McShane *et al.* 2004, pp. 3-58).

Threats

When the murrelet was listed under the Endangered Species Act (USFWS 1992) and threats summarized in the Recovery Plan (USFWS 1997, pp. 43-76), several anthropogenic threats were identified as having caused the dramatic decline in the species:

- habitat destruction and modification in the terrestrial environment from timber harvest and human development caused a severe reduction in the amount of nesting habitat;
- unnaturally high levels of predation resulting from forest “edge effects”;
- the existing regulatory mechanisms, such as land management plans (in 1992), were considered inadequate to ensure protection of the remaining nesting habitat and reestablishment of future nesting habitat; and
- manmade factors such as mortality from oil spills and entanglement in fishing nets used in gill-net fisheries.

There have been changes in the levels of these threats since the 1992 listing (USFWS 2004, pp. 11-12; USFWS 2009, pp. 27-67). The regulatory mechanisms implemented since 1992 that affect land management in Washington, Oregon, and California (for example, the NWFP) and new gill-netting regulations in northern California and Washington have reduced the threats to murrelets (USFWS 2004, pp. 11-12). The levels for the other threats identified in 1992 listing (USFWS 1992) including the loss of nesting habitat, predation rates, and mortality risks from oil spills and gill net fisheries (despite the regulatory changes) remained unchanged following the FWS’s 2004, 5-year, range-wide status review for the murrelet (USFWS 2004, pp. 11-12).

However, new threats were identified in the FWS’s 2009, 5-year review for the murrelet (USFWS 2009, pp. 27-67). These new stressors are due to several environmental factors affecting murrelets in the marine environment. These new stressors include:

- Habitat destruction, modification, or curtailment of the marine environmental conditions necessary to support murrelets due to:
 - elevated levels of polychlorinated biphenyls in murrelet prey species;
 - changes in prey abundance and availability;
 - changes in prey quality;
 - harmful algal blooms that produce biotoxins leading to domoic acid and paralytic shellfish poisoning that have caused murrelet mortality; and
 - climate change in the Pacific Northwest.
- Manmade factors that affect the continued existence of the species include:
 - derelict fishing gear leading to mortality from entanglement;
 - energy development projects (wave, tidal, and on-shore wind energy projects) leading to mortality; and
 - disturbance in the marine environment (from exposures to lethal and sub-lethal levels of high underwater sound pressures caused by pile-driving, underwater detonations, and potential disturbance from high vessel traffic; particularly a factor in Washington state).

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth *et al.* 2002; Walther *et al.* 2002; Ådahl *et al.* 2006; Karl *et al.* 2009; Moritz *et al.* 2012; Westerling *et al.* 2011, p. S459; Marlon *et al.* 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

The Service believes climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought-related fire, mortality, insects and disease in the short-term (10 to 30 years). These potential impacts will affect the environmental baseline for murrelets and other listed species, and we provide a general overview of these potential effects in Appendix D. Although it appears likely that the murrelet will be adversely affected by long-term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species (USFWS 2009, p. 34). However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long-term persistence of the murrelet and other forest-dependent species. For example, the PRMP will result in a net increase in higher quality late-successional forest during the 50 years of the plan; the total area of protected forest reserves will increase; the district-mapped older, structurally complex, conifer forests were included in the LSRs; and the BLM will apply ecological forestry management principles that will better enable management of risk due to catastrophic wildfire. These measures, described in detail elsewhere in this BO, will increase the ability of the murrelet to persist and recover in the face of climate change effects by providing additional areas of habitat. Several threats to murrelets, present in both the marine and terrestrial environments, have been identified. These threats collectively comprise a suite of environmental stressors that, individually or through interaction, have significantly disrupted or impaired behaviors which are essential to the reproduction or survival of individuals. When combined with the species naturally low reproductive rate, these stressors have led to declines in murrelet abundance, distribution, and reproduction at the population scale within the listed range.

Detailed discussions of the above-mentioned threats, life-history, biology, and status of the murrelet are presented in the Federal Register, listing the murrelet as a threatened species (USFWS 1992); the Biological Opinion—Marbled Murrelet

Recovery Plan, Ecology and Conservation of the Murrelet (Ralph *et al.* 1995); the final rule designating murrelet critical habitat (USFWS 1996); the Evaluation Report in the 5-Year Status Review of the Murrelet in Washington, Oregon, and California (McShane *et al.* 2004); the 2004 and 2009, 5-year Reviews for the Murrelet (USFWS 2004; USFWS 2009), and the final rule revising critical habitat for the murrelet (USFWS 2011)].

Conservation

Needs

Reestablishing an abundant supply of high quality murrelet nesting habitat is a vital conservation need given the extensive habitat removal during the 20th century. However, there are other conservation imperatives. Foremost among the conservation needs are those in the marine and terrestrial environments to increase murrelet fecundity by increasing the number of breeding adults, improving murrelet nest success (due to low nestling survival and low fledging rates), and reducing anthropogenic stressors that reduce individual fitness or lead to mortality.

The overall reproductive success (fecundity) of murrelets is directly influenced by nest predation rates (reducing nestling survival rates) in the terrestrial environment and an abundant supply of high quality prey in the marine environment during the breeding season (improving potential nestling survival and fledging rates). Anthropogenic stressors affecting murrelet fitness and survival in the marine environment are associated with commercial and tribal gillnets, derelict fishing gear, oil spills, and high underwater sound pressure (energy) levels generated by pile-driving and underwater detonations (that can be lethal or reduce individual fitness).

General criteria for murrelet recovery (delisting) were established at the inception of the Plan and they have not been met. More specific delisting criteria are expected in the future to address population, demographic, and habitat based recovery criteria (USFWS 1997, pp. 114-115). The general criteria include:

- documenting stable or increasing population trends in population size, density, and productivity in four of the six Conservation Zones for a 10-year period; and
- implementing management and monitoring strategies in the marine and terrestrial environments to ensure protection of murrelets for at least 50 years.

Thus, in addition to habitat protection, increasing murrelet reproductive success and reducing the frequency, magnitude, or duration of any anthropogenic stressor that directly or indirectly affects murrelet fitness or survival in the marine and terrestrial environments are the priority conservation needs of the species. The Service estimates recovery of the murrelet will require at least 50 years (USFWS 1997, pp. vi and 10).

Recovery Plan

The Marbled Murrelet Recovery Plan outlines the conservation strategy with both short- and long-term objectives. The Plan places special emphasis on the terrestrial environment for habitat-based recovery actions due to nesting occurring in inland forests.

In the short-term, specific actions identified as necessary to stabilize the population include protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat (USFWS 1997, p. 119). Specific actions include maintaining large blocks of suitable habitat, maintaining and enhancing buffer

habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance. The designation of critical habitat also contributes towards the initial objective of stabilizing the population size through the maintenance and protection of occupied habitat and minimizing the loss of unoccupied but suitable habitat.

Long-term conservation needs identified in the Plan include:

- increasing productivity (abundance, the ratio of juveniles to adults, and nest success) and population size;
- increasing the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat;
- protecting and improving the quality of the marine environment; and
- reducing or eliminating threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea.

Conservation Zone 3 Recovery objectives: Murrelet occupied sites along the western portion of the Tillamook State Forest are especially important to maintaining well distributed murrelet populations. The murrelet recovery plan states that efforts should focus on maintaining these occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. Relatively few known occupied sites occur north of the Tillamook State Forest. Recovery efforts should be directed at restoring some of the north-south distribution of murrelet populations and habitat in this Zone. Murrelet sites along the western portion of the Tillamook State Forest are especially important to maintaining well-distributed murrelet populations. Maintaining suitable and occupied murrelet habitat on the Elliot State Forest, Tillamook State Forest, Siuslaw NF, and BLM-administered forests is an essential component for the stabilization and recovery of murrelets (USFWS 1997, p. 127).

Conservation Zone 4 Recovery Objectives: Recovery actions in Zone 4 should be focused on preventing the loss of occupied nesting habitat, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new suitable habitat. Much murrelet nesting habitat is found in state and national parks that receive considerable recreational use. The need to maintain high quality murrelet terrestrial habitat should be considered in planning any modifications to state or national parks for recreational purposes. Both highway and campground construction, including picnic areas, parking lots, and visitors centers, could present threats to the murrelet through loss of habitat, nest disturbance, and/or increasing potential predation from corvids associated with human activities such as Steller's jays and crows. Implementing appropriate garbage/trash disposal may help decrease potential predator populations in high human use areas such as county, state and national parks. Zone 4 has large blocks of suitable habitat critical to the three-state murrelet population recovery over the next 100 years. However, the amount of suitable habitat protected in parks is probably not sufficient by itself to guarantee long-term survival of murrelets in this Zone. On the other hand, a considerable amount of habitat is preserved in parks such that survival may be more likely in this Zone than in several other Zones. Private lands at the southern end of this Zone are important for maintaining the current distribution of the species. There is already a considerable gap in distribution between this area and the central California population in Zone 6. Efforts should be implemented to, at a minimum, not expand the current distribution gap (USFWS 1997, p. 128).

NWFP Protections

On Federal lands under the NWFP surveys are required for all timber sales that remove murrelet habitat. If habitat outside of mapped Late-Successional Reserves (LSRs) is found to be used by murrelets, then the habitat and recruitment habitat (within 25 years) within a 0.5-mile radius of the occupied behavior is

designated as a new LSR. Timber harvest within LSRs is designed to benefit the development of late-successional conditions, which should improve future conditions of murrelet nesting habitat. Designated LSRs not only protect habitat currently suitable to murrelets (whether occupied or not), but will also develop future suitable habitat in large blocks.

Effects of Tree Removal on Murrelets

Terrestrial habitat for murrelets has both a local and landscape aspect. At the local level a forest stand with branch platforms can provide nesting structure with minimal requirements for the murrelet, although we know murrelets are more likely to occur where there is large contiguous blocks of late-successional or old growth habitat on the landscape (Falxa and Raphael 2015, p. 156). This patch of forested area can be either late-successional or old growth habitat with wide branches or younger trees with mistletoe infections or other deformities that form a platform wide enough for a nest. Murrelets use a wide variety of forest stands although they all must contain nesting structure.

There can be short and/or long-term potential effects associated with habitat modification. Thinning to increase growth rates and crowns by reducing competition for the retained trees can make currently unsuitable nest trees and trees of marginal habitat quality become nest trees sooner than without treatment. These types of thinning treatments also encourage currently suitable trees to maintain full crowns and branch development, and to create holes and gaps in the canopy that allow murrelets better access into tree crowns.

A 300-600 foot buffer from occupied or unsurveyed murrelet nesting habitat is recommended in the murrelet recovery plan as a short-term conservation action to stabilize and increase the population (USFWS 1997, p. 140). The part of an adjacent stand which lacks nesting structure, but supports an adjacent stand or individual trees with murrelet nesting structure is referred to as buffer habitat. Thinning of buffer habitat may also affect murrelets by impacting the buffering habitat's ability to provide for windthrow during storms, provide a microclimate that supports moss growth, and/or provides a stands with low usage by murrelet nest predators. These effects are expected to be minimal if treatments are designed to: 1) minimize potential windthrow; 2) microclimate changes; and 3) minimize change that would increase stand usage by murrelet predators.

Predation by jays may increase when berry production and, potentially, insects increase in adjacent lands. The increase is likely due to the increased forage time spent by Steller's jays, (*Cyanocitta stelleri*) in the open areas. The following is from Zharikov *et al.* (2006, p. 117):

"Populations of potential nest predators rarely increase in forest landscapes managed for timber, in contrast to forests adjacent to human settlements or agricultural fields (Henske *et al.* 2001). This is because local predator populations will increase only if fragmentation produces a concurrent increase in the amount of their staple food supply (*e.g.*, berries) and/or breeding habitat (Marzluff and Restani 1999; Raphael *et al.* 2002). In this study area clear-cutting is not associated with development of human habitation or agricultural fields. It is thus unlikely that recent forest fragmentation could create anthropogenic sources of food. At the same time, clear-cutting may have decreased the amount of nesting habitat for such known adult and nest predators of murrelets as the northern goshawk (*Accipiter gentilis*), common raven (*Corvus corax*) and gray jay (*Perisoreus canadiensis*) and thus lower their abundance in recently logged areas (Raphael *et al.* 2002). However, as clearcuts overgrow and berry producing shrubs become established there (Nielsen *et al.* 2004), their usage by nest predators may increase Steller's jay, *Cyanocitta stelleri*, (Raphael *et al.* 2002), explaining the lower breeding success closer to old (fuzzy-edge) clearcuts."

Effects of Associated Disturbance on Murrelets

The effects to murrelets from disturbance are largely unknown, although effects such as increased energetic expenditure, elevated stress levels, and susceptibility to predation have been documented in other wildlife and are assumed to effect murrelets, as well. For these reasons disturbance is considered a threat to the species (McShane *et al.* 2004) although summary studies on effects of disturbance have not documented any nest failure, abandonment, or chick mortality directly attributed to noise disturbance (Singer *et al.* 1995, Hamer and Nelson 1998, Golightly *et al.* 2002).

During the critical nesting period (Table 49), noise and visual disturbance associated with habitat modification projects may disturb adult or juvenile murrelets. Murrelet reactions to noise, smoke and/or temporary increases in predation due to human presence at or in the immediate vicinity of murrelets could potentially include one or more of the following: a nesting adult flushes and leaves the eggs exposed to predation, an adult aborts a feeding attempt potentially reducing the fitness of the young, or a juvenile prematurely fledges potentially reducing the fitness due to having sub-optimal energy reserves or flight ability before leaving the nest. A murrelet that may be disturbed when it flies into the stands for other reasons than nest exchange or feeding young is presumably capable of moving away from disturbance without a significant disruption of its behavior. Murrelets feed at sea and only rely on forest habitat for nesting.

Table 49. Breeding period used to determine potential effects in this consultation.

Species	Breeding Period	Critical Breeding Period
Murrelet	April 1 – September 15	April 1 – August 5

Therefore, forest management or other forest activities during the murrelet breeding season (April 1 – September 15) may affect murrelets that are nesting. Current disturbance and disruption distances by common sources have been summarized in Table 2. Disruption is a subset of disturbance, to indicate the subset of disturbance that may adversely affect murrelets due to the greater impacts when closer to nesting murrelets.

In the late breeding period (August 6 – September 15), potential effects from disturbance decline because all breeding murrelets have establishing a nest, most are finished incubating and either have completed nesting (about half of the chicks have fledged) (Hamer *et al.* 2003) or adult murrelets are still feeding the chick. Adults still tending their young in the late breeding period are heavily invested in chick-rearing, and it is during the crepuscular periods, which we define as two hours after sunrise and two hours before sunset, when most food deliveries to the young are made. When disruption events are limited to during the day and outside the crepuscular periods (which will be referred to as daily timing restrictions), the likelihood of nest abandonment or significant alteration of breeding success in the late breeding period is minimized because disruption will not occur during the periods of the majority of food deliveries to the chick plus the percent of young that have fledged is increasing every day. Therefore, the likelihood of injury by annoying the adult murrelets to such an extent as to significantly disrupt normal behavior patterns, which includes, but are not limited to, breeding, feeding or sheltering is not reasonably certain to occur in the late breeding period with daily timing restrictions and are considered insignificant effects (excluding activities that cause physical injury or mortality; *e.g.*, blasting and helicopter hovering, Table 2).

Although disruption distances in Table 50 are based on the interpretation of the best available information, the exact distance where different types of noise, smoke and/or temporary increases in predation due to human presence may disrupt breeding, including feeding young, are difficult to predict and can be influenced by a multitude of factors. Site-specific information (*e.g.*, topographic features, project length or frequency of disturbance to an area) could factor into the severity of anticipated effects. The potential for noise or human intrusion activities to create the likelihood of injury to murrelets is also dependent on the background or baseline levels in the environment. In areas that are continually exposed to higher ambient noise or human presence levels (*e.g.*, areas near well-traveled roads, campgrounds), murrelets are likely less susceptible to small potential increases in disturbances because they are acclimated to such activities. Murrelets do occur in areas near human activities and may habituate to certain levels of noise or human presence.

For disruption of murrelet behavior to occur as a result of disturbance (noise, smoke and/or temporary increases in predation due to human presence) caused by a proposed action, the effects and the murrelet(s) must be in proximity to one another during the murrelet nesting season (see Table 50).

A summary of effects determinations for disturbance-related actions are listed in Table 51.

Table 50. Disturbance and disruption distances for murrelets during the breeding period from the edge of unsurveyed or known occupied stand or nest structure in younger stands.

Disturbance Source	Disturbance Distances During the Breeding Period (Apr 1 – Sep 15)	LAA Disruption Distances During the Breeding Period	LAA Disruption Distances with daily timing restrictions *, unless noted otherwise
	NLAA when distance is beyond disruption distances but within the maximum disturbance distance	(Apr 1 – Sep 15)	(Aug 6 – Sep 15)
Light maintenance of roads, campgrounds, and administrative facilities	≤ 0.25 mile	N/A ¹	N/A ¹ no daily timing restrictions required
Log hauling on open roads	≤ 0.25 mile	N/A ¹	N/A ¹ no daily timing restrictions required
Chainsaws (includes felling hazard/danger trees)	≤ 0.25 mile	≤ 110 yards ²	N/A

Disturbance Source	Disturbance Distances During the Breeding Period (Apr 1 – Sep 15) NLAA when distance is beyond disruption distances but within the maximum disturbance distance	LAA Disruption Distances During the Breeding Period (Apr 1 – Sep 15)	LAA Disruption Distances with daily timing restrictions *, unless noted otherwise (Aug 6 – Sep 15)
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	≤ 0.25 mile	≤ 110 yards ²	N/A
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	≤ 0.25 mile	≤ 120 yards ³	N/A
Blasting	≤ 1 mile	≤ 0.25 mile ³	≤ 0.25 mile ³
** Helicopter: Chinook 47d (described as a large helicopter in the rest of this document)	≤ 0.5 mile	≤ 265 yards ⁵	≤ 100 yards ⁶ (hovering only)
** Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	≤ 0.25 mile	≤ 150 yards ⁷	≤ 50 yards ⁶ (hovering only)
** Helicopters: K-MAX, Bell 206 L4, Hughes 500	≤ 0.25 mile	≤ 110 yards ⁸	≤ 50 yards ⁶ (hovering only)
** Small fixed-wing aircraft (Cessna 185, etc.)	≤ 0.25 mile	≤ 110 yards	N/A
Tree Climbing	≤ 110 yards	≤ 110 yards ⁹	N/A
Burning (prescribed fires, pile burning)	≤ 1 mile	≤ 0.25 mile ¹⁰	N/A
Example: Chainsaws are being used adjacent to a murrelet occupied stand during the period of April 1 to September 15, less than 110 yards from the stand. In this scenario (within the disruption distance), murrelets could be disrupted to the point of likely adversely affecting the murrelets or their young. However if the chainsaws were being used further than 110 yards away from the occupied stand during the same time period (within the .25 mile disturbance distance, but beyond the 110 yard disruption distance), this chainsaw use would only slightly disturb murrelets, not disrupt their normal behavior. In this case, the chainsaw use is not likely to adversely affect the murrelets because of the further distance the chainsaw use is away from them.			

Table 50 (Murrelet) Footnotes:

1. N/A = not applicable. We anticipate that the few murrelets that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads (Hamer and Nelson 1998, p. 21).
 2. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2015a, pp. 6-9).
 3. Impulsive sound associated with blasts and pile-driving is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 – 0.6 miles from blast sites (Holthuijzen *et al.* 1990, p. 273). We have conservatively chosen a distance threshold of 120 yards for impact pile-driving and rock-crushing operations to avoid potential hearing loss effects and to account for significant behavioral responses (*e.g.*, flushing) from exposure to continuous sounds from impact pile driving.
 4. Exposure to peak sound levels that are >140 dBA are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pp. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen *et al.* (1990, p. 272), which documented peak sound levels from small blasts at 138 – 146 dBA at a distance of 100 m (110 yards).
 5. Based on an estimated 92 dBA sound-contour (approximately 265 yards) for the Chinook 47d (Newman *et al.* 1984, Table D.1).
 6. Because murrelet chicks are present at the nest until they fledge, they are vulnerable to direct injury or mortality from flying debris caused by intense rotor wash directly under a hovering helicopter. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due to the potential for flying debris and shaking of trees located directly under a hovering helicopter. Hovering rotor-wash distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
 7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
 8. Based on Delaney *et al.* (1999, p. 74), which concluded that a buffer of 105 m (115) yards for helicopter overflights would eliminate flush responses from military helicopter overflights. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (*e.g.*, K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dBA at 100 m)(Grubb *et al.* 2010, p. 1277).
 9. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2015a, pp. 6-9).
 10. Based on recommendations presented in Smoke Effects to Northern Spotted Owls (USFWS 2008, p. 4).
- * Daily timing restrictions: Activities would not begin until two hours after sunrise and would end two hours before sunset.
- ** Aircraft normally use above ground level (AGL) as a unit of measure. For instance, to not cause a disruption by medium and small helicopters during the late breeding season, the AGL would be 350 feet. 350 feet AGL would account for 200 foot tall trees that murrelets would be occupying plus the 50 yards disruption distance.

Table 51. Disturbance and disruption distances with effects determinations for the murrelet.

MURRELET				
Associated Activity	Distances from an Occupied or Unsurveyed Nesting Structure or Suitable Habitat. <i>Disruption distances</i> have a spatial and time aspect. LAA indicates an activity is within the disruption distance, then cross reference above for the distance and to the right for the time period it applies.			Time Periods
Use of a Chinook 47 D helicopter with no hovering	≤ 265 yards	265-880 yards	> 880 yards	
	LAA	MA-NLAA	NE	April 1 – September 15
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31
Use of a Boeing Vertol 107, Sikorsky S-64 (SkyCrane) helicopter with no hovering	≤ 150 yards	151 – 440 yards	> 440 yards	
	LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31
Use of other helicopters <i>e.g.</i> , K-MAX, Bell 206 L4, Hughes 500	≤ 110 yards	111 – 440 yards	> 440 yards	
	LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31
Use of chainsaws	≤ 110 yards	111 – 440 yards	> 440 yards	
	LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31

MURRELET				
Associated Activity	Distances from an Occupied or Unsurveyed Nesting Structure or Suitable Habitat. <i>Disruption distances</i> have a spatial and time aspect. LAA indicates an activity is within the disruption distance, then cross reference above for the distance and to the right for the time period it applies.			Time Periods
Use of heavy equipment	≤ 110 yards	111 – 440 yards	> 440 yards	
	LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31
Burning	≤ 440 yards	440 – 1760 yards	>1760 yards	
	LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA**	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31
Hauling on open roads	≤ 440 yards	> 440 yards		
	MA-NLAA	MA-NLAA		April 1 – September 15
	NE	NE		September 16 – March 31
* NE: No effect MA-NLAA: May affect, but not likely to adversely affect MA-LAA: May affect, and likely to adversely affect ** The determination is MA-NLAA only if time-of-day restrictions are applied. Otherwise the determination is MA-LAA.				

STATUS OF MARBLED MURRELET CRITICAL HABITAT

Critical habitat consists of geographic areas essential to the conservation of a listed species. Under the Act, conservation means to use and the use of all methods and procedures which are necessary to bring an endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary.

Critical habitat is provided protection under section 7 of the Act by ensuring that activities funded, authorized, or carried out by Federal agencies are not likely “to result in the destruction or adverse modification” such habitat. “Destruction or adverse modification means a direct or indirect alteration

that appreciably diminishes the value of critical habitat for the conservation of the listed species. Such alternations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.” (USFWS and NOAA 2016, p. 7216).

On May 24, 1996, the Service designated critical habitat for the murrelet within 104 CHUs encompassing approximately 3.9 million acres across Washington (1.6 million), Oregon (1.5 million), and California (0.7 million). The final rule became effective June 24, 1996. The final rule indicated that the scope of the section 7(a)(2) analysis should evaluate impacts of an action on critical habitat at the conservation zone(s) or even a major part of a conservation zone (USFWS 1996, p. 26271).

On October 5, 2011, the final rule revising critical habitat for the murrelet was published (USFWS 2011). The Service reduced critical habitat in Northern California and Oregon. New information indicates that these areas do not meet the definition of critical habitat and 189,671 acres were removed from the network (USFWS 2011, p. 61599).

In 2012, the American Forest Resource Council (AFRC) and other parties filed suit against the Service, challenging the designation of critical habitat for the murrelet, among other things. After this suit was filed, the Service concluded that the 1996 rule that first designated critical habitat for the murrelet, as well as the 2011 rule that revised that designation, did not comport with recent case law holding that the Service should specify which areas were occupied at the time of listing, and should further explain why unoccupied areas are essential for conservation of the species. Hence, the Service moved for a voluntary remand of the critical habitat rule, requesting until September 30, 2015, to issue a proposed rule, and until September 30, 2016, to issue a final rule. On September 5, 2013, the court granted the Service's motion, leaving the current critical habitat rule in effect pending completion of the remand. The proposed rule (USFWS 2015b) determined that all of the designated areas meet the statutory definition of critical habitat. Because the proposed determination is that all areas currently designated as critical habitat do meet the statutory definition, the Service is not proposing any changes to the boundaries of the specific areas identified as critical habitat at this time.

Description

The PBFs are physical and biological features the Service determines are essential to a species' conservation (*i.e.*, recovery) and require special management considerations. For murrelets, the Service determined the PBF (also referred to as the primary constituent elements (PCEs)) associated with the terrestrial environment that support nesting, roosting, and other normal behaviors are essential to the conservation of the murrelet and require special management considerations. The PBFs for the murrelet are: (1) individual trees with potential nesting platforms; and (2) forested lands of at least one half site potential tree height regardless of contiguity within 0.8 kilometers (0.5 miles) of individual trees with potential nesting platforms, and that are used or potentially used by murrelets for nesting or roosting (USFWS 1996, p. 26264). The site-potential tree height is the average maximum height for trees given the local growing conditions, and is based on species-specific site index tables. These PBFs are intended to support terrestrial habitat for successful reproduction, roosting and other normal behaviors.

Conservation Strategy and Objectives

The Service's primary objective in designating critical habitat was to identify existing terrestrial murrelet habitat that supports nesting, roosting, and other normal behaviors that require special management considerations and to highlight specific areas where management should be given highest

priority. The Service designated critical habitat to protect murrelets and their habitat in a well-distributed manner throughout the three states. Critical habitat is primarily based on the LSRs identified in the NWFP (approximately 3 million acres of critical habitat are located within the 3.9 million acre LSR boundary designation). These LSRs were designed to respond to the problems of fragmentation of suitable murrelet habitat, potential increases in predation due to fragmentation, and reduced reproductive success of murrelets in fragmented habitat. The LSR system identifies large, contiguous blocks of late-successional forest that are to be managed for the conservation and development of the older forest features required by the murrelet, and as such, serve as an ideal basis for murrelet critical habitat. Where Federal lands were not sufficient to provide habitat considered crucial to retain distribution of the species, other lands were identified, including state, county, city and private lands (USFWS 1996, p. 26265).

Status and Distribution

The majority (77 percent) of designated critical habitat occurs on Federal lands in LSRs as identified in the NWFP. Because of this high degree of overlap with LSRs and LSR management guidelines, the condition of most of the range-wide network of murrelet critical habitat has experienced little modification of habitat since designation. Consultation data from October 1, 2003 – July 19, 2016 is displayed in Table 52. All consulted on acres impacted in the Oregon Coast Range occur on NWFP lands.

Climate Change

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth *et al.* 2002; Walther *et al.* 2002; Ådahl *et al.* 2006; Karl *et al.* 2009; Moritz *et al.* 2012; Westerling *et al.* 2011, p. S459; Marlon *et al.* 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife habitats; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

The Service believes climate change is likely to further exacerbate some existing threats to murrelet critical habitat such as the projected potential for increased habitat loss from drought-related fire, mortality, insects and disease in the short-term (10 to 30 years). These potential impacts will affect the environmental baseline for murrelet critical habitat, and we provide a general overview of these potential effects in Appendix D. Although it appears likely that murrelet critical habitat will be adversely affected by long-term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the critical habitat network. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long-term persistence of murrelet critical habitat. For example, the PRMP will result in a net increase in higher quality late-successional forest (PBF 1) during the 50 years of the plan; the total area of protected murrelet critical habitat in forest reserves will increase; the district-mapped older, structurally complex, conifer forests (PBF 1) were included in the LSRs; and the BLM will apply ecological forestry management principles that will better enable management of risk due to catastrophic wildfire. These measures, described in detail elsewhere in this BO, will increase the ability of murrelet critical habitat to persist and recover in the face of climate change effects by providing additional areas of habitat. Several threats to murrelet critical habitat have been identified. These threats collectively comprise a suite of environmental stressors that, individually or through interaction, have significantly disrupted or impaired the maintenance and development of PBFs.

Table 52. Aggregate Results of All Critical Habitat Affected by Section 7 Consultation for the Murrelet; Baseline and Summary of Effects By Conservation Zone and Habitat Type From October 1, 2003, to July 19, 2016.

Conservation Zone ¹	Designated Acres ²	Authorized Habitat Effects in Acres ³			Reported Habitat Effects in Acres ³		
	Total CHU Acres	Stands ⁴	Remnants ⁵	PBF 2 ⁶	Stands ⁴	Remnants ⁵	PBF 2 ⁶
1: Puget Sound	1,271,782	-59	0	-21	0	-1	0
2: Western Washington	414,050	0	0	0	0	0	0
Outside CZ Area in WA	0	0	0	0	0	0	0
3: Oregon Coast Range	1,024,122	-13	0	-208	0	0	0
4: Siskiyou Coast Range	1,055,788	-959	0	-241	0	-97	0
Outside CZ Area in OR	0	0	0	0	0	0	0
5: Mendocino	122,882	0	0	0	0	0	0
6: Santa Cruz Mountains	47,993	0	0	0	0	0	0
Outside CZ Area in CA	0	0	0	0	0	0	0
Total	3,936,617	-1,031	0	-470	0	-98	0

Notes:

1. Conservation Zones (CZ) six zones were established by the 1997 Recovery Plan to guide terrestrial and marine management planning and monitoring for the Murrelet (USFWS 1997, pp. 114, 125-130).

2. Critical Habitat Unit acres within each Conservation zones, as presented in the Murrelet Recovery Plan Figure 8, p. 114.

3. Habitat includes all known occupied sites, as well as other suitable habitat, though it is not necessarily occupied. Importantly, there is no single definition of suitable habitat, though the Murrelet Effectiveness Monitoring Module is in the process. Some useable working definitions include the Primary Constituent Elements as defined in the Critical Habitat Final Rule, or the criteria used for Washington State by Raphael *et al.* (2002).

4. Stand: A patch of older forest in an area with potential platform trees.

5. Remnants: A residual/remnant stand is an area with scattered potential platform trees within a younger forest that lacks, overall, the structures for murrelet nesting.

6. PBF 2: trees with a ½ site-potential tree height within .5 mile of a potential nest tree.

ENVIRONMENTAL BASELINE – MARBLED MURRELET

Except as supplemented by the Service, the following section is from the BA (BLM 2016, pp. 68-85, Appendix E). The Service recognizes that the habitat breakdown by BLM does not correlate precisely with murrelet habitat, but it is the best available approach for a landscape level analysis of murrelet habitat. At the local scale murrelet habitat will be identified though other methods, including visual evaluation of stands during subsequent consultations.

BLM divided the state by the north south boundary associated with the north south boundary between Conservation Zone 3 and 4 (Figure 11). Conservation zones in Oregon includes all lands within 35 miles of the coast and any lands designated as critical habitat beyond 35 miles of the coast (USFWS 1997, p. 127). However, for the purposes of their analysis BLM divide data based on an associated with Biological Opinion—Marbled Murrelet

the north south division of these conservation zones. For the purposes of their analysis BLM also established two management zones for the murrelet: inland zone 1 from the coast to approximately 35 miles inland; and inland zone 2 from the eastern boundary of inland zone 1 to approximately 50 miles inland from the coast (Figure 12). These zones are not the same as the inland zones mapped under the NWFP, but are the same as the NWFP inland zone 1 and inland zone 2 boundary lines as described by the Forest Ecosystem Management Assessment Team (USDA *et al.* 1993, pp. IV-23 and IV-24). This BO indicates when inland zone 1 or inland zone 2 is associated with only the NWFP and if it is the mapped or described zone.

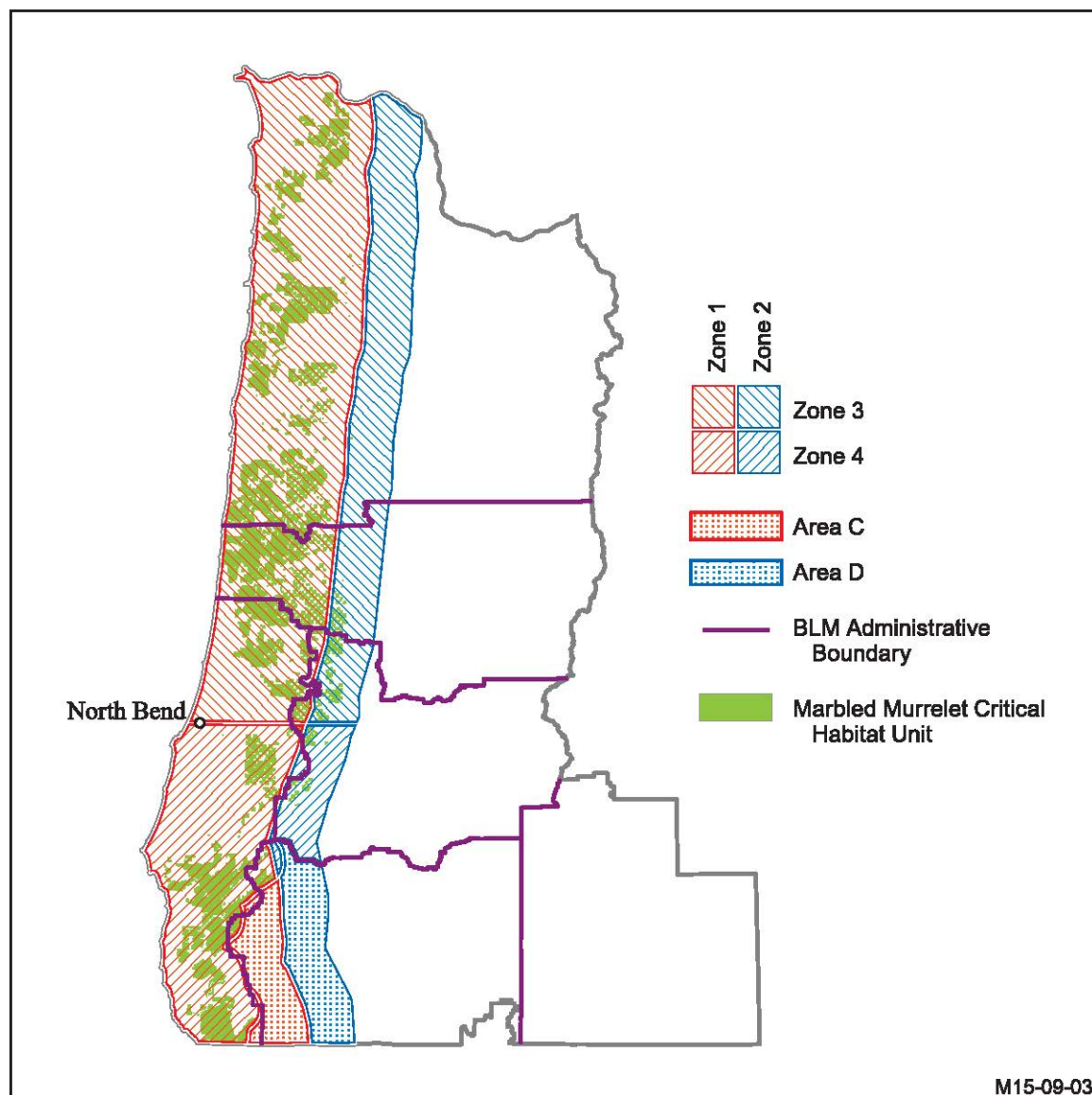


Figure 12. Range and management zones of the murrelet.

Systematic surveys in the Medford District have indicated that murrelets are likely confined to the hemlock-tanoak vegetation zone (USFS and BLM 2002, USFWS 2002). The portion formally considered part of the range of the murrelet in the Medford District is depicted as Area C and Area D in

Figure 12. Areas C and D are no longer part of the murrelet nesting range because they are not in the hemlock-tanoak zone.

Coquille Tribe's Lands

Coquille Tribe lands associated with the PRMP are referred to as the Coquille Forest that encompasses approximately 5,396 acres of coastal forestland across approximately 20 distinct parcels in Coos County, Oregon, Conservation Zone 4 and in inland zone 1. These lands are currently managed consistent with the standards and guidelines of the NWFP as it applies to the Coos Bay BLM. There are currently approximately 2,017 acres of murrelet nesting habitat on the Coquille Forest lands, 832 acres are currently managed as Riparian Reserve (545 acres of murrelet nesting habitat) and the rest is currently managed as Matrix lands. Of the nesting habitat acres, 1,431 are high-quality murrelet nesting habitat (Table 53). The Service is not aware of any murrelet nest sites on Coquille Forest lands, although surveys have not been completed across the entire ownership. The Tribe consults with the Service through the Bureau of Indian Affairs when conducting activities that may affect listed species. The primary activity consulted on by the Tribe is timber management actions.

Table 53. High-quality nesting habitat on non-BLM lands within the action area (Glenn 2016a, pers. comm.).

Non-BLM lands within the action area	High Quality Murrelet Nesting Habitat - Conservation Zone 3, (Acres)	High Quality Murrelet Nesting Habitat - Conservation Zone 4, (Acres)	Total High Quality Murrelet Nesting Habitat, (Acres)
Coquille Tribe lands (Coquille Forest)	0	1,431	1,431
State, County and Private lands	29,645	23,644	53,289
Total	29,645	25,075	54,720

State, County and Private Lands

These lands contribute another 53,289 acres of high-quality nesting habitat to the action area (Table 53). These lands are not managed under the NWFP nor are they proposed for management under the PRMP, but they do have an obligation under the ESA to avoid taking of murrelets.

BLM Lands within the Action Area

Nesting Habitat Classification and Modeling by BLM

In its analysis in the BA, the BLM considered nesting habitat for the murrelet to be young forests with structural legacies, mature forests, and structurally-complex forests within the range of the murrelet (Table 54). The BLM divided nesting habitat for the murrelet into two categories: high-quality nesting habitat (structural stages 5.1, 5.2, or 5.3, Table 54) and low-quality nesting habitat (structural stages 3.1, 3.3, 4.1, and 4.2, Table 54). The BLM assumed that structurally-complex forest stands within the range of the murrelet represent high-quality nesting habitat, which provides trees and platforms suitable for nesting on a regular, reliable basis. Based on vegetation data, the BLM estimates the average platform density in high-quality nesting habitat is 54.2 platforms/ac in inland zone 1 and 41.8 platforms/ac in

inland zone 2. Young stands with structural legacies and mature stands represent lower-quality nesting habitat, which may have trees and platforms suitable for nesting murrelets, but the frequency and density of such structures is lower. The BLM estimates the average platform density in lower-quality nesting habitat is 18.1 platforms/ac in inland zone 1 and 15.3 platforms/ac in inland zone 2.

The BLM modeled habitat on non-BLM-administered lands within Oregon using the USFS 2012 Gradient Nearest Neighbor (GNN) structural condition. The GNN structural condition categories used for estimating high-quality nesting habitat on non-BLM-administered lands include structural components and provide a reasonable estimate of high-quality nesting habitat in Oregon for context. However, the GNN structural condition categories are not effective for estimating lower-quality nesting habitat. Initial calculations of total nesting habitat at the state scale using the GNN structural condition categories were unreasonably high when compared to Raphael *et al.* (2011) and Falxa and Raphael (2015). The GNN structural condition categories cannot distinguish young stands with structural legacies from young stands without structural legacies, and would therefore include all young stands in lower-quality nesting habitat, grossly overestimating the amount of lower-quality nesting habitat and total murrelet nesting habitat. Therefore, the BLM limited discussion of murrelet nesting habitat at the state scale to high-quality nesting habitat only, because of the limitations on interpreting the data available for non-BLM-administered lands.

BLM also did not incorporate projections of climate change into the simulation of the growth of stands through time because of the uncertainty in climate change predictions and problems in downscaling the available climate predictions for use in forest stand growth and harvesting models (BLM 2016a, p. 89).

Falxa and Raphael (2015) present a different methodology to model murrelet habitat. The two models are coincident on 847,826 acres of BLM-administered lands. The habitat model in Falxa and Raphael (2015) extends to approximately 35 miles inland from the Pacific Ocean and as such does not provide coverage on all BLM-administered lands in the action area. The BLM quantitatively compared the level of agreement between two different models of murrelet habitat in the action area (BLM 2016a, Appendix E). Overall, the murrelet habitat model in this analysis appears to have fair agreement with the habitat model described in Falxa and Raphael (2015). The models generally were consistent in identifying: 1) nesting habitat from non-habitat; and 2) high-quality habitat from non-habitat and lower-quality nesting habitat. The models have somewhat less consistency in identifying higher-quality from lower-quality habitat. However, BLM was not able to identify any disagreement in the models that would contribute to inconsistencies in habitat identification.

The BLM assessed habitat connectivity by calculating the amount of “edge habitat” and “core habitat” on BLM-administered lands. Following Raphael *et al.* (2011, p. 19), the BLM defined core habitat as the interior portion of a contiguous block of nesting habitat that is more than 295 feet from non-habitat. BLM also defined edge habitat as nesting habitat that within 295 feet of non-habitat. The distance to edge or core habitat is based on findings that murrelets have reduced nest success along forested edges due to nest depredation, predominantly by species of corvids (Falxa and Raphael 2015, Raphael *et al.* 2011, McShane *et al.* 2004). The BLM assumed that since the risk of nest predation by corvids is greater along habitat edges, there would be less risk of nest predation within larger patches of nesting habitat. There are no quantified thresholds for core habitat needed by murrelets though it is assumed that the quality of nesting habitat increases as the proportion of available habitat in core habitat increases and as patch size increases.

Table 54. Structural stage descriptions for classifying murrelet habitat.

Structural Stages	Subdivisions	Numeric Code	Descriptions	Moist	Dry
Early Successional	with Structural legacies	1.1	Very young forest, with less than 30% canopy cover with larger trees	≤ 30 years old and ≥ 6 trees per acre ≥ 20 inches dbh and $< 30\%$ canopy cover	≤ 50 years old and ≥ 6 trees per acre ≥ 20 inches dbh and $< 30\%$ canopy cover
	without Structural Legacies	1.2	Very young forest, with less than 30% canopy cover without larger trees	≤ 30 years old and < 6 trees per acre ≥ 20 inches dbh and $< 30\%$ canopy cover	≤ 50 years old and < 6 trees per acre ≥ 20 inches dbh and $< 30\%$ canopy cover
Stand Establishment	with Structural Legacies	2.1	Very young forest, with greater than 30% canopy cover with larger trees	≤ 30 years old and ≥ 6 trees per acre ≥ 20 inches dbh and $\geq 30\%$ canopy cover	≤ 50 years old and ≥ 6 trees per acre ≥ 20 inches dbh and $\geq 30\%$ canopy cover
	without Structural legacies	2.2	Very young forest, with greater than 30% canopy cover without larger trees	≤ 30 years old and < 6 trees per acre ≥ 20 inches dbh and $\geq 30\%$ canopy cover	≤ 50 years old and < 6 trees per acre ≥ 20 inches dbh and $\geq 30\%$ canopy cover
Young	High Density (Curtis RD ≥ 25)				
	with Structural legacies	3.1	Young high density forest with more than one canopy layer	< 24 trees per acre ≥ 20 inches dbh and RD ≥ 25 ; CVgt(10) ≥ 0.35	< 12 trees per acre ≥ 20 inches dbh and RD ≥ 25 ; CVgt(10) ≥ 0.35
	without Structural Legacies	3.2	Young high density forest with little variation in tree size	< 24 trees per acre ≥ 20 inches dbh and RD ≥ 25 ; CVgt(10) < 0.35	< 12 trees per acre ≥ 20 inches dbh and RD ≥ 25 ; CVgt(10) < 0.35
	Low Density (Curtis RD < 25)				
	with Structural legacies	3.3	Young low density forest with more than one canopy layer	< 24 trees per acre ≥ 20 inches dbh and RD < 25 ; CVgt(10) ≥ 0.35	< 12 trees per acre ≥ 20 inches dbh and RD < 25 ; CVgt(10) ≥ 0.35
	without Structural Legacies	3.4	Young low density forest with little variation in tree size	< 24 trees per acre ≥ 20 inches dbh and RD < 25 ; CVgt(10) < 0.35	< 12 trees per acre ≥ 20 inches dbh and RD < 25 ; CVgt(10) < 0.35
Mature	Single-Layered Canopy	4.1	Larger trees (> 20 "dbh) with little variation in tree size	≥ 24 trees per acre ≥ 20 inches dbh and (CVgt[10]) < 0.35	≥ 12 trees per acre ≥ 20 inches dbh and (CVgt[10]) < 0.34
	Multi-layered Canopy	4.2	Larger trees (> 20 "dbh) with more than one canopy layer	≥ 24 trees per acre ≥ 20 inches dbh and (CVgt[10]) ≥ 0.35 and < 4.7 tpa ≥ 40 inches dbh	≥ 12 trees per acre ≥ 20 inches dbh and (CVgt[10]) ≥ 0.34 and < 2.1 tpa ≥ 40 inches dbh

Structural Stages	Subdivisions	Numeric Code	Descriptions	Moist	Dry
Structurally Complex	Existing Old Forest	5.2	Stands currently ≥ 200 years but < 400		
	Existing Very Old Forest	5.3	Stands currently ≥ 400 years old		
	Developed Structurally Complex	5.1	Larger trees (20" dbh) with some very large trees (> 40 inches dbh) and more than one canopy layer	(CVgt[10]) ≥ 0.35 ; ≥ 24 tpa ≥ 20 inches dbh; ≥ 4.7 tpa ≥ 40 inches dbh	(CVgt[10]) ≥ 0.34 ; ≥ 12 tpa ≥ 20 inches dbh; ≥ 2.1 tpa ≥ 40 inches dbh

High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3. These codes have a gray background to differentiate them in the above table.

Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3. These codes are highlighted in blue to differentiate them in the above table.

Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

Based on BLM modeling, there are 493,434 acres of total nesting habitat for the murrelet on BLM-administered lands in the action area, of which, 232,493 acres is high-quality nesting habitat (Table 55).⁷ Of the forested lands capable of providing nesting habitat on BLM lands in the action area, 56 percent is currently nesting habitat, and 26 percent is currently high-quality nesting habitat.

Table 55. Current murrelet nesting habitat on BLM lands in the action area and within Oregon.

Murrelet Habitat	BLM lands in the Action area		Planning area	
	(Acres)	(% of Habitat Capable)	(Acres)	(% of Habitat Capable)
High-Quality Nesting Habitat	232,493	26%	572,424	9%
Lower-Quality Nesting Habitat	260,942	29%	-	-
Total Nesting Habitat	493,434	56%	-	-
Total Habitat-Capable Acres	885,590	100%	6,638,960	100%

Currently, the average patch size of murrelet nesting habitat on BLM-administered lands in the action area is 33.2 acres (Table 56). Currently, 35 percent of nesting habitat is core habitat (Table 56).

Table 56. Current murrelet nesting habitat patch metrics on BLM lands in the action area.

	Mean Patch Size (Acres)	Edge vs. Core Habitat		
		Edge Habitat (Acres)	Core Habitat (Acres)	Percent Core (%)
Current Condition (2013)	33.2	320,463	172,969	35%

BLM-administered lands currently support 232,493 ac of the high-quality nesting habitat for the murrelet, or 41 percent of all high-quality habitat on all land ownerships in Oregon (Table 55). Currently, there are 572,424 acres of high-quality nesting habitat for the murrelet across all ownerships, or nine percent of the forest land capable of providing nesting habitat in Oregon (Table 55). Falxa and Raphael (2015, pp. 115-118) report that approximately 12 percent of habitat-capable lands was higher-suitability nesting habitat in 2012 within the NWFP mapped inland zone 1 in Oregon. Thus, the BLM estimate of high-quality nesting habitat across all

⁷ These acreages for the current condition represent the BLM update of baseline forest structural conditions resulting from 2013/2014 wildfires. There are 726 acres less high-quality nesting habitat under the updated current condition of the PRMP incorporating the effect of the 2013/2014 wildfires than under the current condition previously modeled for the other alternatives. This difference in starting condition represents a difference of less than 1 percent and does not alter the comparative analytical results.

ownerships as modeled in this analysis is slightly lower but comparable to estimates in Falxa and Raphael (2015).

Occupancy on BLM lands in the Action Area and in Oregon

Murrelets are documented in the Coos Bay, Eugene, Roseburg, and Salem Districts and are suspected in the Medford District. The BLM used the BLM corporate murrelet database to identify known, occupied murrelet sites.

The BLM forecasted the number of murrelet occupied sites that the BLM may identify in the future by applying observed detection rates of occupancy and the mean size of occupied stands. Through preliminary analysis of previous surveys, the BLM found murrelet occupancy at 54.8 percent of survey polygons within 0 to 25 miles of the coast (251 of 458 survey polygons) and 10.2 percent of survey polygons within 25 to 50 miles of the coast (106 of 1,038 survey polygons). The BLM used two different detection rates (54.8 percent and 10.2 percent) split at 25 miles from the Pacific Ocean, because there was a marked difference in the rate of occupancy detections within 25 miles of the Pacific Ocean and 25 to 50 miles from the Pacific Ocean (Figure 13). The survey polygons examined in this preliminary analysis represent 83,234 acres of survey effort.

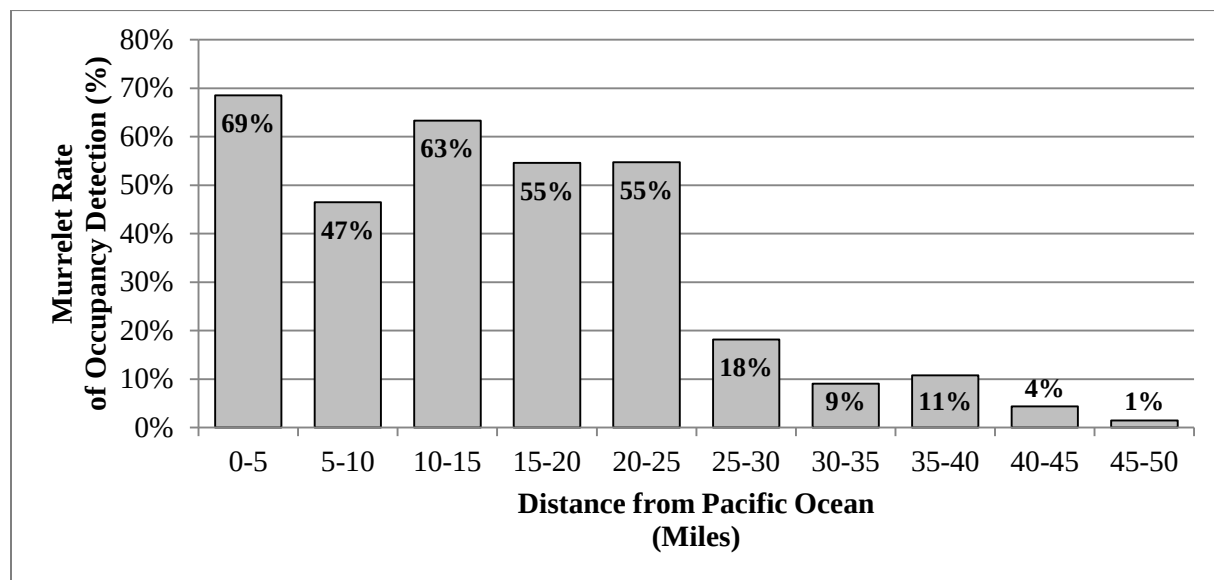


Figure 13. Murrelet occupancy detection rates.

The BLM applied these detection rates to the amount of murrelet nesting habitat that the BLM modeled within the action area to obtain an estimate of occupied habitat (54.8 percent for 0-25 miles inland and 10.2 percent for 25-50 miles inland). The average size of survey polygons is 55.6 acres (BLM 2016a, page 81), and the BLM assumed that survey polygons are the best available dataset depicting murrelet occupancy at the stand level. Therefore, BLM divided the acres of estimated occupied habitat by 55.6 to obtain estimates of occupancy by sites.

Based on total amount of nesting habitat, the observed detection rates of occupancy and the mean size of occupied stands described above, the action area currently supports an estimated 2,459 murrelet sites (1,615 associated with Conservation zone 3 and 843 associated with Conservation zone 4). To evaluate the accuracy of this forecast, the BLM estimated murrelet occupied sites on BLM-administered lands using a different methodology. Raphael *et al.* (2002, p. 340) estimated 370 acres (150 hectares) of nesting habitat could support a pair of murrelets on the Olympic Peninsula. However, Raphael *et al.* (2002, p. 340) states that they would expect 370 acres could support more than a single pair of murrelets. Huff *et al.* (2006, p. 141) found an average of 186 acres of habitat per murrelet. Using a current data pool compared to Huff *et al.* (2006) and a current and larger data pool compared to Raphael *et al.* (2002), we estimated a relationship between nesting habitat monitored under the NWFP for murrelets and the at sea population of murrelets of 113 acres per murrelet at the range-wide scale (see Potential use of unsurveyed and occupied habitat section). If we multiply BLM's occupied sites by 2 murrelets and then divide this number into the total nesting habitat, we get 100 acres of habitat per murrelet, which is very close to the range wide estimate of 113 acres per murrelet. Compared to our NWFP-wide estimate of murrelet occupancy of nesting habitat, BLM's estimate seems consistent although it does provide a larger total estimate of murrelet occupancy. The goal of conducting this comparison was to determine if the BLM's data were consistent with our understanding of murrelet habitat usage, not to get estimates from different data sets that matched precisely. This analysis provides support to BLM's approach of estimating occupied habitat and occupied sites.

There are 351 known, occupied murrelet sites on BLM-administered lands in the action area, encompassing 51,995 acres, as delineated by the BLM administrative units (Figure 14). There are also 417 known occupied murrelet sites on the lands administered by the U.S. Forest Service in Oregon, and 237 sites on state lands managed by the Oregon Department of Forestry, for a total of 1,005 sites in Oregon (Table 57). Information regarding murrelet occupancy for other land-owners is not available. BLM-administered lands support 35 percent of the known, occupied murrelet sites in Oregon, whereas BLM-administered lands only comprise 13 percent (885,590 acres) of the habitat-capable acres within the range of the murrelet in Oregon (6,638,960 acres; Table 55). This may, in part, reflect a greater survey effort on BLM-administered lands than on other land ownerships, given the lack of information on survey efforts on several land ownerships. However, as detailed above, BLM-administered lands currently contribute 41 percent of the high-quality nesting habitat for the murrelet in Oregon. This suggests that BLM-administered lands play a substantial role in the conservation of the murrelet.

Table 57. Known murrelet sites in Oregon.

Ownership	Known Occupied Murrelet Sites			Murrelet Survey Effort			
	(#)	Total Known Sites (%)	(Acres)	Survey Period (Years)	Stations (#)	Survey Polygons (#)	Survey Area (Acres)
BLM	351	35%	51,995	1991-2014	6,121	1,496	83,234
Forest Service	417 ^a	41%	21,144 ^b	1986-2009	Not Available	Not Available	Not Available
Oregon Department of Forestry	237	24%	21,235	1989-2014	9,650	2,107	300,455
Totals	1,005	100%	94,374	-	-	-	-

^a Combination of 133 occupied murrelet sites reported from the Rogue-Siskiyou National Forest and surveyors observed occupied behaviors at 381 survey stations on the Siuslaw National Forest. For this analysis, BLM assumed that the stations within 400 meters of each other represented the same occupied site since the maximum effective distance of a survey station is 200 meters radius (Evans Mack *et al.* 2003, p. 9). Thus, the 381 survey stations with occupied behaviors represent approximately 284 occupied sites.

^b Only includes acreage from the Rogue-Siskiyou National Forest; acreage from the Siuslaw National Forest is not available.

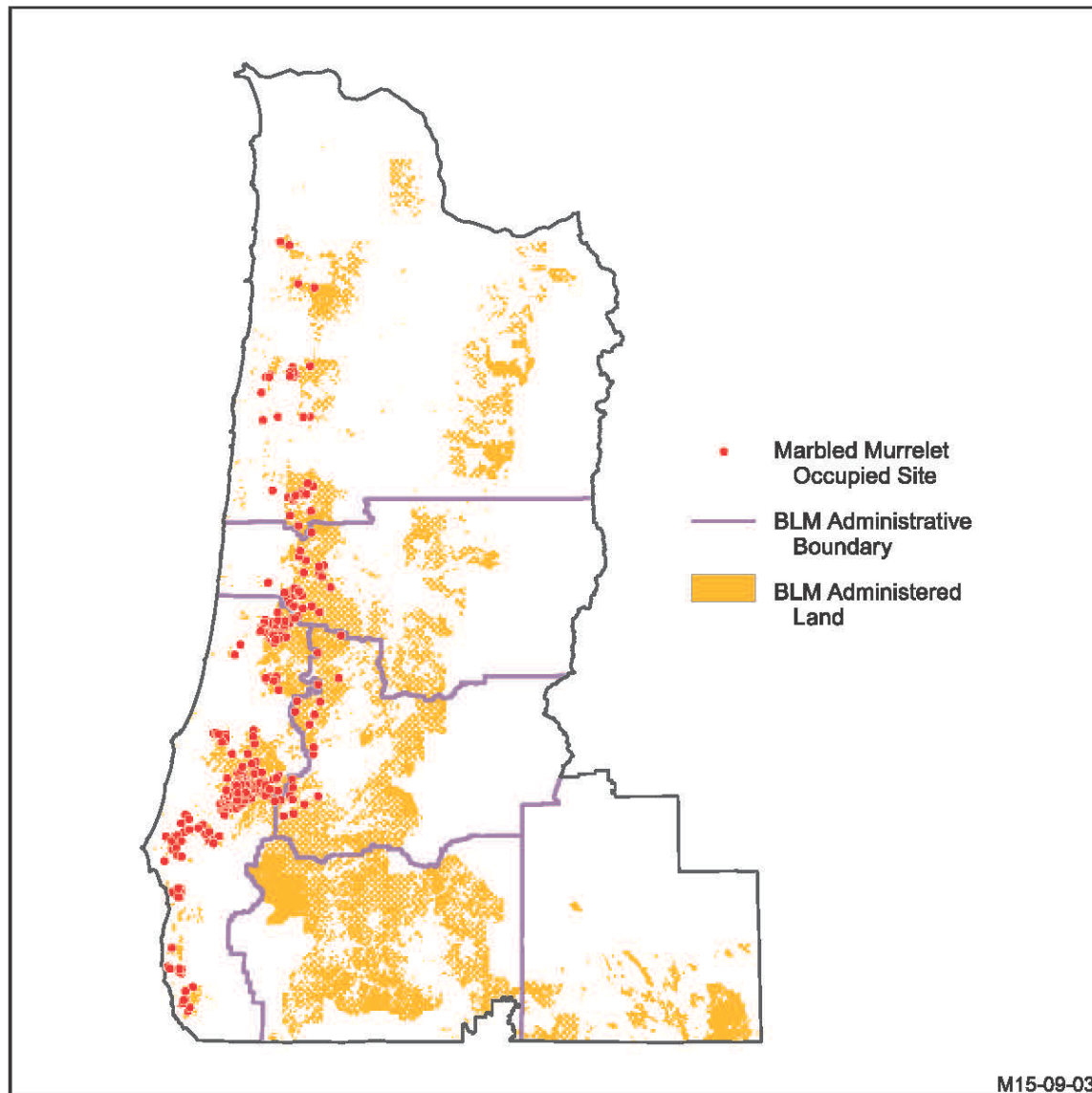


Figure 14. Known, occupied murrelet sites in the action area.

Population trends

There is no evidence for a trend in the murrelet population in Oregon (+0.3 percent per year; 95 percent confidence interval: -1.8 to 2.5; Falxa and Raphael 2015, pp. 23, 43). There is also no evidence for a trend for the murrelet population within the NWFP area (all five conservation zones) (Falxa and Raphael 2015, p. 23). Even though the estimates for the annual rate of population change in Oregon was +0.3 and the rate of population change for the Northwest Forest Plan area was -1.2 percent, the evidence is inconclusive, because the 95 percent confidence interval includes zero in both cases (Falxa and Raphael 2015, p. 23).

Falxa *et al.* (2016, p. 13) more recently reported that the 2014 at-sea population estimate for murrelets was 8,841 birds in Conservation Zone 3 (95 percent confidence interval: 6,819 to

11,276 murrelets) and 2015 at-sea population estimate for murrelets was 8,743 birds in Conservation Zone 4 (95 percent confidence interval: 7,409 to 13,125 murrelets). The 2014 population estimate for all five conservation zones is 21,305 murrelets (95 percent confidence interval: 17,492 to 25,118 murrelets). The annual rate of population change between 2000 and 2014 was +1.3 percent in Conservation Zone 3 and between 2000 and 2015 was +3 percent in Conservation Zone 4 (Falxa *et al.* 2016, p. 9). However, the Zone 3 results are still inconclusive because the confidence interval for the rate of population change overlaps zero.

The lack of a conclusive trend in murrelet populations described above is different than previous reports. Previously, Miller *et al.* (2012) reported that the murrelet population was declining throughout its range (estimated at 29 percent decline for the listed population from 2001 to 2010). The annual population decline during 2001 to 2010 was 3.7 percent. It is unknown what is driving recent population levels. It is premature to conclude that the observations during 2011 to 2013 indicate a change in the declining trend (Falxa and Raphael 2015; Falxa *et al.* 2014). According to Falxa and Raphael (2015, p. 29), the apparent increase in the murrelet population between 2011 and 2013 is too rapid to be attributable to habitat change, because nesting habitat takes many decades to several centuries to develop and is too slow a process to account for the rate of population change. These results could be due to small sample size, the statistical power of the sampling design, a lag in the response of nesting murrelets to available habitat, or population shifts within the species' range.

Nesting habitat trends

In Oregon, 9.2 percent of higher-suitability nesting habitat was lost between 1993 and 2012 on all lands (Falxa and Raphael 2015, p. 89). Falxa and Raphael (2015, pp. 90, 120) reported that 21.1 percent of higher-suitability nesting habitat on non-federal lands in Oregon was lost between 1993 and 2012. Timber harvest accounted for 98 percent of nesting habitat loss on non-federal lands (Falxa and Raphael 2015, p. 90). On Federal lands, 0.3 percent of higher-suitability nesting habitat on non-reserved Federal lands was lost between 1993 and 2012, and 3.8 percent was lost on Federal reserved lands (Falxa and Raphael 2015, p. 119). Wildfire, timber harvest, insects and disease, and other natural disturbances accounted for 80, 18, 1, and <1 percent of the loss of higher-suitability habitat from federal lands in Oregon, respectively (Falxa and Raphael 2015, p. 123). While timber harvest resulting in nesting habitat removal is generally restricted in Federal reserves, some harvest did occur here after implementation of the NWFP where timber sales had been approved prior to 1994 (Falxa and Raphael 2015, p. 90). The greater loss of higher-suitability nesting habitat on non-reserved Federal lands is mainly due to wildfire (Falxa and Raphael 2015, p. 123). The 2002 Biscuit fire occurred in Conservation Zone 4 in Oregon, which was Oregon's largest contiguous, single-year fire on record (Azuma *et al.* 2004, p. 2), we believe this wildfire event is the main reason the loss of higher-suitability nesting murrelet habitat is not proportional in the non-reserved and reserved Federal lands in Oregon.

Conservation Zone 3

The action area includes parts of murrelet Conservation Zone 3: Oregon Coast Range (USFWS 1997, p. 126). This zone extends from the Columbia River, south to North Bend, Coos County, Oregon. This zone includes waters within 1.2 miles of the Pacific Ocean shoreline and extends

inland a distance of up to 35 miles from the Pacific Ocean. The boundary encompasses all of the murrelet CHUs (the boundary extends slightly beyond 35 miles in certain areas).

Zone 3 includes the majority of known murrelet occupied sites in Oregon. Murrelet occupied sites along the western portion of the Tillamook State Forest are especially important to maintaining well distributed murrelet populations (USFWS 1997, p. 127). The murrelet recovery plan states that efforts should focus on maintaining these occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. Relatively few known occupied sites occurred north of the Tillamook State Forest when the recovery plan was written, and this is still the case today. The murrelet recovery plan states “Recovery efforts should be directed at restoring some of the north-south distribution of murrelet populations and habitat in this Zone. Maintenance of suitable and occupied murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, Siuslaw National Forest, and BLM-administered forests is an essential component for the stabilization and recovery of the murrelet” (USFWS 1997, p. 127).

Most recently Raphael *et al.* (2015a) used habitat modeling to estimate potential murrelet habitat for the period from 1993 to 2012 on both Federal and non-federal lands within the five Conservation Zones in the NWFP area. Raphael *et al.* (2015a, pp. 121) estimated the Conservation zone 3 contains 610,583 acres of higher suitable habitat (class 3 and 4 habitat).

Within Conservation Zone 3 and within the action area, acres and percent of nesting habitat is displayed in Table 58, acres and percent of high-quality nesting habitat is displayed in Table 59, and acres and occupied sites is displayed in Table 60.

Table 58. Current murrelet nesting habitat under the PRMP on BLM-administered lands associated with north south division of Conservation Zone 3.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	34,268	11%	280,331	89%	314,599

Table 59. Current high-quality murrelet nesting habitat under the PRMP on BLM-administered lands associated with north south division of Conservation Zone 3.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	2,837	2%	136,471	98%	139,308

Table 60. Current murrelet occupied sites expected under the PRMP on BLM lands in the action area associated with north south division of Conservation Zone 3.

Decade ¹	Nesting Habitat on BLM lands in the Action Area Conservation Zone 3 (Acres)	Occupied Sites on BLM lands in the Action Area (Number)
Current	314,599	1,615

Population within Conservation Zone 3

In 2014, the population for Conservation Zone 3 was estimated at 8,840 birds, with a 95 percent confidence interval of 7,937 to 10,822 birds. Though this was the highest estimate for Zone 3, there is no evidence for a long term trend (CCR 2015, p. 2).

Consulted on Effects to murrelets within Conservation Zone 3

Since October 2003 through April 14, 2015, 3,226 acres of suitable habitat and 1,050 acres of younger stands with remnant trees have been consulted on for removal within Conservation Zone 3 (Table 46).

Conservation Zone 4

The action area for this consultation falls within murrelet Conservation Zone 4: Siskiyou Coast Range (USFWS 1997, p. 127). This zone extends from North Bend, Coos County, Oregon, south to the southern end of Humboldt County, California. This zone includes waters within 1.2 miles of the Pacific Ocean shoreline and extends inland a distance of up to 35 miles from the Pacific Ocean. The boundary encompasses all of the murrelet CHUs (the boundary extends slightly beyond 35 miles in certain areas).

Zone 4 includes the marbled murrelet population occupying sites in Redwood National Park and several state parks (Jedediah Smith, Del Norte, Prairie Creek, Grizzly Creek, and Humboldt) in California (USFWS 1997, p. 127). In addition, Zone 4 includes nesting habitat on private lands in southern Humboldt County. Additional marbled murrelet nesting habitat occurs at lower elevations in western portions of the Smith River National Recreation Area (USFWS 1997, p. 127).

Most recently Raphael *et al.* (2015a) used habitat modeling to estimate potential murrelet habitat for the period from 1993 to 2012 on both Federal and non-federal lands within the five Conservation Zones in the NWFP area. Raphael *et al.* (2015a, p. 121) estimated the Conservation zone 4 contains 256,636 acres of higher suitable habitat (class 3 and 4 habitat).

Within Conservation Zone 4 and within the action area, acres and percent of nesting habitat is displayed in Table 61, acres and percent of high-quality nesting habitat is displayed in Table 62, and acres and sites are displayed in Table 63.

Table 61. Current murrelet nesting habitat under the PRMP on BLM-administered lands associated with north south division of Conservation Zone 4.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	14,950	8%	163,886	92%	178,835

Table 62. Current high-quality murrelet nesting habitat under the PRMP on BLM-administered lands associated with north south division of Conservation Zone 4.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	2,752	3%	90,433	97%	93,185

Table 63. Current murrelet occupied sites expected under the PRMP on BLM lands in the action area associated with north south division of Conservation Zone 4.

Decade ¹	Nesting Habitat on BLM lands in the Action Area Conservation Zone 4 (Acres)	Occupied Sites Forecast on BLM lands in the Action Area (Number)
Current	178,835	843

Population within Conservation Zone 4

In 2014, the population for Conservation Zone 4 was estimated at 8,743 birds, with a 95 percent confidence interval of 7,409 to 13,125 birds. Though this was the highest estimate for Zone 4, there is no evidence for a long term trend (CCR 2016, p. 2).

Consulted on Effects to murrelets within Conservation Zone 4

Since October 2003 through April 14, 2015, 3,830 acres of suitable habitat and zero acres of younger stands with remnant trees have been consulted on for removal within Conservation Zone 4 (Table 46).

Potential use of unsurveyed and occupied murrelet habitat

Comparing the murrelet population to the amount of inland suitable habitat has resulted in our best estimates of habitat use to date. Huff *et al.* (2006, p. 141) found an average of 186 acres of habitat per murrelet. Raphael *et al.* (2015b, pp. 156 and 171) found that among the factors they investigated, nesting habitat factors (amounts and pattern, large contiguous patches) were the best predictors of murrelet population distribution and trends at sea. We repeated this estimate of at sea murrelet population to inland habitat with current data at the range-wide scale. The calculations of habitat for Oregon were only within the mapped NWFP inland zone 1; we believe this was because murrelets appear to prefer habitat closer to the ocean in Oregon. The result was 113 acres per murrelet at the range-wide scale (data for nesting habitat from habitat class 3-4 for all land, Falxa and Raphael 2015, p. 118). The Service feels that the range-wide scale is the better estimate to gauge habitat correlations at a local scale because using the range-wide scale provides more data on which to base our estimate.

Estimates of high-quality habitat within the range of murrelets in Oregon is 572,424 acres and within BLM lands is 232,493 acres or 40.6 percent of the high quality habitat within Oregon (Table 55). BLM was not able to estimate total nesting habitat for Oregon. We are assuming that murrelet low quality habitat is at the same ratio Oregon wide as is BLM wide to calculate an estimate of murrelet density inland. We have no other estimate of habitat range-wide in Oregon to use. The NWFP monitoring of habitat in Oregon only models habitat within the mapped NWFP inland zone 1. Using this assumption, we calculate 642,260 acres of low quality nesting habitat statewide. This results in an estimate of 1,214,684 acres of murrelet habitat state-wide.

Within Oregon, the population is estimated at 11,384 murrelets (95 percent confidence interval: 5,104 to 17,664 murrelets, Falxa *et al.* 2016, p. 14). This estimate is based on a combination of 2014 and 2013 survey data. If we then look at the ratio of nesting habitat (estimated above at 1,214,684 acres) to the at sea population estimates we get 106 acres of nesting habitat per murrelet. This is very close to the range wide estimate of 113 acres per murrelet calculated above.

Also for the first time BLM has analyzed extensive occupancy data. They found the average survey polygon was 55.6 acres (BLM 2016a, page 81). Survey polygons are defined by the area surveyed. The area surveyed is defined as all contiguous habitat available at a site out a maximum of a ¼ mile (Evans Mack *et al.* 2003, p. 6). This is the calculation BLM used to estimate the number of occupied stands impacted by timber sales.

BLM had an overall detection rate of 23.9 percent in all murrelet habitat. Applying this to our calculation of a statewide total (1,214,684 acres), we calculate that 290,309 acres of murrelet habitat are occupied. Dividing 290,309 acres of occupied habitat statewide by the average occupied stand size of 55.6 acres we calculate the state has an estimated 5,221 occupied stands. If we assume one pair is occupying a stand, then our count is 10,442 murrelets using inland breeding habitat. This number is 91.7 percent of the estimated population of 11,384 murrelets. The sex ratio is believed to be equal for murrelets in all Recovery Zones and juvenile murrelets are estimated to be eight percent of the population (McShane *et al.* 2004, p 3-45). Efforts to determine the proportion of adults breeding have resulted in estimates of 31 to 95 percent,

potentially varying based on food availability (McShane *et al.* 2004, pp 3-39 and 40). Therefore, the assumption that one murrelet pair is using each average occupied stand is reasonable as the above estimate of the population is only taking into account breeding murrelets. Therefore, lacking site specific information on stand sizes the Service estimates that one pair of murrelets would use known or forecasted occupied habitat at a rate of 1 pair per 55.6 acres.

The previous estimates of one murrelet per 100 or 113 acres in the above section, “Occupancy on BLM lands in the Action Area and in Oregon,” was based on all available nesting habitat and was an analysis to compare NWFP data to Oregon BLM data. Not all nesting habitat is occupied. The above estimate of 55.6 acres per occupied site is for the amount of nesting habitat a murrelet pair uses, on average, based on inland BLM audio-visual murrelet survey data.

NWFP in the Action Area

No Forest Service lands occur in the action area. Within the listed range of the murrelet, Forest Service lands are managed under the direction of the NWFP, which established a conservation strategy for the murrelet on Federal lands designed around the designation of a variety of LUAs whose objectives are to provide for a north/south and east/west distribution of murrelet habitat up to 50 miles inland from the marine environment. The LSRs are intended to contribute to supporting “blocked up” habitat. While not intended to maintain or develop murrelet habitat, all occupied sites found in other LUAs must be designated as LSRs and maintained under the NWFP.

Recovery Plan for the Murrelet

The recovery plan recommends two Recovery Actions (RAs) relating to the proposed action. The RA 2 includes protecting terrestrial habitat essential for murrelet recovery (*i.e.*, CH, LSR). The RA 3 includes maintaining occupied habitat, unoccupied and un-surveyed habitat; maintaining and enhancing (*i.e.*, using silviculture to speed development) buffers around occupied habitat, unoccupied and un-surveyed habitat; and reduce nest disturbance.

Role of the Action Area in the Survival and Recovery of the Murrelet

Federal lands within the action area are intended to provide for breeding murrelets by preserving habitat blocks to maintain and recover the murrelet. BLM-administered lands currently support 41 percent of all high-quality habitat on all land ownerships in Oregon (Table 64). As explained above (section Nesting Habitat) no estimate of low quality habitat was available for non-BLM lands. BLM provides significant contributions to nesting habitat for murrelets in the state of Oregon. Within the listed range of the murrelet, Oregon contributes 35 percent of the high-quality habitat (Falxa and Ralph 2015, p. 118 with high-quality being class 3 and 4). Therefore, BLM is contributing about 14 percent of the high-quality murrelet habitat within the listed range. Based on this information, the Service believes the population of murrelets relying on BLM’s nesting habitat is a significant portion of the population.

Table 64. Current high-quality murrelet nesting habitat in the action area and non-BLM lands within Oregon.

Murrelet Habitat	Action area (BLM lands)		Non BLM lands within Oregon		Total	
	Acres	% of Habitat Capable	Acres	% of Habitat Capable	Acres	% of Habitat Capable
High-Quality Nesting Habitat	232,493	26%	339,931	6%	572,424	9%
Total Habitat-Capable Acres	885,590	100%	5,753,370	100%	6,638,960	100%

ENVIRONMENTAL BASELINE – MARBLED MURRELET CRITICAL HABITAT

Except as supplemented by the Service, the following section is from the BA (BLM 2016, pp. 71, 77-79, Appendix B). The Service recognizes that the habitat breakdown by BLM does not correlate precisely with the PBFs, but it is the best available approach for a landscape level analysis of PBFs. At the local scale PBFs will be identified through other methods, including visual evaluation of stands during subsequent consultations.

Coquille Lands

Critical habitat was not designated on the Coquille Forest.

State, County and Private Lands

These lands contribute another 1,165 acres of high-quality nesting habitat in critical habitat to the action area (Table 65). These lands are not managed under the NWFP nor are they proposed for management under the PRMP, but they do have an obligation under the ESA to avoid taking of murrelets.

Table 65. High-quality nesting habitat within critical habitat on non-BLM lands within the action area (Glenn 2016b, pers. comm.).

CHU	State lands - High Quality Murrelet Nesting Habitat, (Acres)	County and Private lands - High Quality Murrelet Nesting Habitat, (Acres)	Total High Quality Murrelet Nesting Habitat, (Acres)
OR-01-b	5	0	5
OR-01-c	448	121	569
OR-02-a	8	0	8
OR-03-a	11	7	18
OR-03-b	16	0	16

CHU	State lands - High Quality Murrelet Nesting Habitat, (Acres)	County and Private lands - High Quality Murrelet Nesting Habitat, (Acres)	Total High Quality Murrelet Nesting Habitat, (Acres)
OR-03-c	528	20	548
Total	1016	148	1164

BLM lands within the Action Area

Table 66 shows the acres on murrelet critical habitat in the **action area** that the BLM would allocate to each LUA under the PRMP. There is 1,469,131 acres designated as critical habitat within the state of Oregon.

Table 66. Acres of murrelet critical habitat on BLM lands in the action area by LUA.

Land Use Allocation	Acres
Late-Successional Reserve	261,587
Riparian Reserve	157,035
Inner Riparian Reserve	83,874
Middle Riparian Reserve (moist & dry)	24,959
Outer Riparian Reserve (moist & dry)	48,201
Congressionally Reserved Lands and the National Landscape Conservation System	1,914
District-Designated Reserve	20,145
Harvest Land Base	39,718
Moderate Intensity Timber Area	15,310
Low Intensity Timber Area	23,877
Uneven-Aged Timber Area	531
TOTAL ACRES IN THE ACTION AREA	480,398

Nesting Habitat within Critical Habitat

Currently, 273,178 acres of murrelet critical habitat on BLM-administered lands in the action area support nesting habitat and 154,331 of those acres support high-quality nesting habitat (Table 67).

Table 67. Land Use Allocations and current murrelet habitat conditions in murrelet critical habitat on BLM lands in the action area.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	811	123,908	124,719	409	29,203	29,612	1,220	153,111	154,331
Nesting ²	11,804	218,960	230,764	2,693	39,718	42,410	14,496	258,678	273,174
Recruitment ³	17,210	143,707	160,917	8,005	17,571	25,576	25,215	161,278	186,493
Non-Forest	7	17,595	17,602	-	3,101	3,101	7	20,696	20,703
Total ⁴	29,020	380,262	409,283	10,698	60,389	71,087	39,718	440,652	480,369

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.⁴ Total in Table B-1 = sum of nesting habitat, recruitment habitat, and non-forest.

Consulted on Effects within Critical habitat

Conservation Zone 3

Although no critical habitat baseline for PBFs was established within the 1,024,122 acres of critical habitat designated within this Conservation Zone, from October 1st, 2003, through April 14, 2015, 13 acres of suitable habitat and 208 acres of trees with a ½ site-potential tree height or greater within 0.5 mile of a potential nest trees have been consulted on for removal within Conservation Zone 3.

Conservation Zone 4

Although no critical habitat baseline for PBFs was established within the 1,055,788 acres of critical habitat designated within this conservation Zone, from October 1st, 2003, through April 14, 2015, 959 acres of suitable habitat and 241 acres of trees with a ½ site-potential tree height or greater within 0.5 mile of a potential nest trees have been consulted on for removal within Conservation Zone 4.

Critical Habitat Units on BLM Lands within the Action Area

The following are summary conditions of Critical Habitat Units (CHUs) within the action area, including one table for each CHU with the current conditions of BLM's lands within the CHUs.

CHU OR-01-b

Total CHU acres = 32,477 acres

BLM-administered lands within CHU = 1 acre (0 percent of CHU)⁸

- o BLM Harvest Land Base = < 1 acre (0 percent of CHU)

- o BLM Reserves = < 1 acre (0 percent of CHU)

Habitat-capable BLM-administered lands within CHU = < 1 acres (0 percent of CHU)

Other landowners within CHU = 32,476 acres (100 percent of CHU)

Table 68. Land Use Allocations and current murrelet habitat conditions within **CHU OR-01-b**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	-	-	-	-	-	-	-	-
Nesting ²	0	0	1	-	-	-	0	0	1
Recruitment ³	-	-	-	-	-	-	-	-	-
Non-Forest	-	-	-	-	-	-	-	-	-
Total	0	0	1	-	-	-	0	0	1

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁸ As critical habitat was only designated on state lands in the CHU (USFWS 1996, page 26295), the BLM lands in this CHU is a GIS projection error.

CHU OR-01-c

Total CHU acres = 33,535 acres

BLM-administered lands within CHU = 7,725 acres (23 percent of CHU)

o BLM Harvest Land Base = 2,030 acres (6 percent of CHU)

o BLM Reserves = 5,695 acres (17 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 7,207 acres (21 percent of CHU)

Other landowners within CHU = 25,810 acres (77 percent of CHU)

Table 69. Land Use Allocations and current murrelet habitat conditions within **CHU OR-01-c**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	102	1,024	1,126	-	-	-	102	1,024	1,126
Nesting ²	1,191	4,090	5,281	-	-	-	1,191	4,090	5,281
Recruitment ³	833	1,093	1,926	-	-	-	833	1,093	1,926
Non-Forest	7	512	519	-	-	-	7	512	519
Total	2,030	5,695	7,725	-	-	-	2,030	5,695	7,725

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

CHU OR-02-b

Total CHU acres = 32,496 acres

BLM-administered lands within CHU = 4 acres (0 percent of CHU)

o BLM Harvest Land Base = 1 acres (0 percent of CHU)

o BLM Reserves = 3 acres (0 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 4 acres (0 percent of CHU)

Other landowners within CHU = 32,492 acres (100 percent of CHU)

Table 70. Land Use Allocations and current murrelet habitat conditions within **CHU OR-02-b**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	0	0	-	-	-	-	0	0
Nesting ²	-	0	0	-	-	-	-	0	0
Recruitment ³	1	3	4	-	-	-	1	3	4
Non-Forest	-	0	0	-	-	-	-	0	0
Total	1	3	4	-	-	-	1	3	4

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

CHU OR-02-c

Total CHU acres = 31,484 acres

BLM-administered lands within CHU = 3,605 acres (11 percent of CHU)

o BLM Harvest Land Base = 306 acres (1 percent of CHU)

o BLM Reserves = 3,300 acres (10 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 3,490 acres (11 percent of CHU)

Other landowners within CHU = 27,879 acres (89 percent of CHU)

Table 71. Land Use Allocations and current murrelet habitat conditions within **CHU OR-02-c**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	1	458	459	-	-	-	1	458	459
Nesting ²	45	1,978	2,023	-	-	-	45	1,978	2,023
Recruitment ³	260	1,206	1,467	-	-	-	260	1,206	1,467
Non-Forest	-	115	115	-	-	-	-	115	115
Total⁴	306	3,300	3,605	-	-	-	306	3,300	3,605

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-02-d

Total CHU acres = 27,220 acres

BLM-administered lands within CHU = 26,557 acres (98 percent of CHU)

o BLM Harvest Land Base = 9,370 acres (34 percent of CHU)

o BLM Reserves = 17,188 acres (63 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 25,342 acres (93 percent of CHU)

Other landowners within CHU = 443 acres (2 percent of CHU)

Table 72. Land Use Allocations and current murrelet habitat conditions within **CHU OR-02-d**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	69	2,900	2,969	-	-	-	69	2,900	2,969
Nesting ²	4,645	8,463	13,108	-	-	-	4,645	8,463	13,108
Recruitment ³	5,303	6,931	12,234	-	-	-	5,303	6,931	12,234
Non-Forest	-	1,216	1,216	-	-	-	-	1,216	1,216
Total ⁴	9,948	16,610	26,557	-	-	-	9,948	16,610	26,557

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-02-e

Total CHU acres = 89,747 acres

BLM-administered lands within CHU = 41,185 acres (46 percent of CHU)

o BLM Harvest Land Base = 772 acres (1 percent of CHU)

o BLM Reserves = 40,413 acres (45 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 38,585 acres (43 percent of CHU)

Other landowners within CHU = 48,562 acres (54 percent of CHU)

Table 73. Land Use Allocations and current murrelet habitat conditions within **CHU OR-02-e**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	80	8,203	8,284	-	-	-	80	8,203	8,284
Nesting ²	520	20,199	20,719	-	-	-	520	20,199	20,719
Recruitment ³	252	17,613	17,866	-	-	-	252	17,613	17,866
Non-Forest	-	2,600	2,600	-	-	-	-	2,600	2,600
Total⁴	772	40,413	41,185	-	-	-	772	40,413	41,185

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-03-a

Total CHU acres = 1,469 acres

BLM-administered lands within CHU = 38 acres (3 percent of CHU)

o BLM Harvest Land Base = 0 acres (0 percent of CHU)

o BLM Reserves = 38 acres (3 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 37 acres (3 percent of CHU)

Other landowners within CHU = 1,431 acres (97 percent of CHU)

Table 74. Land Use Allocations and current murrelet habitat conditions within **CHU OR-03-a**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	22	22	-	-	-	-	22	22
Nesting ²	0	37	37	-	-	-	0	37	37
Recruitment ³	-	-	-	-	-	-	-	-	-
Non-Forest	-	1	1	-	-	-	-	1	1
Total ⁴	0	38	38	-	-	-	0	38	38

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-03-c

Total CHU acres = 20,569 acres

BLM-administered lands within CHU = 8,747 acres (43 percent of CHU)

o BLM Harvest Land Base = 2,648 acres (13 percent of CHU)

o BLM Reserves = 6,099 acres (30 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 8,404 acres (41 percent of CHU)

Other landowners within CHU = 11,822 acres (57 percent of CHU)

Table 75. Land Use Allocations and current murrelet habitat conditions within **CHU OR-03-c**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	27	2,194	2,221	-	75	75	27	2,269	2,296
Nesting ²	734	3,767	4,501	-	75	75	734	3,842	4,576
Recruitment ³	1,898	1,898	3,796	16	17	32	1,913	1,914	3,828
Non-Forest	-	339	339	-	4	4	-	343	343
Total⁴	2,632	6,003	8,636	16	96	111	2,648	6,099	8,747

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-a

Total CHU acres = 92,227 acres

BLM-administered lands within CHU = 1,303 acres (1 percent of CHU)

o BLM Harvest Land Base = 40 acres (0 percent of CHU)

o BLM Reserves = 1,263 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,265 acres (1 percent of CHU)

Other landowners within CHU = 90,924 acres (99 percent of CHU)

Table 76. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-a**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	0	501	501	-	-	-	0	501	501
Nesting ²	0	769	769	-	-	-	0	769	769
Recruitment ³	39	457	496	-	-	-	39	457	496
Non-Forest	-	38	38	-	-	-	-	38	38
Total⁴	40	1,263	1,303	-	-	-	40	1,263	1,303

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-b

Total CHU acres = 149,771 acres

BLM-administered lands within CHU = 1,118 acres (1 percent of CHU)

o BLM Harvest Land Base = 5 acres (0 percent of CHU)

o BLM Reserves = 1,113 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,117 acres (1 percent of CHU)

Other landowners within CHU = 148,653 acres (99 percent of CHU)

Table 77. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-b**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	872	872	-	-	-	-	872	872
Nesting ²	5	1,005	1,009	-	-	-	5	1,005	1,009
Recruitment ³	-	108	108	-	-	-	-	108	108
Non-Forest	-	0	0	-	-	-	-	0	0
Total⁴	5	1,113	1,118	-	-	-	5	1,113	1,118

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-c

Total CHU acres = 82,252 acres

BLM-administered lands within CHU = 14,478 acres (18 percent of CHU)

o BLM Harvest Land Base = 0 acres (0 percent of CHU)

o BLM Reserves = 14,477 acres (18 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 13,914 acres (17 percent of CHU)

Other landowners within CHU = 67,774 acres (82 percent of CHU)

Table 78. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-c**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	6,925	6,925	-	-	-	-	6,925	6,925
Nesting ²	-	8,291	8,291	-	-	-	-	8,291	8,291
Recruitment ³	0	5,623	5,623	-	-	-	0	5,623	5,623
Non-Forest	-	563	563	-	-	-	-	563	563
Total⁴	0	14,477	14,478	-	-	-	0	14,477	14,478

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-d

Total CHU acres = 47,091 acres

BLM-administered lands within CHU = 21,070 acres (45 percent of CHU)

o BLM Harvest Land Base = 1 acre (0 percent of CHU)

o BLM Reserves = 21,069 acres (45 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 19,995 acres (42 percent of CHU)

Other landowners within CHU = 26,021 acres (55 percent of CHU)

Table 79. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-d**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	7,403	7,403	-	-	-	-	7,403	7,403
Nesting ²	-	12,349	12,349	-	-	-	-	12,349	12,349
Recruitment ³	1	7,646	7,646	-	-	-	1	7,646	7,646
Non-Forest	-	1,075	1,075	-	-	-	-	1,075	1,075
Total⁴	1	21,069	21,070	-	-	-	1	21,069	21,070

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-e

Total CHU acres = 53,809 acres

BLM-administered lands within CHU = 53,183 acres (99 percent of CHU)

o BLM Harvest Land Base = 1,735 acres (3 percent of CHU)

o BLM Reserves = 51,448 acres (96 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 50,978 acres (95 percent of CHU)

Other landowners within CHU = 626 acres (1 percent of CHU)

Table 80. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-e**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	61	20,278	20,339	5	4,572	4,577	66	24,850	24,916
Nesting ²	186	24,743	24,928	41	4,821	4,862	227	29,564	29,791
Recruitment ³	1,372	16,633	18,005	136	3,046	3,182	1,508	19,679	21,187
Non-Forest	-	1,932	1,932	-	273	273	-	2,205	2,205
Total ⁴	1,558	43,308	44,866	177	8,141	8,317	1,735	51,448	53,183

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-f

Total CHU acres = 21,129 acres

BLM-administered lands within CHU = 20,743 acres (98 percent of CHU)

o BLM Harvest Land Base = 5,532 acres (26 percent of CHU)

o BLM Reserves = 15,211 acres (72 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 20,030 acres (95 percent of CHU)

Other landowners within CHU = 391 acres (2 percent of CHU)

Table 81. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-f**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	-	-	326	8,234	8,560	326	8,234	8,560
Nesting ²	-		-	1,586	11,605	13,191	1,586	11,605	13,191
Recruitment ³			-	3,945	2,894	6,839	3,945	2,894	6,839
Non-Forest	-	-	-	-	712	712	-	712	712
Total ⁴	-	-	-	5,532	15,211	20,743	5,532	15,211	20,743

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-g

Total CHU acres = 16,547 acres

BLM-administered lands within CHU = 16,227 acres (98 percent of CHU)

o BLM Harvest Land Base = 1,004 acres (6 percent of CHU)

o BLM Reserves = 15,223 acres (92 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 15,333 acres (93 percent of CHU)

Other landowners within CHU = 320 acres (2 percent of CHU)

Table 82. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-g**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	36	5,086	5,122	2	1,549	1,551	38	6,635	6,673
Nesting ²	87	5,865	5,952	2	1,610	1,612	89	7,475	7,564
Recruitment ³	139	5,998	6,137	776	856	1,632	915	6,854	7,769
Non-Forest	-	774	774	-	120	120	-	894	894
Total⁴	226	12,637	12,863	778	2,586	3,364	1,004	15,223	16,227

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-i

Total CHU acres = 83,996 acres

BLM-administered lands within CHU = 82,458 acres (98 percent of CHU)

o BLM Harvest Land Base = 3,486 acres (4 percent of CHU)

o BLM Reserves = 78,972 acres (94 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 79,763 acres (95 percent of CHU)

Other landowners within CHU = 1,538 acres (2 percent of CHU)

Table 83. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-i**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	33	15,155	15,188	3	10,997	11,000	36	26,152	26,188
Nesting ²	1,195	29,359	30,554	499	16,377	16,876	1,694	45,736	47,430
Recruitment ³	988	22,169	23,157	804	8,372	9,175	1,792	30,541	32,333
Non-Forest	-	1,798	1,798	-	897	897	-	2,695	2,695
Total⁴	2,183	53,326	55,509	1,302	25,646	26,948	3,486	78,972	82,458

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-j

Total CHU acres = 67,858 acres

BLM-administered lands within CHU = 58,203 acres (86 percent of CHU)

o BLM Harvest Land Base = 4,835 acres (7 percent of CHU)

o BLM Reserves = 53,368 acres (79 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 56,226 acres (83 percent of CHU)

Other landowners within CHU = 9,655 acres (14 percent of CHU)

Table 84. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-j**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	98	14,798	14,896	59	153	212	158	14,950	15,108
Nesting ²	1,568	31,330	32,898	139	164	303	1,707	31,494	33,201
Recruitment ³	2,903	19,858	22,760	224	40	264	3,127	19,897	23,025
Non-Forest	-	1,957	1,957	-	19	19	-	1,977	1,977
Total⁴	4,471	53,145	57,616	363	223	586	4,835	53,368	58,203

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-04-k

Total CHU acres = 43,287 acres

BLM-administered lands within CHU = 26,665 acres (62 percent of CHU)

o BLM Harvest Land Base = 1,155 acres (3 percent of CHU)

o BLM Reserves = 25,510 acres (59 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 25,609 acres (59 percent of CHU)

Other landowners within CHU = 16,622 acres (38 percent of CHU)

Table 85. Land Use Allocations and current murrelet habitat conditions within **CHU OR-04-k**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	57	5,865	5,923	-	-	-	57	5,865	5,923
Nesting ²	210	16,212	16,423	-	-	-	210	16,212	16,423
Recruitment ³	944	8,242	9,186	-	-	-	944	8,242	9,186
Non-Forest	-	1,056	1,056	-	-	-	-	1,056	1,056
Total⁴	1,155	25,510	26,665	-	-	-	1,155	25,510	26,665

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-06-a

Total CHU acres = 39 acres

BLM-administered lands within CHU = 39 acres (100 percent of CHU)

o BLM Harvest Land Base = 0 acres (0 percent of CHU)

o BLM Reserves = 39 acres (100 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 38 acres (97 percent of CHU)

Other landowners within CHU = 0 acres (0 percent of CHU)

Table 86. Land Use Allocations and current murrelet habitat conditions within **CHU OR-06-a**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	1	1	-	-	-	-	1	1
Nesting ²	-	26	26	-	-	-	-	26	26
Recruitment ³	0	12	12	-	-	-	0	12	12
Non-Forest	-	1	1	-	-	-	-	1	1
Total ⁴	0	39	39	-	-	-	0	39	39

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-06-b

Total CHU acres = 52,851 acres

BLM-administered lands within CHU = 52,314 acres (99 percent of CHU)

o BLM Harvest Land Base = 71 acres (0 percent of CHU)

o BLM Reserves = 52,243 acres (99 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 49,763 acres (94 percent of CHU)

Other landowners within CHU = 537 acres (1 percent of CHU)

Table 87. Land Use Allocations and current murrelet habitat conditions within **CHU OR-06-b**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	21,374	21,374	-	-	-	-	21,374	21,374
Nesting ²	2	31,016	31,017	-	-	-	2	31,016	31,017
Recruitment ³	69	18,677	18,746	-	-	-	69	18,677	18,746
Non-Forest	-	2,551	2,551	-	-	-	-	2,551	2,551
Total ⁴	71	52,243	52,314	-	-	-	71	52,243	52,314

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-06-c

Total CHU acres = 4,762 acres

BLM-administered lands within CHU = 4,717 acres (99 percent of CHU)

o BLM Harvest Land Base = 742 acres (16 percent of CHU)

o BLM Reserves = 3,975 acres (83 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 4,590 acres (96 percent of CHU)

Other landowners within CHU = 45 acres (1 percent of CHU)

Table 88. Land Use Allocations and current murrelet habitat conditions within **CHU OR-06-c**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	-	826	826	-	-	-	-	826	826
Nesting ²	217	3,409	3,626	-	-	-	217	3,409	3,626
Recruitment ³	525	439	964	-	-	-	525	439	964
Non-Forest	-	127	127	-	-	-	-	127	127
Total⁴	742	3,975	4,717	-	-	-	742	3,975	4,717

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-06-d

Total CHU acres = 17,721 acres

BLM-administered lands within CHU = 17,430 acres (98 percent of CHU)

o BLM Harvest Land Base = 3,576 acres (20 percent of CHU)

o BLM Reserves = 13,853 acres (78 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 16,050 acres (91 percent of CHU)

Other landowners within CHU = 304 acres (2 percent of CHU)

Table 89. Land Use Allocations and current murrelet habitat conditions within **CHU OR-06-d**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	2	2,948	2,949	10	3,142	3,152	12	6,089	6,101
Nesting ²	128	3,833	3,961	422	4,519	4,942	550	8,352	8,902
Recruitment ³	922	2,103	3,025	2,104	2,018	4,123	3,026	4,121	7,147
Non-Forest	-	332	332	-	1,048	1,048	-	1,380	1,380
Total⁴	1,050	6,268	7,318	2,527	7,585	10,112	3,576	13,853	17,430

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-07-a

Total CHU acres = 148,081 acres

BLM-administered lands within CHU = 2,401 acres (2 percent of CHU)

o BLM Harvest Land Base = 477 acres (0 percent of CHU)

o BLM Reserves = 1,924 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,355 acres (2 percent of CHU)

Other landowners within CHU = 145,680 acres (98 percent of CHU)

Table 90. Land Use Allocations and current murrelet habitat conditions within **CHU OR-07-a**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	56	1,264	1,320	-	-	-	56	1,264	1,320
Nesting ²	156	1,564	1,719	-	-	-	156	1,564	1,719
Recruitment ³	321	315	636	-	-	-	321	315	636
Non-Forest	-	45	45	-	-	-	-	45	45
Total⁴	477	1,924	2,401	-	-	-	477	1,924	2,401

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-07-b

Total CHU acres = 46,291 acres

BLM-administered lands within CHU = 2,208 acres (5 percent of CHU)

o BLM Harvest Land Base = 203 acres (0 percent of CHU)

o BLM Reserves = 2,004 acres (4 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,180 acres (5 percent of CHU)

Other landowners within CHU = 44,083 acres (95 percent of CHU)

Table 91. Land Use Allocations and current murrelet habitat conditions within **CHU OR-07-b**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	1	474	475	-	-	-	1	474	475
Nesting ²	138	1,485	1,623	-	-	-	138	1,485	1,623
Recruitment ³	65	492	557	-	-	-	65	492	557
Non-Forest	-	27	27	-	-	-	-	27	27
Total⁴	203	2,004	2,208	-	-	-	203	2,004	2,208

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-07-d

Total CHU acres = 86,790 acres

BLM-administered lands within CHU = 1,865 acres (2 percent of CHU)

o BLM Harvest Land Base = 747 acres (1 percent of CHU)

o BLM Reserves = 1,118 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,826 acres (2 percent of CHU)

Other landowners within CHU = 84,925 acres (98 percent of CHU)

Table 92. Land Use Allocations and current murrelet habitat conditions within **CHU OR-07-d**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	11	64	75	-	-	-	11	64	75
Nesting ²	533	520	1,052	-	-	-	533	520	1,052
Recruitment ³	214	559	774	-	-	-	214	559	774
Non-Forest	-	38	38	-	-	-	-	38	38
Total⁴	747	1,118	1,865	-	-	-	747	1,118	1,865

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-07-f

Total CHU acres = 49,126 acres

BLM-administered lands within CHU = 13,879 acres (13 percent of CHU)

o BLM Harvest Land Base = 1 acres (0 percent of CHU)

o BLM Reserves = 13,878 acres (13 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 13,499 acres (27 percent of CHU)

Other landowners within CHU = 35,247 acres (72 percent of CHU)

Table 93. Land Use Allocations and current murrelet habitat conditions within **CHU OR-07-f**.

Habitat Type	inland zone 1 (acres)			inland zone 2 (acres)			Total (acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	0	4,686	4,687	-	246	246	0	4,932	4,932
Nesting ²	1	7,648	7,649	-	274	274	1	7,922	7,922
Recruitment ³	0	5,305	5,305	-	272	272	0	5,577	5,577
Non-Forest	-	379	379	-	-	-	-	379	379
Total⁴	1	13,332	13,333	-	546	546	1	13,878	13,879

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHU OR-07-g

Total CHU acres = 2,286 acres

BLM-administered lands within CHU = 2,210 acres (97 percent of CHU)

o BLM Harvest Land Base = 405 acres (18 percent of CHU)

o BLM Reserves = 1,805 acres (79 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,064 acres (90 percent of CHU)

Other landowners within CHU = 76 acres (3 percent of CHU)

Table 94. Land Use Allocations and current murrelet habitat conditions within **CHU OR-07-g**.

Habitat Type	inland zone 1			inland zone 2			Total		
	(acres)			(acres)			(acres)		
	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal	HLB	Reserve	Subtotal
High-Quality Nesting ¹	176	588	764	4	237	240	179	825	1,004
Nesting ²	242	1,003	1,246	4	271	275	246	1,275	1,521
Recruitment ³	159	328	487	-	56	56	159	384	543
Non-Forest	-	118	118	-	27	27	-	146	146
Total ⁴	401	1,450	1,851	4	355	359	405	1,805	2,210

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

⁴ Total = sum of nesting habitat, recruitment habitat, and non-forest.

CHUs only on Non-federal Lands within the Action Area

The following are summary conditions of CHUs that occur only on non-federal lands within the action area. Both of these CHUs were only designated on State lands.

CHU OR-02-a

This CHU contains 3,534 acres, of which 14 acres are high-quality habitat (Glenn 2016c, pers. comm.).

CHU OR-03-b

This CHU contains 14,847 acres, of which 214 acres are high-quality habitat (Glenn 2016c, pers. comm.).

EFFECTS OF THE ACTION ON MARBLED MURRELETS

The following effects section tracks a deconstruction of the proposed action that is derived from the BA as follows: Overarching protection; Timber Harvest –BLM lands; Timber Harvest – Coquille lands; Non-timber Actions; and Indirect actions – State, County and Private Lands. These sections relating to impacts to individual murrelets are followed by a consistency review with the murrelet recovery plan and a population impact analysis.

Tables and Figures are from the BA with modifications or generated by the Service (BLM 2016, pp. 68-85, Appendix B and E). Tables and Figures that are from a different source are cited as such.

Effects to Individual Murrelets

Overall, the PRMP will provide for the survival and recovery of the murrelet. Compared to the NWFP, the PRMP within the murrelet range will include an immediate net gain of 79,500 acres to the reserve system including an immediate net gain of 48,182 acres of murrelet nesting habitat, of which 24,234 acres are high-quality murrelet nesting habitat now added to the PRMP reserve system. The PRMP includes all currently known occupied murrelet sites within the Late-successional Reserves. Future sites discovered outside of LSRs in inland zone 1 and future sites discovered within Riparian Reserves within inland zone 2 will have the LUAs updated to LSR to protect the occupied stand. The PRMP will significantly minimize habitat modification by applying protective measures to activities in all LUAs in inland zone 1 and to activities in the late-successional and riparian LUAs in inland zone 2. The PRMP will significantly minimize nest disturbance by applying protective measures to activities in all LUAs in inland zone 1 and to activities in the reserve LUAs in inland zone 2 to allow for undisrupted murrelet nesting. Although future implementation activities will impact murrelet nest sites in zone 2 (35-50 miles from the coast) within the harvest land base and the district designated reserve LUAs (all of which will be subject to their own, future consultation), the overall protections and management of murrelet habitat and sites in the PRMP are expected to result in an increase in the murrelet population within BLM lands and within the action area. The Service concludes the PRMP is consistent with the conservation of the murrelet for the following reasons:

- The PRMP will improve the amount, quality and distribution of murrelet nesting habitat over the 50 year life of the PRMP.
- The PRMP will potentially increase the murrelet population every decade with a 52 percent increase in the population over 50 years.
- Activities in inland zone 1 will have protective measures to retain murrelet occupancy and allow for undisrupted nesting. The majority of known sites and 75 percent projected murrelet sites on BLM lands in the action area occur in inland zone 1. All Coquille Tribe lands occur in inland zone 1.
- Activities in inland zone 2 within the late-successional and riparian reserves systems will have protective measures to retain murrelet occupancy and allow for undisrupted nesting. Because the majority of high-quality nesting habitat has been placed in the reserve systems, the majority of occupied sites in inland zone 2 are expected to be protected (84 percent of the nesting habitat on BLM lands in inland zone 2 which means

an additional 21 percent of nesting habitat on BLM lands in the action area will be protected).

- Total area associated with protective measures to retain murrelet occupancy and allow for undisturbed nesting is 96 percent of the projected sites on BLM lands in the action area.
- Of the remaining 4 percent of BLM land in the action area not associated with full protective measures, activities occurring in the 25 percent of those lands associated with the reserved lands outside of LSR and Riparian Reserve will have protective measures to provide undisturbed nesting.
- The PRMP provides for ingrowth to meaningfully increase the number of occupied sites.
- The largest increases in occupied sites are expected to occur in late-successional and riparian reserves. Therefore, the percent of occupied sites that will have protective measures will also increase over time.

Overarching protection

Under the PRMP, the Wildlife Resource Program's Management Direction for murrelets provides protection for murrelets. The extent to which the protective measures are applied within the action area is directed by the LUAs and distance from the ocean (inland zone 1 or 2).

Habitat protections

The BLM Wildlife management direction for murrelets states (BLM 2016a, A-57-A-58):

“Before modifying nesting habitat or removing nesting structure in (1) all LUAs within 35 miles of the Pacific Coast, and (2) Late-Successional Reserve and Riparian Reserve between 35– 50 miles from the Pacific Coast and outside of exclusion Areas C and D (shown in Figure III 9),—

- *Assess the analysis area for marbled murrelet nesting structure.²⁰ The analysis area consists of the proposed project and lands within 726 feet of the project boundary. This area includes all habitat that would be examined by a 5-acre moving circle (526 feet in diameter) whose inner edge (i.e., the edge closest to the center of the project area) is within 200 feet of the project area boundary. The analysis area includes all nesting structures that could be affected by habitat modification.*
- *If the analysis area contains no nesting structure, no further consideration of marbled murrelet habitat is required.*
- *Before modifying forest stands in any 5-acre portion of the analysis area that contains at least 6 trees with nesting structure, implement Option 1, 2, or 3.*
- *Before modifying forest stands in any 5-acre portion of the analysis area that contain 1–5 trees with nesting structure, implement Options 1, 2, 3, or 4.*

²⁰*Marbled murrelet nesting structure is a conifer tree with all of the following characteristics (which are not always visible from the ground):*

- *A DBH of at least 19.1” and a height greater than 107’.*
- *A nest platform at least 32.5’ above the ground. A nest platform is a relatively flat surface at least 4” wide, with nesting substrate (e.g., moss, epiphytes, duff), and an access route through the canopy that a murrelet could use to approach and land on that platform.*
- *A tree branch or foliage, either on the tree with potential structure or on an adjacent tree, which provides protective cover over the platform.*

Note: Nesting structure does not have to be occupied by nesting marbled murrelets.”

BLM protection measures apply for occupied stands (including stands with an unknown occupancy status) in all LUAs in inland zone 1 and Late-successional and Riparian reserves in inland zone 2 (Table 95).

To determine if protective measures apply, BLM will conduct an analysis of all activities that modify nesting habitat or remove nesting structure. Modify nesting habitat includes affecting adjacent stands that would modify the nesting structures wind firmness, microclimate and/or predation risks. In addition to identifying nesting structure outside the treatment unit that may be affected by the treatment, this analysis will also be used to determine which of four protective measures apply. Although impacts from treating adjacent stands without nesting structure (referred to as buffer habitat) is expected within 300 to 600 feet from nesting structure, the analysis of habitat goes out 726 feet from the treatment boundary to properly identify low density nesting structure in younger stands, as option 4 can only be selected as an option in these situations.

Table 95. Summary of where protection measures apply for occupied stands and unsurveyed stands.

Land Use Allocation	Habitat modification from any activities within 35 miles from the coast	Habitat modification from any activities 35 -50 miles from the coast and in the range of the murrelets (range line is adjusted inland in the southern portion of the range, see Figure 12)
Late-Successional Reserve	Protection measures apply	Protection measures apply
Riparian Reserve	Protection measures apply	Protection measures apply
District-Designated Reserve	Protection measures apply	Protection measures do not apply

Land Use Allocation	Habitat modification from any activities within 35 miles from the coast	Habitat modification from any activities 35 -50 miles from the coast and in the range of the murrelets (range line is adjusted inland in the southern portion of the range, see Figure 12)
Congressional ly Reserved Lands and the National Landscape Conservation System	Protection measures apply	Protection measures do not apply
Harvest Land Base	Protection measures apply	Protection measures do not apply

Option 1

Specifically the BLM Wildlife management direction for murrelets states (BLM 2016a, A-58):

“Option 1. *Survey for the marbled murrelet using a protocol with a defined methodology and a resultant probability of detection.*

- *If no occupancy is determined, no further consideration of marbled murrelet habitat is required.*
- *If occupancy is determined, do not conduct activities within the **occupied stand**²¹ and all forest within 300 feet of the occupied stand.*
- *The following are exceptions that may be implemented as long as the stand continues to support nesting:*
 - o *Felling of hazard trees and trees for instream restoration projects.*
 - o *Construction of linear and nonlinear rights-of-way, spur roads, yarding corridors, or other facilities.*
- *As needed to protect the overall health of the **occupied stand**, the following activities would be implemented as long as the stand continues to support nesting:*
 - o *Wildfire suppression.*
 - o *Fuels reduction.*
 - o *Insect and disease control.*
 - o *Other activities to improve the health of the stand or adjacent stands.*

²¹ *Marbled murrelet occupied stand refers to all forest stands, regardless of age or structure, within ¼ mile (1,320 feet) of the location of marbled murrelet behavior indicating occupancy and not separated from the location of marbled murrelet behavior indicating occupancy by more than 328 feet of non-forest.”*

This option ensures that timber harvest will not remove occupied habitat. If occupancy is detected a 125.66 acre circle of protection is applied (extant maybe limited if a 328 feet or greater break of non-forest occurs in the circle of protection). In addition, another 63.6 acres of buffer is applied based on an additional 300 foot buffer (this calculation is based on the occupied stand being a ¼ mile circle).

The exempted activities and activities to improve the occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) will only occur if the stand continues to support nesting. This means there may be some adverse effects to murrelets from a localized loss of nesting function, but the effect will not impact the ability of the stand to provide nesting structure or the stand's ability to provide support for the nesting structure at the stand scale.

Option 2

Specifically the BLM Wildlife management direction for murrelets states (BLM 2016a, A-58-A-59):

“Option 2. *Exclude nesting structure from the project area by doing all of the following:*

- *Do not remove or damage nesting structure. This includes trees with nesting structure and adjacent trees with branches that interlock the branches of any tree with nesting structure.*
- *Do not conduct timber harvest and associated ground disturbing activities during the murrelet nesting period (April 1 – September 15) unless the U.S. Fish and Wildlife Service concurs that disturbances would not adversely affect nesting marbled murrelets.*
- *Maintain a 150-foot un-thinned buffer around all trees with nesting structure. Within this buffer, do not remove trees for any reason associated with timber harvest, including the placement of roads, landings, or yarding corridors. Other activities are permitted if the U.S. Fish and Wildlife Service concurs that such activities would not adversely affect nesting marbled murrelet.*
- *Maintain an average canopy cover of at least 60 percent post-project (averaged over each 40-acre area) in the zone between 150 feet and 300 feet of all trees with nesting structure.*
- *Include additional, site-specific prescriptive measures to maintain or enhance habitat conditions, as needed, in the zone between 150 feet and 300 feet from all trees with nesting structure. In this context, **maintain marbled murrelet habitat** means to maintain stand structural characteristics such that, following habitat modification, the stand could support marbled murrelet nesting.*
- *Maintain an average canopy cover of at least 40 percent post-project (averaged over each 40-acre area) within the project area beyond 300 feet from all trees with nesting structure.”*

This option ensures that timber harvest that occurs next to stands of an unknown occupancy status will still provide protection for nesting murrelets. This option is not allowed within the

designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

Option 3

Specifically the BLM Wildlife management direction for murrelets states (BLM 2016a, A-59):

“Option 3. With concurrence from the U.S. Fish and Wildlife Service, manage nesting structure in a manner that would not adversely affect nesting marbled murrelets, except when taking actions that are necessary to treat or protect stands from sudden oak death. Take actions necessary to treat or protect stands from sudden oak death, including actions that may adversely affect nesting marbled murrelets.”

This option allows for adaptive management in stands associated with stands of an unknown occupancy status, while still provide for nesting murrelets. This option is not allowed within the designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

This option also allows for the treatment of sudden oak death, regardless of occupancy status. Treatment of sudden oak death may have some impacts to murrelets from reducing the canopy cover supporting a nest tree. Treatment for sudden oak death includes removing infected deciduous trees. The reduction of canopy cover/fragmentation of the stand may cause: 1) nest trees to blow down; 2) change the microclimate causing potential loss of moss cover at nest sites; which could eliminate the function of the platform for nesting; or 3) increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young.

Currently BLM’s treatment for sudden oak death is a yearly process and the amount of treatment needed has significantly reduced since the time sudden oak death was first identified on BLM lands (Donegan 2016, pers. comm.).

In the BA the BLM was not able to provide any precise estimates of treatments for sudden oak death treatments that may occur over the next 50 years as part of the PRMP; such activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential activities until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Option 4

Specifically the BLM Wildlife management direction for murrelets states (BLM 2016a, A-59):

“Option 4. Protect nesting structure within the project area by doing all of the following:

- *If the nesting structure is within 20 miles of the coast—
 - o Between April 1 and August 5, stand modification would not occur;*

- o Between August 6 and September 15, stand modification activities would not begin until 2 hours after sunrise and would conclude 2 hours before sunset.*
- *Design projects in accordance with Late-Successional Reserve management direction.*
- *Do not remove or damage nesting structure.*
- *Design habitat modifications that occur within one site-potential tree height of nesting structure to protect and improve future habitat conditions. Examples include—*
 - o Protecting the roots of trees with nesting structure;*
 - o Removing suppressed trees;*
 - o Removing trees that might damage nesting structure during wind storms;*
 - o Removing trees that compete with key adjacent trees that are, or will be, providing cover to potential nest platforms.*
- *Implement management actions that aid development of limbs and adjacent cover.*
- *Prohibit the creation of any opening (i.e., a gap ≥ 0.25 acre in size) within a distance equal to one site-potential tree height of nesting structure.”*

This option can only be used when the nesting structure is occurring at a low density in the analysis area. This option allows for silviculture treatments that promote late-successional conditions, when the prescription is designed to protect the low density nesting structure in or adjacent to the treated unit. This option is designed to protect remnant trees within young plantation stands. Over time, the plantation stand's live crown gains height and shades out killing the lower live limbs on the remnant structure, eventually leaving the potential nest platforms below the live crown of the stand. Murrelets are prone to nest predation and appear to seek out the live crown to help conceal their nests (Nelson 1997, p. 16; Nelson and Wilson 2002, pp. 24, 98 and 99). Platforms below the live crown no longer provide nesting structure for murrelets. Therefore, this option is helping to provide future habitat in younger stands, and it is helping to retain the nesting structure this is already present in the stand.

This option is not allowed within the designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

Disruption Protections

Specifically the BLM Wildlife management direction for murrelets states (2016a, p. A 57, updated by Hardt 2016, pers. comm.):

*“Except as stated under Option 3, below, and except when needed to protect human safety and property, prohibit activities that **disrupt**¹⁹ marbled murrelet nesting at occupied sites when conducting activities within all land use allocations within 35 miles of the Pacific Coast and when conducting activities within reserved land use allocations between 35-50 miles of the Pacific Coast.*

¹⁹**Disruption** is a type of **disturbance** that creates the likelihood of injury to listed species to such an extent as to significantly **disrupt** normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (see 50 § CFR 17.3). An action that would **disrupt** the normal behavior of a listed species may affect, and would be likely to adversely affect, the species and would cause the taking of affected individual(s). In contrast, **disturbance**

*is a human action that may affect a federally-listed animal species by the addition, above ambient condition, of noise or human intrusion, or the mechanical movement of habitat (e.g., the shaking of the forest canopy from helicopter rotor wash). **Disturbance** is temporary/short term (minutes to days) and does not modify habitat structure, or water/air flow or quality. (**Disturbance** should not be confused with “surface disturbance,” which refers to an action that modifies soil, water or vegetation). **Disturbance** requires the presence of a listed animal. Disruption is a subset of disturbance.”*

To further clarify the difference between disruption and disturbance we offer the following explanation:

Disturbance is when an action is expected to cause any change in the behavior of nesting murrelets.

Disruption is a disturbance where the change in behavior of nesting murrelets is to an extent that is likely to cause injury to the murrelet egg or young.

Option 3 (BLM 2016a, p. A 59):

“Option 3. *With concurrence from the U.S. Fish and Wildlife Service, manage nesting structure in a manner that would not adversely affect nesting marbled murrelets, except when taking actions that are necessary to treat or protect stands from sudden oak death. Take actions necessary to treat or protect stands from sudden oak death, including actions that may adversely affect nesting marbled murrelets.”*

This protective measure applies to activities in all LUAs, except when activities occur within the Harvest Land Base within inland zone 2 (Table 96). The BLM does not provide direction for requirements for surveys before disruption activities occur within or adjacent to stands with unknown occupancy status. If the occupancy status of a site is unknown, the status needs to be confirmed unoccupied through surveys or the activity needs to occur outside the disruption distances. Therefore, avoiding disruption to any occupied stand, whether known or unsurveyed, is required when conducting activities within all land use allocations within 35 miles of the Pacific Coast and when conducting activities within reserved land use allocations between 35-50 miles of the Pacific Coast.

In the BA the BLM was not able to provide any precise estimates of disruption events that may occur over the next 50 years as part of the PRMP. However, timber activities in the Harvest Land Base in inland zone 2 were forecasted and an unknown quantity of these timber sales will cause disruption. Such activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential activities until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when these projects are proposed the BLM will complete project-specific and site-specific NEPA and section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Table 96. Summary of where protection measures apply for disruption of occupied (including unsurveyed) stands.

Land Use Allocation activity is occur within	Disruption from proposed management direction	Disruption from proposed management direction
	Within 35 miles from the coast	35-50 miles from the coast
Late-Successional Reserves	Protection measures apply	Protection measures apply
Riparian Reserves	Protection measures apply	Protection measures apply
District-Designated Reserves	Protection measures apply	Protection measures apply
Congressionally Reserved Lands and the National Landscape Conservation System	Protection measures apply	Not applicable as this LUA does not occur in this inland zone.
Harvest Land Base	Protection measures apply	Protection measures do not apply

Timber Harvest – BLM lands

BLM predicted the potential timber harvest over time, based on LUAs and treatment types (Table 97). Of these acres, up to 104,332 acres over 50 years will potentially involve murrelet habitat (Table 98). Based on the Wildlife Resource Program's Management Direction for murrelets, timber harvest will not negatively impact murrelets in any LUAs within 35 miles of the Pacific Coast, or in Late-Successional Reserves and Riparian Reserves between 35– 50 miles from the Pacific Coast outside of exclusion Areas C and D. No timber harvest is planned in District Designated Reserves or in Congressionally Reserved Lands and the National Landscape Conservation System (Table 97 and McGraw 2016a, pers. comm.). Therefore, impacts from timber harvest to individual murrelets are only expected in the harvest land base LUA when occurring within inland zone 2 (Table 99). The remaining acres will be subject to protection of occupied habitat under the Wildlife Resource Program's Management Direction for murrelets and will only be harvested if no adverse effects are anticipated to occupied murrelet habitat either within or adjacent to the harvest unit except when taking actions that are necessary to treat or protect stands from sudden oak death (Table 100).

BLM then applied the detection rates to the acreage in Table 98 to estimate that 39 occupied sites in inland zone 2 may be lost due to harvest over the next 50 years due to the proposed action (Table 101).

In addition to the potential impact to murrelets through the loss or modification of habitat from harvest units, impacts associated with timber sales may also include spur roads, landings and yarding corridors.

These impacts may kill eggs or young or increase the risk for injury to eggs or young. This situation would occur if an active nest is removed or impacted to an extent that causes a chick or egg to fall from the nest tree. If an active nest was within or adjacent to a project area, activities might increase the risk of injury to eggs or young due to disruption. Excessive noise might cause flushing of the adult from the egg further increasing its risk of predation or delay the adults coming in to feed a chick, which could reduce the chick's fitness. Human presence can increase the risk of predation. Modifying adjacent trees to murrelets nesting can increase fragmentation. Fragmentation may cause nest trees to blow down, change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting and increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young. In all cases, we expect the adults to be able to move away from activities without injuring themselves. If an active nest site is lost and no habitat remains locally, a murrelet pair may take an extended period to locate an adequate nesting site. Although there are many different ways breeding murrelets may be affected from activities, the primary impact to the population is the loss of new individuals entering the population.

In the BA the BLM was not able to provide precise locations for potential timber harvest or estimates of potential yarding corridors, landings or spur roads that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed over the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. When these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

Table 97. Estimated acres of timber harvest, based on BLM Woodstock modeling (McGraw 2016b, pers. comm.), by LUA and decade, under the PRMP within the range of the murrelet.

Land Use Allocation	Acres	Treatment	Acres of Treatment per Decade				
			First	Second	Third	Fourth	Fifth
1. Late-successional Reserve (344,239 acres)							
1a. Structurally-complex Forest			0	0	0	0	0
1b. Late-Successional Reserve (Moist)		Commercial thinning	18,937	15,881	14,696	11,787	8,784
1b. Late-Successional Reserve (Dry)		Group and single-tree selection harvest	3,895	3,407	2,984	3,235	3,521
2. Riparian Reserve (Moist and Dry)	250,568	Commercial thinning	4,445	4,882	4,216	3,062	2,254
		Non-commercial thinning	1,496	1,391	1,318	1,076	640
District Designated Reserves			0	0	0	0	0

Land Use Allocation	Acres	Treatment	Acres of Treatment per Decade				
			First	Second	Third	Fourth	Fifth
3. Harvest Land Base (83,736 acres)							
3a. Moderate Intensity Timber Area		Commercial thinning	5,460	12,344	6471	4,430	5,863
		Salvage (variable retention harvest)	0	0	90	0	0
		Regeneration harvest (variable retention harvest)	10,694	7,027	12,929	6,641	5,014
3b. Low Intensity Timber Area		Commercial thinning	2,481	4,900	2,777	4,333	5,532
		Salvage (variable retention harvest)	0	0	0	0	0
		Regeneration harvest (variable retention harvest)	3,968	2,057	3,480	3,334	2,613
3c. Uneven-Aged Timber Area		Group or single-tree selection harvest	924	724	819	880	981
		Salvage	0	0	0	0	0

Table 98. Decadal forecast for murrelet nesting habitat potentially harvested over 50 years (2013-2063) under the PRMP.

	Murrelet Nesting Habitat Potentially Harvested by End of Decade (Acres)					Cumulative Nesting Habitat Potentially Harvested (Acres)
	2023	2033	2043	2053	2063	
PRMP	28,493	21,166	15,329	16,287	23,056	104,332

Table 99. Murrelet nesting habitat modeled for harvest that would not be subject to Wildlife Resource Program's Management Direction for murrelet protection under the PRMP (Harvest Land Base beyond 35 miles from the coastline).

	Murrelet Nesting Habitat Potentially Harvested by End of Decade, which could include occupied murrelet habitat (Acres)					Cumulative Nesting Habitat Potentially Harvested (Acres)
	2023	2033	2043	2053	2063	
PRMP	7,162	3,143	3,758	2,586	4,723	21,371

Table 100. Murrelet nesting habitat modeled for harvest that would be subject to protection of occupied habitat (Wildlife Resource Program’s Management Direction for murrelets) under the PRMP.

	Murrelet Nesting Habitat Potentially Harvested if no occupied murrelet habitat is adversely affected (Acres)					Cumulative Nesting Habitat Potentially Harvested (Acres)
	2023	2033	2043	2053	2063	
PRMP	21,331	18,024	11,571	13,702	18,333	82,960

Table 101. Decadal forecast for murrelet occupied sites lost to timber harvest activities over 50 years (2013-2063).

	Occupied Sites Forecast to be Lost (by End of Decade)					Cumulative Occupied Sites Lost
	2023	2033	2043	2053	2063	
PRMP	13	6	7	5	9	39

Non-timber Actions

Future Actions

In addition to timber production, the PRMP includes non-timber activities that may affect murrelets (Table 102). Resource programs are potentially implemented across all LUAs. We anticipate that the effects from these resource programs (Table 103) will occur on BLM lands within the action area.

Table 102. Resource Programs for non-timber actions that may affect murrelets.

Resource Programs for Non-timber Activities	Actions that may affect murrelets
Areas of Critical Environmental Concern ⁹	None currently identified
Fire, Fuels and Wildfire Response	Wildfire suppression, fuels reduction

⁹ On BLM lands in the action area there is 25,257 acres of LUA that are also designated as Areas of Critical Environmental Concern (McGraw 2016c, pers. comm.). Within these acres, there is 17,488 acres of nesting habitat, of which 7,876 acres are of high-quality habitat for murrelets.

Resource Programs for Non-timber Activities	Actions that may affect murrelets
Fisheries	Trees for instream restoration, culvert and bridge replacements
Forest Management	Hazard trees, rights-of-ways, insect and disease control (including treatment for sudden oak death), other activities to improve forest health, pre-commercial thinning, sample tree-falling
Hydrology	Trees for instream restoration, other facilities, culvert and bridge replacements
Invasive Species	insect and disease control (including treatment for sudden oak death)
Lands, Realty, and Roads	Hazard trees, culvert and bridge replacements, rights-of-ways
Rare Plants and Fungi	Oak restoration, meadow restoration
Recreation and Visitor Services	Hazard trees, camp ground, other facilities
Trails and Travel Management	Hazard trees, culvert and bridge replacements, other facilities

The Wildlife Resource Program imposes additional murrelet-specific restrictions to Resource Programs that carry out activities on BLM, which will limit the impacts to murrelets within the LUA system.

Except for District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2, the following activities may only occur in occupied habitat when the stand continues to support nesting post treatment (BLM 2016a, p. A-58) and no disruption to murrelets will occur, except for treatment of sudden oak death and actions that protect human safety or property (BLM 2016a, p. A-57):

- *Felling of hazard trees and trees for instream restoration projects*
- *Construction of linear and nonlinear rights-of-way*
- *Construction of other facilities*
- *Wildfire suppression*
- *Fuels reduction*
- *Insect and disease control*
- *Other activities to improve the health of the stand or adjacent stands*

Within the range of the murrelet, except for District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2, the following activities may only occur in unoccupied habitat (BLM 2016a, p. A-58):

- *Oak restoration*
- *Meadow restoration*
- *Pre-commercial thinning*

Within the District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2 the above activities may take place in occupied stands with no restrictions for the stand to continue to support nesting and no restrictions on avoiding disruption.

These impacts have the potential to kill eggs or young or increase the risk for injury to eggs or young. This situation would occur if there is an active nest removed or impacted to an extent that causes a check or egg to fall from the nest tree. If an active nest was within or adjacent to a project area, activities might increase the risk of injury to eggs or young due to disruption. Excessive noise might cause flushing of the adult from the egg, further increasing its risk of predation or delay the adults coming in to feed a chick, which could reduce the chick's fitness. Human presence can increase the risk of predation. Modifying trees adjacent to nesting murrelets can increase fragmentation. Fragmentation may cause nest trees to blow down, change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting and increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young. In all cases, we expect the adults to be able to move away from activities without injuring themselves. If an active nest site is lost and habitat is not remaining locally, a murrelet pair may take an extended period to locate an adequate nesting site. Although there are many different ways breeding murrelets may be affected from activities, the impact to the population is the loss of new individuals entering the population.

The BLM was not able to provide any precise estimates of the potential non-timber activities or projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed during in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

Ongoing Presence of Non-commercial Vehicles

Roads carry a risk of vehicle collisions with murrelets, although we believe that risk to be exceedingly small given the available data of five murrelets potentially being impacted by vehicles, since 1935 (Nelson 1997, p. 21). Kim Nelson confirmed two of the potential collisions with vehicles were in Oregon with one being from a logging truck (Nelson 2016, pers. comm.). No other known collision incidences have occurred in Oregon. Cars have a lower profile and higher profile vehicles such as RVs are driving at slower speeds on back roads compared to commercial log trucks. Although the vehicle type of the other collision is not known, we believe the risk of collision is associated with high profile vehicles that are driving at faster speed on the narrower back roads that murrelets may be using as corridors for approaching or leaving a nest tree. Additionally, the commercial log truck drivers are familiar with the back roads and use radio communication to clear routes, which we have observed allows for faster driving speeds compared to recreational traffic. Therefore, we believe the risk of vehicle collision is associated with commercial vehicles on roads in the action area and not non-commercial vehicles.

Indirect Effects to Individual Murrelets

Coquille Lands

Since management direction in the PRMP is considered to be synonymous with “standards and guidelines” per Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208, pp. 537-541) it will apply to the Coquille Forest lands. Therefore, management direction not related to land use allocations will apply and, once land use allocations are made by the Coquille Tribe, the management direction specific to the LUAs will be applied. While we do not know how LUAs will be designated on Coquille lands, the LUA management direction will establish the suite of possible management approaches available for the Coquille Forest. Timber Harvest -

No timber harvest projections have been made for the Coquille Forest, but due to the Coquille Forest location in inland zone 1 no timber harvest is expected to be proposed that will adversely affect murrelets, because management direction for murrelet protection measures applies to all LUAs in inland zone 1 (see above Overarching protection section).

Non-timber Actions

Future Actions

In addition to timber production, the PRMP includes non-timber activities that may affect murrelets (Table 102). Resource programs are potentially implemented across all LUAs. We anticipate that the effects from these resource programs (Table 103) will potentially occur on the lands included in the Coquille Forest.

Table 103. Resource Programs for non-timber actions in the Coquille Forest that may affect murrelets.

Resource Programs for Non-timber Activities	Actions that may affect murrelets
Areas of Critical Environmental Concern ¹⁰	None currently identified
Fire, Fuels and Wildfire Response	Wildfire suppression, fuels reduction
Fisheries	Trees for instream restoration, culvert and bridge replacements

¹⁰ On BLM lands in the action area there is 25,257 acres of LUA that are also designated as Areas of Critical Environmental Concern (McGraw 2016c, pers. comm.). Within these acres, there is 17,488 acres of nesting habitat, of which 7,876 acres are of high-quality habitat for murrelets.

Resource Programs for Non-timber Activities	Actions that may affect murrelets
Forest Management	Hazard trees, rights-of-ways, insect and disease control (including treatment for sudden oak death), other activities to improve forest health, pre-commercial thinning, sample tree-falling
Hydrology	Trees for instream restoration, other facilities, culvert and bridge replacements
Invasive Species	insect and disease control (including treatment for sudden oak death)
Lands, Realty, and Roads	Hazard trees, culvert and bridge replacements, rights-of-ways
Rare Plants and Fungi	Oak restoration, meadow restoration
Recreation and Visitor Services	Hazard trees, camp ground, other facilities
Trails and Travel Management	Hazard trees, culvert and bridge replacements, other facilities

The Wildlife Resource Program imposes additional murrelet-specific restrictions to Resource Programs that carry out activities on Coquille lands, which will limit the impacts to murrelets within the LUA system.

Except for District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2, the following activities may only occur in occupied habitat when the stand continues to support nesting post treatment (BLM 2016a, p. A-58) and no disruption to murrelets will occur, except for treatment of sudden oak death and actions that protect human safety or property (BLM 2016a, p. A-57):

- *Felling of hazard trees and trees for instream restoration projects*
- *Construction of linear and nonlinear rights-of-way*
- *Construction of other facilities*
- *Wildfire suppression*
- *Fuels reduction*
- *Insect and disease control*
- *Other activities to improve the health of the stand or adjacent stands*

Within the range of the murrelet, except for District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2, the following activities may only occur in unoccupied habitat (BLM 2016a, p. A-58):

- *Oak restoration*
- *Meadow restoration*
- *Pre-commercial thinning*

Within the District-Designated Reserves within inland zone 2 and Harvest Land Base within inland zone 2 the above activities may take place in occupied stands with no restrictions for the stand to continue to support nesting and no restrictions on avoiding disruption.

These impacts have the potential to kill eggs or young or increase the risk for injury to eggs or young. This situation would occur if there is an active nest removed or impacted to an extent that causes a check or egg to fall from the nest tree. If an active nest was within or adjacent to a project area, activities might increase the risk of injury to eggs or young due to disruption. Excessive noise might cause flushing of the adult from the egg, further increasing its risk of predation or delay the adults coming in to feed a chick, which could reduce the chick's fitness. Human presence can increase the risk of predation. Modifying trees adjacent to nesting murrelets can increase fragmentation. Fragmentation may cause nest trees to blow down, change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting and increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young. In all cases, we expect the adults to be able to move away from activities without injuring themselves. If an active nest site is lost and habitat is not remaining locally, a murrelet pair may take an extended period to locate an adequate nesting site. Although there are many different ways breeding murrelets may be affected from activities, the impact to the population is the loss of new individuals entering the population.

The BLM was not able to provide any estimates of the potential non-timber activities or projects on the Coquille Forest that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed during in the next 50 years. However, when these projects are proposed the Coquille Tribe will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

Ongoing Presence of Non-commercial Vehicles

Roads carry a risk of vehicle collisions with murrelets, although we believe that risk to be exceedingly small given the available data of five murrelets potentially being impacted by vehicles, since 1935 (Nelson 1997, p. 21). Kim Nelson confirmed two of the potential collisions with vehicles were in Oregon with one being from a logging truck (Nelson 2016, pers. comm.). No other known collision incidences have occurred in Oregon. Cars have a lower profile and higher profile vehicles such as RVs are driving at slower speeds on back roads compared to commercial log trucks. Although the vehicle type of the other collision is not known, we believe the risk of collision is associated with high profile vehicles that are driving at faster speed on the narrower back roads that murrelets may be using as corridors for approaching or leaving a nest tree. Additionally, the commercial log truck drivers are familiar with the back roads and use radio communication to clear routes, which we have observed allows for faster driving speeds compared to recreational traffic. Therefore, we believe the risk of vehicle collision is associated with commercial vehicles on roads in the action area and not non-commercial vehicles. State, County and Private Lands

State, county and private actions within the action area may be facilitated by travel over BLM roads or by the use of tailhold or guyline trees on BLM lands. Such uses of BLM lands and roads are indirect effects of the proposed action.

The PRMP has no authority on state, county or private lands. Non-federal landowners are required to avoid taking of murrelets per section 9 of the Act unless they have a permit or exemption for incidental take under sections 7 or 10 of the Act. Therefore, we do not expect murrelets to be harmed from timber harvest on state, county or private lands in the action area except in accordance with a biological opinion or Habitat Conservation.

In the BA the BLM was not able to provide any estimates of indirect timber harvest or non-timber activities or projects that may occur over the next 50 years as part of the PRMP associated with the state, county or private lands; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when projects are proposed by the state, county or private land owners and they are likely to result in incidental take of marbled murrelets, there will be project-specific and site-specific section 7 consultation or section 10 compliance, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Summary of effects to individual murrelets

Timber harvest is expected to be associated with 104,332 acres of murrelet nesting habitat (Table 104). Of these acres only 21,371 acres are expected to be associated with occupied murrelet stands. The remaining 82,960 acres of nesting habitat would only be harvested if surveys determined no occupancy.

Table 104. Summary of decadal forecast for murrelet nesting habitat potentially harvested over 50 years (2013-2063) under the PRMP.

PRMP	Murrelet Nesting Habitat Potentially Harvested by End of Decade (Acres)					Cumulative Nesting Habitat Potentially Harvested (Acres)
	2023	2033	2043	2053	2063	
Potential timber sales, Total	28,493	21,166	15,329	16,287	23,056	104,332
No surveys required	7,162	3,143	3,758	2,586	4,723	21,371
Surveys and detection of no occupancy before timber sales may occur	21,331	18,024	11,571	13,702	18,333	82,960

Occupied sites in inland zone 1, which account for the majority of known (Figure 12 and Figure 14) and projected occupied sites, will have protective measures to retain their occupancy and allow for undisrupted murrelet nesting. Projected site expectations are based on presence of nesting habitat. Nesting habitat in inland zone 1 accounts for 75 percent of the nesting habitat on BLM lands in the action area (see Delineating Essential Habitat for Recovery section below).

Occupied sites in inland zone 2 within late-successional and riparian reserve LUAs will have protective measures from activities in the Late-successional and Riparian Reserve LUAs to retain their occupancy and allow for undisrupted murrelet nesting. Total percent of occupied sites projected to be protected is 96 percent of the occupied sites on BLM lands in the action area. In addition, all occupied sites on the Coquille Forest will have protective measures.

The remaining area in inland zone 2 and outside of the late-successional and riparian reserve LUAs will not have protective measures on activities to retain occupancy of murrelets. This area accounts for 4 percent of the projected occupied sites (see Delineating Essential Habitat for Recovery section below), though there may be additional impacts to occupied sites in adjacent LUAs. Of that remaining 4 percent of projected occupied sites on BLM land in the action area without measures to protect their habitat, the 25 percent of those lands associated with the reserved lands outside of LSR and Riparian Reserve will have protective measures for undisrupted nesting. The additional protective measure for disruption for 25 percent of the 4 percent of projected occupied sites on BLM lands in the action area is due to other reserve LUAs and not Late-successional or Riparian Reserves.

Impacts from activities in the Harvest Land Base in inland zone 2 may also affect murrelets occurring in adjacent LUAs. The main adjacent LUA is Riparian Reserves, as this LUA is interspersed with the Harvest Land Base. However, when an occupied site is discovered in an adjacent riparian reserve or late-successional reserve LUA, the ¼ mile radius of protection is likely to change some of the adjacent Harvest Land Base to LSR. Therefore, known occupied sites combined with the 300 feet of protection will protect occupied sites within the Riparian Reserve or late-successional LUAs in inland zone 2 from habitat modifications and disruption. We only anticipate occupied sites being discovered in Riparian Reserve or Late-successional Reserve LUAs in inland zone 2 as other reserve LUAs do not have requirements for surveying for murrelets before habitat modification or removing nesting structure. Once sites are discovered, if the occupied site extends into the Harvest Land Base, then the Harvest Land Base becomes LSR.

Protection measures on activities that disrupt murrelets apply in a larger portion of the action area than protective measures for habitat modification or removing nesting structure. Protection measures for activities that disrupt murrelets apply in all LUAs, except in the Harvest Land Base within inland zone 2. This is in contrast to the protection measures for habitat modification or removing nesting structure, which does not apply to inland zone 2 LUAs of Harvest Land Base, District Designated Reserve, Congressional Reserves, and Congressionally Reserved Lands and the National Landscape Conservation System.

The proposed action could potentially result in removing habitat at 39 occupied sites over 50 years in inland zone 2 due to harvest activities. Additionally, yarding corridors, spur roads, other

non-timber actions and indirect actions could affect marbled murrelets but the effects cannot be quantified at this time due to lack of site specific information at the programmatic, landscape scale. These types of activities generally cover a very small percentage of BLM lands and so are not expected to have significant effects to the murrelet population.

Consistency of PRMP with Recovery Plan Guidance for the Murrelet

Two murrelet recovery actions apply to the PRMP and are discussed below. The two recovery actions are to delineate and protect habitat within each conservation zone (Recovery Action 2), and incorporate management recommendations for protecting habitat areas (Recovery Action 3).

The below PRMP analysis relies on LUA acreage values and predicted harvest impacts from only BLM lands within the action area. The Coquille Forest is a small area compared to BLM lands in the action area (0.6 percent of the area the PRMP will be applied on). Therefore, we do not expect application of management direction on the Coquille Forest to change our analyses of the PRMP below. On the Coquille Forest, because it is located in inland zone 1, only unoccupied nesting habitat and buffer habitat associated with unoccupied nesting structure will be removed through timber harvest. The protection of occupied sites is expected to be greater than current protections (see Protection of Occupied Sites section below).

Delineate and Protect Habitat within each Conservation Zone (Recovery Action 2)

Within the range of the murrelet, the Recovery Plan identified lands within each zone that are necessary for the recovery of the murrelet (USFWS 1997, p. 123). These lands in Oregon extend inland up to 35 miles from the ocean and coincide with inland zone 1 described by the Forest Ecosystem Management Assessment Team, with minor adjustments (USDA *et al.* 1993, p. IV-23) and critical habitat that extends beyond the 35 mile distance of inland zone 1 (USFWS 1997, p. 127). Recovery Action 2 includes delineating and protecting habitat essential for recovery within the each Conservation Zone (USFWS 1997, p. 113).

Delineating Essential Habitat for Recovery

Essential habitat, relating to Oregon Federal lands and the Oregon Conservation Zones, is identified (USFWS 1997, p. 131) as:

- *Any suitable habitat in Late-Successional Reserves located in the Forest Ecosystem Management Assessment Team inland zone 1 (see pages IV-23 and IV-24 in U.S. Department of Agriculture et al. 1993 for a description of inland zone 1); (USFWS 1997, page 131)*
- *Other large areas of suitable nesting habitat outside of Late-Successional Reserves on Federal lands, though none was identified on BLM lands (USFWS 1997, page 132)*
- *Critical habitat (USFWS 2011, page 61605)*

Inland zone 1

While BLM's inland zone 1 does not align with the NWFP mapped inland zone 1, it does line up

with the written description of inland zone 1 in the Recovery plan, which in Oregon is from the marine environment to 35 miles inland (USDA *et al.* 1993, p. IV-23). Additionally, the NWFP states that inland zone 1 extends approximately 35 miles inland in Oregon and that the Alternative 9 map will be remapped to be consistent with the above description for survey purposes (USDA and USDI 1994b, p. C-10). On page A-6 and A-7 the NWFP ROD (USDA and USDI 1994b) states “To more accurately define the zone in which marbled murrelet surveys are required, the marbled murrelet zone is being remapped in some areas to more closely parallel the coastline, consistent with the narrative description of these zones on page C-10 of these standards and guidelines.” The murrelet recovery plan states that the conservation zones include all lands within 35 miles of the coast and any lands designated as critical habitat beyond 35 miles of the coast (USFWS 1997, p. 127). Therefore, we feel comparing the PRMP inland zone 1’s 0-35 mile distance between the two plans is an accurate and reasonable approach. Additionally we compare the PRMP inland zone 2 (35-50 mile distance from the coastline) by critical habitat and non -critical habitat between the two plans. Although the NWFP inland zone 2 extends to 62 miles inland from the coast near Reedsport, Oregon, this is beyond the expected range of the murrelet in Oregon. Therefore, our comparison only extended 50 miles inland.

A comparison of the NWFP and the PRMP in inland zone 1 is displayed in Table 105. LSRs are proposed to go from 169,987 acres to 344,239 acres of BLM lands within inland zone 1, which is an increase of 174,252 acres. Because LSRs do not include Riparian Reserves in the PRMP nor Adaptive Management Reserves, the actual lands promoting late-successional conditions is a combination of these LUAs. LSRs, Adaptive Management Reserves and Riparian Reserves are proposed to go from 557,074 acres to 594,807 acres of BLM lands within inland zone 1, which is an increase of 37,733 acres containing 22,701 acres of nesting habitat. Therefore, the proposed reserve system in inland zone 1 will contain a higher quantity of murrelet nesting habitat and will allow for a larger acreage of late-successional conditions in the future (see the following section, Timber Production in the reserve system, for ingrowth expectations in the different reserve systems). Additionally within inland zone 1, nesting habitat in the LUA for timber production will decrease by 34,112 acres, of which 15,290 acres is high-quality habitat.

Table 105. Comparison of NWFP and PRMP Reserve system using the current baseline data for 0-35 miles from the coast. All numbers calculated for these tables are from within the range of the murrelet. Acres within each column are mutually exclusive (non-overlapping).

0-35 miles from the coast (inland zone 1)									
NWFP	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹	PRMP Reserve system	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹
Late-Successional Reserves ²	169,987	97,270	56,830	9,472	Late-Successional Reserves	344,239	213,688	121,268	35,920
Adaptive Management Reserves	33,632	17,281	5,954	651	-	-	-	-	-
District-Defined Reserves	24	24	24	23	District-designated Reserves	26,728	12,017	4,227	1,445

0-35 miles from the coast (inland zone 1)									
NWFP	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹	PRMP Reserve system	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹
Riparian Reserves outside of the above designations	353,455	184,276	82,908	24,232	Riparian Reserves ³	250,568	107,840	36,094	8,751
Congressionally Reserved Lands and the National Landscape Conservation System	11,176	2,026	1,242	46	Congressionally Reserved Lands and the National Landscape Conservation System	10,587	1,443	658	0
Matrix & Adaptive Management Area	147,585	68,354	19,073	11,737	Harvest Land Base	83,736	34,242	3,783	45 ⁴
TOTAL	715,858	369,230	166,030	46,160	TOTAL	715,858	369,230	166,030	46,160

1 Existing, known occupied murrelet sites as of March 26, 2015(re-freezing date for GeoBOB data used in the analysis).

2 NWFP Late Successional Reserves = the mapped LSR LUA.

3 Under the PRMP, Riparian Reserves are their own LUA.

4 No occupied habitat is designated in the Harvest Land Base; these are map projection errors resulting in slivers adding up to this acre value.

Inland zone 2 and within Critical Habitat

Within inland zone 2, we further compared the NWFP with the PRMP by looking at “within designated critical habitat” (Table 106) and “outside designated critical habitat” (Table 107). Critical habitat was only designated within NWFP LSRs, which included Riparian Reserves. Acres displayed in Matrix are map projection errors, creating slivers that added up to the values in the table below. Within critical habitat in inland zone 2, the protection for murrelet nesting habitat from timber production is proposed to be reduced by 10,698 acres, containing 2,693 acres of murrelet nesting habitat, of which 409 acres are high-quality nesting habitat.

Comparing this loss to the gain of area that moved out of the timber production lands in inland zone 1 (a protection gain of 63,846 acres, containing 34,112 acres of nesting habitat, of these acres 15,290 acres is a proposed decrease in high-quality habitat) the PRMP provides an increase in the essential habitat proposed for protection. The difference is estimated as a net gain to the reserve system of 53,148 acres, containing 31,419 acres of murrelet nesting habitat, 14,881 acres of which are high-quality murrelet nesting habitat. Comparing the acres in NWFP LSRs, Adaptive Management Reserves and Riparian Reserves to PRMP LSRs and Riparian Reserves the gain is 23,230 acres, containing 18,273 acres of murrelet nesting habitat, of which 10,393 acres are high-quality murrelet nesting habitat. We broke out these reserve systems from the other LUAs, because the proposed late-successional and riparian reserve systems are where we expect the majority of ingrowth to occur. See the following section, Timber Production in the reserve system, for ingrowth expectations in the different Reserve systems.

Table 106. Comparison of NWFP and PRMP Reserve system using the current baseline data for 35-50 miles from the coast and within murrelet critical habitat. All numbers calculated for these tables are from within the range of the murrelet. Acres within each column are mutually exclusive (non-overlapping).

35-50 miles from the coast and <u>within</u> murrelet critical habitat									
NWFP	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹	PRMP Reserve system	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹
Late-Successional Reserves ²	37,571	22,175	15,470	1,090	Late-Successional Reserves	37,493	29,595	23,362	1,641
Adaptive Management Reserves	0	0	0	0	-	-	-	-	-
District-designated Reserves	0	0	0	0	District-designated Reserves	3,912	1,776	890	0
Riparian Reserves outside of the above designations	33,409	20,194	14,121	820	Riparian Reserves ³	18,984	8,346	4,952	278
Congressionally Reserved Lands and the National Landscape Conservation System	0	0	0	0	Congressionally Reserved Lands and the National Landscape Conservation System	0	0	0	0
Matrix ⁴	107	42	21	12	Harvest Land Base	10,698	2,693	409	2 ⁵
TOTAL	71,087	42,410	29,612	1,922	TOTAL	71,087	42,410	29,612	1,922

1 Existing, known occupied murrelet sites as of March 26, 2015 (re-freezing date for GeoBOB data used in the analysis).

2 NWFP Late Successional Reserves = the mapped LSR LUA.

3 Under the PRMP, Riparian Reserves are their own LUA.

4 No Matrix occurs in critical habitat, these are map projection errors resulting in slivers adding up to these acre values.

5 No occupied habitat is designated in the Harvest Land Base; these are map projection errors resulting in slivers adding up to this acre value.

Inland zone 2 and Outside of Critical Habitat

Although not designated as essential for the species, habitat outside of critical habitat and within inland zone 2 also supports nesting murrelets (Table 107). LSRs are proposed to go from 28,673 acres to 69,707 acres of BLM lands within inland zone 2 and outside of critical habitat, which is an increase of 41,034 acres. However, as LSRs do not include riparian reserves in the PRMP, the actual lands promoting late-successional conditions is a combination of these two LUAs. LSRs and Riparian Reserves are proposed to go from 100,183 acres to 119,540 acres of BLM

lands within inland zone 2 and outside of critical habitat, which is an increase of 19,357 acres containing an additional 13,718 acres of nesting habitat. The entire BLM Reserve system within inland zone 2 and outside of critical habitat is proposed to go from 100,204 acres to 126,556 acres of BLM lands, which is an increase of 26,352 acres containing an additional 16,763 acres of nesting habitat. Therefore, the proposed reserve system in inland zone 2 and outside of critical habitat will contain a higher quantity of murrelet nesting habitat and will allow for a larger acreage of late-successional conditions in the future. Additionally within inland zone 2 and outside of critical habitat, the nesting habitat in the LUA for timber production has decreased by 16,763 acres of nesting habitat, of which 9,353 acres is a proposed decrease in high-quality habitat.

The benefit to the species on all BLM lands in the action area is estimated as a net gain to the reserve system of 79,500 acres, containing 48,182 acres of murrelet nesting habitat, of which 24,234 acres are high-quality murrelet nesting habitat. In just LSRs, Adaptive Management Reserves, and Riparian Reserves the gain is 42,587 acres, containing 31,991 acres of murrelet nesting habitat, of which 18,034 acres are high-quality murrelet nesting habitat. As stated above, we broke out these reserve systems from the other LUAs, because the reserves are where we expect the majority of ingrowth to occur. See the following section, Timber Production in the reserve system, for ingrowth expectations in the different Reserve systems.

Table 107. Comparison of NWFP and PRMP Reserve system using the current baseline data for 35-50 miles from the coast and outside of murrelet critical habitat. All numbers calculated for these tables are from within the range of the murrelet. Acres within each column are mutually exclusive (non-overlapping).

35-50 miles from the coast and <u>outside</u> of murrelet critical habitat									
NWFP	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹	PRMP Reserve system	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹
Late-Successional Reserves ²	28,673	16,105	10,035	90	Late-Successional Reserves	69,707	45,126	27,108	2,941
Adaptive Management Reserves	0	0	0	0	-	-	-	-	-
District-designated Reserves	0	0	0	0	District-designated Reserves	7,016	3,055	1,722	2
Riparian Reserves outside of the above designations	71,510	36,633	16,055	1,342	Riparian Reserves ³	49,833	21,330	6,623	420

35-50 miles from the coast and outside of murrelet critical habitat									
NWFP	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹	PRMP Reserve system	All acres	Acres of habitat (2013)	Acres of high quality habitat (2013)	Acres of MAMU occupied sites ¹
Congressionally Reserved Lands and the National Landscape Conservation System	22	10	10	0	Congressionally Reserved Lands and the National Landscape Conservation System	0	0	0	0
Matrix	56,408	29,046	10,750	1,933	Harvest Land Base	30,056	12,283	1,397	2 ⁴
TOTAL	156,612	81,794	36,850	3,365	TOTAL	156,612	81,794	36,850	3,365

1 Existing, known occupied murrelet sites as of March 26, 2015 (re-freezing date for GeoBOB data used in the analysis).

2 NWFP Late Successional Reserves = the mapped LSR LUA.

3 Under the PRMP, Riparian Reserves are their own LUA.

4 No occupied habitat is designated in the Harvest Land Base; these are map projection errors resulting in slivers adding up to this acre value.

Summary of Delineation

The proposed reserve system LUA delineation, compared to the existing NWFP LUA delineation, provides a net benefit of protecting 48,222 acres of murrelet nesting habitat, of which 24,255 acres are high-quality habitat. Combined conservation zones (lands within 35 miles plus critical habitat beyond 35 miles) with a comparison of the proposed reserve system LUA delineation to the NWFP LUA delineation is a net benefit to protecting habitat for murrelets of 31,459 acres of murrelet nesting habitat, of which 14,902 acres are high-quality habitat. Combined conservation zones essential habitat (LSR, Riparian Reserves and Adaptive Management Reserves) with a comparison of the proposed reserve system LUA delineation to the NWFP LUA delineation is a net benefit to protecting habitat for murrelets of 18,273 acres of murrelet nesting habitat, of which 10,393 acres are high-quality habitat. This net increase in the reserve systems is consistent with the conservation of the species because of the combination of a larger reserve acreage and the benefits of the different reserve LUAs. The following section will discuss how each proposed reserve system will protect habitat and provide ingrowth of murrelet habitat. We divided this examination by timber production in the reserve system and non-timber activities in the reserve system.

Timber Production in the Reserve System

Late-successional Reserves

Late-successional reserves have the following management objectives and management direction relating to timber production and murrelets (BLM 2016a, p. A14-A19):

Management Objectives

- *Promote the development of nesting habitat for the murrelet in stands that do not currently meet nesting habitat criteria.*

Management Direction

- *Protect¹¹ stands of older, structurally-complex conifer forest. Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat.*
- *Protect marbled murrelet occupied stands. In this context, **protect marbled murrelet occupied stands** means to prohibit activities in the occupied stand except for the following: felling of live or dead hazard trees, felling trees for habitat restoration, and the construction or maintenance of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the occupied stand continues to support marbled murrelet nesting. Implement wildfire management actions and activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, as long as the occupied stand continues to support marbled murrelet nesting.*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *In stands that are not northern spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of northern spotted owl nesting-roosting habitat or improve the quality of northern spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens.*
- *Utilize integrated vegetation management¹² in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*

¹¹ **Protect older, structurally-complex conifer forest** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and logs for streams, the construction, modification, maintenance and removal of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl and marbled murrelet life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival; and marbled murrelet nesting habitat continues to support marbled murrelet nesting. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat or remove marbled murrelet habitat.

¹² **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include but

- *Promote the development and retention of large, open grown trees and multi-cohort stands.*
- *Develop diverse understory plant communities.*
- *Increase or maintain vegetative species diversity.*
- *Restore and maintain habitat for Bureau Special Status species.*
- *Promote or enhance the development of structural complexity and heterogeneity.*
- *Create growing space for hardwood and pine persistence and regeneration.*
- *Create and maintain areas for hardwood and shrub dominance.*
- *Adjust stand composition or dominance.*
- *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In stands ≥ 10 acres treated with selection harvest or commercial thinning,*
 - *Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings¹³ more than 4 acres in size.*
 - *Do not create group selection openings on more than 25 percent of the stand area.*
 - *Leave untreated skips on at least 10 percent of the stand area.*
- *In stands < 10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.*
- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.*
- *Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*

Summary of Silvicultural Activities

Timber production in LSRs are designed to speed the development of older forest structure, such as murrelet habitat, retain species and compositional heterogeneity, retain and promote species diversity, treat insect infestations and reduce the threat from wildfires. These activities may target non-Douglas fir species, but are designed to retain these species that are being crowded out in areas where they currently occur and are adapted for persistence.

Overall the aggregate effects of silvicultural activities in LSRs are expected to be small compared to the overall size and distribution of LSRs in the action area, and these effects are not expected to preclude the effectiveness of this long-term ecosystem approach to management of

are not limited to vegetation control, planting, snag creation, prescribed fire, thinning, single tree selection harvest, and group selection harvest.

¹³ **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7 " DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

the LSRs. While short-term impacts to murrelet habitat are expected and will be examined in project-level section 7 consultations, these projects will be spread out spatially across the LSR landscape and temporally over the 50 years of the PRMP. Additionally treatments will be designed to limit blow down.

We believe this LUA provides a high level of protection for habitat and provides a high potential for ingrowth of murrelet habitat.

Riparian Reserves

The Riparian Reserves have the following management objectives and management directions related to timber activities and murrelets (BLM 2016a, pp. A19-A24):

Management Objectives

- *Maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.*

Management Direction

- *Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.*
- *Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.*
- *Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *Prohibit timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*
- *Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.*

Summary of Silvicultural Activities

Because the Riparian Reserves are being established to provide for producing large wood that will contribute to stream habitat structure, protecting cold, clear water, and the conservation and recovery of listed fish, the stand management of these lands is expected to be consistent with the production of older, larger trees and natural processes which should benefit murrelets. Some treatments may have short-term impacts on murrelet habitat (and will be subject to future section 7 consultation) due to thinning treatments opening up stands below 40 percent canopy cover to support murrelet trees with nesting structure, but treatments will have long term improvement for murrelet habitat development as thinning treatments will be designed to promote larger tree growth and cover will close back in over time. Impacts will also be reduced because 1) Riparian Reserves are strips of lands and the harvest area is only the outside portion of these lands, therefore the canopy cover dropping below 40 percent will be a limited part of the stand, reducing the likelihood of a significant increase in the stands usage by murrelet nest predators, and 2) the treatment will be designed to prevent blowdown.

We believe this LUA provides a high level of protection for habitat and provides a high potential for ingrowth of murrelet habitat. Although treatments are designed for fish, they will help achieve the desired results of stands that will also support murrelet nesting habitat.

District Designated Reserves

District Designated Reserves have the following management objectives and management directions related to timber activities and murrelets (BLM 2016a, p. A14-A19):

Management Objectives

- *None applicable*

Management Direction

- *None applicable*

District-Designated Reserve – Timber Production Capability Classification

Management Direction

- *Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).*
- *Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions*

produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system,

*District-Designated Reserve – Lands Managed for their Wilderness Characteristics*¹⁴

Management Objectives

- *None applicable*

Management Direction

- *Allow mechanical vegetation treatment consistent with Visual Resource Management Class II for the purpose of improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*

Summary of Timber Activities

Although these lands are a Reserve, their management as a whole is a mix of activities, some of which are consistent with developing murrelet habitat. Timber harvest is not an objective of this reserve designation, but timber sales may be used to manage habitat. These lands include (BLM 2016c, pp. 39-40):

- *Areas that the BLM has constructed for specific purposes (e.g., roads, buildings, maintenance yards, seed orchards, and other facilities and infrastructure);*
- *Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops);*
- *Areas of Critical Environmental Concern, including Research Natural Areas, that would not overlap the Harvest Land Base; and*
- *Other reserves (e.g., Special Recreation Management Areas that would not overlap the Harvest Land Base, areas protected for Bureau Sensitive species, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics).. Timber production may be used to obtain a direct condition, specifically the management objectives discuss that restore or maintain community-level structural characteristics, promote desired species composition, emulate ecological conditions produced by historic fire regimes, improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*

¹⁴ These objectives and direction apply to lands outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is proposing to manage for the protection of those wilderness characteristics.

We believe this LUA provides a high level of protection for habitat and provides for moderate ingrowth of murrelet habitat. We believe only a moderate level of ingrowth will occur because management is designed for a mix of conditions, of which only some will be consistent with developing murrelet habitat (e.g., Natural Areas, Lands Managed for their Wilderness Characteristics).

Congressionally Reserved Lands and the National Landscape Conservation System

Congressionally Reserved Lands and the National Landscape Conservation System have the following management objectives and management directions related to timber activities and murrelets (BLM 2016a, p. A2-A4):

Management Objectives

- *Preserve the wilderness character of designated Wilderness Areas.*
- *Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (BLM Manual 6330 – Management of BLM Wilderness Study Areas; USDI BLM 2012, pages 1-10 to 1-13), until Congress either designates these lands as Wilderness or releases them for other purposes.*

Management Direction

- *Enhance, promote, and protect the scenic, natural, and cultural resource values associated with current and future designated National Scenic and Historic Trails.*
- *Conduct silvicultural treatments in National Trail management corridors (including those classified as Scenic, Historical, and Recreational) only as needed to protect or maintain recreation setting characteristics or to achieve recreation objectives.*
- *Conduct management actions, including but not limited to fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and trail construction, in Wild and Scenic River corridors only if consistent with designated or tentative classifications and if any reductions in outstandingly remarkable values would be temporary and outstandingly remarkable values would be protected or enhanced over the long term.*
- *Do not use ground-disturbing equipment or aerial application of non-fugitive retardant in areas visible from the river within Wild and Scenic River corridors during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property, or where use is essential for wildfire control.*

Summary of Silvicultural Activities

Timber harvest in this LUA will only occur as needed for fuels treatments, invasive species management, riparian or wildlife habitat improvements, or forest management. This Reserve is not designed to actively promote murrelet habitat conditions, but the direction to promote wilderness character does include late-successional conditions.

We believe this LUA provides a high level of protection for habitat and provides for moderate ingrowth of murrelet habitat. Currently 1,443 acres of nesting habitat occurs in this LUA (Table 105). We believe a moderate to high level of ingrowth will occur due to the fact that management is for preserving the suitability of these areas for designation as Wilderness. We expect the forest to develop more late-successional conditions over time, but management may involve some activities for recreation that are consistent with the designation of wilderness but which may preclude late-successional conditions in localized stands.

Summary of Reserve System and Timber Production

As identified above, silvicultural activities occurring in the Late-successional Reserve and Riparian Reserves Systems will benefit the development of late-successional conditions. However, both Reserves systems may reduce the functionality of low quality murrelet habitat in an effort to develop high quality habitat quicker than if left untreated. Within the District Designated Reserve and the Congressionally Reserved Lands and the National Landscape Conservation System, no timber sales are planned, but timber sales may be used to manage habitat.

We believe the reserve system provides a high level of protection for habitat and provides a high potential for ingrowth of murrelet habitat in the Late-successional and Riparian Reserve designations.

Non-timber activities in the Reserve System

In addition to timber production, the PRMP includes other activities that may affect murrelet habitat (Table 108).

Table 108. Resource Programs for non-timber actions that may affect murrelet habitat in the reserve system.

Resource Programs for Non-timber Activities	Actions that may affect murrelet habitat in the Reserves system
Areas of Critical Environmental Concern	None currently identified
Fire, Fuels and Wildfire Response	Wildfire suppression, fuels reduction
Fisheries	Trees for instream restoration, culvert and bridge replacements
Forest Management	Hazard trees, rights-of-ways, insect and disease control (including treatment for sudden oak death), other activities to improve forest health, Pre-commercial thinning
Hydrology	Trees for instream restoration, other facilities, culvert and bridge replacements

Resource Programs for Non-timber Activities	Actions that may affect murrelet habitat in the Reserves system
Invasive Species	insect and disease control (including treatment for sudden oak death)
Lands, Realty, and Roads	Hazard trees, culvert and bridge replacements, rights-of-ways
Rare Plants and Fungi	Oak restoration, Meadow restoration
Recreation and Visitor Services	Hazard trees, camp ground, other facilities
Trails and Travel Management	Hazard trees, culvert and bridge replacements, other facilities

The Wildlife Resource Program imposes additional restrictions to other Resource Programs that carry out activities within the reserve system, which will limit the impacts to murrelet habitat within the reserve system.

Within the reserve system, except for District-Designated Reserves within inland zone 2, the following activities may only occur in occupied habitat when the stand continues to support nesting post treatment (BLM 2016a, p. A-58):

- *Felling of hazard trees and trees for instream restoration projects*
- *Construction of linear and nonlinear rights-of-way*
- *Construction of other facilities*
- *Wildfire suppression*
- *Fuels reduction*
- *Insect and disease control*
- *Other activities to improve the health of the stand or adjacent stands*

Within the reserve system, except for District-Designated Reserves within inland zone 2, the following activities may only occur in non-occupied habitat (BLM 2016a, p. A-58):

- *Oak restoration*
- *Meadow restoration*
- *Pre-commercial thinning*

The BLM was not able to provide precise estimates of the non-timber activity projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Recovery Action 2 - Conclusion

The Service concludes that the proposed action at the landscape scale is consistent with Recovery Action 2, to delineate and protect habitat within each conservation zone. There is no threshold for the amount of essential habitat within the recovery plan, but the plan does refer to nesting habitat in the NWFP Late-Successional Reserve LUA and critical habitat as essential habitat. Therefore, we used the NWFP nesting habitat to analyze if the PRMP meets the goals of the recovery plan. The BLM will include more acres of murrelet nesting habitat within the reserves and critical habitat under the PRMP than the NWFP and we believe the PRMP reserve system provides a high level of protection for habitat and provides a high potential for ingrowth of murrelet habitat in the Late-successional and Riparian Reserve designations. Due to the greater amount and protection of nesting habitat for murrelets than in the NWFP as referenced in the recovery plan, we believe the PRMP is consistent with the conservation needs of the murrelet as outlined in the murrelet recovery plan. Site-specific evaluation of projects will be completed as the site-specific scale as information becomes available.

Incorporate Management Recommendations for Protecting Habitat Areas (Recovery Action 3)

“Management recommendations for the marbled murrelet need to address two different biological time frames, which reflect: (1) aspects of the murrelet’s life history and demographic trends; and (2) the length of time required to develop the majority of new nesting habitat or improve current forest habitat conditions. Short-term actions must address the apparent rapid decline of current populations and the need for immediate stabilization. The ability of marbled murrelet populations to recover rapidly is low due to the low reproductive potential of the species. Long-term actions address the long time-frames required to cultivate or enhance mature forest habitat conditions or to improve marine habitat quality because of the nature and complexity of these ecosystems. Little additional older forest habitat will become available until after 2040” (USFWS 1997, p. 138).

Short Term Actions to Stabilize and Increase the population (Recovery Action 3.1)

Maintain occupied Nesting Habitat (Recovery Action 3.1.1.1) and Buffer Habitat (Recovery Action 3.1.1.3)

Occupied sites will not be lost from habitat modification in the majority of the range of the murrelet (see section Overarching Protections for a complete description of the proposed protection for murrelets). Protection for occupied nest trees includes a 300-foot buffer habitat; therefore the following discussion on protection of occupied sites includes protection for buffer habitat. Undiscovered occupied sites may be lost only in the Harvest Land Base in inland zone 2.

Existing, known occupied murrelet sites would be included within the LSRs under the PRMP. Therefore, all current nesting habitat associated with occupied sites would be retained.

Under the PRMP, the BLM would apply protective measures to occupied murrelet nesting habitat in all LUAs in inland zone 1 (0 to 35 miles from the coast). In inland zone 2 (35 to 50 miles from the coast) the BLM would apply protective measures to occupied murrelet nesting habitat in the Late-successional and Riparian reserve LUAs but would not protect nesting habitat in the District-Designated Reserve or Harvest Land Base if it is not occupied or occupancy status is unknown. Occupied sites with protective measures are predicted to be 96 percent of the murrelet occupancy on BLM lands in the action area (see Summary of Effects to Individual Murrelets section above).

For its analysis, the BLM assumed that nesting habitat without protections would still contain murrelet sites using the detection rates described above, but that those sites would remain undiscovered and the habitat at those sites within the Harvest Land Base would be removed by timber harvest over the 50-year course of the PRMP. No timber harvest is planned within the District-Designated Reserves.

Under the PRMP, the BLM would discover and protect an estimated 377 occupied murrelet sites during the next five decades (Table 109) through surveys of nesting habitat in all LUAs in inland zone 1 and outside the Harvest Land Base in inland zone 2. In the Harvest Land Base in inland zone 2 under the PRMP, an estimated 39 occupied murrelet sites may be lost during the first five decades (Table 110) because the BLM would not conduct surveys prior to modification or removal of nesting habitat in the Harvest Land Base in inland zone 2.

Table 109. Decadal forecast for murrelet occupied sites discovered over 50 years (2013-2063) on BLM lands in the action area.

	Occupied Sites Discovered and Protected (by End of Decade)					Cumulative Occupied Sites Discovered and Protected (due to rounding, previous numbers do not add up to this number)
	2023	2033	2043	2053	2063	
PRMP	97	76	42	69	91	377

Table 110. Decadal forecast for murrelet occupied sites lost to timber harvest over 50 years (2013-2063) on BLM lands in the action area.

	Occupied Sites Forecast to be Lost (by End of Decade)					Sites Lost (due to rounding, previous numbers do not add up to this number)
	2023	2033	2043	2053	2063	
PRMP	13	6	7	5	9	39

Table 111 and Figure 15 show the BLM forecasts of the number of occupied murrelet sites that would occur on BLM lands in the action area, by decade, according to the No Timber Harvest Reference Analysis and under the PRMP. Despite the anticipated losses of undiscovered murrelet occupied sites under the PRMP, the BLM forecasts that the murrelet population would

increase over 50 years due to the continued development of nesting habitat and the net increase in the number of occupied sites, reaching 94 percent of the number of occupied sites that could occur on BLM lands in the action area compared to the No Timber Harvest Reference Analysis.

Table 111. Estimated changes in the number of murrelet occupied sites on BLM lands in the action area during the next 50 years (2012 – 2063), by decade, according to the No Timber Harvest Reference Analysis and under the PRMP.

	2013	2023	2033	2043	2053	2063
No Timber Harvest	2,461	2,621	3,080	3,544	4,043	4,193
PRMP ¹	2,459	2,524	2,838	3,246	3,710	3,932

¹ Douglas Fire Complex was updated in the PRMP baseline but not the No timber harvest, hence the PRMP has 2 less occupied murrelets sites in the baseline year of 2013.

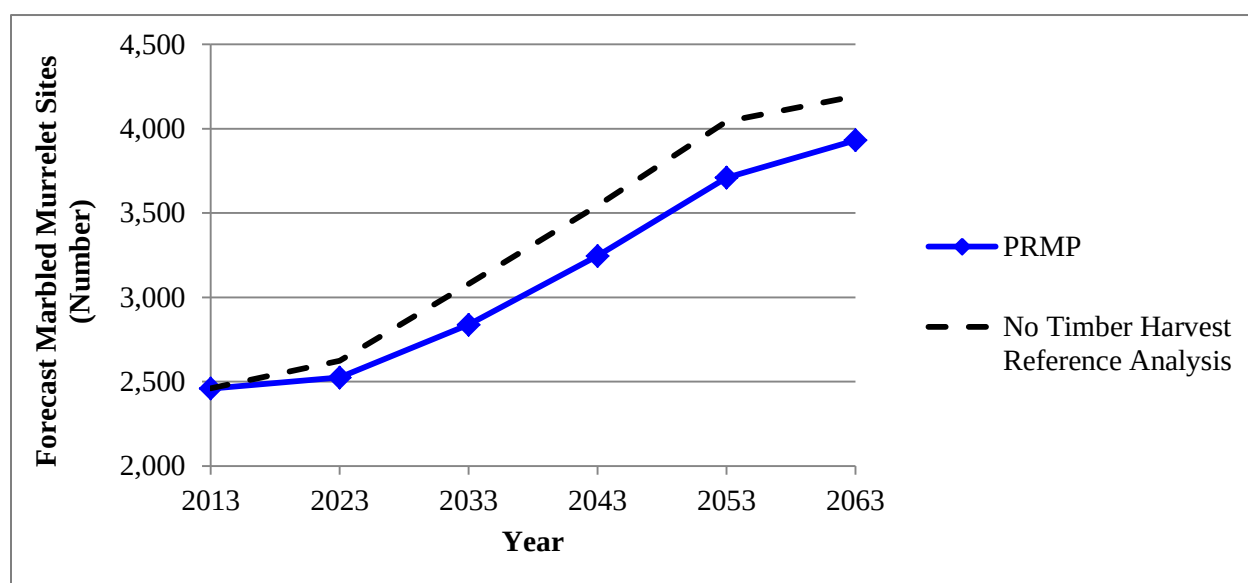


Figure 15. Forecast of the number occupied murrelet sites on BLM lands in the action area.

Protection of Occupied Sites

BLM past protections for occupied murrelet sites included all stands with nesting structure or that would develop nesting structure in the next 25 years within ½ mile of the occupied detection. BLM's past surveys have resulted in an average nesting habitat patch size of 55.6 acres at the occupied site (BLM 2016a, page 81), which occurs in a matrix of younger stands. There are 351 known, occupied marbled murrelet sites on BLM-administered lands in the action area, encompassing 51,995 acres, as delineated by the BLM offices (BLM 2016a, p. 81), which equates to an average of 148 acres of protection per occupied site. Approximately 88 percent of total occupied site acres in the action area are currently nesting habitat, 9 percent is capable of developing into nesting habitat in the future, and 3 percent is non-forest (BLM 2016a, p. 83). Nest trees ranged in age from 66 to 363 years (Nelson and Wilson 2002, pp. 125-131).

Younger trees with dwarf mistletoe infections or deformities may have potential nesting structure but then there is an age gap until non-mistletoe infected and non-damaged trees develop limbs large enough to support a murrelet platform. Therefore, younger stands surrounding nesting habitat patches have not always been included in the protection of stands with an occupied murrelet detection on BLM lands, resulting in significantly less (i.e., an average of 148 acres) than the potential 502.66 acres that could be protected within a ½ mile radius circle.

The Service believes the proposed protection for occupied sites will work more effectively to block up habitat in fragmented high-quality habitat and in low quality habitat where nesting structure may be unevenly distributed throughout younger stands compared to BLM's interpretation of their current RMP. More nesting habitat is expected to be included because additional patches of nest trees will be captured as long as there is a stand of any age connecting the two patches within the ¼ mile protection. Within the harvest land base, only 7 percent of the LUA is considered to contain high-quality nesting habitat, the remaining acres in the harvest land base contain 52 percent of low-quality nesting habitat (See Delineating Essential Habitat for Recovery section above and Table 97).

The change to include all younger stands will reduce fragmentation near occupied sites and will provide ingrowth of stands over the next 25 years and longer. Protection of a ¼ mile radius circle includes 125.66 acres. Additionally, there are activity restrictions in the 300 feet beyond the occupied stand (BLM 2016a, p. A-58). The addition of 300 feet to a ¼ mile radius circle produces a total area of 189.27 acres with restrictions to protect nesting murrelets.

Although the NWFP had the potential for a larger acreage to be protected for murrelets on BLM lands, we believe the PRMP protections will ultimately result in overall greater effective protection for murrelets. We believe this because the PRMP will potentially require BLM to capture more habitat than the current average of 55.6 acres associated with occupied sites, because the PRMP will capture all nesting habitat within a ¼ mile and not just the contiguous habitat. Furthermore, all younger stands within the ¼ mile occupied site plus the 300 foot buffer will be managed to protect nesting habitat reducing local fragmentation and allowing more potential for ingrowth over the long term (current average occupied site protection is 148 acres versus the PRMP 189.27 acres). Additionally, the PRMP's protection of the occupied site and adjacent stands is consistent with the recovery plan because it protects occupied stands, protects buffer habitat, provides for ingrowth and reduces fragmentation of nesting habitat as called for in the recovery plan.

Minimize Nest Disturbance to Increase Reproduction Success (Recovery Action 3.1.3)

Occupied sites will not be disrupted in the majority of the range of the murrelet (see section Overarching Protections for a complete description of the proposed protection for murrelets). Disruption to occupied sites will only occur for human safety and property needs, to treat sudden Oak death, or for activities within the Harvest Land Base within inland zone 2, and only have additional site-specific section 7 consultation.

Timber activities in the Harvest Land Base in zone 2 may disrupt nesting murrelets if the timber sale was associated with an occupied stand and occurred during the breeding season. The PRMP

management direction for murrelets prohibits disruption from activities in all other LUAs and within the Harvest Land Base when in inland zone 1.

The BLM was not able to provide precise estimates of non-timber activity projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Summary of Short Term Actions

BLM has minimized nest disturbance but the PRMP includes a small percent of timber actions that will eliminate an estimated 5 percent of occupied murrelet sites (Table 112). The biggest reduction is at the beginning of the plan and then again in the last decade.

Table 112. Summary of potential impacts to projected sites in areas where BLM will harvest murrelet habitat.

	Projected Occupied Sites (by End of Decade)					TOTAL (due to rounding, previous numbers do not add up to this number)
	2023	2033	2043	2053	2063	
Projected sites that may be lost as a result of timber harvest	-13	-6	-7	-5	-9	-39
Projected new known sites determined by surveys that would be protected	97	76	42	69	91	377
Projected sites (2,459 in 2013) (protected)	2,524	2,838	3,246	3,710	3,932	3,932

Long Term Actions to Stop Population Decline and Increase Population Growth (Recovery Action 3.2)

Increase the Amount and Quality of Nesting Habitat (Recovery Action 3.2.1)

Between the North/South Boundaries of Conservation Zone 3

Under the PRMP, BLM-administered lands between the north and south boundaries¹⁵ of Conservation Zone 3 would support 513,228 acres of nesting habitat and 168,778 acres of high-quality nesting habitat in 50 years (Table 113 and Table 114). Although, during the first decade (2013 – 2023), implementation of the PRMP would result in a less than one percent loss of high-quality nesting habitat (821 acres), sufficient high-quality nesting habitat would develop by the second decade to surpass current amounts. Under the PRMP, the BLM would include 89 percent (280,331 acres) of existing nesting habitat, and 98 percent (136,471 acres) of existing high-quality nesting habitat, in reserved LUAs. Therefore, within the BLM portion of the action area in Conservation Zone 3 the amount and quality of nesting habitat is expected to increase and improve over the 50 year life of the PRMP, although short term impacts to habitat are expected. The removal of 0.6 percent of the extant high-quality murrelet nesting habitat in the first decade of PRMP implementation is not expected to significantly reduce the contribution of the action area to the recovery of the species because of the extremely small percentage of habitat removed. In addition, overall nesting habitat within this analysis area does not drop below current baseline levels in any future decade under the PRMP and the projected number of occupied sites never decline below the original baseline levels.

Table 113. Murrelet nesting habitat in LUAs under the PRMP on BLM-administered lands between the north and south boundaries of Conservation Zone 3.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	34,268	11%	280,331	89%	314,599
2023	28,150	9%	293,265	91%	321,415
2033	29,383	8%	337,721	92%	367,104
2043	29,297	7%	391,470	93%	420,767
2053	34,833	7%	449,588	93%	484,421
2063	42,070	8%	471,158	92%	513,228

¹⁵ The recovery plan describes Oregon Conservation Zones as a subset of the Oregon range of the murrelet. BLM provided data based on a horizontal boundary between Conservation Zone 3 and 4 within Oregon. BLM included murrelet data from all lands within these north-to-south boundaries associated with either Conservation Zone 3 or 4, although the recovery plan states that these conservation zones extend 35 miles inland and include all critical habitat (USFWS 1997, pp. 126 and 127).

Table 114. High-quality murrelet nesting habitat in LUAs under the PRMP on BLM-administered lands between the north and south boundaries of Conservation Zone 3.

Year	Within the HLB		Within Reserves		Total High-quality Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	2,837	2%	136,471	98%	139,308
2023	1,552	1%	136,935	99%	138,487
2033	2,170	1%	158,684	99%	160,854
2043	2,291	1%	166,487	99%	168,778
2053	3,284	2%	175,416	98%	178,700
2063	5,184	3%	187,622	97%	192,805

Between the North/South Boundaries of Conservation Zone 4 Within Oregon

Under the PRMP, BLM-administered lands in the northern portion of south division¹⁶ of Conservation Zone 4 would support 264,947 acres of nesting habitat and 102,718 acres of high-quality nesting habitat in 50 years (Table 115 and Table 116). There is no decadal drop in either nesting habitat or high-quality habitat anticipated in this conservation zone. Under the PRMP, the BLM would include 92 percent (163,886 acres) of existing nesting habitat, and 97 percent (90,433 acres) of existing high-quality nesting habitat, in reserved LUAs. Therefore, within Conservation Zone 4 and the BLM portion of the action area the amount and quality of nesting habitat is expected to improve over the 50 year life of the PRMP, though short term impacts to habitat are expected. The removal of 1.3 percent of the extant high-quality murrelet nesting habitat in the first decade of PRMP implementation is not expected to significantly reduce the contribution of the action area to the recovery of the species because of the extremely small percentage of habitat removed. In addition, overall nesting habitat within this analysis area does not drop below current baseline levels in any future decade under the PRMP.

¹⁶ The recovery plan describes Oregon Conservation Zones as a subset of the Oregon range of the murrelet. BLM provided data based on a horizontal boundary between Conservation Zone 3 and 4 within Oregon. BLM included murrelet data from all lands within these north-to-south boundaries associated with either Conservation Zone 3 or 4, although the recovery plan states that these conservation zones extend 35 miles inland and include all critical habitat (USFWS 1997, pp. 126 and 127).

Table 115. Murrelet nesting habitat in LUAs under the PRMP on BLM-administered lands between the north and south boundaries of Conservation Zone 4.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	14,950	8%	163,886	92%	178,835
2023	11,874	6%	172,322	94%	184,197
2033	12,675	6%	190,081	94%	202,757
2043	15,542	7%	212,105	93%	227,647
2053	19,431	8%	230,942	92%	250,373
2063	25,411	10%	239,537	90%	264,947

Table 116. High-quality murrelet nesting habitat in LUAs under the PRMP on BLM-administered lands between the north and south boundaries of Conservation Zone 4.

Year	Within the HLB		Within Reserves		Total High-quality Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	2,752	3%	90,433	97%	93,185
2023	2,228	2%	89,791	98%	92,018
2033	2,248	2%	95,693	98%	97,941
2043	2,571	3%	100,147	97%	102,718
2053	2,841	3%	106,350	97%	109,191
2063	3,253	3%	112,805	97%	116,058

Statewide

Under the PRMP, BLM-administered lands in the action area would potentially support 778,175 acres of nesting habitat and 308,863 acres of high-quality nesting habitat after 50 years (Table 117 and Table 118). Although the first decade (2013 – 2023) of implementation of the PRMP would result in a one percent loss (1,988 acres) of high-quality nesting habitat, sufficient high-quality nesting habitat would develop by the second decade to surpass current amounts. The removal of 0.9 percent of the extant high-quality murrelet nesting habitat in the first decade of PRMP implementation is not expected to significantly reduce the contribution of the action area to the recovery of the species because of the extremely small percentage of habitat removed. In addition, overall nesting habitat within this analysis area does not drop below current baseline levels in any future decade under the PRMP. Also under the PRMP, the BLM would include 90 percent (444,217 acres) of existing nesting habitat, and 98 percent (229,904 acres) of existing

high-quality nesting habitat, in reserved LUAs¹⁷. Therefore, within the state and the BLM portion of the action area, the amount and quality of nesting habitat is expected to improve over the 50 year life of the PRMP, though some short term impacts to habitat are expected. The overall decadal increase in nesting habitat in all decades of the PRMP is believed to be consistent with the recovery needs of the species by increasing nesting opportunities.

Table 117. Murrelet nesting habitat in LUAs under the PRMP on BLM lands in the action area.

Year	Within the HLB		Within Reserves		Total Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	49,218	10%	444,217	90%	493,434
2023	40,024	8%	465,587	92%	505,612
2033	42,058	7%	527,802	93%	569,861
2043	44,839	7%	603,575	93%	648,414
2053	54,264	7%	680,530	93%	734,794
2063	67,481	9%	710,695	91%	778, 175

Table 118. High-quality murrelet nesting habitat in LUAs under the PRMP on BLM lands in the action area.

Year	Within the HLB		Within Reserves		Total High-quality Nesting Habitat (Acres)
	(Acres)	(%)	(Acres)	(%)	
2013	5,589	2%	226,904	98%	232,493
2023	3,780	2%	226,726	98%	230,505
2033	4,418	2%	254,377	98%	258,795
2043	4,862	2%	266,634	98%	271,496
2053	6,125	2%	281,766	98%	287,891
2063	8,437	3%	300,427	97%	308,863

The average patch size of murrelet nesting habitat on BLM-administered lands in the action area will shift from 33.2 acres (Table 119) to 42.3 acres in 50 years. Currently, 35 percent of nesting habitat is core habitat (Table 119), under the PRMP, the percent of core habitat would increase to 38 percent in 50 years.

¹⁷ This information is based on the BA Appendix E and is different than described on page 75 of the BA: BLM would include 93 percent (459,072 acres) of existing nesting habitat, and 99 percent (229,067 acres) of existing high-quality nesting habitat, in reserved LUAs.

Table 119. Murrelet nesting habitat patch metrics.

	Mean Patch Size (Acres)	Edge vs. Core Habitat		
		Edge Habitat (Acres)	Core Habitat (Acres)	Percent Core (%)
Current Condition (2013)	33.2	320,463	172,969	35%
PRMP (2063)	42.3	481,482	296,690	38%

Improve Distribution of Nesting Habitat (Recovery Action 3.2.2)

Figure 16 shows the distribution of LUAs on BLM lands in the action area. The overall color scheme west of I-5 is mostly blue (Riparian reserve) and green (LSRs) with some purple (District-Designated reserves). These are reserve lands where murrelet habitat is expected to be generally retained, with minimal impacts. Proposed harvest impacts are from harvest treatments to promote late-successional conditions in Late-Successional and Riparian Reserve LUAs. Additionally, within late-successional and Riparian Reserve LUAs non-habitat will be managed to promote late-successional conditions. Over 50 years habitat distribution will improve, although there will be areas that have a reduced level of habitat in the first or second decades, or even longer.

To analyze the potential habitat impacts within BLM lands in the action area (Figure 16) over time we utilized data within the CHUs as provided by the BLM (see below, Effects to murrelet critical habitat: Combined effects) to identify four areas of the landscape where BLM's PRMP will impact the distribution of nesting habitat. These four areas are discussed below as referenced in Conservation Zones 3 and 4.

All other larger landscape areas associated with the proposed action are expected to support the murrelet and improve nesting habitat, even though at the CHU level there will be impacts to the distribution of nesting habitat in the action area. The PRMP projects that the BLM lands associated with CHU OR-02-c and OR-06-c will not improve in nesting habitat amounts until the third decade. Both of these CHU impacts are expected to be minimal at the landscape level due to the scale of expected impacts. BLM lands in CHU OR-02-c comprise 11 percent of this CHU and, of these lands, the drop from BLM base line conditions in the first decade is 87 acres of nesting habitat (8 percent reduction) and in the second decade is 23 acres (1percent reduction). Other lands in CHU OR-02-c are Forest Service lands which are managed for late-successional conditions. BLM lands comprise 99 percent of CHU OR-06-c, where base line conditions may drop 21 acres (1 percent reduction) in the first decade and 55 acres the second decade (2 percent reduction). The landscape area associated with CHU OR-06-a will not have BLM lands in the action area improve in nesting habitat amounts until the fourth decade. BLM lands comprise 100 percent of CHU OR-06-a, but this CHU is only 39 acres. Projected thinning for late-successional conditions in 7 acres of nesting habitat (27 percent reduction) would set this CHU back in development until the fourth decade. Because of CHU OR-06-a's size it does not significantly contribute to the landscape's ability to provide nesting habitat. Under PRMP projections, the landscape area associated with CHU OR-07-d in the action area would not

improve in nesting habitat amounts compared to baseline conditions, but the impacts are expected to be minimal at the landscape level due to the scale of expected impact. BLM lands in CHU OR-07-d comprise 2 percent of this CHU and, for these BLM lands, the largest drop from baseline conditions is at the end of the second decade when 304 acres are projected to be harvested (29 percent reduction). Other lands in OR-07-d are Forest Service lands which are managed for late-successional conditions.

Conservation Zone 3

Looking at the landscape aspect of the Harvest Land Base (Figure 16) combined with the potential habitat impacts over time by CHU (see below, Effects to murrelet critical habitat: Combined effects) we identified three areas of the landscape that BLM's PRMP may have short-term impacts to the distribution of nesting habitat within Conservation Zone 3.

The BLM's designation of Harvest Land Base lands east of Tillamook may impair the development of the habitat in the Northern range in Oregon and create significant fragmentation, in an area lacking murrelet distribution. This area, OR-01-c, is expected to drop by 116 acres or 2 percent of the BLM baseline nesting habitat levels for two decades. No other Federal lands occur in this area of the landscape to support murrelet nesting habitat, with only 40 Federal acres occurring north of this area in Oregon. By 2043 ingrowth will result in BLM lands contributing more than their 2013 baseline in this CHU, with significant gains (33 percent increase in nesting habitat and 152 percent increase in high-quality nesting habitat) by 2063.

The next area of concern is west of Salem where there is another gap in Federal ownership. BLM nesting habitat associated with OR-02-d occurs north of this gap and may cause significant fragmentation of blocked up murrelet habitat, which may reduce reproductive success in the near-term. By 2033, ingrowth in CHU OR-02-d will result in this CHU contributing more than the 2013 baseline, with significant gains (60 percent increase in nesting habitat and 41 percent increase in high-quality nesting habitat) by 2063. BLM nesting habitat associated with OR-03-c occurs in the middle of this Federal gap and the PRMP projects a potential reduction in its habitat levels lasting one decade potentially resulting in significant fragmentation of blocked up murrelet habitat. BLM lands within this CHU are expected drop below baseline conditions by 154 acres or 3 percent of the nesting habitat for the first decade. In 2023, ingrowth will result in OR-03-c contributing more than the 2013 baseline, with significant gains (58 percent increase in nesting habitat and 21 percent increase in high-quality nesting habitat) by 2063. Additionally, Forest Service nesting habitat provides support to this gap in Federal lands to the north, associated with CHU OR-02-c, and to the south, associated with CHUs OR-04-a and OR-04-k.

The third area of concern is the BLM lands north-northwest of Roseburg associated with OR-04-f. This CHU contains 27 percent of its BLM lands in the harvest land base and BLM projects a potential reduction in its nesting habitat levels lasting two decades, resulting in significant fragmentation of blocked up murrelet habitat. Under these projections, BLM lands within this CHU may drop below baseline conditions by 1,446 acres or 11 percent of the nesting habitat for the first decade and 650 acres or 5 percent of the nesting habitat for the first decade. In the long term, by 2043, ingrowth within OR-04-f is expected to result in this CHU contributing more than the 2013 baseline, with modest gains (17 percent increase in nesting habitat and 14 percent

increase in high-quality nesting habitat) by 2063. Additionally OR-04-e to the west, OR-04-g the north west, OR-06-a to the south, and OR-04-i to the north provides habitat support to conserve the species in the larger landscape area.

Overall Impacts within Conservation Zone 3

All nesting habitat providing the highest conservation value to murrelets will be protected in inland zone 1 and within Riparian Reserves and Late-Successional Reserve LUAs in inland zone 2; and LSR and Riparian Reserve lands will be managed for developing late-successional conditions. Figure 16 shows the distribution of LUAs on BLM lands in the action area. As stated above, the overall color scheme west of I-5 is mostly blue (Riparian Reserve) and green (LSRs) with some purple (District-Designated reserves). The main impacts are expected to be from fragmentation and loss of habitat in the harvest land base. Although we identified three areas associated with this Conservation Zone where nesting habitat distribution may be impacted due to short term habitat losses and fragmentation, nesting habitat and habitat patch size are expected to increase in all three of these landscape areas over the life of the plan in the BLM action area (Table 119). We expect this increase in nesting habitat and habitat patch size to potentially improve the distribution of nesting habitat in the Conservation Zone. Although we identified some near-term impacts, because of the distribution of land use allocations and the overall distribution of murrelet nesting habitat within Conservation Zone 3 we believe the PRMP will continue to provide for murrelet conservation in the near and long-term.

Conservation Zone 4

Looking at the landscape aspect of the Harvest Land Base (Figure 16) combined with the potential habitat impacts over time by CHU (see below, Effects to murrelet critical habitat: Combined effects) we identified one area of the landscape, associated with OR-06-d, where BLM's PRMP may have impacts to distribution of nesting habitat within Conservation Zone 4.

The area of concern is the BLM lands south-southwest of Roseburg associated with OR-06-d. Twenty-one percent of the BLM lands in this CHU are in the harvest land base. BLM projects a potential reduction in nesting habitat levels on these lands lasting one decade which may result in significant fragmentation of blocked up murrelet habitat. BLM lands within this CHU may drop below baseline conditions by 18 acres or less than 1 percent of the nesting habitat for the first decade. In the long term, specifically 2033, ingrowth within OR-06-d will result in this CHU contributing more than the 2013 baseline, with modest gains (35 percent increase in nesting habitat and 6 percent increase in high-quality nesting habitat) by 2063. Additionally OR-04-e to the west, OR-04-g the north west, OR-06-a to the south and OR-04-i to the north provide habitat support to conserve the species in the larger landscape area.

Overall Impacts within Conservation Zone 4. All nesting habitat providing the highest conservation value to murrelets will be protected in inland zone 1 and within riparian reserves and late-successional LUAs in inland zone 2; and Late-successional and Riparian Reserve lands will be managed for developing late-successional conditions. Figure 16 show the distribution of LUAs on BLM lands in the action area. As stated above, the overall color scheme west of I-5 is mostly blue (Riparian reserve) and green (Late-Successional Reserves) with some purple

(District-designated reserves). The main impacts are expected to be from fragmentation and loss of habitat in the harvest land base. Although we identified some near-term impacts, because of the distribution of land use allocations and the overall distribution of murrelet nesting habitat within Conservation Zone 4 we believe the PRMP will continue to provide for murrelet conservation in the near and long-term.

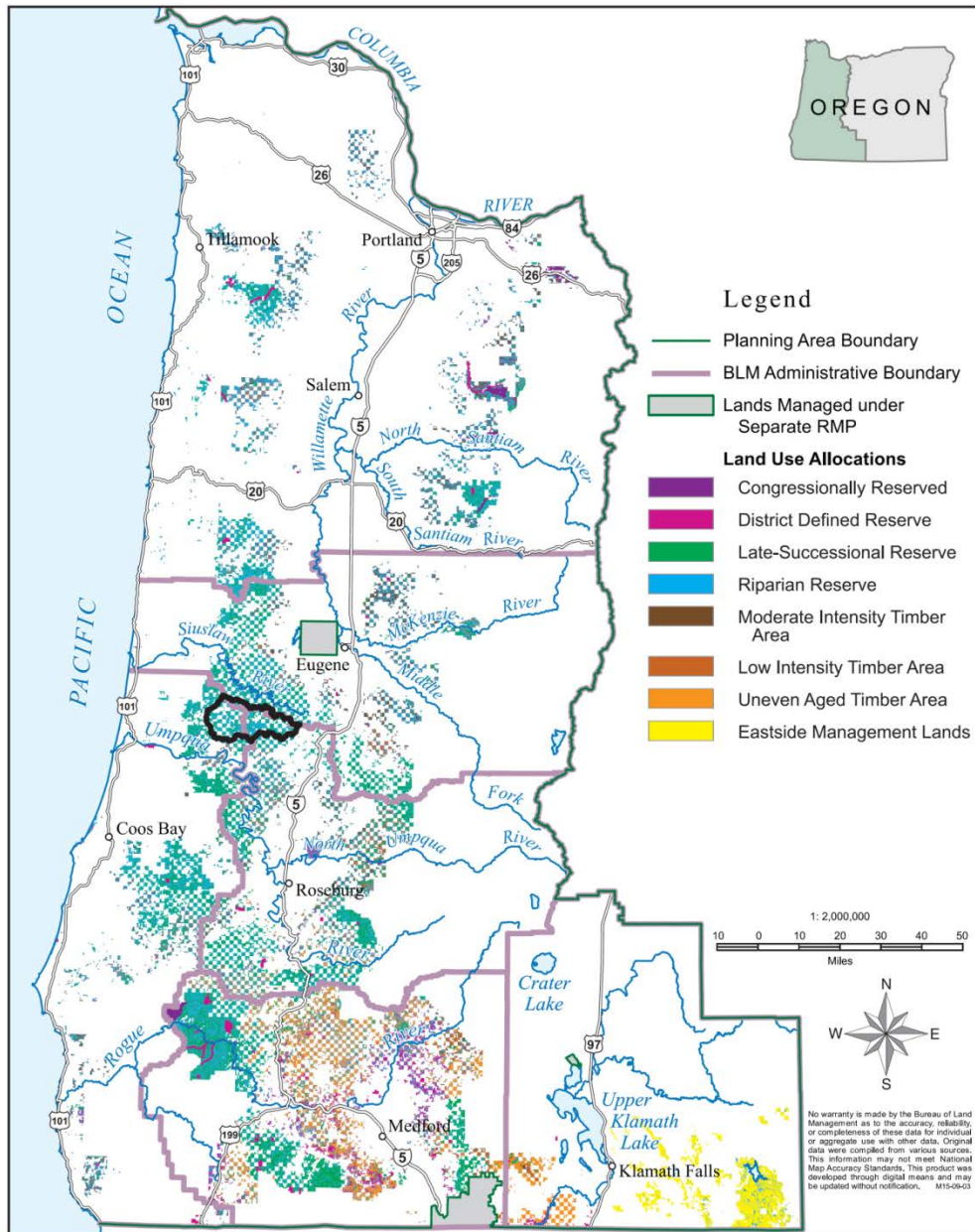


Figure 16. The BLM lands in the action area are delineated by the proposed LUAs.

Statewide

Because the distribution of nesting habitat over the 50 year life of the PRMP in Conservation Zones 3 and 4 in Oregon is expected to improve, we also conclude that the PRMP will continue

to function for murrelet conservation in the near-term, and improve in function over the life of the plan statewide.

Summary of Long Term Actions

Within the BLM portion of the action area the amount, quality and distribution of nesting habitat is expected to improve over the 50 year life of the PRMP, though short term impacts to habitat are expected in each conservation zone. Loss of high-quality habitat in the first decade is expected to outpace ingrowth, but then ingrowth will outpace losses by the second decade. Four areas of the landscape important for habitat distribution will also have harvest outpace ingrowth. These areas will recover in two to three decades. As noted above, because of the distribution of land use allocations and the overall distribution of murrelet nesting habitat we believe the PRMP will continue to provide for murrelet conservation in the near and long-term.

Recovery Action 3 - Conclusion

Although in the first two decades there will be some impacts to amount, quality and distribution of nesting habitat and 0.7 to 2.8 percent of occupied sites will be lost per decade, the Service concludes that the proposed action at the landscape scale over 50 years is consistent with Recovery Action 3 to incorporate management recommendations for protecting habitat areas. BLM RMP will minimize nest disturbance, and will improve the amount, quality and distribution of BLM nesting habitat over the 50 year life of the PRMP potentially increasing the murrelet population every decade with a 56 percent increase in the population over 50 years on BLM lands in the action area (Table 112).

Site-specific evaluation of projects will be completed at the site-specific scale as projects are proposed and information becomes available.

Combined Effects to the Murrelet Population

Because murrelet population numbers have been strongly correlated with amount and pattern of habitat (Raphael *et al* 2015, p. 159), we are using habitat as a surrogate to analyze how the PRMP will influence the murrelet population over the 50 years life of the PRMP. The modeled habitat projections, produced by BLM, include proposed harvest activities and projected wildfires.

BLM did not provide estimates of timber harvest and projected fire for the Coquille Forest, state, county or private lands within the action area. BLM did include state, county and private lands in the action area within the estimates of high-quality habitat on other lands within the state of Oregon.

To forecast habitat changes on the Coquille Forest, state, county or private lands within the action area, we used past landscape level changes on non-federal lands to predict future changes of habitat through the 50 years of the proposed action. We believe the estimate of change on non-federal lands will be a better estimate of the change on Coquille Forest lands because previously the Coquille Tribe managed their lands outside of riparian reserves for timber harvest

and we believe this practice will continue in the future (see Coquille Tribe, State, County and Private Lands in the Action Area section below). This forecasted change in murrelet habitat is used to estimate the PRMP's impacts to the murrelet population over the 50 year life of the PRMP, see below.

Conservation Zone 3

BLM Lands in the Action Area

The BLM applied detection rates to the amount of murrelet nesting habitat they modeled within the action area on BLM lands to forecast occupied murrelet sites over time within north south division of Conservation Zone 3 (Table 120 and Figure 17). Although ingrowth is slow at first to improve the baseline for nesting habitat, the projected occupied sites do not drop below the original levels and by the end of the second decade, ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the BLM lands under the PRMP would support 64 percent more occupied sites than the current baseline.

Table 120. Decadal forecast (2013-2063) of murrelet occupied sites expected under the PRMP on BLM lands associated with north south division of Conservation Zone 3.

Decade ¹	Nesting Habitat on BLM lands in the Action Area between the north and south boundaries of Conservation Zone 3 (Acres)	Occupied Sites Forecast on BLM lands in the Action Area (Number)
Current	314,599	1,615
1 st	321,415	1,652
2 nd	367,104	1,866
3 rd	420,767	2,153
4 th	484,421	2,501
5 th	513,228	2,652

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

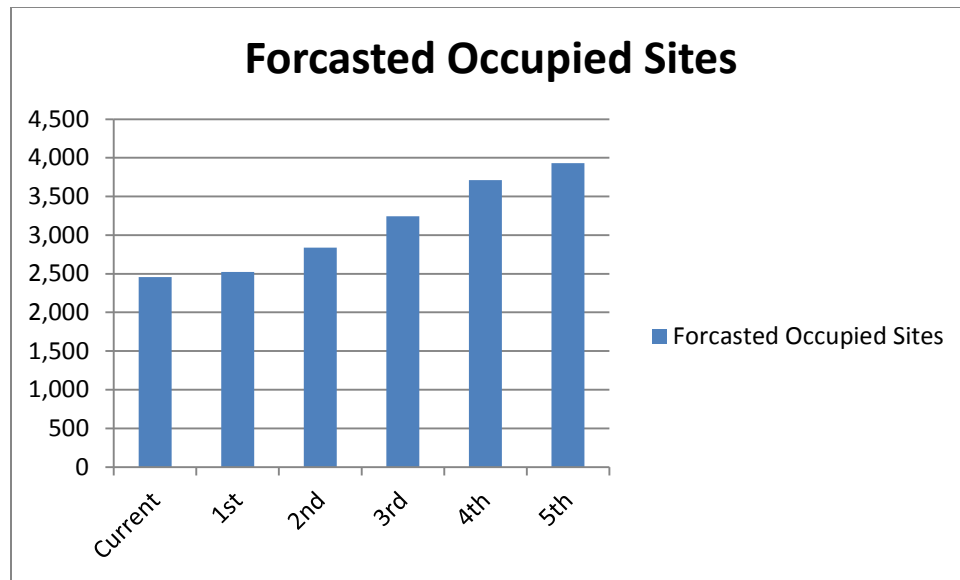


Figure 17. Decadal forecast (2013-2063) of murrelet occupied sites expected under the PRMP on BLM lands in the action area associated with north south division of Conservation Zone 3.

State, County and Private Lands in the Action Area

To estimate future trends in these lands we first look back at the past trends of habitat loss on non-federal lands. We looked at the NWFP 20-year report for murrelets, which calculated the trends in murrelet nesting habitat from 1993 to 2012 in the Oregon NWFP mapped inland zone 1 area.

Data extracted from the NWFP 20 year review for murrelets is displayed in Table 121 (Falxa and Raphael 2015, pp. 118 and 121). The change in habitat includes all actions (*e.g.*, timber harvest, wildfire, insects and other natural disturbances). Because the 2002 Biscuit fire occurred between the north and south boundaries of Conservation Zone 4 in Oregon, which was Oregon's largest contiguous, single-year fire on record (Azuma *et al.* 2004, p. 2), we believe this wildfire event is the main reason the loss of higher-suitability nesting murrelet habitat is not proportional in the two conservation zones in Oregon.

Table 121. Trends in higher-suitability nesting murrelet habitat from 1993 to 2012 by north south division of conservation zones within the Oregon NWFP mapped inland zone 1 area (Falxa and Raphael 2015, pp. 118 and 121).

NWFP mapped inland zone 1 divided by the north south division of Conservation Zone	1997 baseline	Total losses	Non-federal timber losses	wildfire, insects and natural disturbances	Federal timber losses	2012 baseline	Change in baseline from 1997 to 2012	Yearly change
	Acres						Percent	
Zone 3	662,767	No data available	No data available	No data available	No data available	610,583	-8	0.5
Portion of Zone 4 within Oregon	190,633	No data available	No data available	No data available	No data available	164,117	-14	0.9
Total	853,400	115,111	88,065	22,363	4,683	774,700	-9	0.6

State, county and private lands in the action area currently contribute 29,645 acres of high-quality habitat within Conservation zone 3 (Table 53). We then used the yearly change in habitat conditions on non-federal lands for this conservation zone to forecast the habitat over the next five decades on non-BLM lands in the action area and then forecasted occupied sites (Table 122). Although we have no detection rate or occupied stand size information for non-BLM lands in the action area, we believe this data is appropriate to use due to these lands close proximity to BLM lands and the data is the best available information for the action area. There is an estimated loss of 28 occupied sites on state, county and private lands in the action area over the next 50 years.

Table 122. Decadal forecast (2013-2063) of murrelet occupied sites expected on non-BLM lands in the action area associated with north south division of Conservation Zone 3.

Decade ¹	High-quality nesting Habitat on non-BLM lands in the Action Area between the north/south boundaries of Conservation Zone 3 (Acres)	Occupied Sites Forecast on non-BLM lands in the Action Area (habitat x BLM's overall detection rate of 23.9%/ 55.6 – acreage of BLM's mean occupied site) (Number)
Current	29,645	127
1 st	28,163	121
2 nd	26,755	115
3 rd	25,417	109
4 th	24,146	104
5 th	22,939	99

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

All Lands in the Action Area

When all lands are combined, ingrowth is still slow at first to improve the baseline for nesting habitat. Despite the expected localized declines in murrelet nesting habitat in the first two decades, the projected occupied sites never decline below the original baseline levels, and by the end of the second decade ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the action area would support 58 percent more occupied sites than the current baseline (Table 123). As noted in the Status of the Species, current population trends in Oregon appear to be stable (Table 43). Because the PRMP is not projected to decrease the number of occupied murrelet sites during any decade, Conservation Zone 3 is providing, and is expected to continue to provide, the BLM's contribution for the survival and recovery of the murrelet.

Table 123. Decadal forecast (2013-2063) of murrelet occupied sites expected on all in the action area associated with north south division of Conservation Zone 3.

Occupied sites forecasted between the north and south boundaries of Conservation Zone 3				
Decade ¹	Occupied Sites Forecast on BLM lands in the Action Area (Number)	Occupied Sites Forecast on non-BLM lands in the Action Area (Number)	Total forecasted occupied sites in the action area	Yearly Change in occupancy
Current	1,615	127	1,742	-
1 st	1,652	121	1,773	31
2 nd	1,866	115	1,981	208
3 rd	2,153	109	2,262	281
4 th	2,501	104	2,605	343
5 th	2,652	99	2,751	146

Conservation Zone 4

BLM Lands in the Action Area

The BLM applied their detection rates to the amount of murrelet nesting habitat that the BLM modeled within the action area on BLM lands to forecast occupied murrelet sites over time within north south division of Conservation Zone 4 (Table 124 and Figure 18). Although ingrowth is slow at first to improve the baseline for nesting habitat, the projected occupied sites do not drop below the original levels and by the end of the second decade, ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the BLM lands under the PRMP would support 52 percent more occupied sites then the current baseline.

Table 124. Decadal forecast (2013-2063) of murrelet occupied sites expected under the PRMP on BLM lands associated with north south division of Conservation Zone 4.

Decade ¹	Nesting Habitat on BLM lands in the Action Area between the north and south boundaries of Conservation Zone 4 (Acres)	Occupied Sites Forecast on BLM lands in the Action Area (Number)
Current	178,835	843
1 st	184,197	872
2 nd	202,757	971
3 rd	227,647	1,093
4 th	250,373	1,209
5 th	264,947	1,280

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

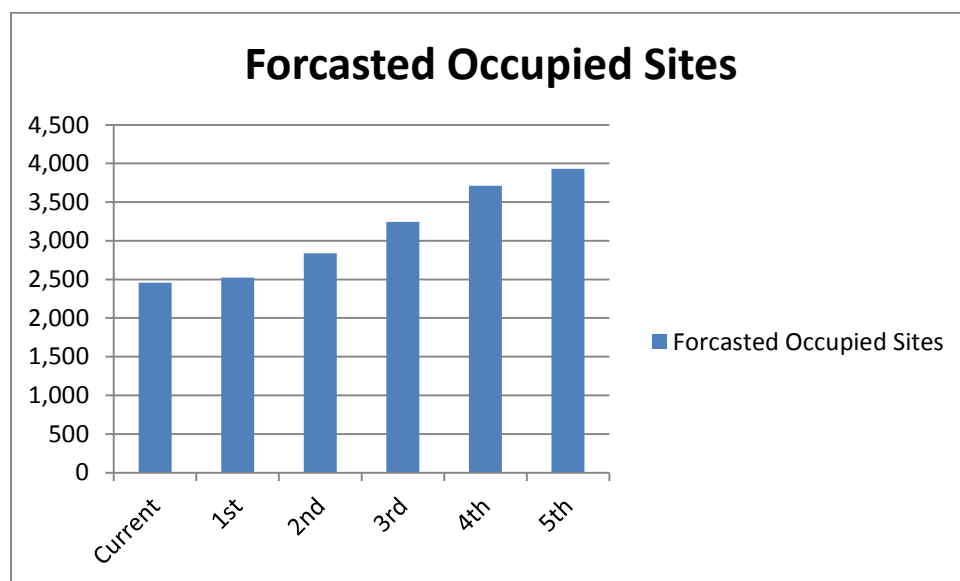


Figure 18. Decadal forecast (2013-2063) of murrelet occupied sites expected under the PRMP on BLM lands in the action area associated with north south division of Conservation Zone 4.

Coquille Tribe, State, County and Private Lands in the Action Area

The Coquille Forest, state, county and private lands in the action area currently contribute 25,075 acres of high-quality habitat within Conservation zone 4 (Table 53). Again, we then used the yearly change in habitat conditions on non-federal lands for this conservation zone (Table 121) to forecast the habitat over the next five decades on non-BLM lands in the action area and then forecasted occupied sites (Table 125). Although we have no detection rate or occupied stand

size information for non-BLM lands in the action area, we believe this data is appropriate to use due to these lands close proximity to BLM lands and the data is the best available information for the action area. There is an estimated loss of 41 occupied sites on these lands in the action area over the next 50 years. No occupied sites will be lost on the Coquille Forest from timber harvest, but the estimated change in habitat conditions includes fire and other natural events. We anticipate, on the Coquille Forest, there will be a loss of unoccupied high-quality nesting habitat from timber activities and there may be a loss of occupied high-quality nesting habitat from natural events. Therefore, we incorporated the potential loss of habitat on the Coquille Forest within the overall analysis for murrelets between the north and south boundaries of Conservation Zone 4 in Oregon.

Table 125. Decadal forecast (2013-2063) of murrelet occupied sites expected on non-BLM lands in the action area associated with north south division of Conservation Zone 4.

Decade ¹	High-quality nesting Habitat on non-BLM lands in the Action Area between the north and south boundaries of Conservation Zone 4 (Acres)	Occupied Sites Forecast on non-BLM lands in the Action Area (habitat x BLM's overall detection rate of 23.9%/ 55.6 – acreage of BLM's mean occupied site) (Number)
Current	25,075	108
1 st	22,818	98
2 nd	20,765	89
3 rd	18,896	81
4 th	17,195	74
5 th	15,648	67

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

All Lands in the Action Area

When all lands are combined, ingrowth is still slow at first to improve the baseline for nesting habitat. Despite the expected localized decline in murrelet nesting habitat in the first decade, the projected occupied sites never decline below the original baseline levels, and by the end of the second decade ingrowth starts to noticeably overtake the potential impacts of timber harvest. The projected occupied sites do not drop below the original levels and by the end of the second decade, ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the action area would support 41 percent more occupied sites than the current baseline (Table 126). As noted in the Status of the Species, current population trends in Oregon appear to be stable (Table 43). Because the PRMP is not projected to decrease the number of occupied murrelet sites during any decade, Conservation Zone 4 is providing, and is expected to continue to provide, the BLM's contribution for the survival and recovery of the murrelet.

Table 126. Decadal forecast (2013-2063) of murrelet occupied sites expected on all in the action area associated with north south division of Conservation Zone 4.

Occupied sites forecasted between the north and south boundaries of Conservation Zone 4				
Decade ¹	Occupied Sites Forecast on BLM lands in the Action Area (Number)	Occupied Sites Forecast on non-BLM lands in the Action Area (Number)	Total forecasted occupied sites in the action area	Yearly Change in occupancy
Current	843	108	951	-
1 st	872	98	970	19
2 nd	971	89	1,060	90
3 rd	1,093	81	1,174	114
4 th	1,209	74	1,283	109
5 th	1,280	67	1,347	64

Statewide

BLM Lands in the Action Area

As with the previous conservation zones, we see that ingrowth is slow at first to improve the statewide BLM action area baseline for nesting habitat, but the projected occupied sites do not drop below the original levels and by the end of the second decade, ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the BLM lands under the PRMP would support 60 percent more occupied sites than the current baseline. Therefore, the Service believes the PRMP at the state scale is providing for the survival and recovery of the murrelet.

Table 127. Estimated changes in the number of murrelet occupied sites on BLM lands in the **action area** during the next 50 years (2012 – 2063), by decade, under the PRMP.

Decade ¹	Nesting Habitat on BLM lands in the Action Area (Acres)	Occupied Sites Forecast on BLM lands in the Action Area (Number)
Current	493,434	2,459
1 st	505,612	2,524
2 nd	569,861	2,838
3 rd	648,414	3,246
4 th	734,794	3,710
5 th	778,175	3,932

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

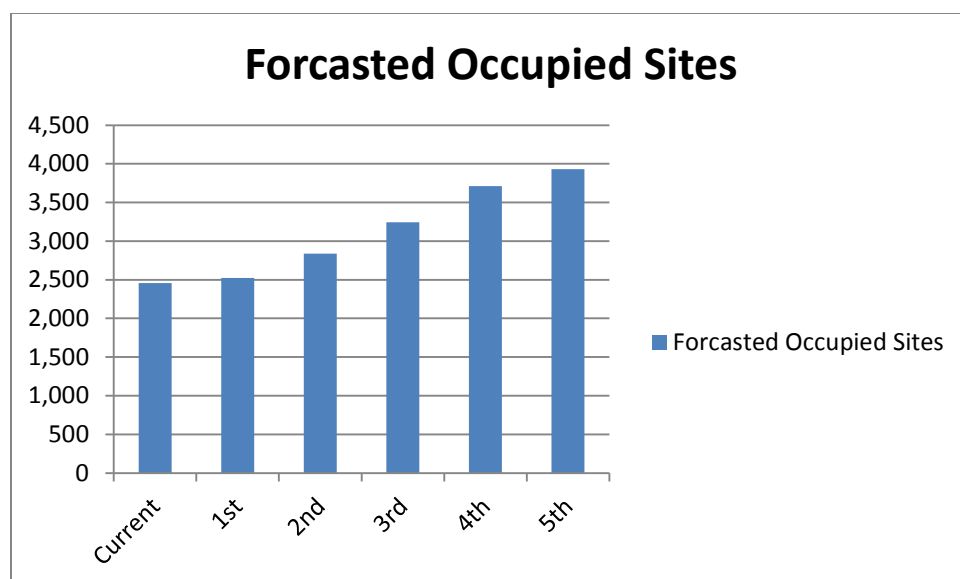


Figure 19. Decadal forecast (2013-2063) of murrelet occupied sites expected under the PRMP on BLM lands in the action area.

Coquille Tribe, State, County and Private Lands in the Action Area

The Coquille Forest, state, county and private lands in the action area currently contribute 54,720 acres of high-quality habitat within Conservation zone 4 (Table 53). We add Table 122 and Table 125 to produce Table 128. There is an estimated loss of 69 occupied sites on non-BLM lands in the action area over the next 50 years.

No occupied habitat will be lost on the Coquille Forest from timber harvest, although our projected change in habitat also takes into account forest fire and other natural events. Additionally, our analysis of impacts to murrelets is not meant to provide estimates at a local scale. Therefore, we incorporated the potential loss of habitat on the Coquille Forest at this larger scale, even though no occupied habitat will be removed from timber harvest in the Coquille Forest, to allow for a better overall analysis of how non-BLM lands contribute to murrelet survival and recovery.

Table 128. Decadal forecast (2013-2063) of murrelet occupied sites expected on non-BLM lands in the action area.

Decade ¹	High-quality nesting Habitat on non-BLM lands in the Action Area (Acres)	Occupied Sites Forecast on non-BLM lands in the Action Area (Number)
Current	54,720	235
1 st	50,981	219
2 nd	47,520	204
3 rd	44,313	190

Decade ¹	High-quality nesting Habitat on non-BLM lands in the Action Area (Acres)	Occupied Sites Forecast on non-BLM lands in the Action Area (Number)
4 th	41,341	178
5 th	38,587	166

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

All Lands in the Action Area

When all lands are combined, ingrowth is still slow at first to improve the baseline for nesting habitat. Despite the expected localized declines in murrelet nesting habitat in the first decade, the projected occupied sites never decline below the original baseline levels, and by the end of the second decade ingrowth starts to noticeably overtake the potential impacts of timber harvest. The projected occupied sites do not drop below the original levels and by the end of the second decade, ingrowth starts to noticeably overtake the potential impacts of timber harvest. By the fifth decade (2063), the action area would support 52 percent more occupied sites than the current baseline (Table 129). As noted in the Status of the Species, current population trends in Oregon appear to be stable (Table 43). Because the PRMP is not projected to decrease the number of occupied murrelet sites during any decade, the action area is providing, and is expected to continue to provide, the BLM's contribution for the survival and recovery of the murrelet.

Table 129. Decadal forecast (2013-2063) of murrelet occupied sites expected on all lands in the action area.

Statewide				
Decade ¹	Occupied Sites Forecast on BLM lands in the Action Area (Number)	Occupied Sites Forecast on non-BLM lands in the Action Area (Number)	Total forecasted occupied sites in the action area	Yearly Change in occupancy
Current	2,459	235	2,694	-
1 st	2,524	219	2,743	49
2 nd	2,838	204	3,042	299
3 rd	3,246	190	3,436	394
4 th	3,710	178	3,888	452
5 th	3,932	166	4,098	210

Listed Range

Despite the expected localized declines in murrelet nesting habitat in the first decade, the projected occupied sites never decline below the original baseline levels, and by the end of the second decade ingrowth starts to noticeably overtake the potential impacts of timber harvest. As

noted in the Status of the Species, current population trends throughout the listed range appear to be declining (Table 2). Because the PRMP is not projected to decrease the number of occupied murrelet sites during any decade, the action area is providing, and is expected to continue to provide, the BLM's contribution for the survival and recovery of the murrelet at this scale. Because the Service believes the proposed action will provide for the survival and recovery of the murrelet at the Conservation Zones and Statewide scales, the Service also believes the proposed action will provide for the survival and recovery of the murrelet at the scale of the listed range.

EFFECTS OF THE ACTION ON MARBLED MURRELET CRITICAL HABITAT

Overall, the PRMP will provide for the conservation of murrelet critical habitat. The main impacts to critical habitat are due to fragmentation and loss of habitat in portions of the Harvest Land Base. During the early years of the PRMP there will be some impacts to amount, quality and distribution of nesting habitat, mainly in the first two decades. However, the PRMP will improve the amount, quality and distribution of BLM murrelet nesting habitat over its 50 year life. Within the action area nesting habitat in critical habitat is forecasted to increase every decade, with a 54 percent on BLM lands in the action area over the 50 year life of the PRMP. The Service concludes the PRMP is consistent with the conservation function of critical habitat for the murrelet for the following reasons:

- Nesting habitat within critical habitat providing the highest conservation value to murrelets will be protected in inland zone 1 and within riparian reserves and late-successional LUAs in inland zone 2.
- Critical habitat within Late-successional and Riparian Reserves will be managed for developing late-successional conditions.
- Murrelet nesting habitat in critical habitat on BLM lands is expected to increase in all CHUs, except OR-07-d (BLM lands are 2 percent of this CHU).
- Murrelet nesting habitat in critical habitat on BLM lands is expected to increase in both conservation zones.
- BLM has projected that murrelet nesting habitat patch size will increase over the life of the plan for the BLM action areas, potentially reducing fragmentation from timber harvest within critical habitat.

Any activity occurring within designated critical habitat or adjacent to it that alters PBFs either directly or due to adjacent impact may affect murrelet critical habitat. Effects which are discountable, insignificant, or entirely beneficial are not likely to adversely affect critical habitat. Effects that exceed this level are likely to adversely affect critical habitat.

Effects to critical habitat are irrelevant of its occupancy status. Here we mention activities that will occur in unoccupied and occupied habitat only to document BLM's activities within critical habitat. Murrelet critical habitat consists of both PBF1 (a tree with nesting structure) and PBF 2 (trees without nesting structure but at least a ½ site-potential tree height and within a 0.5 mile of a PBF1 tree). The Service believes removal of PBF1 is an adverse effect to murrelet critical habitat. Removal of PBF2 to an extent that it affects its ability to develop into or to support

PBF1 is an adverse effect to murrelet critical habitat. Removal of buffer habitat to an extent that affects its function to support PBF1 is an adverse effect to murrelet critical habitat.

As mentioned under the Environmental Baseline for Critical Habitat section, the BLM's habitat data does not correlate precisely with the critical habitat PBFs. BLM's classification of both "nesting" habitat and "high-quality nesting" habitat captures nesting trees (PBF1) and associated trees within the same stand (PBF2). However, PBF2 stands lacking nesting structure (but within a ½ mile of a nesting tree) were not captured by the BLM's definition of nesting habitat or high-quality nesting habitat. BLM's classification of nesting habitat does include, however, young stands that may not yet be ½ site-potential tree height with a low density of older nest trees, which murrelets are known to use for nesting. These stands of young trees do not meet the definition of PBF2, but are included at this landscape scale in the BLM's definition of nesting habitat. Therefore, at the scale of this PRMP the BLM's categories of nesting habitat include some stand conditions that do not yet meet the definition of a PBF and exclude some stand conditions that do meet the definition of a PBF. The Service believes these data are the best available information to perform an analysis of how the PRMP affects murrelet critical habitat at this landscape scale. Site specific projects over the next 50 years will have PBFs identified through other methods, including visual evaluation of stands, which will be utilized for the local, refined analysis of impacts from projects under the PRMP during subsequent consultations.

The 2011 critical habitat rule discusses how actions outside areas with PBFs can affect the quality of the PBFs, such as changes in predation levels due to fragmentation (USFWS 2011, p 61604 response to comment 14). However, on pages 61609-61610 (USFWS 2011) the rule also states that activities that do not affect the PBFs or the ability for the PBFs to support the species are unlikely to be affected by the designation of critical habitat. Although we have described disruption as potentially causing temporary increases in predation risks to murrelets, because it does not affect the PBFs we address it under the effects to the species rather than effects to critical habitat. Additionally, collision risks are not associated with critical habitat and will not be discussed in this critical habitat section.

No part of the PRMP provides direct protection for murrelet critical habitat, though both the Wildlife Resource Program's Management Direction for murrelets and the Reserve designation provide indirect benefits to critical habitat.

Tables and Figures are from the BA with modifications or generated by the Service (BLM 2016, pp. 68-85, Appendix B and E). Tables and Figures that are from different sources are referenced as such.

Overarching protection

Under the PRMP, the Wildlife Resource Program's Management Direction for murrelets provides protection for murrelets. These protective measures provide indirect benefits to murrelet critical habitat by providing protection to the PBFs providing the greatest conservation benefit to the species (occupied habitat). The extent to which the protective measures apply on BLM lands within the action area is governed by the LUAs and distance from the ocean (inland zone 1 or 2).

The Habitat protection section above, which discusses the Wildlife Resource Program's Management Direction for murrelets, is incorporated here by reference. Where that section discusses occupied habitat, it is referencing the PBFs that are providing the highest conservation value for the species because they are currently supporting murrelet nesting.

To summarize, the Wildlife Resource Program's Management Direction for murrelets is protecting PBFs that are currently supporting murrelet nesting in all LUAs in inland zone 1 and Late-successional and Riparian reserves in inland zone 2 (Table 130). The Wildlife Resource Program's Management Direction for murrelets is not protecting all PBFs important for the conservation of the species. See the next section on Timber Harvest for additional indirect benefits for PBFs.

Table 130. Summary of where protection measures apply for currently supporting murrelet nesting.

Land Use Allocation	Habitat modification from any activities within 35 miles from the coast	Habitat modification from any activities 35 -50 miles from the coast and in the range of the murrelets (range line is adjusted inland in the southern portion of the range, see Figure 12)
Late-Successional Reserves	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat
Riparian Reserves	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat
District-Designated Reserves	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat	Protection measures do not apply
Harvest Land Base	Protection measures apply for PBFs providing the greatest conservation benefit to the species (occupied habitat) and within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure), and 300 feet buffer habitat	Protection measures do not apply

The following Options refer to BLM activities expected to occur in murrelet nesting habitat within critical habitat in all LUAs within 35 miles of the coast and within Late-successional and Riparian Reserves between 35 and 50 miles from the coast. The Option followed during future

timber harvest planning is dependent, as applicable, on 1) land use allocation, 2) inland zone, 3) the type of activity, and, potentially, 4) survey results.

Option 1

This option ensures that timber harvest will not remove PBFs providing the greatest conservation benefit to the species (occupied habitat). If PBFs providing the greatest conservation benefit to the species (occupied habitat) are detected, a maximum of a 125.66 acre circle of PBFs and younger stands will be protected protection. In addition, another 63.6 acres of PBFs and younger stands will be protected based on an additional 300 foot buffer (this calculation is based on the PBFs and younger stands being a full ¼ mile circle).

The exempted activities and activities to improve the PBFs and younger stands (1/4 mile radius including all forest types, regardless of nesting structure) will only occur if the stand continues to support nesting. This means there may be some adverse effects to PBFs, a localized loss of nesting function, but that the effect will not affect the ability of the stand to provide nesting structure or the stand's ability to provide support for the nesting structure at the stand scale.

Option 2

This option ensures that timber harvest that occurs next to stands of an unknown conservation value to murrelets will still provide protections for PBFs. This option is not allowed within PBFs providing the greatest conservation benefit to the species (occupied habitat) or within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

Option 3

This option allows for adaptive management in stands associated with stands of an unknown conservation value to murrelets while still providing for PBFs. This option is not allowed within PBFs providing the greatest conservation benefit to the species (occupied habitat) or within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

This option also allows for the treatment of sudden oak death, regardless of conservation value to murrelets. Treatment of sudden oak death may have some impacts to PBFs from reducing the canopy cover supporting a nest tree. Treatment for sudden oak death includes removing infected deciduous trees. The reduction of canopy cover/fragmentation of the stand may cause: 1) nest trees to blow down, 2) change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting or 3) increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young.

Currently BLM's treatment for sudden oak death is a yearly process and the amount of treatment needed has vastly reduced since the time sudden oak death was first identified on BLM lands (Donegan 2016, pers. comm.).

In the BA the BLM was not able to provide any precise estimates of treatments for sudden oak death treatments that may occur over the next 50 years as part of the PRMP; such activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential activities until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when these projects are proposed the BLM will complete project-specific and site-specific NEPA and section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on critical habitat.

Option 4

This option can only be used when the nesting structure is occurring at a low density in the analysis area. This option allows for silviculture treatments that promote late-successional conditions, when the prescription is designed to protect the low density nesting structure in or adjacent to the treated unit. This option is designed to protect remnant trees (PBF1) within young plantation stands (not yet PBF2 stands). Over time, the plantation stand's live crown gains height and shades out killing the lower live limbs on the remnant structure, eventually leaving the potential nest platforms below the live crown of the stand. Murrelets are prone to nest predation and appear to seek out the live crown to help conceal their nests (Nelson 1997, p. 16; Nelson and Wilson 2002, pp. 24, 98 and 99). Platforms below the live crown no longer provide nesting structure for murrelets. Therefore, this option is helping to provide future habitat in younger stands, and it is helping to retain the nesting structure this is already present in the stand.

This option is not allowed within PBFs providing the greatest conservation benefit to the species (occupied habitat) or within any younger stands associated with the PBFs within a designated occupied stand (1/4 mile radius including all forest types, regardless of nesting structure) and 300 feet buffer habitat unless it also meets the requirements of option 1.

Timber Harvest

BLM predicted the timber harvest over time within murrelet critical habitat, based on LUAs and treatment types (Table 131). BLM then estimated the amount of murrelet nesting habitat and high-quality nesting habitat that would be associated with the modeled timber sales (Table 132). Because it is necessary to assess the effects of delaying or precluding the development of PBFs in critical habitat, the BLM projected the amount of regeneration harvest by decade in murrelet critical habitat in non-habitat (Table 133) which would delay or preclude the development of PBFs through timber harvest activities on 8,758 acres of critical habitat. Despite the effects of the PRMP on areas that do not currently contain PBF 1 as noted in this table, nesting habitat in critical habitat is forecasted to increase every decade, with a 54 percent increase on BLM lands in the action area over the 50 year life of the PRMP. While delaying or precluding the

development of the PBFs may reduce the overall improvement of the quality and distribution of murrelet habitat within critical habitat over the life of the PRMP, the result of the proposed action is a large increase in the amount and quality of critical habitat within the action area.

Table 131. Estimated acres of forest treatment, based on BLM Woodstock modeling, by LUA and decade, under the PRMP within murrelet critical habitat.

Land Use Allocation	Acres of critical habitat	Treatment	Acres of Treatment per Decade				
			First	Second	Third	Fourth	Fifth
1. Late-successional Reserve (261,587 in Murrelet Critical Habitat)							
1a. Structurally-complex Forest			0	0	0	0	0
1b. Late-Successional Reserve (Moist)		Commercial thinning	9,269	9,760	8,086	6,847	5,824
1b. Late-Successional Reserve (Dry)		Group and single-tree selection harvest	884	737	481	1,111	482
2. Riparian Reserve (Moist and Dry)	157,035	Commercial thinning	1,630	2,136	2,082	1,493	1,069
		Non-commercial thinning	607	721	517	587	253
District Designated Reserves	20,145		0	0	0	0	0
3. Harvest Land Base (39,718 acres in Murrelet Critical Habitat)							
3a. Moderate Intensity Timber Area	15,310	Commercial thinning	1,024	2,741	1,798	1,499	1,829
		Salvage (variable retention harvest)	0	0	10	0	0
		Regeneration harvest (variable retention harvest)	1,272	1,256	2,776	1,546	601
3b. Low Intensity Timber Area	23,877	Commercial thinning	1,094	2,826	1,728	2,475	3,424
		Salvage (variable retention harvest)	0	0	0	0	0
		Regeneration harvest (variable retention harvest)	2,669	1,027	2,214	1,722	1,702
3c. Uneven-Aged Timber Area	531	Group or single-tree selection harvest	310	39	115	53	120
		Salvage	0	0	0	0	0

Table 132. PRMP Harvest Scenario in murrelet critical habitat for BLM lands within action area.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		702	93	22	24	1
Nesting Habitat ²		4,223	2,189	3,000	3,728	4,962
Reserve						
High-Quality Nesting Habitat ¹		683	394	1	102	68
Nesting Habitat ²		3,918	4,275	1,687	3,991	5,581
Total						
High-Quality Nesting Habitat ²		1,385	487	24	126	69
Nesting Habitat ³		8,141	6,464	4,687	7,719	10,543

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.

Table 133. The acres of regeneration harvest by decade in murrelet critical habitat in nesting habitat and in non-habitat.

Conservation Zone	Regeneration Harvest Treatment by End of Decade (acres)									
	First (2023)		Second (2033)		Third (2043)		Fourth (2053)		Fifth (2063)	
	<i>Non-habitat</i>	<i>Nesting Habitat</i>	<i>Non-habitat</i>	<i>Nesting Habitat</i>	<i>Non-habitat</i>	<i>Nesting Habitat</i>	<i>Non-habitat</i>	<i>Nesting Habitat</i>	<i>Non-habitat</i>	<i>Nesting Habitat</i>
Zone 3	816	2,747	1,382	663	2,697	1,247	1,096	1,546	1,106	847
Zone 4	92	293	123	114	833	214	527	100	85	263
Total	908	3,040	1,505	777	3,530	1,461	1,623	1,646	1,192	1,110

In the Reserve System**Late-successional Reserves**

Late-successional reserves have the following management objectives and management direction relating to timber production and PBFs (BLM 2016a, pp. A14-A19):

Management Objectives

- *Promote the development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.*

Management Direction

- *Protect¹⁸ stands of older, structurally-complex conifer forest. Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat.*
- *Protect marbled murrelet occupied stands. In this context, **protect marbled murrelet occupied stands** means to prohibit activities in the occupied stand except for the following: felling of live or dead hazard trees, felling trees for habitat restoration, and the construction or maintenance of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the occupied stand continues to support marbled murrelet nesting. Implement wildfire management actions and activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, as long as the occupied stand continues to support marbled murrelet nesting.*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *In stands that are not northern spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of northern spotted owl nesting-roosting habitat or improve the quality of northern spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens.*
- *Utilize integrated vegetation management¹⁹ in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*

18 **Protect older, structurally-complex conifer forest** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and logs for streams, the construction, modification, maintenance and removal of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl and marbled murrelet life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival; and marbled murrelet nesting habitat continues to support marbled murrelet nesting. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat or remove marbled murrelet habitat.

19 **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include but are not limited to vegetation control, planting, snag creation, prescribed fire, thinning, single tree selection harvest, and group selection harvest.

- *Promote the development and retention of large, open grown trees and multi-cohort stands.*
- *Develop diverse understory plant communities.*
- *Increase or maintain vegetative species diversity.*
- *Restore and maintain habitat for Bureau Special Status species.*
- *Promote or enhance the development of structural complexity and heterogeneity.*
- *Create growing space for hardwood and pine persistence and regeneration.*
- *Create and maintain areas for hardwood and shrub dominance.*
- *Adjust stand composition or dominance.*
- *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In stands ≥ 10 acres treated with selection harvest or commercial thinning,*
 - *Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings²⁰ more than 4 acres in size.*
 - *Do not create group selection openings on more than 25 percent of the stand area.*
 - *Leave untreated skips on at least 10 percent of the stand area.*
- *In stands < 10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.*
- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.*
- *Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*

Summary of Silvicultural Activities

Timber production in this LUA is designed to promote late-successional conditions benefiting PBFs. Some treatments will have short-term impacts on PBFs due to thinning treatments opening up stands below current recommend levels to support murrelet trees with nesting structure, but treatments will have long term improvement for murrelet habitat development. Additionally treatments will be designed to limit blow down. Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) will not have any adverse impacts at the stand scale.

This LUA provides a high level of protection for PBFs and provides a high potential for ingrowth of murrelet habitat.

²⁰ **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7 " DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

Riparian Reserves

The Riparian Reserves have the following management objectives and management directions related to timber activities and PBFs (BLM 2016a, pp. A19-A24):

Management Objectives

- *Maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.*

Management Direction

- *Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.*
- *Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.*
- *Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *Prohibit timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*
- *Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.*

Summary of Silvicultural Activities

Timber production in this LUA is designed to promote large tree development to benefit fish. Some treatments may have short-term impacts on PBFs due to thinning treatments opening up stands below 40 percent canopy cover to support murrelet trees with nesting structure, but treatments will have long term improvement for murrelet habitat development as thinning treatments will be designed to promote larger tree growth and cover will close back in over time.

Impacts will also be reduced because: 1) Riparian Reserves are strips of lands and the harvest area is only the outside portion of these lands, therefore the canopy cover dropping below 40 percent will be a limited part of the stand, reducing the likelihood of a large increase in the stands usage by murrelet nest predators; and 2) the treatment will be designed to prevent blowdown. Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) will not have any adverse impacts at the stand scale.

This LUA provides a high level of protection for PBFs and provides a high potential for ingrowth of murrelet habitat. Although treatments are designed for fish, the desired result is a stand that will also support murrelet nesting habitat.

District Designated Reserves

District Designated Reserves have the following management objectives and management directions related to timber activities and PBFs (BLM 2016a, pp. A14-A19):

Management Objectives

- *None applicable*

Management Direction

- *None applicable*

District-Designated Reserve – Timber Production Capability Classification

Management Direction

- *Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).*
- *Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system,*

*District-Designated Reserve – Lands Managed for their Wilderness Characteristics*²¹

²¹ These objectives and direction apply to lands outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is proposing to manage for the protection of those wilderness characteristics.

Management Objectives

- *None applicable*

Management Direction

- *Allow mechanical vegetation treatment consistent with Visual Resource Management Class II for the purpose of improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*

Summary of Silvicultural Activities

Although these lands are a Reserve, their management as a whole is a range of activities, some of which are consistent with developing murrelet habitat. No timber sales are planned within this reserve designation, but timber sales may be used to manage habitat. These lands include (BLM 2016c, pp. 39-40):

- *Areas that the BLM has constructed for specific purposes (e.g., roads, buildings, maintenance yards, seed orchards, and other facilities and infrastructure);*
- *Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops);*
- *Areas of Critical Environmental Concern, including Research Natural Areas, that would not overlap the Harvest Land Base; and*
- *Other reserves (e.g., Special Recreation Management Areas that would not overlap the Harvest Land Base, areas protected for Bureau Sensitive species, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics). Timber production may be used to obtain a direct condition, specifically the management objectives discuss that restore or maintain community-level structural characteristics, promote desired species composition, emulate ecological conditions produced by historic fire regimes, improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*

This LUA provides a high level of protection for PBFs and provides for moderate ingrowth of murrelet habitat. We believe only a moderate level of ingrowth will occur due to the management is for a mix of conditions, of which only some will be consistent with developing murrelet habitat (e.g., Natural Areas, Lands Managed for their Wilderness Characteristics). Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) within inland zone 1 and this LUA will not have any adverse impacts at the stand scale. Currently no timber harvest is planned in this LUA (Table 131).

Congressionally Reserved Lands and the National Landscape Conservation System

No murrelet critical habitat was designated in areas that would potentially be included in Congressionally Reserved Lands and the National Landscape Conservation System under the PRMP.

Summary of Silvicultural Activities

Timber treatments will only occurs as needed for fuels treatments, invasive species management, riparian or wildlife habitat improvements, or forest management. This Reserve is not designed to actively promote murrelet habitat conditions, but the direction to promote wilderness character does include late-successional conditions.

The Service believes this LUA provides a high level of protection for PBFs and provides for moderate ingrowth of murrelet habitat. We believe only a moderate level of ingrowth will occur due to the management is for preserving the suitability of these areas for designation as Wilderness. We expect the forest to develop more late-successional conditions over time, but management could involve focusing on any forest development stage that is consistent with the designation of wilderness. The Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) within inland zone 1 and this LUA will not have any adverse impacts at the stand scale. Currently no timber harvest is planned in this LUA under the PRMP (McGraw 2016a, pers. comm.)

Summary of Reserve System and Silvicultural Activities

As identified above, timber actions occurring in the LSR and Riparian Reserves Systems will benefit the development of late-successional conditions. However, both Reserves systems may reduce the functionality of low quality murrelet habitat in an effort to develop high quality habitat quicker than if left untreated. The Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) within inland zone 1 and all reserves and within inland zone 2 and the late-successional and riparian reserves will not have any adverse impacts at the stand scale. Within the District Designated Reserve no timber sales are planned, but timber sales may be used to manage habitat.

We believe the reserve system provides a high level of protection for PBFs and overall provides a high potential for ingrowth of murrelet habitat.

Harvest Land Base

The Harvest Land Base has the following management objectives and management directions related to timber activities and PBFs (BLM 2016a, pp. A8-A14):

Management Objectives

- *Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.*
- *Offer for sale the declared Allowable Sale Quantity of timber.*
- *Recover economic value from timber following disturbances, such as fires, windstorms, disease, or insect infestations.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.*
- *Enhance the economic value of timber in forest stands.*

Management Direction

- *Conduct silvicultural treatments to contribute timber volume to the Allowable Sale Quantity.*
- *Conduct silvicultural treatments to enhance timber values and to reduce fire risks and insect and disease outbreaks.*
- *Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.*
- *Employ site preparation methods such as mechanical treatments (e.g., machine piling), manual treatments (e.g., brushing), and prescribed burns to prepare newly harvested and inadequately stocked areas for the regeneration of desirable tree species.*
- *Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.*
- *During commercial thinning, selection harvest,²² or regeneration harvest treatments of stands, retain existing—*
 - *Snags > 20" DBH*
 - *Snags 6-20" DBH in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook)*
 - *Down woody material > 20" in diameter at the large end and > 20' in length*
 - *Down woody material 6-20" in diameter at the large end and > 20' in length in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook) except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6 " DBH felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *If not suitable for commercial removal, make felled hazard trees available for habitat restoration purposes in any LUA.*

²² **Selection harvest** is a type of commercial harvesting. Selection harvesting generally involves removing individual trees or groups of trees up to four acres in size and is used as part of an uneven-aged management regime, or to create uneven-aged stands.

Summary of Timber Activities

This LUA provides a low level of protection for PBFs and provides for none to low levels of ingrowth of murrelet habitat. Wildlife Resource Program's protective measures will ensure that PBFs providing the greatest conservation benefit to the species (occupied habitat) within inland zone 1 and this LUA will not have any adverse impacts at the stand scale. All other PBFs will be in the BLMs rotation for timber production. We believe none to low levels of ingrowth will occur due to the management is for timber production.

Timber Activities - Summary

The PRMP Harvest Scenario in murrelet critical habitat will potentially affect 37,554 acres of PBFs over the next 50 years (

Table 132). Of these acres, 19,453 acres will potentially occur within the Reserve LUAs and 18,102 acres will potentially occur with the Harvest Land Base over the next 50 years. In addition to the potential impact to PBFs from harvest units, impacts associated with timber sales may also include spur roads, landings and yarding corridors.

These impacts affect PBFs by removing nest trees or modifying trees supporting nest trees and increasing fragmentation on the landscape. Fragmentation may cause nest trees to blow down, change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting and increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young. If a nest tree is lost and nesting is limited, then the stand's ability to support nesting may also be lost or reduced. Although there are many different ways PBFs may be affected from these activities, the impact to critical habitat is the loss of PBFs to support murrelet conservation. The analysis of effects to murrelet critical habitat from these activities is discussed below in the Combined Effects section.

In the BA the BLM was not able to provide precise locations for potential timber harvest or estimates of yarding corridors or spur roads that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on critical habitat.

Non-timber Actions

In addition to silvicultural activities and timber production, BLM is proposing to conduct other activities that may affect murrelet critical habitat (Table 134).

Table 134. Resource Programs for non-timber actions that may affect murrelet critical habitat.

Resource Programs for Non-timber Activities	Actions that may affect murrelet critical habitat
Areas of Critical Environmental Concern ²³	None currently identified
Fire, Fuels and Wildfire Response	Wildfire suppression, fuels reduction
Fisheries	Trees for instream restoration, culvert and bridge replacements
Forest Management	Hazard trees, rights-of-ways, insect and disease control (including treatment for sudden oak death), other activities to improve forest health, pre-commercial thinning, sample tree-falling
Hydrology	Trees for instream restoration, other facilities, culvert and bridge replacements
Invasive Species	insect and disease control (including treatment for sudden oak death)
Lands, Realty, and Roads	Hazard trees, culvert and bridge replacements, rights-of-ways
Rare Plants and Fungi	Oak restoration, meadow restoration
Recreation and Visitor Services	Hazard trees, camp ground, other facilities
Trails and Travel Management	Hazard trees, culvert and bridge replacements, other facilities

The Resource Program of Wildlife imposes additional restrictions to Resource Programs that carry out activities on BLM lands, which will limit the impacts to murrelet critical habitat within the LUA system.

Except for District-Designated Reserves within inland zone 2 and Harvest land base within inland zone 2, the following activities may only occur in habitat currently supporting murrelet nesting when the stand continues to support nesting post treatment (BLM 2016a, p. A-58):

²³ On BLM lands in the action area and in critical habitat, there is 16,859 acres of LUA that are also designated as Areas of Critical Environmental Concern (McGraw 2016c, pers. comm.). Within these acres, there is 12,982 acres of nesting habitat, of which 5,874 acres are of high-quality habitat.

- *Felling of hazard trees and trees for instream restoration projects*
- *Construction of linear and nonlinear rights-of-way*
- *Construction of other facilities*
- *Wildfire suppression*
- *Fuels reduction*
- *Insect and disease control*
- *Other activities to improve the health of the stand or adjacent stands*

Within the reserve system, except for District-Designated Reserves within inland zone 2 and Harvest land base within inland zone 2, the following activities may only occur in habitat that is not currently supporting murrelet nesting (BLM 2016a, p. A-58):

- *Oak restoration*
- *Meadow restoration*
- *Pre-commercial thinning*

Within the District-Designated Reserves within inland zone 2 and Harvest land base within inland zone 2 the above activities may take place with no restrictions.

The BLM was not able to provide any precise estimates of the non-timber activity projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, when these projects are proposed the BLM will complete project-specific and site-specific NEPA and section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

Indirect Effects from Actions on State, County and Private Lands

State, county and private actions within the action area and critical habitat may be facilitated by travel over BLM roads or by the use of tailhold or guyline trees on BLM lands. The PRMP has no authority on state, county or private lands. BLM consults on right-of-way actions on their lands, but they do not include indirect actions. They do provide notification to the landowner that they should seek consultation with the Service. Non-federal landowners have no obligation to preserve or grow murrelet critical habitat. No murrelet critical habitat was designated on the Coquille Forest lands.

In the BA the BLM was not able to provide any estimates of indirect timber harvest or non-timber activities or projects that may occur over the next 50 years as part of the PRMP associated with the state, county or private lands. We did not estimate the potential non-federal timber sales in the action area.

To evaluate the PRMP impacts to the non-federal portion of the action area over time, we forecasted the critical habitat trends on non-federal lands based on past management data in Conservation Zone 3 (Table 135 and Table 136) based on the NWFP 20-year monitoring report for murrelets (Falxa and Raphael 2015, pp. 118 and 121). For a detailed description of this

process see the Combined Effects to the Murrelet Population section above. No non-federal critical habitat occurs in Conservation Zone 4. We forecast 264 acres of PBFs will be lost over the next 50 years due to a variety of activities, including timber harvest and non-timber activities, and natural events that may occur associated with state, county or private lands within the action area. The analysis of effects to murrelet critical habitat from these activities is discussed below in the Combined Effects section

Table 135. Decadal forecast (2013-2063) of high-quality nesting habitat containing PBFs 1 and 2 expected on non-BLM lands designated as critical habitat in the action area associated with north south division of Conservation Zone 3.

Decade ¹	High-quality nesting Habitat on Non-BLM lands in the Action Area designated as critical habitat Conservation Zone 3 (Acres)
Current	1,164
1 st	1,107
2 nd	1,051
3 rd	998
4 th	948
5 th	900

¹ Habitat acreage based on the start of the decade (*i.e.*, 2023, 2033, 2043, 2053, 2063).

Table 136. Decadal forecast of high-quality nesting habitat on non-BLM lands designated critical habitat in the action area critical habitat unit.

		High-quality nesting habitat on non-BLM lands and critical habitat in the Action Area, by Decade					
CHU	Owner	Current	1 st	2 nd	3 rd	4 th	5 th
OR-01-b	State	5	5	5	4	4	4
OR-01-c	State & County	569	541	514	488	463	440
OR-02-a	State	8	8	7	7	7	6
OR-03-a	State, County & Private	18	17	16	15	15	14
OR-03-b	State	16	15	14	14	13	12
OR-03-c	State	548	521	495	470	446	424

Summary of Effects to Critical Habitat

The main adverse effects to murrelet critical habitat are due to fragmentation and loss of habitat in portions of the Harvest Land Base. Harvest activities removing PBFs, are summarized in the next paragraph. However, as discussed above, the PRMP will have many beneficial aspects to critical habitat and the development of PBFs that offset these adverse impacts. The PBFs currently supporting murrelet nesting will be protected in inland zone 1 and within Riparian Reserves and LSRs in inland zone 2. Late-successional and Riparian Reserves will be managed for developing late-successional conditions, which is also consistent with developing murrelet PBFs. The following section on combined effects looks at the spatial scale of potential timber sales and ingrowth in each CHU, Conservation Zone, the state-wide and range-wide scales and documents how each will be affected for the conservation of the murrelet over the 50 year life of the PRMP.

The PRMP Harvest Scenario in murrelet critical habitat will potentially directly affect 92,446 acres of critical habitat over the next 50 years (Table 132). Of these acres, 37,554 acres will potentially contain PBFs (Table 132). Of these PBF acres, 19,453 acres will potentially occur within the reserve LUAs and 18,102 acres will potentially occur with the harvest land base over the next 50 years. We calculated another 264 acres of PBFs on state, county and private lands may be affected from indirect actions or other natural events. Additionally, yarding corridors, spur roads and other non-timber actions on BLM lands in the action area could affect murrelet critical habitat but the effects cannot be quantified at this time due to lack of site-specific information at the programmatic, landscape scale. Of the 54,892 acres of critical habitat that does not contain PBFs, 8,758 are expected to experience timber harvest that will either preclude or significantly delay the development of murrelet critical habitat PBFs. These effects are addressed below.

These activities may affect PBFs by removing nest trees or modifying trees supporting nest trees and increasing fragmentation on the landscape. Fragmentation may cause nest trees to blow down, change the microclimate causing potential loss of moss cover at nest sites, which could eliminate the function of the platform for nesting and increase predator (corvid) levels or usage at the nest site resulting in a greater risk of predation of the egg or young. If a nest tree is lost and nesting is limited, then the stand's ability to support nesting may also be lost. Although there are many different ways PBFs may be affected from activities, the impact to critical habitat is the loss of PBFs to support murrelet conservation.

The BLM was not able to provide precise estimates of yarding corridors, landings or spur roads outside of harvest units of potential timber harvest or non-timber activities over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years and, as is appropriate for programmatic reviews, it is not possible or advisable to precisely estimate in this BO the potential impacts of the future actions. However, these types of activities are generally rare when not associated with timber harvest activities, particularly outside the Harvest Land Base. In reserved LUAs the objectives and management direction associated with these areas would generally function to minimize the effects of these management features on the landscape

and on the function of these LUAs. When these projects are proposed the BLM will complete project-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on critical habitat.

In addition to the effects to murrelet critical habitat that contain PBFs, the BLM projected the amount of regeneration harvest by decade in murrelet critical habitat in non-habitat (Table 133) which would delay or preclude the development of PBFs through timber harvest activities on 8,758 acres of critical habitat. Despite the effects of the PRMP on areas that do not currently contain PBF 1 as noted in Table 133, nesting habitat in critical habitat is forecasted to increase every decade, with a 54 percent increase on BLM lands in the action area over the 50 year life of the PRMP. While delaying or precluding the development of the PBFs may reduce the overall improvement of the quality and distribution of murrelet habitat within critical habitat over the life of the PRMP, the result of the proposed action is a large increase in the amount and quality of critical habitat within the action area. This overall increase will improve the condition and function of the critical habitat network at multiple spatial scales.

Combined Effects

As established above, impacts are expected to affect PBFs essential to the conservation of murrelets and affect the rate of ingrowth.

CHUs within the Action Area

The following CHUs sections include our analysis for impacts at the CHU scale. BLM predicted ingrowth and modeled fire for each CHU to assist with this analysis. The fire results by CHU are displayed in Table 137. Each CHU section also includes summary conditions and two tables. The first table has the projected acres of the CHU being affected by harvest activities. The second table has the projected development of the BLM's lands within the CHU, including harvest activities, ingrowth and fire. Figure 20 through Figure 23 show the location of the harvest land base in each CHU on BLM lands in the action area progressing from the north to the south.

Marbled Murrelet Critical Habitat Subunits (1 of 4) *Depiction of Harvest Land Base (Alt. B) within marbled murrelet Critical Habitat*

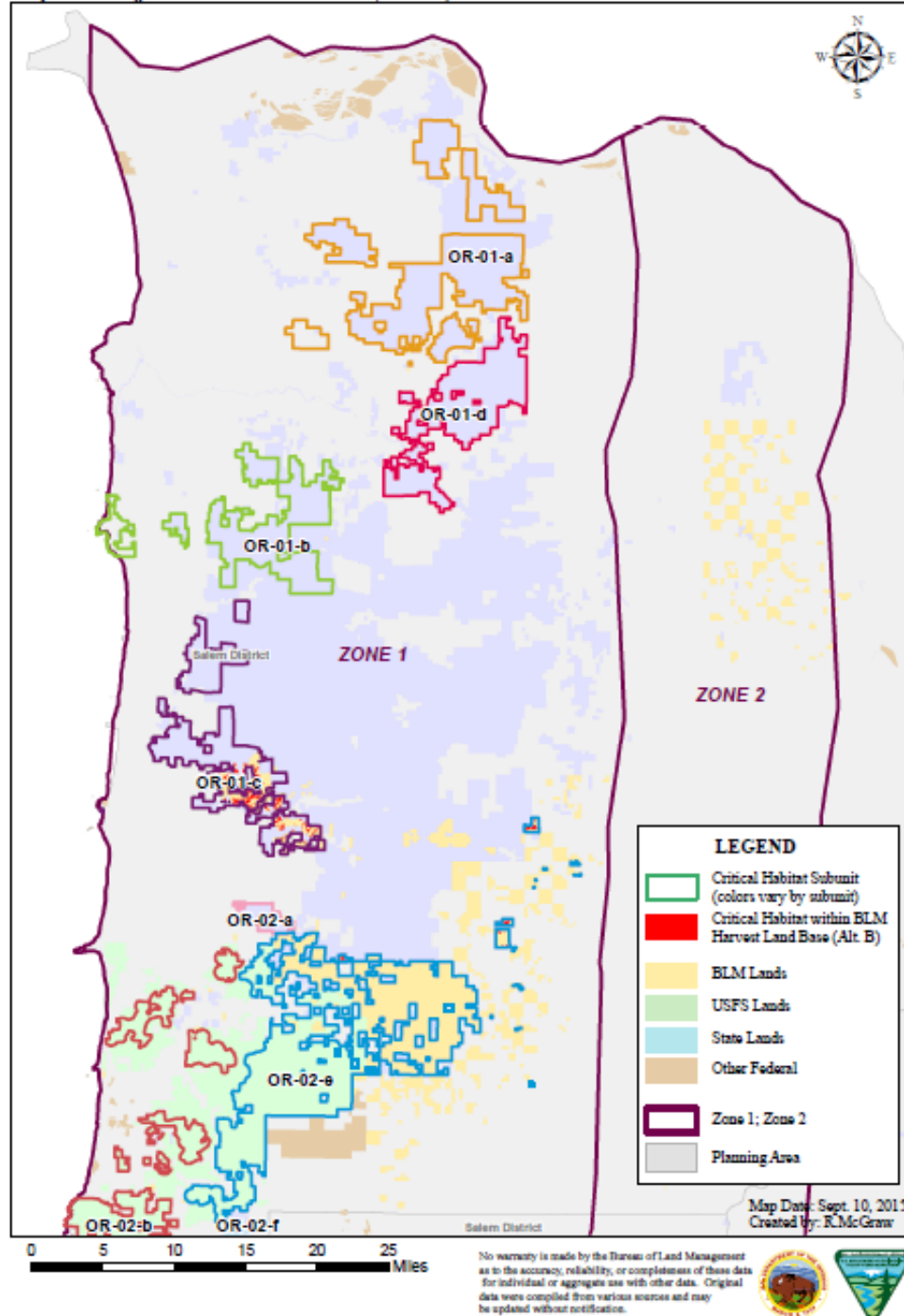


Figure 20. Location of Harvest Land Base within CHUs, 1 of 4. CHU is referred to as sub-unit in BLM’s Figure (McGraw 2016d, pers. comm.).

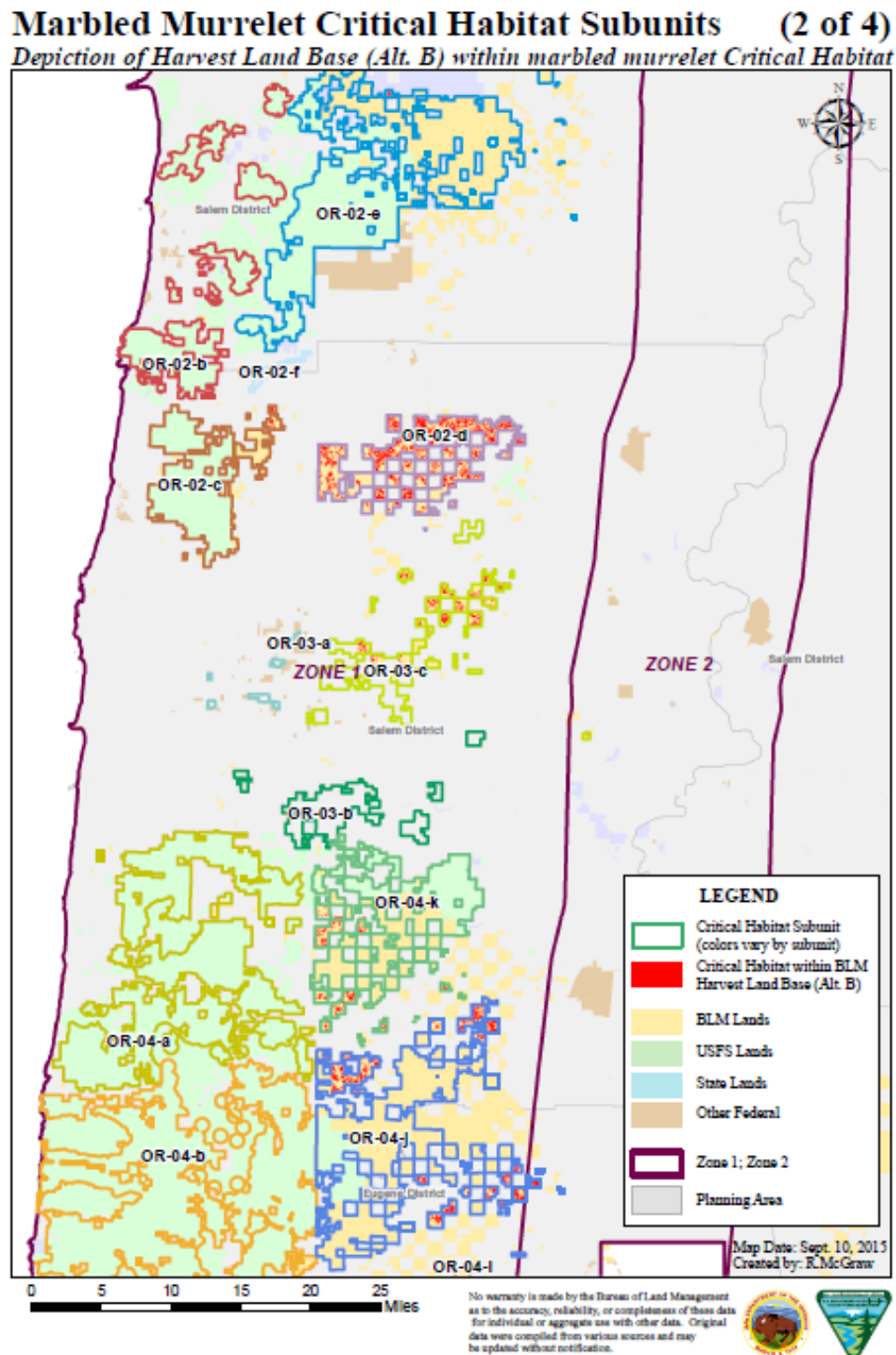


Figure 21. Location of Harvest Land Base within CHUs, 2 of 4. CHU is referred to as sub-unit in BLM's Figure (McGraw 2016d, pers. comm.).

Marbled Murrelet Critical Habitat Subunits (3 of 4)

Depiction of Harvest Land Base (Alt. B) within marbled murrelet Critical Habitat

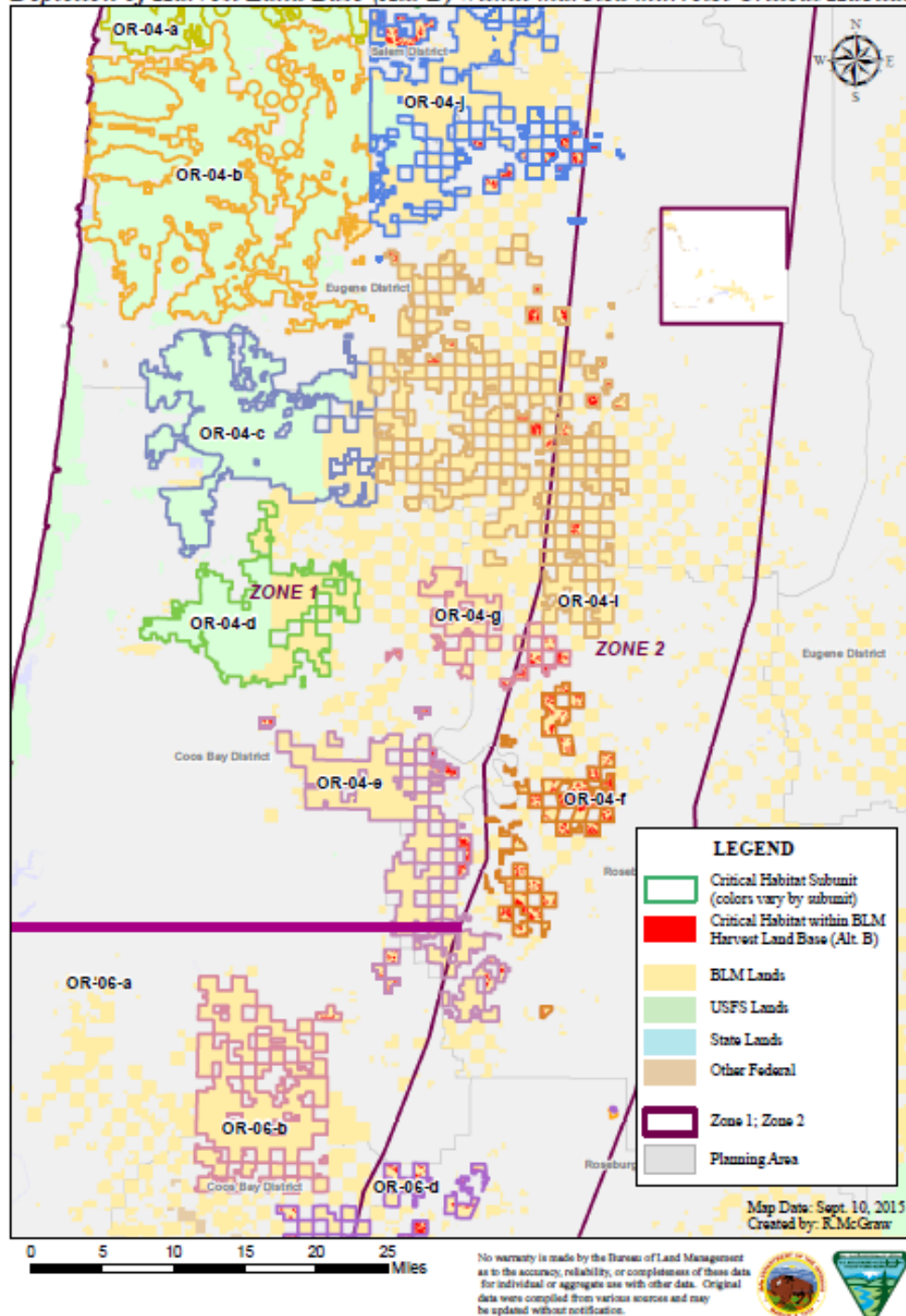


Figure 22. Location of Harvest Land Base within CHUs, 3 of 4. CHU is referred to as sub-unit in BLM's Figure and the Elliot state forest is not mapped (McGraw 2016d, pers. comm.).

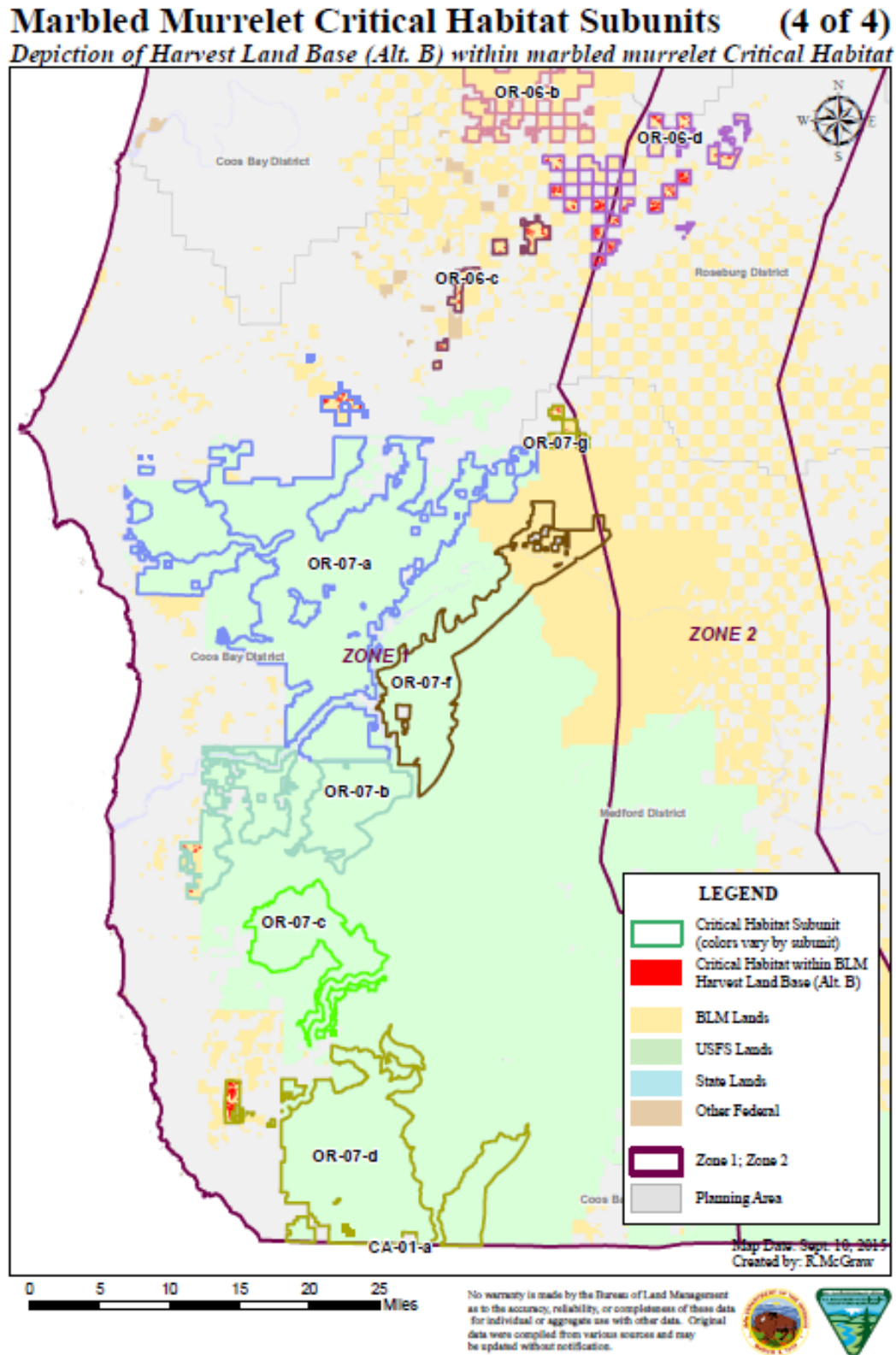


Figure 23. Location of Harvest Land Base within CHUs, 4 of 4. CHU is referred to as sub-unit in BLM's Figure (McGraw 2016d, pers. comm.).

Table 137. Predicted fire within murrelet designated CHUs on BLM-administered lands.

CHU Name	Acres of BLM within CHU (acres)	Predicted Fire on BLM-administered lands within MAMU CHUs (acres)					
		1 st Decade	2 nd Decade	3 rd Decade	4 th Decade	5 th Decade	Total*
OR-01-b	1	-	-	-	-	-	-
OR-01-c	7,725	-	-	-	-	-	-
OR-02-a	0	-	-	-	-	-	-
OR-02-b	4	-	-	-	-	-	-
OR-02-c	3,605	-	-	-	-	-	-
OR-02-d	26,557	-	-	-	-	-	-
OR-02-e	41,185	-	300	-	-	-	300
OR-03-a	38	-	-	-	-	-	-
OR-03-c	8,747	-	-	-	-	-	-
OR-04-a	1,303	-	-	-	-	-	-
OR-04-b	1,118	-	-	-	-	-	-
OR-04-c	14,478	-	-	-	-	-	-
OR-04-d	21,070	-	-	-	-	-	-
OR-04-e	53,183	-	650	-	-	-	650
OR-04-f	20,743	-	-	-	-	-	-
OR-04-g	16,227	-	-	-	-	-	-
OR-04-i	82,458	-	-	-	1,231	1,364	2,595
OR-04-j	58,203	-	920	-	-	-	920
OR-04-k	26,665	-	-	-	-	-	-
OR-06-a	39	-	-	-	-	-	-
OR-06-b	52,314	-	-	-	-	-	-
OR-06-c	4,717	-	-	-	-	-	-
OR-06-d	17,430	-	-	-	-	-	-
OR-07-a	2,401	-	5	-	-	-	5
OR-07-b	2,208	-	-	-	-	-	-
OR-07-d	1,865	-	-	-	-	-	-
OR-07-f	13,879	-	3,453	-	1,795	1,576	6,223
OR-07-g	2,210	-	-	-	-	-	-
Grand Total	480,369	-	5,328	-	3,026	2,940	10,693

*For OR-07-f, the total does not equal the sum of the decadal fires because ~601 acres re-burned in the 4th decade that had previously burned in the 2nd decade.

Effects to Non-habitat in Murrelet Critical habitat

The BLM modeled the amount of non-habitat (acres with no PBFs) within murrelet critical habitat that would be affected by regeneration timber harvest (Table 138). In these areas we

anticipate there will be a significant delay in the development of PBFs, or their development will be precluded altogether. The effects of these harvests could delay the development and quality of the critical habitat units. However, as noted above, we do not anticipate that this will affect the function of the critical habitat network at the action area, conservation zone or listed range scales because nesting habitat in critical habitat within the action area is forecasted to increase every decade which will improve the quality and functionality of the network. The BLM anticipates a 54 percent increase in murrelet nesting habitat in critical habitat on BLM lands in the action area over the 50 year life of the PRMP. The following analyses by CHU, conservation zone and listed range include these effects to non-habitat in their analysis to ingrowth over time.

Table 138. Modeled PRMP regeneration harvest within murrelet critical habitat units.

CHU Name	Cons. Zone	Regeneration Harvest Treatment by End of Decade (acres)									
		First (2023)		Second (2033)		Third (2043)		Fourth (2053)		Fifth (2063)	
		Non-habitat	Nesting Habitat	Non-habitat	Nesting Habitat	Non-habitat	Nesting Habitat	Non-habitat	Nesting Habitat	Non-habitat	Nesting Habitat
OR-01-b	3	-	-	-	-	-	-	-	-	-	-
OR-01-c	3	-	31	-	-	-	-	8	24	-	6
OR-02-b	3	-	-	-	-	-	-	-	-	-	-
OR-02-c	3	2	1	41	-	13	-	3	-	56	-
OR-02-d	3	386	68	353	45	1,489	222	314	395	293	302
OR-02-e	3	0	194	83	110	88	24	0	35	2	0
OR-03-a	3	-	0	-	-	540	-	-	-	-	-
OR-03-c	3	103	143	23	-	0	25	129	91	95	80
OR-04-a	3	-	0	-	-	-	-	2	-	12	-
OR-04-b	3	-	-	-	-	-	-	-	-	-	-
OR-04-c	3	-	-	-	-	-	-	-	-	-	-
OR-04-d	3	0	-	-	-	0	-	-	-	0	0
OR-04-e	3	-	103	15	14	129	-	285	55	21	72
OR-04-e	4	-	41	-	-	43	-	25	-	-	44
OR-04-f	3	20	1,264	121	208	196	485	218	73	269	4
OR-04-f	4	-	-	3	-	4	7	33	-	-	-
OR-04-g	3	131	2	211	69	99	80	52	0	59	-
OR-04-i	3	124	517	173	33	54	321	21	439	80	113
OR-04-j	3	28	343	303	157	67	88	57	320	153	179
OR-04-k	3	21	78	59	28	22	2	7	114	66	89
OR-06-a	4	-	7	-	-	-	-	0	-	-	-
OR-06-b	4	-	1	0	0	2	0	16	1	-	1
OR-06-c	4	-	21	0	25	18	-	12	-	-	34
OR-06-d	4	91	135	111	63	631	86	398	84	83	133
OR-07-a	4	-	1	9	0	104	-	38	15	0	51
OR-07-b	4	1	-	-	-	-	65	-	-	-	-
OR-07-d	4	0	86	-	25	30	56	4	-	3	-
OR-07-f	4	-	1	-	-	-	-	-	-	-	0
OR-07-g	4	-	-	-	-	-	-	-	-	-	-
Total	-	908	3,040	1,505	777	3,530	1,461	1,623	1,646	1,192	1,110

CHU OR-01-b

As critical habitat was only designated on state lands in the CHU (USFWS 1996, p. 26295), the BLM lands in this CHU is a GIS projection error. BLM calculated less than 1 acre of habitat-capable BLM lands occurred in this CHU. We removed these lands from our analysis of this CHU, but due to the acre value being less than 1 acre we did not recalculate the conservation zone and state totals for BLM in growth over the five decades of the PRMP.

On state lands in this CHU, we forecast one acre of high-quality nesting habitat maybe lost in the action area over 50 years (Table 139). This potential change in non-federal high-quality nesting habitat in the action area related to indirect non-federal actions represents less than a 1 percent reduction at the CHU scale.

Because no BLM timber harvest will occur in this CHU and the potential small percent of indirect, non-federal activities that may occur in the CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 32,477 acres

BLM-administered lands within CHU = 0 acre (0 percent of CHU)

Other landowners within CHU = 32,476 acres (100 percent of CHU)

Table 139. Murrelet habitat development in **CHU OR-01-b**.

(acres)	2013	2023	2033	2043	2053	2063
Non-federal lands in the action area						
High-Quality Nesting Habitat	5	5	5	4	4	4
CHU Total ³						
High-Quality Nesting Habitat ¹	1,011					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-01-c

BLM manages 23 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 140. Although BLM is projecting that 5 percent of the BLM-managed nesting habitat within this CHU may be affected, 27 percent of these effects that will be in Late-Successional or Riparian Reserves will be thinning prescriptions that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first and second decades dropping below the original BLM decade nesting total by 24 acres and by 116²⁴ acres, respectfully. The 116 acre reduction in the second decade of the plan is about 2 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 33 percent and to increase high-quality nesting habitat by 152 percent. BLM projects within this CHU affect less than 1 percent of the high-quality nesting habitat (Table 141) and don't reduce the decadal amount of high-quality nesting habitat in any decade of the plan.

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys. The spatial array of Harvest Land Base within this CHU could potentially fragment blocked up murrelet habitat. However, based on BLM's timber harvest projections these impacts will affect only 10 percent of the Harvest Land Base in this CHU.

The other ownerships in this CHU are State and County lands. Because ODF and local Counties do not manage critical habitat for the recovery of murrelets, there is a greater need for support from BLM lands in this CHU. On state and county lands in this CHU, we forecast another 129 acres of high-quality nesting habitat maybe lost in the action area over 50 years (Table 141). This potential change in non-federal high-quality nesting habitat in the action area is a 5 percent reduction at the CHU scale.

Based on the level of impacts and the potential acreage of indirect non-federal activities that may occur in the CHU, the Service believes the proposed action has the potential to adversely affect the function of this CHU in the near-term. In the long-term this CHU is projected to greatly increase the amount of PBFs which will increase its quality and functionality. The effects of this reduction in nesting habitat are a reduction in the capability of this CHU to provide murrelet nesting opportunities. While murrelets will continue to nest in this CHU, the CHU will likely be able to support less murrelets when the amount of nesting habitat decreases. Fragmentation may also decrease the reproductive success rate.

Total CHU = 33,535 acres

BLM-administered lands within CHU = 7,725 acres (23 percent of CHU)

24 Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

o BLM Harvest Land Base = 2,030 acres (6 percent of CHU)

o BLM Reserves = 5,695 acres (17 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 7,207 acres (21 percent of CHU)

Other landowners within CHU = 25,810 acres (77 percent of CHU)

Table 140. PRMP Harvest Scenario in **CHU OR-01-c**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		3	-	-	4	-
Nesting Habitat ²		31	-	-	24	156
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	21	-	-	56
Total						
High-Quality Nesting Habitat ¹		3	-	-	4	-
Nesting Habitat ²		31	21	-	24	212

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

Table 141. Murrelet habitat development in **CHU OR-01-c**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	1,126	1,205	2,104	2,451	2,658	2,842
Nesting Habitat ²	5,281	5,257	5,165	5,818	6,651	7,013
Non-federal lands in the action area						
High-Quality Nesting Habitat ¹	569	541	514	488	463	440
CHU Total⁵						
High-Quality Nesting Habitat ¹	2,798					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-02-a

BLM manages no lands in this CHU, but BLM lands in OR-02-e occur adjacent to OR-02-a. Therefore, part of the action area occurs within this CHU. This CHU contains 3,534 acres of state lands, of which 14 acres are high-quality habitat (Table 142). On state lands in this CHU, we forecast two acres of the high-quality nesting habitat maybe lost in the action area over 50 years. This potential change in non-federal high-quality nesting habitat in the action area potentially resulting from indirect non-federal actions represents a 14 percent reduction at the CHU scale.

Although no Federal lands occur in this CHU, the potential effects of indirect non-federal activities that may occur in the CHU combined with a small baseline of high-quality nesting habitat, leads the Service to conclude that the proposed action has the potential to adversely affect the already impaired function of this CHU.

Total CHU = 3,534 acres

BLM-administered lands within CHU = 0 acres (0 percent of CHU)

Other landowners within CHU = 3,534 acres (100 percent of CHU)

Table 142. Murrelet habitat development in **CHU OR-02-a**.

(acres)	2013	2023	2033	2043	2053	2063
Non-federal lands in the action area						
High-Quality Nesting Habitat	8	8	7	7	7	6
CHU Total						
High-Quality Nesting Habitat	14					

CHU OR-02-b

BLM manages less than 1 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 143. Although BLM is potentially affecting 25 percent of the ingrowth of BLM-managed nesting habitat within this CHU, their ownership is less than 1 percent of the CHU and currently contains no nesting habitat (Table 144). Even with ingrowth throughout 50 years, BLM's high-quality nesting habitat within the CHU is still 0 percent of the total for the CHU (Table 144).

This CHU is located in inland zone 1, which means that the one potential planned timber sale may not occur due to murrelet surveys being required in this zone. Additionally, the one acre of potential timber harvest is in the fifth decade when more murrelet habitat will have come on line. Because of the level of impacts and that those impacts are not projected until the fifth decade, the Service believes the proposed action will not adversely affect the function of this CHU.

Total CHU = 32,496 acres

BLM-administered lands within CHU = 4 acres (0 percent of CHU)

o BLM Harvest Land Base = 1 acres (0 percent of CHU)

o BLM Reserves = 3 acres (0 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 4 acres (0 percent of CHU)

Other landowners within CHU = 32,492 acres (100 percent of CHU)

Table 143. PRMP Harvest Scenario in **CHU OR-02-b**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		0	-	-	-	1
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	0
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		0	-	-	-	1

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

Table 144. Murrelet habitat development in **CHU OR-02-b**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	0	0	0	0	0	0
Nesting Habitat ²	0	0	0	4	4	3
CHU Total ⁵						
High-Quality Nesting Habitat ¹	6,922					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-02-c

BLM manages 11 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 145. Although BLM is potentially affecting 19 percent of the BLM-managed nesting habitat within this CHU, 56 percent of these effects will be thinning prescriptions that will potentially develop higher quality habitat quicker than if left unmanaged (projected timber harvest in Late-successional and Riparian Reserves). Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first and second decades dropping below the original BLM decade nesting total by 87 acres²⁵ and then by 23 acres, respectfully. The 87 acre reduction in the first decade of the plan is about 4 percent of the BLM nesting habitat within this CHU. However, BLM only manages 11 percent of this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 58 percent and to increase high-quality nesting habitat by 171 percent over 50 years. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than one percent of the high-quality nesting habitat (Table 146).

This CHU is located in inland zone 1, which means some potential timber sales may not occur if occupied murrelet sites are located during this zone. The spatial array of Harvest Land Base within this CHU could potentially create some fragmentation in the northeast corner of this CHU. Based on BLM's timber harvest projections for this CHU impacts will potentially be 56 percent of the Harvest Land Base displayed in Figure 21, though almost all of these impacts will occur in the fourth and fifth decades. This delay in impacts within the harvest land base allows the CHU to produce more habitat and therefore reducing the scale of the impacts. The potential impacts in the first two decades are almost entirely from thinning that will occur within the Reserves system. Because thinning treatments are expected to maintain trees containing nesting structure at the stand scale, some of the thinning units are expected to continue to provide murrelet habitat. Other thinning treatments are expected to open the canopy cover up too much for murrelet habitat, but because nesting structure is maintained at the stand scale nesting function of the stand will return as the tree crowns fill in. Because of the level of impacts in both the near-term and long-term, ingrowth, the impact to future habitat development, and because this CHU is entirely Federal lands, the Service believes the proposed action will not adversely affect the function of this CHU at any time during the life of the PRMP.

Total CHU = 31,484 acres

BLM-administered lands within CHU = 3,605 acres (11 percent of CHU)

- o BLM Harvest Land Base = 306 acres (1 percent of CHU)

- o BLM Reserves = 3,300 acres (10 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 3,490 acres (11 percent of CHU)

²⁵ Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

Other landowners within CHU = 27,879 acres (89 percent of CHU)

Table 145. PRMP Harvest Scenario in **CHU OR-02-c**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		1	-	-	-	-
Nesting Habitat ²		1	-	-	56	114
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		36	51	-	17	111
CHU Total						
High-Quality Nesting Habitat ¹		1	-	-	-	-
Nesting Habitat ²		36	51	-	73	225

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

Table 146. Murrelet habitat development in **CHU OR-02-c**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	459	655	880	1,048	1,261	1,246
Nesting Habitat ²	2,023	1,936	2,000	2,448	3,030	3,194
CHU Total³						
High-Quality Nesting Habitat ¹	5,812					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-02-d

BLM manages 98 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 147. Although BLM is potentially affecting 25 percent of the BLM-managed nesting habitat within this CHU, 7 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade of high-quality nesting habitat dropping below the original BLM baseline amount by one acre²⁶. This reduction is less than one percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 60 percent and to increase high-quality nesting habitat by 41 percent. Within the CHU, BLM proposes to affect less than 0.5 acres of the high-quality nesting habitat (Table 148).

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys. The spatial array of Harvest Land Base within this CHU, it could fragment the currently blocked up habitat for murrelets. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 33 percent of the Harvest Land Base displayed in Figure 21. Because of the extremely low level of impacts compared to the current habitat levels and ingrowth, the Service believes the proposed action does not have the potential to adversely affect the function of this CHU. The effects of this reduction in nesting habitat are a reduction in the capability of this CHU to provide murrelet nesting opportunities. While murrelets will continue to nest in this CHU, the CHU will likely be able to support less murrelets when the amount of nesting habitat decreases. Fragmentation may also decrease the reproductive success rate.

Total CHU = 27,220 acres

BLM-administered lands within CHU = 26,557 acres (98 percent of CHU)

- o BLM Harvest Land Base = 9,370 acres (34 percent of CHU)
- o BLM Reserves = 17,188 acres (63 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 25,342 acres (93 percent of CHU)

Other landowners within CHU = 443 acres (2 percent of CHU)

²⁶ Acre lost is due to tree mortality dropping the classification of this acre in the modeling process.

Table 147. PRMP Harvest Scenario in **CHU OR-02-d**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		303	595	603	1,013	532
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		54	32	21	107	32
Total						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		357	626	624	1,120	563

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 148. Murrelet habitat development in **CHU OR-02-d**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	2,969	2,968	3,236	3,274	3,704	4,176
Nesting Habitat ²	13,108	13,623	16,622	18,886	20,101	21,049
CHU Total³						
High-Quality Nesting Habitat ¹	2,980					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-02-e

BLM manages 46 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 149. Although BLM is potentially affecting 11 percent of the BLM-managed nesting habitat within this CHU, 79 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with BLM habitat levels remaining above baseline levels in all decades. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 79 percent and to increase high-quality nesting habitat by 73 percent. These values include a predicted fire loss of 300 acres of BLM stands in the second decade (Table 137). Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 141).

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys. Because of the spatial array of Harvest Land Base within this CHU, it could create three small areas of fragmentation in the northern portion of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 60 percent of the Harvest Land Base displayed in Figure 20. Impacts in the reserve system will consist of thinning treatments. Because thinning treatments are expected to maintain trees containing nesting structure at the stand scale, some of the thinning units are expected to continue to provide murrelet habitat. Other thinning treatments are expected to open the canopy cover up too much for murrelet habitat, but because nesting structure is maintained at the stand scale nesting function of the stand will return as the tree crowns fill in. Because of the level of impacts related to the current habitat levels, ingrowth which outpaces harvest impacts, and because this CHU is entirely Federal lands, the Service believes the proposed action will not adversely affect the function of this CHU in either the near-term or long-term.

Total CHU = 89,747 acres

BLM-administered lands within CHU = 41,185 acres (46 percent of CHU)

- o BLM Harvest Land Base = 772 acres (1 percent of CHU)
- o BLM Reserves = 40,413 acres (45 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 38,585 acres (43 percent of CHU)

Other landowners within CHU = 48,562 acres (54 percent of CHU)

Table 149. PRMP Harvest Scenario in **CHU OR-02-e**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		54	-	1	0	-
Nesting Habitat ²		275	135	25	38	2
Reserve						
High-Quality Nesting Habitat ¹		-	0	1	-	-
Nesting Habitat ²		3	397	122	432	805
Total						
High-Quality Nesting Habitat ¹		54	0	2	0	-
Nesting Habitat ²		278	531	146	469	806

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 150. Murrelet habitat development in **CHU OR-02-e**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	8,284	8,316	11,069	12,117	13,931	14,371
Nesting Habitat ²	20,719	21,523	23,355	27,366	33,964	37,039
CHU Total³						
High-Quality Nesting Habitat ¹	16,609					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-03-a

BLM manages three percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 151. BLM is potentially affecting less than 0.5 acre of the BLM-managed nesting habitat within this CHU (Table 152). Because of the current condition in this CHU, ingrowth of nesting habitat is not expected over the next 50 years. On state, county and private lands in this CHU, we forecast 4 acres of the high-quality nesting habitat may be lost in the action area over 50 years (Table 152). This potential change in non-federal high-quality nesting habitat in the action area related to indirect non-federal actions represents a 3 percent reduction at the CHU scale.

Because less than 0.5 acres of BLM timber harvest will occur in this CHU and the potential small percent of indirect non-federal activities that may occur in the CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 1,469 acres

BLM-administered lands within CHU = 38 acres (3 percent of CHU)

- o BLM Harvest Land Base = 0 acres (0 percent of CHU)
- o BLM Reserves = 38 acres (3 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 37 acres (3 percent of CHU)

Other landowners within CHU = 1,431 acres (97 percent of CHU)

Table 151. PRMP Harvest Scenario in **CHU OR-03-a**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		0	-	-	-	-
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Total						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		0	-	-	-	-

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

Table 152. Murrelet habitat development in **CHU OR-03-a**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	22	22	22	22	22	22
Nesting Habitat ²	37	37	37	37	37	37
Non-federal lands in the action area						
High-Quality Nesting Habitat ¹	18	17	16	15	15	14
CHU Total ³						
High-Quality Nesting Habitat ¹	139					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-03-b

BLM manages no lands in this CHU, but BLM lands outside of critical habitat occur adjacent to OR-03-b. Therefore, part of the action area occurs within this CHU. This CHU contains 14,847 acres of state lands, of which 214 acres are high-quality habitat (Table 153). On state lands in this CHU, we forecast three acres of the high-quality nesting habitat maybe lost in the action area over 50 years. This potential change in non-federal high-quality nesting habitat in the action area related to indirect non-federal actions represents a 1 percent reduction at the CHU scale.

Because no BLM timber harvest will occur in this CHU and the potential small percent of indirect non-federal activities that may occur in the CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 14,847 acres

BLM-administered lands within CHU = 0 acres (0 percent of CHU)

Other landowners within CHU = 14,847 acres (100 percent of CHU)

Table 153. Murrelet habitat development in **CHU OR-03-b**.

(acres)	2013	2023	2033	2043	2053	2063
Non-federal lands in the action area						
High-Quality Nesting Habitat	16	15	14	14	13	13
CHU Total						
High-Quality Nesting Habitat	214					

CHU OR-03-c

BLM manages 43 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 154. Although BLM is potentially affecting 27 percent of the BLM-managed nesting habitat within this CHU, six percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the BLM's baseline of nesting habitat by 154 acres; this potential reduction is about three percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 58 percent and to increase high-quality nesting habitat by 21 percent. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 0.5 acre of the high-quality nesting habitat (Table 155).

This CHU is located mostly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves (Figure 21). The spatial array of Harvest Land Base within this CHU, it has the potential to fragment blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be to 44 percent of the Harvest Land Base displayed in Figure 21. The other ownership in this CHU is non-federal: state and private lands. Because neither ODF nor private lands manage critical habitat for the recovery of murrelets, there is a greater need for support from BLM lands in this CHU. On state and private lands in this CHU, we forecast another 124 acre of high-quality nesting habitat maybe lost in the action area over 50 years (Table 155). This potential change in non-federal high-quality nesting habitat in the action area related to indirect non-federal actions represents a 3 percent reduction at the CHU scale.

Because of the level of impacts compared to the current habitat levels and ingrowth, and the potential small percent of indirect non-federal activities that may occur in the CHU, the Service believes the proposed action has the potential to adversely affect the function of this CHU in the first decade. The effects of this reduction in nesting habitat are a reduction in the capability of this CHU to provide murrelet nesting opportunities. While murrelets will continue to nest in this CHU, the CHU will likely be able to support less murrelets when the amount of nesting habitat decreases. Fragmentation may also decrease the reproductive success rate. By the second decade management of this CHU is expected to provide for more nesting habitat and high-quality nesting habitat (PBFs 1 and 2) than the current baseline amounts.

Total CHU = 20,569 acres

BLM-administered lands within CHU = 8,747 acres (43 percent of CHU)

- o BLM Harvest Land Base = 2,648 acres (13 percent of CHU)

- o BLM Reserves = 6,099 acres (30 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 8,404 acres (41 percent of CHU)

Other landowners within CHU = 11,822 acres (57 percent of CHU)

Table 154. PRMP Harvest Scenario in **CHU OR-03-c**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		156	162	112	255	482
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		41	-	9	16	12
Total						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		197	162	121	271	494

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 155. Murrelet habitat development in **CHU OR-03-c**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	2,296	2,296	2,718	2,718	2,806	2,771
Nesting Habitat ²	4,576	4,422	5,114	5,739	6,934	7,228
Non-federal lands in the action area						
High-Quality Nesting Habitat ¹	548	521	495	470	446	424
CHU Total³						
High-Quality Nesting Habitat ¹	4,047					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-a

BLM manages one percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 156. Although BLM is potentially affecting eight percent of the BLM-managed nesting habitat within this CHU, 45 percent of these effects will be thinning prescriptions that will potentially develop higher quality habitat quicker than if left unmanaged (projected timber harvest in Late-successional and Riparian Reserves). Ingrowth of nesting habitat helps to compensate for the acres being removed, with BLM habitat levels remaining at or above baseline levels in all decades (Table 157). BLM lands in this CHU over the next 50 years are expected to increase nesting habitat by 58 percent and to increase high-quality nesting habitat by 19 percent. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 0.5 acres of the high-quality nesting habitat.

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys. Looking at the spatial array of Harvest Land Base within this CHU, it is so small it is masked by the CHU boundary lines in Figure 21. Impacts will potentially be 90 percent of the Harvest Land Base in this CHU, though almost all of these impacts will occur in the fourth and fifth decades. This delay in impacts within the harvest land base allows the CHU to produce more habitat and therefore delay and reduce the scale of the impacts. Because of the level of impacts and ingrowth compared to the current baseline, the potential impacts to future habitat development and because this CHU is entirely Federal lands, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 92,227 acres

BLM-administered lands within CHU = 1,303 acres (1 percent of CHU)

- o BLM Harvest Land Base = 40 acres (0 percent of CHU)

- o BLM Reserves = 1,263 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,265 acres (1 percent of CHU)

Other landowners within CHU = 90,924 acres (99 percent of CHU)

Table 156. PRMP Harvest Scenario in **CHU OR-04-a**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		0	-	-	12	24
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	0	7	22
Total						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		0	-	0	19	46

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 157. Murrelet habitat development in **CHU OR-04-a**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	501	503	552	559	576	599
Nesting Habitat ²	769	769	808	943	1,193	1,214
CHU Total³						
High-Quality Nesting Habitat ¹	34,169					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-b

BLM manages less than one acre of ownership in this CHU, which is partly in the Harvest Land Base, and no harvest activities have been modeled in this CHU (Table 158). Therefore, the Service believes within this CHU the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 149,771 acres

BLM-administered lands within CHU = 1,118 acres (1 percent of CHU)

o BLM Harvest Land Base = 5 acres (0 percent of CHU)

o BLM Reserves = 1,113 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,117 acres (1 percent of CHU)

Other landowners within CHU = 148,653 acres (99 percent of CHU)

Table 158. PRMP Harvest Scenario in **CHU OR-04-b**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

Table 159. Murrelet habitat development in **CHU OR-04-b**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	872	872	872	887	904	932
Nesting Habitat ²	1,009	1,009	1,037	1,057	1,063	1,063
CHU Total ³						
High-Quality Nesting Habitat ¹	52,825					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-c

BLM manages 18 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 160. Although BLM is potentially affecting seven percent of the BLM-managed nesting habitat within this CHU, 100 percent of these effects will result from thinning prescriptions that are designed to develop higher quality habitat quicker than if left untreated (projected timber harvest in Late-successional and Riparian Reserves). BLM is potentially not reducing nesting habitat in this CHU (Table 161). Ingrowth of nesting habitat compensate for the acres being removed, with BLM habitat levels remaining above baseline levels in all decades. Natural events will potentially drop the decade high-quality nesting habitat by 41 acre²⁷ for the first decade, this reduction is less than one percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 62 percent and to increase high-quality nesting habitat by eight percent.

This CHU is located in inland zone 1, which means potential planned timber sales may not occur due to murrelet surveys being required in this zone. No Harvest Land Base occurs within this CHU. The impacts to this CHU are entirely from harvest within the reserve system. Because thinning treatments are expected to maintain trees containing nesting structure at the stand scale, some of the thinning units are expected to continue to provide murrelet habitat. Other thinning treatments are expected to open the canopy cover up too much for murrelet habitat, but because nesting structure is maintained at the stand scale nesting function of the stand will return as the tree crowns fill in. Because of the level of impacts compared to baseline levels and ingrowth, the potential impacts to future habitat development and because this CHU is entirely Federal lands, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 82,252 acres

BLM-administered lands within CHU = 14,478 acres (18 percent of CHU)

- o BLM Harvest Land Base = 0 acres (0 percent of CHU)
- o BLM Reserves = 14,477 acres (18 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 13,914 acres (17 percent of CHU)

Other landowners within CHU = 67,774 acres (82 percent of CHU)

²⁷ Acres lost are due to tree mortality dropping the classification of these acres in the modeling process.

Table 160. PRMP Harvest Scenario in **CHU OR-04-c**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		142	93	-	158	224
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		142	93	-	158	224

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 161. Murrelet habitat development in **CHU OR-04-c**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	6,925	6,884	7,392	7,434	7,403	7,503
Nesting Habitat ²	8,291	8,449	9,834	11,045	12,500	13,432
CHU Total³						
High-Quality Nesting Habitat ¹	28,277					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-d

BLM manages 45 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 162. Although BLM is potentially affecting four percent of the BLM-managed nesting habitat within this CHU, all but less than one acre within the Harvest Land Base will be thinning prescriptions that are designed to develop higher quality habitat quicker than if left unmanaged (projected timber harvest in Late-successional and Riparian Reserves). Ingrowth of nesting habitat helps to compensate for the acres being removed, with BLM habitat levels remaining above baseline levels in all decades (Table 163). BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 57 percent and to increase high-quality nesting habitat by 34 percent. Within the CHU high-quality nesting habitat for all lands, BLM is not proposing to affect any high-quality nesting habitat (Table 163).

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during this zone. No Harvest Land Base occurs within this CHU. The impacts to this CHU are entirely from harvest within the Reserves system. Because thinning treatments are expected to maintain trees containing nesting structure at the stand scale, some of the thinning units are expected to continue to provide murrelet habitat. Other thinning treatments are expected to open the canopy cover up too much for murrelet habitat, but because nesting structure is maintained at the stand scale nesting function of the stand will return as the tree crowns fill in. Because of the level of impacts and ingrowth compared to the current habitat baseline, the potential impacts to future habitat development, and because this CHU is entirely Federal lands, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 47,091 acres

BLM-administered lands within CHU = 21,070 acres (45 percent of CHU)

- o BLM Harvest Land Base = 1 acre (0 percent of CHU)
- o BLM Reserves = 21,069 acres (45 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 19,995 acres (42 percent of CHU)

Other landowners within CHU = 26,021 acres (55 percent of CHU)

Table 162. PRMP Harvest Scenario in **CHU OR-04-d**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	0	0
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		117	18	-	198	214
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		117	18	-	198	215

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 163. Murrelet habitat development in **CHU OR-04-d**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	7,403	7,403	7,834	8,472	9,729	9,934
Nesting Habitat ²	12,349	12,728	14,619	16,504	18,320	19,434
CHU Total³						
High-Quality Nesting Habitat ¹	15,379					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-e

BLM manages 99 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 164. Although BLM is potentially affecting 6 percent of the BLM-managed nesting habitat within this CHU, 65 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 40 acre²⁸; this reduction is less than 1 percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 57 percent and to increase high-quality nesting habitat by 3 percent. These numbers includes a predicted fire loss of 650 acres of BLM stands in the second decade (Table 137). Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 165).

This CHU is located mostly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in several small areas within this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 36 percent of the Harvest Land Base displayed in Figure 22. Because of the potential level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 99 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 53,809 acres

BLM-administered lands within CHU = 53,183 acres (99 percent of CHU)

- o BLM Harvest Land Base = 1,735 acres (3 percent of CHU)
- o BLM Reserves = 51,448 acres (96 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 50,978 acres (95 percent of CHU)

Other landowners within CHU = 626 acres (1 percent of CHU)

28 Acre lost above harvest impacts is due to tree mortality dropping the classification of these acres in the modeling process.

Table 164. PRMP Harvest Scenario in **CHU OR-04-e**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		39	-	-	-	-
Nesting Habitat ²		158	14	75	212	169
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		170	299	9	258	445
Total						
High-Quality Nesting Habitat ¹		39	-	-	-	-
Nesting Habitat ²		328	313	85	470	614

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 165. Murrelet habitat development in **CHU OR-04-e**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	24,916	24,876	25,363	25,461	25,483	25,618
Nesting Habitat ²	29,791	30,680	32,994	37,894	44,443	46,761
CHU Total³						
High-Quality Nesting Habitat ¹	24,951					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-f

BLM manages 98 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 166. Although BLM is potentially affecting 21 percent of the BLM-managed nesting habitat within this CHU, 3 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first and second decades dropping below the original BLM decade nesting total by 1,446 acre²⁹ and 650 acres respectfully, this drop is 11 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 17 percent and to increase high-quality nesting habitat by 14 percent. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect 4 percent of the high-quality nesting habitat (Table 167).

This CHU is located almost entirely in inland zone 2, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves (Figure 22). Based on the spatial array of Harvest Land Base within this CHU, management could potentially fragment blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 48 percent of the Harvest Land Base displayed in Figure 22. Because of the potential level of impacts compared to the current habitat levels and ingrowth, the Service believes the proposed action has the potential to adversely affect the function of this CHU within the first two decades. The effects of this reduction in nesting habitat are a reduction in the capability of this CHU to provide murrelet nesting opportunities. While murrelets will continue to nest in this CHU, the CHU will likely be able to support less murrelets when the amount of nesting habitat decreases. Fragmentation may also decrease the reproductive success rate.

Total CHU = 21,129 acres

BLM-administered lands within CHU = 20,743 acres (98 percent of CHU)

- o BLM Harvest Land Base = 5,532 acres (26 percent of CHU)
- o BLM Reserves = 15,211 acres (72 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 20,030 acres (95 percent of CHU)

Other landowners within CHU = 391 acres (2 percent of CHU)

29 Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

Table 166. PRMP Harvest Scenario in **CHU OR-04-f**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		326	-	-	-	-
Nesting Habitat ²		1,321	208	492	54	605
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	50	27	13
Total						
High-Quality Nesting Habitat ¹		326	-	-	-	-
Nesting Habitat ²		1,321	208	542	82	618

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 167. Murrelet habitat development in **CHU OR-04-f**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	8,560	8,241	9,450	9,450	9,450	9,790
Nesting Habitat ²	13,191	11,745	12,541	13,364	14,121	15,370
CHU Total³						
High-Quality Nesting Habitat ¹	8,580					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-g

BLM manages 98 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 168. Although BLM is potentially affecting 10 percent of the BLM-managed nesting habitat within this CHU, 75 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 2 acres; this drop is less than 1 percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 82 percent and to increase high-quality nesting habitat by 2 percent. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 169).

This CHU is located mostly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in the southeast of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 19 percent of the Harvest Land Base displayed in Figure 22.

Because of the level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 98 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 16,547 acres

BLM-administered lands within CHU = 16,227 acres (98 percent of CHU)

- o BLM Harvest Land Base = 1,004 acres (6 percent of CHU)

- o BLM Reserves = 15,223 acres (92 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 15,333 acres (93 percent of CHU)

Other landowners within CHU = 320 acres (2 percent of CHU)

Table 168. PRMP Harvest Scenario in **CHU OR-04-g**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		2	-	-	-	-
Nesting Habitat ²		3	69	80	0	40
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		14	333	9	105	119
Total						
High-Quality Nesting Habitat ¹		2	-	-	-	-
Nesting Habitat ²		16	402	89	105	159

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 169. Murrelet habitat development in **CHU OR-04-g**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	6,673	6,671	6,751	6,751	6,751	6,778
Nesting Habitat ²	7,564	8,826	10,291	11,803	13,280	13,805
CHU Total³						
High-Quality Nesting Habitat ¹	6,687					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-i

BLM manages 98 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 170. BLM is potentially affecting 16 percent of the BLM-managed nesting habitat within this CHU, 60 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Although 8 acres of high-quality nesting habitat are potentially being thinned in the reserve system loss their higher-quality nesting habitat status, they will requalify for high-quality nesting habitat in the third decade. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 162 acres³⁰; this reduction is less than 1 percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 60 percent and to increase high-quality nesting habitat by 33 percent. These numbers includes a predicted fire loss of 1,231 and 1,364 acres of BLM stands in the fourth and fifth decade respectively (Table 137). Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 171).

This CHU is located mostly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in several small areas of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 87 percent of the Harvest Land Base displayed in Figure 22. Because of the level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 98 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 83,996 acres

BLM-administered lands within CHU = 82,458 acres (98 percent of CHU)

- o BLM Harvest Land Base = 3,486 acres (4 percent of CHU)
- o BLM Reserves = 78,972 acres (94 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 79,763 acres (95 percent of CHU)

Other landowners within CHU = 1,538 acres (2 percent of CHU)

30 Acres lost above harvest impacts are due to fire or tree mortality dropping the classification of these acres in the modeling process.

Table 170. PRMP Harvest Scenario in **CHU OR-04-i**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		3	33	-	5	-
Nesting Habitat ²		683	398	641	762	546
Reserve						
High-Quality Nesting Habitat ¹		8	-	-	-	-
Nesting Habitat ²		922	965	522	667	1,404
Total						
High-Quality Nesting Habitat ¹		11	33	-	5	-
Nesting Habitat ²		1,605	1,363	1,163	1,429	1,951

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 171. Murrelet habitat development in **CHU OR-04-i**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	26,188	26,026	31,237	32,067	32,960	34,934
Nesting Habitat ²	47,430	48,659	54,958	63,553	72,311	75,890
CHU Total³						
High-Quality Nesting Habitat ¹	26,250					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-j

BLM manages 86 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 172. Although BLM is potentially affecting 20 percent of the BLM-managed nesting habitat within this CHU, 51 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 76 acre³¹, a reduction of less than 1 percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 58 percent and to increase high-quality nesting habitat by 38 percent. These numbers includes a predicted fire loss of 920 acres of BLM stands in the second decade (Table 137). Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 173).

This CHU is located mainly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in three areas of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 67 percent of the Harvest Land Base displayed in Figure 21.

Because of the low level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 86 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 67,858 acres

BLM-administered lands within CHU = 58,203 acres (86 percent of CHU)

- o BLM Harvest Land Base = 4,835 acres (7 percent of CHU)
- o BLM Reserves = 53,368 acres (79 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 56,226 acres (83 percent of CHU)

Other landowners within CHU = 9,655 acres (14 percent of CHU)

31 Acres lost above harvest impacts are due to fire or tree mortality dropping the classification of these acres in the modeling process.

Table 172. PRMP Harvest Scenario in **CHU OR-04-j**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		60	58	4	10	-
Nesting Habitat ²		650	295	420	805	1,084
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		922	916	326	214	971
Total						
High-Quality Nesting Habitat ¹		60	58	4	10	-
Nesting Habitat ²		1,572	1,212	746	1,019	2,055

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 173. Murrelet habitat development in **CHU OR-04-j**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	15,108	15,032	16,926	17,842	19,357	20,922
Nesting Habitat ²	33,201	33,326	36,998	43,084	50,388	52,498
CHU Total³						
High-Quality Nesting Habitat ¹	17,773					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-04-k

BLM manages 62 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 174. Although BLM is potentially affecting 11 percent of the BLM-managed nesting habitat within this CHU, 54 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 96 acres³²; a reduction of 2 percent of the total BLM high-quality nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 60 percent and to increase high-quality nesting habitat by 41 percent. Within the CHU high-quality nesting habitat for all lands BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 175).

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during this zone. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in two areas of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 76 percent of the Harvest Land Base (which is only 3 percent of the CHU) displayed in Figure 21. Because of the low level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 62 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 43,287 acres

BLM-administered lands within CHU = 26,665 acres (62 percent of CHU)

- o BLM Harvest Land Base = 1,155 acres (3 percent of CHU)
- o BLM Reserves = 25,510 acres (59 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 25,609 acres (59 percent of CHU)

Other landowners within CHU = 16,622 acres (38 percent of CHU)

32 Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

Table 174. PRMP Harvest Scenario in **CHU OR-04-k**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		42	-	-	5	-
Nesting Habitat ²		123	34	110	286	321
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		300	257	176	130	140
Total						
High-Quality Nesting Habitat ¹		42	-	-	5	-
Nesting Habitat ²		423	290	286	416	461

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 175. Murrelet habitat development in **CHU OR-04-k**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	5,923	5,827	8,338	9,528	10,057	9,953
Nesting Habitat ²	16,423	16,704	18,478	20,254	23,920	24,412
CHU Total³						
High-Quality Nesting Habitat ¹	11,328					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-06-a

BLM manages 100 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 176. Although BLM is potentially affecting 50 percent of the BLM-managed nesting habitat within this CHU, 100 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, though it takes 4 decades for BLM nesting habitat in this CHU to recover from the potential harvest in the first decade. The baseline reduction is 30 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 46 percent and to not have an increase in high-quality nesting habitat. Within the CHU high-quality nesting habitat for all lands, BLM is not proposing to affect any high-quality nesting habitat (Table 177).

This CHU is located in inland zone 1, which means the timber sales may not occur if occupied murrelet sites are located during this zone (Figure 22). No Harvest Land Base occurs within this CHU. Because of the level of impacts compared to the current habitat levels and ingrowth, the Service believes the proposed action has the potential to adversely affect the function of this extremely small CHU. The effects of this reduction in nesting habitat are a reduction in the capability of this CHU to provide murrelet nesting opportunities. While murrelets will continue to nest in this CHU, the CHU will likely be able to support less murrelets when the amount of nesting habitat decreases. Fragmentation may also decrease the reproductive success rate.

Total CHU = 39 acres

BLM-administered lands within CHU = 39 acres (100 percent of CHU)

- o BLM Harvest Land Base = 0 acres (0 percent of CHU)
- o BLM Reserves = 39 acres (100 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 38 acres (97 percent of CHU)

Other landowners within CHU = 0 acres (0 percent of CHU)

Table 176. PRMP Harvest Scenario in **CHU OR-06-a**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		7	-	-	-	6
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		7	-	-	-	6

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 177. Murrelet habitat development in **CHU OR-06-a**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	1	1	1	1	1	1
Nesting Habitat ²	26	19	19	25	31	38
CHU Total³						
High-Quality Nesting Habitat ¹	1	1	1	1	1	1

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-06-b

BLM manages 99 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 178. Although BLM is potentially affecting 7 percent of the BLM-managed nesting habitat within this CHU, 98 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed with BLM habitat levels remaining above baseline levels in all decades (Table 179). BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 52 percent and to increase high-quality nesting habitat by 21 percent. Within the CHU high-quality nesting habitat for all lands, BLM is not proposing to affect any high-quality nesting habitat.

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during this zone. The spatial array of Harvest Land Base within this CHU could potentially create fragmentation in the northwest in one small area of this CHU. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 76 percent of the Harvest Land Base displayed in Figure 22.

Because of the low level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 99 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 52,851 acres

BLM-administered lands within CHU = 52,314 acres (99 percent of CHU)

- o BLM Harvest Land Base = 71 acres (0 percent of CHU)
- o BLM Reserves = 52,243 acres (99 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 49,763 acres (94 percent of CHU)

Other landowners within CHU = 537 acres (1 percent of CHU)

Table 178. PRMP Harvest Scenario in **CHU OR-06-b**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		2	1	16	1	34
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		192	193	222	862	769
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		193	193	238	863	803

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 179. Murrelet habitat development in **CHU OR-06-b**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	21,374	21,374	22,627	23,081	25,091	25,953
Nesting Habitat ²	31,017	33,389	38,403	42,663	46,578	47,236
CHU Total³						
High-Quality Nesting Habitat ¹	21,422					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-06-c

BLM manages 99 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 180. Although BLM is potentially affecting 7 percent of the BLM-managed nesting habitat within this CHU, 5 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first and second decades dropping below the original BLM decade nesting total by 21 acre and 51 acres³³, respectfully, resulting in a reduction of 1 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 20 percent and to increase high-quality nesting habitat by 182 percent. Within the CHU the BLM is not proposing to affect any high-quality nesting habitat (Table 181).

This CHU is located in inland zone 1, which means some potential timber sales will not occur due to murrelet surveys being required within this zone (Figure 23). The spatial array of Harvest Land Base within this CHU could potentially create moderate fragmentation of blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 34 percent of the Harvest Land Base displayed in Figure 22.

Because of the low level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are 99 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 4,762 acres

BLM-administered lands within CHU = 4,717 acres (99 percent of CHU)

- o BLM Harvest Land Base = 742 acres (16 percent of CHU)
- o BLM Reserves = 3,975 acres (83 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 4,590 acres (96 percent of CHU)

Other landowners within CHU = 45 acres (1 percent of CHU)

33 Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

Table 180. PRMP Harvest Scenario in **CHU OR-06-c**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		24	25	-	4	200
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	12
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		24	25	-	4	211

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 181. Murrelet habitat development in **CHU OR-06-c**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	826	786	1,155	1,804	2,249	2,330
Nesting Habitat ²	3,626	3,605	3,571	4,132	4,337	4,343
CHU Total³						
High-Quality Nesting Habitat ¹	836					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-06-d

BLM manages 98 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 182. Although BLM is potentially affecting 16 percent of the BLM-managed nesting habitat within this CHU, 21 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original BLM decade nesting total by 18 acre; a reduction of less than 1 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 35 percent and to increase high-quality nesting habitat by 6 percent. Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 183).

This CHU is located in both zones, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves (Figure 23). The spatial array of Harvest Land Base within this CHU could potentially fragment blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 32 percent of the Harvest Land Base displayed in Figure 23. Because of the amount of potential fragmentation, the Service believes the proposed action has the potential to adversely affect the function of this CHU. Fragmentation may decrease the reproductive success rate in this CHU.

Total CHU = 17,721 acres

BLM-administered lands within CHU = 17,430 acres (98 percent of CHU)

- o BLM Harvest Land Base = 3,576 acres (20 percent of CHU)

- o BLM Reserves = 13,853 acres (78 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 16,050 acres (91 percent of CHU)

Other landowners within CHU = 304 acres (2 percent of CHU)

Table 182. PRMP Harvest Scenario in **CHU OR-06-d**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		9	2	-	-	0
Nesting Habitat ²		217	69	215	185	442
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		63	-	92	76	76
Total						
High-Quality Nesting Habitat ¹		9	2	-	-	0
Nesting Habitat ²		280	69	307	261	519

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 183. Murrelet habitat development in **CHU OR-06-d**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	6,101	6,092	6,281	6,368	6,466	6,462
Nesting Habitat ²	8,902	8,884	9,348	10,191	11,449	12,023
CHU Total³						
High-Quality Nesting Habitat ¹	6,115					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-07-a

BLM manages two percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 184. Although BLM is potentially affecting 8 percent of the BLM-managed nesting habitat within this CHU, 9 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, with only the first decade dropping below the original decade high-quality nesting total by 1 acre; a reduction of less than 1 percent of the BLM nesting habitat within this CHU. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 23 percent and to increase high-quality nesting habitat by 10 percent. These numbers includes a predicted fire loss of 5 acres of BLM stands in the second decade (Table 137). Within the CHU high-quality nesting habitat for all lands, BLM proposes to affect less than 1 percent of the high-quality nesting habitat (Table 185).

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during this zone (Figure 23). The spatial array of Harvest Land Base within this CHU could potentially create moderate fragmentation of blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 27 percent of the Harvest Land Base displayed in Figure 23. Although the BLM portion of this CHU is small, it assists to provide critical habitat support on the southern edge of an area lacking critical habitat.

Because of the level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are only 2 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 148,081 acres

BLM-administered lands within CHU = 2,401 acres (2 percent of CHU)

- o BLM Harvest Land Base = 477 acres (0 percent of CHU)
- o BLM Reserves = 1,924 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,355 acres (2 percent of CHU)

Other landowners within CHU = 145,680 acres (98 percent of CHU)

Table 184. PRMP Harvest Scenario in **CHU OR-07-a**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		1	0	-	-	-
Nesting Habitat ²		1	0	48	15	64
Reserve						
High-Quality Nesting Habitat ¹		1	-	-	-	1
Nesting Habitat ²		2	-	-	-	10
Total						
High-Quality Nesting Habitat ¹		2	0	-	-	1
Nesting Habitat ²		3	0	48	15	73

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 185. Murrelet habitat development in **CHU OR-07-a**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	1,320	1,319	1,371	1,449	1,449	1,449
Nesting Habitat ²	1,719	1,754	1,878	2,010	2,169	2,124
CHU Total³						
High-Quality Nesting Habitat ¹	21,048					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-07-b

BLM manages 5 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 186. Ingrowth of nesting habitat helps to compensate for the acres being removed, with BLM habitat levels remaining at or above baseline levels in all decades (Table 187). BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 4 percent and to increase high-quality nesting habitat by 26 percent. Within the CHU high-quality nesting habitat for all lands, BLM is not proposing to affect any high-quality nesting habitat.

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located in this zone (Figure 23). The spatial array of Harvest Land Base within this CHU could potentially create minimal fragmentation of blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 32 percent of the Harvest Land Base displayed in Figure 23. Although the BLM portion of this CHU is small, it assists to provide critical habitat support on the western edge of an area lacking critical habitat closer to the ocean.

Because of the level of impacts compared to the current habitat levels and ingrowth, and because BLM lands are only 5 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 46,291 acres

BLM-administered lands within CHU = 2,208 acres (5 percent of CHU)

- o BLM Harvest Land Base = 203 acres (0 percent of CHU)

- o BLM Reserves = 2,004 acres (4 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,180 acres (5 percent of CHU)

Other landowners within CHU = 44,083 acres (95 percent of CHU)

Table 186. PRMP Harvest Scenario in **CHU OR-07-b**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	65	65	-	-
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	-	-	-	-
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		-	65	65	-	-

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 187. Murrelet habitat development in **CHU OR-07-b**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	475	475	475	599	599	599
Nesting Habitat ²	1,623	1,623	1,623	1,559	1,688	1,688
CHU Total³						
High-Quality Nesting Habitat ¹	3,557					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-07-d

BLM manages 2 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 188. Although BLM is potentially affecting 30 percent of the BLM-managed nesting habitat within this CHU, 7 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Ingrowth of nesting habitat helps to compensate for the acres being removed, but even by the fifth decade BLM nesting habitat within this CHU is still below baseline conditions. The largest deviation from the baseline conditions is 304 acres³⁴, which is 29 percent of the BLM nesting habitat within this CHU (Table 189). BLM lands in this CHU over the next 50 years are expected to increase high-quality nesting habitat by 261 percent. Within the CHU high-quality nesting habitat for all lands, BLM is not proposing to affect any high-quality nesting habitat.

This CHU is located in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during this zone (Figure 23). The spatial array of Harvest Land Base within this CHU could potentially fragment blocked up murrelet habitat. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 39 percent of the Harvest Land Base displayed in Figure 23. Although the BLM portion of this CHU is small, it assists to provide critical habitat support on the western edge of an area lacking critical habitat closer to the ocean.

Because of the level of impacts compared to the current habitat levels and ingrowth (mainly on Forest Service lands) and because BLM lands are only 2 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 86,790 acres

BLM-administered lands within CHU = 1,865 acres (2 percent of CHU)

- o BLM Harvest Land Base = 747 acres (1 percent of CHU)
- o BLM Reserves = 1,118 acres (1 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 1,826 acres (2 percent of CHU)

Other landowners within CHU = 84,925 acres (98 percent of CHU)

34 Acres lost above harvest impacts are due to tree mortality dropping the classification of these acres in the modeling process.

Table 188. PRMP Harvest Scenario in **CHU OR-07-d**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		112	81	59	-	40
Reserve						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		4	14	-	-	4
Total						
High-Quality Nesting Habitat ¹		-	-	-	-	-
Nesting Habitat ²		115	95	59	-	43

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 189. Murrelet habitat development in **CHU OR-07-d**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	75	184	151	271	271	271
Nesting Habitat ²	1,052	769	748	910	978	1,049
CHU Total³						
High-Quality Nesting Habitat ¹	7,994					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-07-f

BLM manages 13 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 190. Although BLM is potentially affecting 28 percent of the BLM-managed nesting habitat within this CHU, almost 100 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves) that will potentially develop higher quality habitat quicker than if left unmanaged. Although 937 acres of high-quality nesting habitat are potentially being thinned in the reserve system in the first and second decades of this plan they will retain their higher-quality nesting habitat function post-treatment. Ingrowth of nesting habitat helps to compensate for the acres being removed, with BLM habitat levels remaining above baseline levels in all decades. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 59 percent and to increase high-quality nesting habitat by 9 percent. These numbers include a predicted fire loss of 3,453, 1,795 and 1,576 acres of BLM stands in the second, fourth and fifth decades, respectively (Table 137). Within the CHU BLM proposes to affect 12 percent of the high-quality nesting habitat (Table 191).

This CHU is located in mainly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during inland zone 1 and within inland zone 2 surveys are required in Late-successional Reserves and in Riparian Reserves (Figure 23). The Harvest Land Base within this CHU is only one acre so timber harvest here will not cause any noticeable fragmentation of blocked up murrelet habitat.

Because of the level of impacts compared to the current habitat levels and ingrowth (mainly on Forest Service lands), and because BLM lands are 13 percent of the ownership in this CHU, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 49,126 acres

BLM-administered lands within CHU = 13,879 acres (13 percent of CHU)

- o BLM Harvest Land Base = 1 acres (0 percent of CHU)
- o BLM Reserves = 13,878 acres (13 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 13,499 acres (27 percent of CHU)

Other landowners within CHU = 35,247 acres (72 percent of CHU)

Table 190. PRMP Harvest Scenario in **CHU OR-07-f**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		0	-	-	-	-
Nesting Habitat ²		1	-	-	-	0
Reserve						
High-Quality Nesting Habitat ¹		607	330	-	102	-
Nesting Habitat ²		834	470	121	717	62
Total						
High-Quality Nesting Habitat ¹		607	330	-	102	-
Nesting Habitat ²		835	470	121	717	62

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 191. Murrelet habitat development in **CHU OR-07-f**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	4,932	4,932	4,878	5,275	5,014	5,379
Nesting Habitat ²	7,922	9,013	9,969	11,528	11,886	12,564
CHU Total³						
High-Quality Nesting Habitat ¹	8,488					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

CHU OR-07-g

BLM manages 97 percent of the lands in this CHU. Potential harvest activities expected to adversely affect critical habitat at the stand level are displayed in Table 192. Although BLM is potentially affecting 34 percent of the BLM-managed nesting habitat within this CHU, 53 percent of these effects will be thinning prescriptions in Late-successional and Riparian Reserves that will potentially develop higher quality habitat quicker than if left unmanaged. Although 132 acres of high-quality nesting habitat are potentially being thinned in the reserve system the first and second decades, they retain their higher-quality nesting habitat function post-treatment. Ingrowth of nesting habitat helps to compensate for the acres being managed, with BLM habitat levels remaining above baseline levels in all decades. BLM lands in this CHU over the next 50 years are expected to increase in nesting habitat by 18 percent and to increase high-quality nesting habitat by 26 percent. Within the CHU the BLM proposes to affect 38 percent of the high-quality nesting habitat (Table 193).

This CHU is located in mainly in inland zone 1, which means some potential timber sales will not occur if occupied murrelet sites are located during surveys in inland zone 1 in all LUAs and within inland zone 2 in Late-successional Reserves and in Riparian Reserves (Figure 23). Although the spatial distribution of Harvest Land Base within this CHU could potentially create fragmentation of blocked up murrelet habitat, the location of that Harvest Land Base precludes widespread fragmentation throughout the CHU which reduces the potential effect to the function of this CHU for nesting murrelets. Based on BLM's timber harvest projections for this CHU, impacts will potentially be 87 percent of the Harvest Land Base displayed in Figure 23.

Although this CHU has impacts from timber harvest, these impacts are mitigated by the existing amount of nesting habitat (69 percent on BLM lands) and the projected ingrowth into nesting habitat in the first decade of the plan. Therefore, the Service believes the proposed action will not adversely affect the function of this CHU in the near-term or long-term.

Total CHU = 2,286 acres

BLM-administered lands within CHU = 2,210 acres (97 percent of CHU)

- o BLM Harvest Land Base = 405 acres (18 percent of CHU)
- o BLM Reserves = 1,805 acres (79 percent of CHU)

Habitat-capable BLM-administered lands within CHU = 2,064 acres (90 percent of CHU)

Other landowners within CHU = 76 acres (3 percent of CHU)

Table 192. PRMP Harvest Scenario in **CHU OR-07-g**.

(acres treated by end of decade)	2013	2023	2033	2043	2053	2063
HLB						
High-Quality Nesting Habitat ¹		161	-	18	-	0
Nesting Habitat ²		162	39	40	4	107
Reserve						
High-Quality Nesting Habitat ¹		68	64	-	-	68
Nesting Habitat ²		97	216	8	2	76
Total						
High-Quality Nesting Habitat ¹		229	64	18	-	68
Nesting Habitat ²		258	255	48	6	182

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.Table 193. Murrelet habitat development in **CHU OR-07-g**.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	1,004	1,004	1,118	1,270	1,270	1,270
Nesting Habitat ²	1,521	1,658	1,658	1,731	1,768	1,799
CHU Total³						
High-Quality Nesting Habitat ¹	1,007					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

Summary of Impacts to CHUs

Based on the proposed amounts of harvest of nesting habitat and high-quality nesting habitat (see individual tables for each CHU above) and the regeneration harvest of non-habitat (see Table 138) the Service believes the proposed action has the potential to adversely affect the function of seven out of the 29 CHUs. The proposed action is expected to adversely affect CHUs OR-01-c, OR-02-a, OR-02-d, OR-03-c, OR-04-f, OR-06-a, and OR-06-d. The effects of timber harvest on these CHUs at the Conservation Zone scale is addressed below.

The other 22 CHUs that are projected to experience timber harvest but that will not be adversely affected by the proposed action will continue to provide their current function and will improve in quality and functional over the life of the PRMP. Because their function is maintained (or improved) at the CHU scale for these 22 units, these negligible impacts are not expected to affect the function of critical habitat at subsequently larger landscapes (*e.g.*, Conservation Zones, critical habitat designation) because they do not rise to a level that has affected the functionality of the CHU.

Conservation Zone 3

Conservation Zone 3 contains 23 CHUs, with CHUs OR-4-e and OR-4-f having a small overlap with Conservation Zone 4. Of these CHUs, the proposed action will adversely affect OR-01-C, OR-02-a, OR-02-d, OR-03-c, and OR-04-f. At the landscape of this conservation zone we identified three areas of the landscape that BLM's PRMP will have impacts to distribution of nesting habitat.

In the northern Oregon coast there is a gap in murrelet nesting habitat and Federal land ownership. Two CHUs associated with this gap are OR-01-c and OR-02-a. The Harvest Land Base lands east of Tillamook will adversely affect the near-term development of the habitat in the northern range in Oregon and potentially fragment an area lacking murrelet distribution. In OR-01-c, BLM nesting habitat is expected to be reduced by 116 acres or 2 percent of the BLM baseline nesting habitat level in this CHU over the first two decades, in addition to 55 acres of non-federal high-quality nesting habitat within the CHU. No other Federal lands occur in this area of the landscape to support murrelet nesting habitat, with only 40 Federal acres occurring north of this area in Oregon. By 2043, ingrowth will result in BLM lands contributing more than the 2013 baseline in this CHU, with large gains (33 percent increase in nesting habitat and 152 percent increase in high-quality nesting habitat) by 2063. The short-term adverse effects are expected to reduce the ability of this portion of the landscape to support nesting murrelets, although the loss of 171 acres of nesting habitat represents a relatively small amount of nesting habitat within this Conservation Zone.

OR-02-a is just south of the small gap from OR-01-c. OR-02-a is north and adjacent to OR-02-e and north of OR-02-b (Figure 20), and currently contains less than 0.01 percent of the high-value habitat within this conservation zone (8 total acres). Because of its current baseline condition and because no Federal lands occur in this CHU, we do not expect CHU OR-02-a to contribute greatly to the conservation of the murrelet, even over 50 years. We do expect large amounts of ingrowth on BLM lands in OR-02-e, which we believe will compensate for the potential loss of 2 acres in OR-02-a.

The next gap in Federal ownership is west of Salem. BLM nesting habitat associated with CHU OR-02-d occurs north of this gap and is expected to have potential fragmentation of blocked up murrelet habitat which may result in reduced reproductive success. Ingrowth in CHU OR-02-d will result in this CHU contributing more nesting habitat each decade than the 2013 baseline, with large gains (60 percent increase in nesting habitat and 41 percent increase in high-quality nesting habitat) by 2063. These gains are expected to counteract the effects of fragmentation by providing a greater range of options of potential nest stands within the CHU that are away from the fragmented stands. The increase in nesting habitat within OR-02-d and associated Federal lands in OR-02-c to the west of this unit are expected to compensate for fragmentation in OR-02-d by providing available nesting habitat in the same vicinity (murrelets generally fly straight inland from their foraging areas at-sea).

BLM nesting habitat associated with OR-03-c occurs in the middle of this Federal ownership gap and is projected to have a reduction in its habitat levels lasting one decade and create fragmentation of blocked up murrelet habitat. BLM lands within CHU OR-03-c will be

dropping below baseline conditions by 154 acres or 3 percent of the BLM nesting habitat within the CHU for the first decade, but no high-quality nesting habitat will be lost. In 2033, ingrowth is expected to result in OR-03-c contributing more than the 2013 baseline, with large gains (58 percent increase in nesting habitat and 21 percent increase in high-quality nesting habitat) by 2063. The near-term reduction in murrelet nesting habitat of 3 percent of CHU OR-03-c and fragmentation are expected to be compensated for by the current levels of habitat in OR-04-k and OR-03-b to the south, OR-02-c to the northwest, and OR-03-a to the west. These CHUs are expected to provide available murrelet nesting habitat in the vicinity of OR-03-c to offset the effects of the near-term harvest. Additionally, Forest Service nesting habitat provides support to this gap in Federal lands to the north, associated with CHU OR-02-c, and to the south, associated with CHUs OR-04-a and OR-04-k such that these impacts are not expected to affect the function of the critical habitat network at the Recovery Zone scale.

The third area of concern is the BLM lands north-northwest of Roseburg associated with OR-04-f. In this CHU 27 percent of the BLM lands are in the Harvest Land Base, and it is projected to have a reduction in its nesting habitat lasting two decades and have fragmentation of blocked up murrelet habitat. BLM lands within this CHU will be dropping below baseline conditions by 1,446 acres or 11 percent of the nesting habitat for the first decade and 650 acres or 5 percent of the nesting habitat for the second decade. In the long-term, specifically by 2043, ingrowth within OR-04-f will result in this CHU contributing more than the 2013 baseline, with modest gains (17 percent increase in nesting habitat and 14 percent increase in high-quality nesting habitat) by 2063. Additionally OR-04-e to the west provides habitat support to conserve the species in the larger landscape area. This near-term reduction in murrelet nesting habitat of 11 percent and fragmentation of the CHU are expected to be compensated for by the current amount and ingrowth of habitat in OR-04-e to the west. These CHUs are expected to provide available murrelet nesting habitat in the vicinity of OR-04-f to offset the effects of the near-term harvest.

Summary

All nesting habitat currently supporting murrelet nesting (which is a subset of murrelet critical habitat PBFs) will be protected in inland zone 1 in all LUAs and within riparian reserves and late-successional LUAs in inland zone 2; and Late-successional and Riparian Reserve lands will be managed for developing late-successional conditions. The main impacts to CHUs are from fragmentation and loss of PBFs in the harvest land base.

Murrelet nesting habitat and high-quality nesting habitat within CHUs will increase in this Conservation Zone in every decade of the PRMP, although there are localized areas that experience losses of these habitats during that time (Table 194). Additionally, BLM projected that nesting habitat patch size will increase over the life of the plan for the BLM action areas (Table 119) potentially reducing fragmentation in the harvest land base. Of the CHUs where we do not expect increases in PBFs in the action area over time, three are entirely designated on state lands (OR-01-b, OR-03-b and OR-02-a) and the one on BLM lands (OR-03-a) consists of only 39 acres, which limits its potential conservation value at the landscape scale.

There is a reduction in Conservation Zone 3's high-quality nesting habitat of 480 acres (422 acres on BLM lands and 57 acres on other lands) or <1 percent of the high-quality nesting habitat

in the first decade, which is recovered by ingrowth by the second decade of the PRMP. Because this amount of habitat reduction is <1 percent of the high-quality nesting habitat in critical habitat in the Conservation Zone, the Service believes the critical habitat within this Conservation Zone will continue to provide the current conservation function for the species. Therefore, the proposed action will not appreciably diminish the value of critical habitat for the conservation of murrelets in the near-term. By the second decade of the PRMP the condition of murrelet critical habitat within Conservation Zone 3 begins to vastly improve and continues to through the 50 years of the PRMP. Overall nesting habitat within this Conservation Zone increases throughout the PRMP (Table 194).

Table 194. Murrelet habitat development in CHUs within Conservation Zone 3 that occur in the action area.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	110,968	110,546	127,472	132,810	139,782	145,115
Nesting Habitat ²	207,449	211,456	236,253	270,050	311,799	328,335
Non-federal lands in the action area						
High-Quality Nesting Habitat	1164	1107	1051	998	948	900
CHUs Total within Conservation zone 3 ³						
High-Quality Nesting Habitat ¹	259,280					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.

² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.

³ Total in Table B-3 = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the FEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

Conservation Zone 4

Conservation Zone 4 in Oregon contains 10 entire CHUs plus parts of CHUs OR-4-e and OR-4-f. Of these CHUs, we believe the proposed action will adversely affect OR-04-f, OR-06-a, and OR-06-d.

Only a very small portion of OR-04-f occurs within Conservation Zone 4 (Figure 22), so we addressed the effects to this CHU above and are not including OR-04-f in the discussion of Conservation Zone 4.

We have identified one area of the landscape where BLM's PRMP will have impacts to the distribution of nesting habitat within Conservation Zone 4. This area is the BLM lands south-southwest of Roseburg associated with OR-06-d. This CHU contains 21 percent of its BLM lands in the Harvest Land Base and is projected to have a reduction in its nesting habitat levels lasting one decade and increase fragmentation of blocked up murrelet habitat. BLM lands within this CHU will be dropping below baseline conditions by 18 acres or less than 1 percent of the nesting habitat for the first decade. In the long term, by 2033, ingrowth within OR-04-f will result in this CHU contributing more than the 2013 baseline, with gains (35 percent increase in nesting habitat and 6 percent increase in high-quality nesting habitat) by 2063. This loss of less

than 1 percent of the extant nesting habitat is small enough that we do not believe it will greatly impact the function of this CHU. This near-term reduction in murrelet nesting habitat of 1 percent and fragmentation of the CHU are expected to be compensated for by the current amount and ingrowth of habitat in OR-06-b immediately to the west and northwest by providing available nesting habitat at the vicinity (murrelets generally fly straight inland from their foraging areas at-sea).

OR-06-a is located west of OR-06-b (comprised of BLM lands). Because of its small total size (39 acres) compared to the Conservation Zone, the action area and the listed range, the Service does not believe the impact to this CHU affects the conservation of the murrelet at the landscape or Conservation Zone scales. Additionally, OR-06-b and OR-04-e provide habitat support further east to conserve the species in this area. In the long term (by 2053) ingrowth will result in BLM lands contributing more than their 2013 baseline in this CHU, with large gains (46 percent increase in nesting habitat) by 2063 (Table 177). Even with these long-term gains, this CHU will still be a small percent of the overall conservation value of Conservation Zone 4 due to its size of only 39 acres.

Summary

All nesting habitat currently supporting murrelet nesting (which is a subset of murrelet critical habitat PBFs) will be protected in inland zone 1 and within riparian reserves and late-successional LUAs in inland zone 2, and Late-successional and Riparian Reserve lands will be managed for developing late-successional conditions. The main impacts are from fragmentation and loss of habitat in the Harvest Land Base.

Murrelet nesting habitat and high-quality nesting habitat will increase in this Conservation Zone in every decade of the PRMP, although there are localized areas that experience losses of these habitats during that time (Table 195). BLM has projected that nesting habitat patch size will increase over the life of the plan for the BLM action areas (Table 119), which is expected to result in reduced fragmentation in the Harvest Land Base.

OR-07-d is the only CHU in this conservation zone where we do not believe PBF quantity will improve on BLM lands over the 50 year life of the PRMP (the BLM projection is a loss of 2 acres over 50 years). The reduction of 2 acres over the life of the PRMP is not expected to noticeably affect the function of this CHU or critical habitat at the Conservation Zone scale. The near-term reduction in murrelet nesting habitat of 29 percent of the BLM nesting habitat and fragmentation of the CHU are expected to be compensated for by the current amount of habitat in the remaining 98 percent of this CHU which is managed as LSR by the Forest Service. The quality of PBFs within this Conservation Zone is expected to increase over the next 50 years with an expected increase in high-quality nesting habitat of 261 percent.

Over the 50 year life of the PRMP there are increases in Conservation Zone 4's nesting or high-quality nesting habitat of approximately 70 percent and 85 percent, respectively (Table 195). Taking all of the above discussion on impacts to this conservation zone into consideration, the Service believes the proposed action will not appreciably diminish the value of critical habitat for the conservation of murrelets in the near-term or through the 50 years of the PRMP.

Table 195. Murrelet habitat development in CHUs within Conservation Zone 4 that occur in the action area.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	43,364	43,418	45,328	47,389	49,681	50,991
Nesting Habitat ²	65,722	68,952	75,816	84,499	91,346	93,972
Non-federal lands in the action area						
High-Quality Nesting Habitat ¹	-	-	-	-	-	-
Oregon CHUs Total within Conservation zone 4 ³						
High-Quality Nesting Habitat ¹	77,724	77,777	79,687	81,750	134,187	135,498

Footnotes:¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Total in Table B-3 = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the FEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.**Statewide**

The part of critical habitat that will be impacted on BLM lands within the action area is displayed in Table 132. The combined projected development of the action area in these CHUs, including the proposed action, is displayed in Table 196.

As discussed above for the Conservation Zones, all nesting habitat currently supporting murrelet nesting (which is a subset of murrelet critical habitat PBFs) will be protected in inland zone 1 and within Riparian Reserves and Late-Successional Reserves in inland zone 2; and Late-successional and Riparian Reserve lands will be managed for developing late-successional conditions. The collective total for CHUs associated with BLM lands within the action area shows ingrowth of nesting habitat will improve the functionality at every decade (Table 196). There is an overall drop in high-quality nesting habitat (425 acres [368 acres on BLM lands and 57 acres on other lands] or <1 percent of the high-quality nesting habitat) across the action area in the first decade of the plan, which recovers by the second decade of the plan. Because this reduction in critical habitat PBFs is so small at the Statewide scale we do not anticipate there will be any noticeable impact to the function of the critical habitat network in the first decade as a result of the reduction of approximately 0.3 percent of the high-quality nesting habitat within the action area and approximately 0.1 percent of all the high-quality nesting habitat within critical habitat in Oregon.

Considering the summary of murrelet habitat development in the entire action area and our conclusions for both Conservation Zones 3 and 4, the Service believes the proposed action within the state will not appreciably diminish the value of critical habitat for the conservation of murrelets in the near-term or the long-term at this scale.

Table 196. Murrelet habitat development in CHUs that occur in the action area.

(acres)	2013	2023	2033	2043	2053	2063
BLM-administered lands						
High-Quality Nesting Habitat ¹	154,331	153,963	172,803	180,202	189,464	196,106
Nesting Habitat ²	273,174	280,409	312,068	354,548	403,145	422,306
Non-federal lands in the action area						
High-Quality Nesting Habitat	1164	1107	1051	998	948	900
Oregon CHUs Total ⁴						
High-Quality Nesting Habitat ¹	337,005					

Footnotes:

¹ High-Quality Nesting Habitat = structural stages 5.1, 5.2 or 5.3.² Nesting Habitat = structural stages 3.1, 3.3, 4.1, 4.2, 5.1, 5.2 or 5.3.³ Recruitment Habitat = structural stages 1.1, 1.2, 2.1, 2.2, 3.2, or 3.4.⁴ Total = sum of High-Quality Nesting Habitat only across all land owners; as discussed in the DEIS using the GNN structural condition categories was not effective for estimating lower-quality nesting habitat.

Range-wide

Because the Service anticipates that the proposed action will not appreciably diminish the value of critical habitat at either Conservation Zone or Statewide scale, the Service also believes the range-wide value of critical habitat will not be adversely affected for the conservation of the murrelets in the near-term or the long-term.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

As noted in the description of the action area earlier in this BO, we included non-federal lands within ½ mile of BLM lands in the action area because any activities on those lands that were dependent on BLM roads for access were considered to be indirect effects of the proposed action. Therefore, any future State, tribal, local or private actions that are reasonably certain to occur within critical habitat within the action area are included as indirect effects of the action and are included in our analyses above. We therefore do not anticipate there will be any Cumulative Effects in critical habitat given our rationale for including these non-federal lands in the action area.

Conclusion

After reviewing the current status of the murrelet, the status of murrelet critical habitat, the environmental baseline of the murrelet and for murrelet critical habitat within the action area (including the concurrent effects of climate change), the effects of the proposed action on the

murrelet and its critical habitat and the cumulative effects, it is the Service's biological opinion that the PRMP, as proposed, is not likely to jeopardize the continued existence of the murrelet, and is not likely to destroy or adversely modify murrelet critical habitat. The jeopardy determination is made at the scale of the listed entity, while the destruction or adverse modification determination is made at the scale of the entire designation.

Although there are likely to be some adverse effects to murrelets and murrelet critical habitat in portions of the species' range, the overall outcome of PRMP implementation will be the protection of the vast majority of extant murrelet nesting habitat, and a large long-term net increase in total area and amount of murrelet habitat during the life of the plan. This approach builds on and continues the basic approach of the original conservation strategy for the murrelet first articulated in the NWFP and the recovery plan.

The Service reached these conclusions for the following reasons:

1. The conservation needs of the murrelet will continue to be met at the conservation zone, state and listed range scales because the proposed action is consistent with the guidance of the Recovery Plan for the murrelet, for the next 50 years:

- The number of occupied murrelet nest sites is anticipated to increase in every decade of the PRMP, which is expected to adequately provide for BLM's contribution to murrelet recovery in Oregon.
- The PRMP will include more acres of murrelet nesting habitat within the reserves than are currently provided in the NWFP.
- The PRMP will greatly minimize nest disturbance by applying protective measures to activities in all LUAs in inland zone 1 and to activities in the reserve LUAs in inland zone 2 to allow for undisrupted murrelet nesting.
- The PRMP will improve the amount, quality and distribution of BLM nesting habitat over the 50 year life of the PRMP, offsetting short term impacts during the early years of the PRMP.
- The PRMP will potentially support an increase in habitat for the murrelet population every decade, with a potential 52 percent increase in the population in the action area over 50 years.

2. The proposed project will not appreciably reduce the likelihood of survival or recovery for the murrelet population at the conservation zone, state and listed range scales because:

- The number of occupied murrelet nest sites is anticipated to increase in every decade of the PRMP which will provide for a stable or increasing Oregon murrelet population, and will contribute to the population at the listed range.
- Activities in inland zone 1 will have protective measures to retain murrelet occupancy and allow for undisrupted nesting. The majority of known sites and 75 percent projected murrelet sites on BLM lands in the action area occur in inland zone 1. All Coquille Forest lands occur in inland zone 1.

- Activities in inland zone 2 within the Late-Successional and Riparian Reserves systems will have protective measures to retain murrelet occupancy and allow for undisturbed nesting. Because the majority of high-quality nesting habitat has been placed in the reserve systems, the majority of occupied sites in inland zone 2 are expected to be protected (84 percent of the nesting habitat on BLM lands in inland zone 2 or an additional 21 percent of nesting habitat on BLM lands in the action area).
- 96 percent of the projected sites on BLM lands in the action area are associated with LUAs with restrictions on activities to protect murrelet occupancy and allow for undisturbed nesting.
- Of the remaining 4 percent of BLM land in the action area, activities occurring in the 25 percent associated with the reserve system will have protective measures for undisturbed nesting.
- This adverse effect is offset by the PRMP providing for ingrowth to meaningfully increase the number of occupied sites during the life of the plan.
- The largest increases in occupied sites are expected to occur in late-successional and riparian reserves. Therefore, the percent of occupied sites that will have protective measures will also increase over time.

3. The Service believes the PRMP will not appreciably diminish the conservation value of critical habitat for the murrelet at the conservation zones, state or range-wide scales because:

- Nesting habitat currently supporting murrelet nesting (which is a subset of murrelet critical habitat PBFs) will be protected in inland zone 1 and within riparian reserves and late-successional LUAs in inland zone 2.
- Late-successional and Riparian Reserve lands will be managed for developing late-successional conditions (PBFs 1 and 2).
- Murrelet nesting habitat (PBFs 1 and 2) is expected to increase on BLM lands in all CHUs, except OR-07-d (BLM lands are 2 percent of this CHU).
- Murrelet nesting habitat (PBFs 1 and 2) is expected to increase in both Conservation Zones 3 and 4 under the PRMP.
- BLM has projected that nesting habitat patch size will increase over the life of the plan on BLM lands in the action area (Table 119), potentially reducing fragmentation increases from timber harvest.
- Because nesting habitat in critical habitat within the action area is forecasted to increase every decade of the PRMP, which will improve the quality and functionality of the network, we do not anticipate that the delayed or precluded development of PBFs in areas that do not contain PBFs will affect the function of the critical habitat network at the action area, conservation zone or listed range scales.

4. The PRMP provides measures that will ameliorate the projected impacts of climate change on forest conditions and that should provide for the long term persistence of the murrelet and its critical habitat, including a net increase in older forest habitat over time and the application of ecological forestry management practices that will improve local forest conditions.

5. No known cumulative impacts changed the determinations made under the effects of the proposed action.

NELSON'S CHECKER-MALLOW

STATUS OF THE SPECIES - NELSON'S CHECKER-MALLOW

Nelson's checkermallow was listed as Threatened on February 12, 1993 (USFWS 1993) without designated critical habitat. A recovery plan for the species was finalized on May 20, 2010 (USFWS 2010). This species is on the state of Oregon's Threatened Plant list, and in Washington it is classified by the WNHP as endangered. Nelson's checkermallow occurs in Oregon (Benton, Linn, Marion, Polk, Tillamook, Yamhill, and Washington counties) and Washington (Cowlitz and Lewis counties). Critical habitat for Nelson's checkermallow has not been designated.

Population Trends and Distribution for Nelson's Checkermallow

Nelson's checkermallow primarily occurs in Oregon's Willamette Valley, but is also found at several sites in Oregon's Coast Range and at two sites in the Puget Trough of southwestern Washington. The plant's range extends from southern Benton County, Oregon, north to Cowlitz County, Washington, and from central Linn County, Oregon, west to the crest of the Coast Range. In the late 1990s, the species was known to occur in 65 occurrences within five relict population centers in Oregon and Washington and occupy approximately 273 acres (USFWS 1998).

The 2010 Recovery Plan states that Nelson's checkermallow was known from about 90 sites, comprising about 1,277 acres of total cover (USFWS 2010). Data collection for a range-wide inventory of Nelson's checkermallow was completed in 2014 (Silvernail *et al.* 2016). Results indicated that 71 populations composed of 214,111 individual plants in Oregon that have potential to contribute towards achieving recovery goals. Other smaller populations exist, but are unlikely to contribute to recovery. Of the 71 populations, 21 populations were less than 100 plants; 36 populations had 100 to 2,499 plants; and 14 populations had more than 2500 plants. Of those 14 populations, five contained over 10,000 plants.

Life History and Ecology for Nelson's Checkermallow

Nelson's checkermallow is a perennial herb in the mallow family (*Malvaceae*). It has tall, lavender to deep pink flowers that are borne in somewhat open clusters 50 to 150 cm (19.2 to 48 inches) tall at the end of short stalks (USFWS 1993). Plants are partially dioecious, in that they have either perfect flowers (male and female) or pistillate flowers (female only). The plant can reproduce vegetatively, by rhizomes, and by seeds, which drop near the parent plant. Flowering typically occurs from late May to mid-July, but may extend into September in the Willamette Valley. Fruits have been observed as early as mid-June and as late as mid-October. Coast Range populations generally flower later and produce seed earlier, probably because of the shorter growing season. Seed production for a Nelson's checkermallow plant is typically high. An average plant may produce between 300 and 3000 seeds, but could potentially exceed 10,000 seed. The limiting factor of Nelson's checkermallow seed production is weevil damage. Weevils typically associated with the plants in the wild often infest flowers and eat flowers.

Early in seed production, weevils often consume developing embryos and may account for 80 to 100 percent loss of pre-dispersal seed.

In the Willamette Valley, Nelson's checkermallow begins flowering as early as mid-May, and continues through August to early September, depending upon the moisture and climatic conditions of each site. Coast Range populations experience a shorter growing season and generally flower later and senesce earlier. Nelson's checkermallow inflorescences are indeterminate, and often simultaneously exhibit fruits, open flowers, and unopened buds. Seeds are deposited locally at or near the base of the parent plant and may be shed immediately or persist into winter within the dry flower parts that remain attached to the dead stems. Above-ground portions of the plant die back in the fall, usually followed by some degree of regrowth at the base, with the emergence of small, new leaves that persist through the winter directly above the root crown. It is not uncommon for some plants to continue producing some flowers into the fall and early winter, although this is usually limited to one or two small stems per plant, consequently with little seed production (USFWS 1998).

Perfect-flowered Nelson's checkermallow are protandrous, with complete temporal separation of male and female phases in individual flowers (Gisler and Meinke 1998). This prevents self-fertilization. The bottom-to-top foraging observed among most bee visitors also encourages outcrossing because pollinators leave male-phase flowers at the top of one raceme and then fly to female phase flowers on the bottom of the next raceme. Nelson's checkermallow is pollinated by a variety of insects, including at least 17 species of bees, 3 species of wasps, 9 species of flies, 6 species of beetles, and 5 species of butterflies/moths (Gisler 2003).

Pre-dispersal seed predation by weevils (*Macrorhoptus sidalceae*) is extremely high in many populations, and may severely curtail, if not virtually eliminate, seed survival in many populations (Gisler and Meinke 1998). The weevils appear to be restricted to Willamette Valley, southwestern Washington and lower Coast Range populations (around Grand Ronde), but do not infest the Coast Range populations in Yamhill, Tillamook, and Washington counties. The weevils are native, host-specific, and are themselves parasitized by tiny undescribed wasps (Gisler and Meinke 1998).

Habitat Characteristics for Nelson's Checkermallow

In the Willamette Valley, Nelson's checkermallow is known from wet prairies and stream sides (USFWS 2010). Nelson's checkermallow populations occur at low elevations (below 200 m (650 feet)) within a mosaic of urban and agricultural areas, with concentrations around the cities of Corvallis and Salem. Although occasionally occurring in the understory of *Fraxinus latifolia* (Oregon ash) woodlands or among woody shrubs, Willamette Valley populations usually occupy open habitats supporting early seral plant species. These native prairie remnants are frequently found at the margins of sloughs, ditches, and streams; roadsides; fence rows; drainage swales; and fallow fields. Soil textures of the occupied sites vary from gravelly, well drained loams to poorly drained, hydric clay soils (CH2MHill 1986, Glad *et al.* 1994).

Some of the native plants commonly associated with *Sidalcea nelsoniana* in the Willamette Valley include: *Achillea millefolium* (yarrow), *Juncus effusus* (common rush), *Carex* spp.

(sedge), *Spiraea douglasii* (western spiraea), *Crataegus douglasii* (Douglas' hawthorn), *Geum macrophyllum* (large-leaved avens), and *Fraxinus latifolia* (ODA 1995). Most sites have been densely colonized by invasive weeds, especially introduced forage grasses. Common non-native species found with Nelson's checkermallow include *Festuca arundinacea*, *Rosa* spp. (rose), *Cirsium arvense* (Canada thistle), *Hypericum perforatum* (common St. John's wort), *Rubus* spp. (blackberry), *Phleum pratense* (timothy), *Holcus lanatus* (velvet grass), *Vicia* spp., *Chrysanthemum leucanthemum* (oxeye-daisy), *Agrostis capillaris*, *Alopecurus pratensis*, *Phalaris arundinacea*, *Geranium* spp. (geranium), *Lotus corniculatus* (bird's-foot trefoil) and *Daucus carota* (ODA 1995).

Coast Range Nelson's checkermallow populations typically occur in open, wet to dry grassy meadows, intermittent stream channels, and along margins of coniferous forests, with clay to loam soil textures (Glad *et al.* 1987) at elevation ranging from 490 to 600 m (1,610 to 1,970 feet). These areas generally support more native vegetation than Willamette Valley sites. Native plants commonly associated with Nelson's checkermallow in the Coast Range include *Senecio triangularis* (spear-head senecio), *Fragaria Virginiana*, *Juncus* spp., *Carex* spp., and *Achillea millefolium*; non-native associated species often include *Senecio jacobaea* (tansy ragwort), *Holcus lanatus*, and *Phleum pratense*.

A variety of animal species are associated with Nelson's checkermallow. Stems and inflorescences are commonly eaten by deer and elk. Nelson's checkermallow flowers are visited by a diverse assemblage of insects, including leafcutter bees (Megachilidae), honey bees (Apidae), bumble bees (Bombidae), hover flies (Syrphidae), butterflies (Hesperiidae), and pollen-foraging beetles (Cerambycidae and Meloidae). The species is also a host for various phytophagous insects such as aphids (Aphididae), stinkbugs (Pentatomidae), scentless plant bugs (Rhopalidae), spotted cucumber beetles (Chrysomelidae), plant bugs (Miridae), milkweed bugs (Lygaeidae), spittlebugs (Cercopidae), butterfly larvae (Lycaenidae: *Strymon melinus*; Nymphalidae: *Vanessa anabella*), and in the Willamette Valley, weevils (Curculionidae: *Macrohoptus sidalcae*).

Threats/Reasons for Listing for Nelson's Checkermallow

As with several other rare prairie plants, Nelson's checkermallow threatened by urban and agricultural development, ecological succession that results in shrub and tree encroachment of open prairie habitats, and competition with invasive weeds (USFWS 1993). At many Willamette Valley sites, seedling establishment is inhibited by the dense thatch layer of non-native grasses (Gisler 2004). Other factors specific to Nelson's checkermallow include pre-dispersal seed predation by weevils (Gisler and Meinke 1998), the potential threat of inbreeding depression due to small population sizes, and habitat fragmentation (Gisler 2003).

There is a strong potential for interspecific hybridization among Nelson's checkermallow and other species of checkermallows in the region, although there are some ecological and genetic reproductive barriers to prevent it from occurring (Gisler 2003, 2004). Nelson's checkermallow flowers later in the year than sympatric populations of *Sidalcea malviflora* ssp. *virgata* (rose checkermallow), but allopatric populations sometimes overlap in flowering periods. The two species are sexually compatible, thus human-mediated movement of the plants could result in

formation of hybrids. Nelson's checkermallow and *S. cusickii* (Cusick's checker-mallow) are also fully compatible, and they also share pollinators and flowering times, but their geographic ranges are parapatric, with nearest populations narrowly separated by less than 1.6 km (1 mile) at the south end of Finley National Wildlife Refuge (Gisler 2004). If these species come into contact through human-mediated dispersal, hybridization could easily occur.

Nelson's checkermallow is frequently found growing together with *S. campestris*, and they also share pollinators and flowering times, but they exhibit very low sexual compatibility (Gisler 2004). Reproductive barriers among the checker-mallows in the Willamette Valley likely evolved in response to selective pressure against hybridization (Gisler 2003, 2004); managers should be aware of the potential for hybridization as plants are moved around within the region.

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and result in encroachment to open, wet to dry grassy meadows, intermittent stream channels, and coniferous forest margin habitat. These potential impacts may affect the environmental baseline for Nelson's checkermallow and a general overview of these potential effects is provided in Appendix D. Although it appears likely that Nelson's checkermallow could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of Nelson's checkermallow where it occurs on BLM managed land including the Walker Flat ACEC that will be managed to maintain, enhance or restore Nelson checkermallow at this location. In addition, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within existing and newly discovered (or established) plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning of trees, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including meadows and woodlands. These measures will increase the ability of Nelson's checkermallow to persist and recover in the face of climate change on BLM lands within the action area.

Recovery Measures for Nelson's Checkermallow

Extensive research has been conducted on the ecology and population biology of Nelson's checkermallow, methods of seed predator control, and propagation and reintroduction techniques (Gisler and Meinke 1998, 2001; Bartels and Wilson 2001; Gisler 2003; Wilson 2004). The results of these studies have been used to direct the management of the species at sites managed for wet prairies (USFWS 2010).

Nelson's checkermallow has a highly complex breeding system that facilitates both outcrossing and selfing (USFWS 2010). Control of seed predation by native weevils may be needed to enhance reproductive success at some populations which are heavily infested with weevils (Gisler and Meinke 1998). Research into habitat management techniques indicates that burning may not be directly beneficial to Nelson's checkermallow, and that caution should be used in management of native prairie fragments with populations of Nelson's checkermallow (Bartels and Wilson 2001, Wilson 2004). The species has proved to be readily grown in controlled environments, and several approaches have successfully cultivated healthy plants for augmentation of existing populations (Gisler 2003). Seeds of this species have been banked at the Rae Selling Berry Seed Bank in Portland, Oregon (Portland State Environmental Science and Management 2015) and the University of Washington Botanic Garden.

Populations of Nelson's checkermallow are protected on lands managed by the Service at William L. Finley and Baskett Slough National Wildlife Refuges, the Confederated Tribes of the Grand Ronde in Polk County, and by the BLM at Walker Flat in Yamhill County, Oregon (USFWS 2010). In December 2007, Ridgefield National Wildlife Refuge, in Clark County, Washington, outplanted 2,530 seedlings to establish a new population at the refuge; monitoring and management of the new population is ongoing. A habitat conservation plan that addresses conservation of Nelson's checkermallow within Benton County was completed in 2010 (Benton County 2010).

Threats/ Reasons for Listing for Nelson's Checkermallow

Habitats occupied by Nelson's checker-mallow contain native grassland species and numerous introduced taxa (USFWS 2010). In some areas, habitats occupied by Nelson's checker-mallow are undergoing an active transition towards a later seral stage of vegetative development, often due to the encroachment of non-native, invasive species (*i.e.*, brush competition). Invasive woody species of concern include non-native plants such as Himalayan blackberry (*Rubus discolor*), multiflora rose (*Rosa multiflora*), European hawthorn (*Crataegus monogyna*), and Scot's broom (*Cytisus scoparius*). Invasive native species include Oregon ash, Douglas hawthorn (*Crataegus douglasii*), Nootka rose (*Rosa nutkana*) and Douglas spiraea (*Spiraea douglasii*).

Due to this rapid invasion by woody vegetation (especially Scot's broom) in some areas and the suppression of natural fire regimes, secondary successional pressures on these plant populations are expected to increase over time. Habitat conversion via succession and/or agricultural activities poses measurable threats to the long-term stability of Nelson's checker-mallow populations.

Agricultural and urban development have modified and destroyed habitats, fragmenting populations into small, widely scattered patches (USFWS 2010). In the Willamette Valley, extirpation is an ongoing threat to many Nelson's checker-mallow occurrences on private lands, roadsides, and undeveloped lots zoned for industrial and residential development. Within the genus *Sidalcea*, the actual sex ratio (the number of functionally pistillate to perfect flowers) of a population may be a strong contributing factor to its genetic vigor or vulnerability such that the ratio of pistillate to perfect flowers may ultimately control the amount and quality of seeds

produced regardless of habitat quality. Likewise, seed predation by weevils prior to seed dispersal may also be a factor controlling seed production.

Prior to European colonization of the Willamette Valley, naturally occurring fires and fires set by Native Americans maintained suitable Nelson's checkermallow habitat (USFWS 2010). Current fire suppression practices allow succession of trees and shrubs in Nelson's checkermallow habitat. Remnant prairie patches in the Willamette Valley have been modified by livestock grazing, fire suppression, or agricultural land conversion. Stream channel alterations, such as straightening, splash dam installation, and rip-rapping cause accelerated drainage and reduce the amount of water that is diverted naturally into adjacent meadow areas. As a result, areas that would support Nelson's checkermallow are lost.

The most serious management threat related to land use faced by several populations on private lands that are not subject to state and Federal laws governing listed plant species (USFWS 2010). Seventeen years of population observation has documented the ongoing disturbance or complete extirpation of populations on private land due to non-industrial timber harvest operations, development, herbicide application, agricultural activities, and other land-use practices (CH2MHill 1997). Although numerous checkermallow occurrences are on public lands, many are threatened by inadvertent disturbance from roadside maintenance, herbicide application and mowing, soil cultivation, ditching, and other habitat modification. For additional information on recovery goals, objectives, and criteria, see *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* (USFWS 2010):

<http://www.fws.gov/oregonfwo/Species/PrairieSpecies/Documents/PrairieSpeciesFinalRecoveryPlan.pdf>.

Conservation Measures for Nelson's Checkermallow

All of the General Plant Conservation Measures (Section 3.13.1) apply for Nelson's checkermallow. Nelson's checkermallow does not senesce completely in the fall like many other prairie plant species, and additional protections include:

- Burning: at any site with a population of this species, no more than one half of the occupied habitat may be burned in any year.
- Herbicide use: protect Nelson's checkermallow plants from herbicide drift or overspray:
 - When treating target plants with triclopyr, glyphosate or 2,4-D amine, apply by hand (e.g., with a backpack sprayer wand) when working near Nelson's checker-mallow to ensure protection of the listed plant.
 - For all herbicide applications not excluded below, cover or otherwise protect (e.g., by clipping leaves to remove exposed green tissue) individual Nelson's checker-mallow plants to ensure that no herbicide comes in contact with the plant. Means of coverage may include 5-gallon buckets, tree protection tubes or other suitable shielding or covering material. Immediately after herbicide treatment, remove coverings.
 - When applying glyphosate with a weed wiper in areas with Nelson's checkermallow, no covering of individual Nelson's checker-mallow is necessary

apply glyphosate at a height to target upper grass stems, and avoid shorter Nelson's checkermallow plants.

- o No covering of Nelson's checkermallow is required if treating target plants with sethoxydim or clethodim.
- o Broadcast application of grass-specific herbicides may be used in on up to half of an area occupied by Nelson's checkermallow between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
- o All other broadcast applications will only occur after August 15.
- o All other herbicides will only be applied from August 15 to October 31 when the species is dormant.

ENVIRONMENTAL BASELINE – NELSON'S CHECKERMALLOW

Within the action area on BLM-administered lands, the species occurs at only one site in the Walker Flat ACEC on the Salem District. Most of the plants in this population occur on adjacent City of McMinnville property. The Walker Flat population has more than 4,300 plants and represents one of two existing large populations within the Coastal Recovery Zone (Silvernail *et al.* 2016). A total of 3 populations is needed to meet the defined recovery goals within this recovery zone (USFWS 2010); thus, the Walker Flat population is essential to the overall recovery of Nelson's checkermallow. BLM's continued commitment to manage the Walker Flat population will ensure a significant proportion of that population remains intact regardless of the City of McMinnville's management.

EFFECTS OF THE ACTION TO NELSON'S CHECKER-MALLOW

Although several resource programs under the PRMP have the potential to adversely affect the Nelson's Checker-mallow, the BLM (2016a, pp. 163) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and require BLM to conduct pre-project surveys, protect and manage known populations, and implement conservation measures for the species. The specific measures are:

1. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*

- *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
 - *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
 - *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*
2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*
- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*

Absent the above constraints, some resource programs under the PRMP would have the potential to adversely affect Nelson's Checker-mallow depending on how the BLM implements the particular program in areas occupied by this species. For example, individual management actions within the Walker Flat ACEC may have the potential to injure or kill individual plants while the plants are above ground, but these actions are designed to protect and maintain the species on the site.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on Nelson's Checker-mallow to an extent that is compatible with the conservation of this species. This is because the measures described above would require pre-project surveys for Nelson's Checker-

mallow and preclude implementation of future activities under the PRMP that may affect Nelson's Checker-mallow that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific; conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

The management direction described above has a high potential to protect and restore Nelson's Checker-mallow habitat, maintain known populations, and will facilitate surveys to discover and protect additional populations of this species prior to implementation of PRMP-associated management actions.

The single known occupied site on BLM lands is in the proposed Walker Flat ACEC. This is a large population (4,359 plants) important for reaching recovery goals. This ACEC would be managed to maintain, enhance or restore Nelson's Checker-mallow at this location. There are 5 other populations within the action area: the Service is aware that only one of these populations, which is located on Service refuge lands, is managed to maintain, enhance, and restore Nelson's Checker-mallow.

The Service has published a recovery plan for the Nelson's Checker-mallow (USFWS 2010). The recovery plan provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include (USFWS 2010), preserve, restore and manage Nelson's Checker-mallow populations. This is further defined as permanent reduction or elimination of the threats and application of appropriate and adaptive management to ensure species survival and recovery.

The Service agrees with BLM's assessment that implementation of the PRMP has the potential to adversely affect Nelson's Checker-mallow populations that have not yet been discovered in certain land-use allocations and where no management projects are implemented under the PRMP. Although the effect on Nelson's Checker-mallow of such losses has the potential to be adverse, the Service concludes that implementation of the PRMP has a high potential to result in the retention, management, enhancement and augmentation of the Walker Flat ACEC population and potentially 7 other existing known populations of this species within the action area (which is ~12 percent of the known species' populations), along with the discovery and establishment of new populations. Such potential effects would be consistent with the Nelson's Checker-mallow recovery plan (USFWS 2010) and are sufficient to contribute positively to the recovery needs of the species within the action area because they will have an overall positive impact on numbers, reproduction and distribution of the species.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon.

The potential exists for Nelson’s Checker-mallow populations to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon. On timber lands interspersed within the action area the Service is aware of at least two Nelson’s Checker-mallow populations, which are associated with open habitats in the Tillamook Burn area. The Service has no information to indicate that a departure of management of these non-federal lands within the action area from what has occurred in the past is reasonably certain to occur. Therefore, we expect populations on these lands to remain about the same as the baseline populations. While the loss of these two sites may reduce the overall numbers of the species, it is not expected to reduce the overall distribution of the species.

CONCLUSION

After reviewing the current status of the Nelson’s Checker-mallow, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service’s biological opinion that the PRMP is not likely to jeopardize the continued existence of the Nelson’s Checker-mallow.

The key basis for this conclusion is the two PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on Nelson’s Checker-mallow to an extent that is compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations and on non-federal lands where habitat conditions may not be maintained. The proposed management of the single known population on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing Nelson’s Checker-mallow viability without restricting the species’ range. The Service expects that improvements in these populations are likely to contribute positively to the recovery needs of the species within the BLM portion of the action area. This is not likely to jeopardize the species because under the PRMP the BLM will protect, maintain and enhance all known and newly discovered populations within the action area. Nelson’s Checker-mallow populations on non-federal lands are not anticipated to change appreciably from the current, baseline levels.

NORTHERN SPOTTED OWL

STATUS OF THE SPECIES - NORTHERN SPOTTED OWL

Legal Status

The spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USFWS 1990a, p. 26114). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USFWS 2004, p. 55). Priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies (USFWS 1983b, p. 51895). The "C" reflects conflict with development, construction, or other economic activity (USFWS 1983a, p. 43104). The most recent five year status review was completed on September 29, 2011, and did not propose changes to the listing status or introduce any new threats (USFWS 2011a). In 2012, the Service was petitioned to uplist the northern spotted owl from threatened to endangered status under the Endangered Species Act. In April 2015, the Service determined that petition presented substantial information indicating that the listing may be warranted due to a number of listing factors (USFWS 2015).

Life History

Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, pp.741-742; Barrowclough *et al.* 1999, p. 928; Haig *et al.* 2004, p. 1354), morphological (Gutiérrez *et al.* 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez *et al.* 1995, p.2). Recent studies analyzing mitochondrial DNA sequences (Haig *et al.* 2004, p. 1354; Chi *et al.* 2004, p. 3; Barrowclough *et al.* 2005, p. 1117) and microsatellites (Henke *et al.*, unpublished data, p. 15) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevada, appears to be stable (Barrowclough *et al.* 2005, p. 1116).

Funk *et al.* (2008, pp. 1-11) tested the validity of the three current recognized subspecies of spotted owls and found them to be valid. During this genetics study, bi-directional hybridization and dispersal between northern spotted owls and California spotted owls centered in southern Oregon and northern California was discovered. In addition, a discovery of intro-regression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington was made, indicating long-distance dispersal of Mexican spotted owls into the northern spotted owl range (Funk *et al.* 2008, pp. 1-11). Some hybridization of northern spotted

owls with barred owls has been recorded (Hamer *et al.* 1994, pp. 487-491; Dark *et al.* 1998, pp. 50-56; Kelly 2001, pp. 33, 38).

Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez *et al.* 1995, p. 2). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. as cited in USFWS 2011b, p. A-1). The northern spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen *et al.* 1991, p. 493). The northern spotted owl superficially resembles the barred owl, a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit physical and vocal characteristics of both species (Hamer *et al.* 1994, p. 488).

Current and Historical Range

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USFWS 1990a, p. 26115). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 24) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas *et al.* 1993, USFWS 2011b, p. III-1). These provinces are distributed across the species' range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands
- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993, USFWS 2011b, pp. B-1 to B-4;).

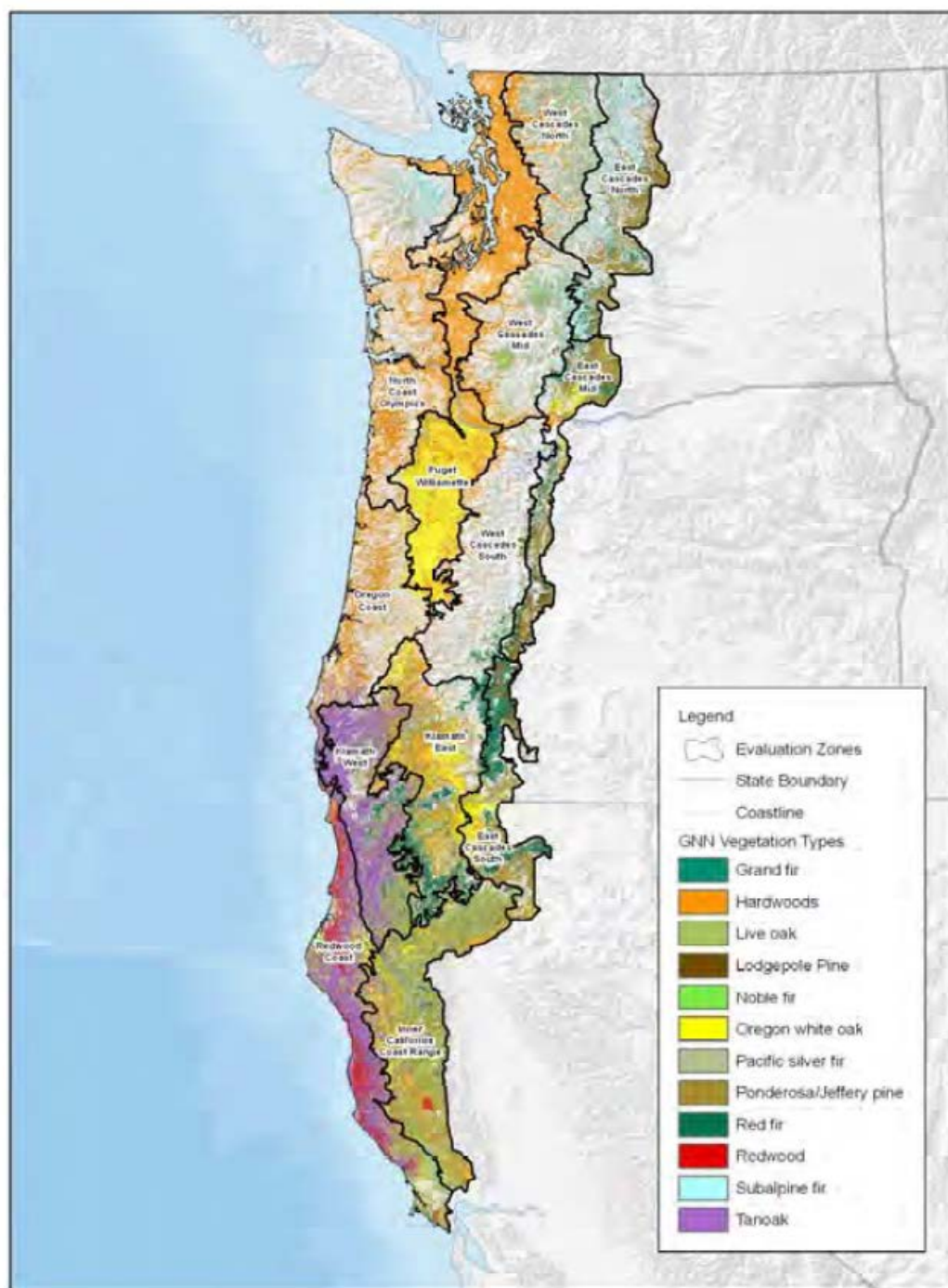


Figure 24. Physiographic provinces within the range of the northern spotted owl.

Behavior

Northern spotted owls are primarily nocturnal (Forsman *et al.* 1984, pp. 51-52) and spend virtually their entire lives beneath the forest canopy (Courtney *et al.* 2004, p. 2-5). They are adapted to maneuverability beneath the forest canopy rather than strong, sustained flight (Gutiérrez *et al.* 1995, p. 9). They forage between dusk and dawn and sleep during the day with peak activity occurring during the two hours after sunset and the two hours prior to sunrise (Gutiérrez *et al.* 1995, p. 5; Delaney *et al.* 1999, p. 44). They will sometimes take advantage of vulnerable prey near their roosts during the day (Layman 1991, pp. 138-140; Sovern *et al.* 1994, p. 202).

Northern spotted owls seek sheltered roosts to avoid inclement weather, summer heat, and predation (Forsman 1975, pp. 105-106; Barrows and Barrows 1978; Barrows 1981; Forsman *et al.* 1984, pp. 29-30). Northern spotted owls become stressed at temperatures above 28°C, but there is no evidence to indicate that they have been directly killed by temperature because of their ability to thermoregulate by seeking out shady roosts in the forest understory on hot days (Barrows and Barrows 1978; Forsman *et al.* 1984, pp. 29-30, 54; Weathers *et al.* 2001, pp. 678, 684). During warm weather, spotted owls seek roosts in shady recesses of understory trees and occasionally will even roost on the ground (Barrows and Barrows 1978, pp. 3, 7-8; Barrows 1981, pp. 302-306, 308; Forsman *et al.* 1984, pp. 29-30, 54; Gutiérrez *et al.* 1995, p. 7). Glenn *et al.* (2010, p. 2549) found that population growth was negatively associated with hot summer temperatures at their southernmost study area in the southern Oregon Cascades, indicating that warm temperatures may still have an effect on the species. Both adults and juveniles have been observed drinking water, primarily during the summer, which is thought to be associated with thermoregulation (Gutiérrez *et al.* 1995, p. 7).

Spotted owls are territorial; however, home ranges of adjacent pairs overlap (Forsman *et al.* 1984, p. 22; Solis and Gutiérrez 1990, p. 746) suggesting that the area defended is smaller than the area used for foraging. They will actively defend their nests and young from predators (Forsman 1975, p. 15; Gutiérrez *et al.* 1995, p. 11). Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996, p. 4). These birds are referred to as “floaters.” Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996, p. 4).

Spotted owls are monogamous and usually form long-term pair bonds. “Divorces” occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez *et al.* 1995, p. 10).

Habitat Relationships

Home Range

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USFWS 1990a, p. 26117). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas and Raphael 1993, pp. IX-15)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas *et al.* 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USFWS 1994a, p. 3). Zabel *et al.* (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman *et al.* 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (approximately 20 percent of the home range), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman *et al.* 1984, pp. 21-22; Sisco 1990, p. iii).

Although differences exist in natural stand characteristics that influence home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, pp. 98-99; Bart 1995, p. 944).

Habitat Use and Selection

Forsman *et al.* (1984, pp.15-16) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*A. concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*A. magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Forsman 1975, p. 27; Forsman *et al.* 1984, pp. 15-16).

Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy cover (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas *et al.* 1990, p. 19). Forested stands with high canopy cover also provide thermal cover (Weathers *et al.* 2001, p. 686) and protection from predators (Franklin *et al.* 2000, p. 578).

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman *et al.* 1984, p. 30; Hershey *et al.* 1998, p. 1402). Even in forests that have been previously logged, spotted owls select forests having a structure (*i.e.*, larger trees, greater canopy cover) different than forests generally available to them (Folliard 1993, p. 40; Buchanan *et al.* 1995, p. 1402; Hershey *et al.* 1998, p. 1404).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 3; Forsman *et al.* 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743). These habitats are usually multi-layered forests having high canopy cover and large diameter trees in the overstory.

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas *et al.* 1990; USFWS 2011b, p. G-2). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy cover or cover and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p. 5). Foraging habitat for spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North *et al.* 1999, p. 524), canopy cover or cover (Irwin *et al.* 2000, p. 180; Courtney *et al.* 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North *et al.* 1999, p. 524; Irwin *et al.* 2000, pp. 179-180; Courtney *et al.* 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North *et al.* 1999, p. 524), volume of woody debris (Irwin *et al.* 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey *et al.* 1992, pp. 245-247; Irwin *et al.* 2000, pp. 178-179). Spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey *et al.* 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman *et al.* 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey *et al.* 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome *et al.* 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy cover to provide protection from avian predators and at least minimal foraging opportunities (USFWS 2011b, p. G-1). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USFWS 2011b, p. G-1). Forsman *et al.* (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. In a study of the natal dispersal of spotted owls, Sovern *et al.* (2015, pp. 257-260) found the majority of roosts were in forested habitats with at least some large (>50 cm dbh) trees and they selected stands with high canopy cover (>70 percent) at the landscape scale. These authors suggested the concept of 'dispersal' habitat as a lower quality type of habitat may be inappropriate. The stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Thomas *et al.* 1990, p. 158; Diller and Thome 1999, p. 275). In mixed conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan *et al.* 1995, p. 304). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin *et al.* 2000, p. 41).

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy cover more often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy cover) less often than expected based on this habitat's availability (Herter *et al.* 2002, p. 437).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman *et al.* 1984, pp. 24-25; Carey *et al.* 1990, pp. 14-15; Thomas *et al.* 1990; Forsman *et al.* 2005, pp. 372-373). Glenn *et al.* (2004, pp. 46-47) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990, p. 62) found that spotted owls foraged in areas with lower variance in prey densities (that is, where the occurrence of prey was more predictable) within older forests and near ecotones of old forest and brush seral stages. Zabel *et al.* (1995, p. 436) showed that spotted owl home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and smaller where wood rats (*Neotoma* spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Zabel *et al.* 2003, p. 1038; Franklin *et al.* 2000, pp. 573-579; Meyer *et al.* 1998, p. 43). In Oregon Klamath and Western Oregon Cascade provinces, Dugger *et al.* (2005, p. 876) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger *et al.* 2005, pp. 873-874). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger *et al.* (2005, p.

876) stated was generally much lower than those in Franklin *et al.* (2000) and Olson *et al.* (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony *et al.* (2006). Olson *et al.* (2004, pp. 1050-1051) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson *et al.* (2004, pp. 1049-1050) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area. In a large-scale demography modeling study, Forsman *et al.* (2011, pp. 1-2) found a positive correlation between the amount of suitable habitat and recruitment of young.

Reproductive Biology

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman *et al.* 1984; Gutiérrez *et al.* 1995, p. 5). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Miller *et al.* 1985, p. 93; Franklin 1992, p. 821; Forsman *et al.* 2002, p. 17). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year (USFWS 1990b; Forsman *et al.* 1984, pp. 32-34; Anthony *et al.* 2006, p. 28), and renesting after a failed nesting attempt is rare (Gutiérrez 1996, p. 4). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996, p. 4).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman *et al.* 1984, p. 32). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (USFWS 1990a; Forsman *et al.* 1984, p. 38). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman *et al.* 1984, p. 38). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig *et al.* 2001, p. 35; Forsman *et al.* 2002, p. 18). Hybridization of spotted owls with California spotted owls and barred owls has been confirmed through genetic research (Hamer *et al.* 1994, pp. 487-492; Gutiérrez *et al.* 1995, pp. 2-3; Dark *et al.* 1998, p. 52; Kelly 2001, pp. 33-35; Funk *et al.* 2008, pp. 161-171).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Miller *et al.* 1997; Forsman *et al.* 2002, p. 13). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman *et al.* 2002, pp. 13-14; Miller *et al.* 1997, p. 143). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman *et al.* 2002, p. 16). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some

studies (USFWS 1990a; Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; USFWS 1990a; Forsman *et al.* 2002, pp. 18-19). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg *et al.* 1989, p. 247; Gutiérrez 1989, pp. 616-617; Forsman *et al.* 2002, pp. 18-19). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye *et al.* 2001, pp. 697-698).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman *et al.* 2002, p. 22). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear, although radio telemetry data indicate that spotted owls move around large water bodies rather than cross them (Forsman *et al.* 2002, p. 22). Analysis of the genetic structure of spotted owl populations suggests that gene flow may have been adequate between the Olympic Mountains and the Washington Cascades, and between the Olympic Mountains and the Oregon Coast Range (Haig *et al.* 2001, p. 35).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman *et al.* 2002, pp. 20-21). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman *et al.* 2002, pp. 21-22). In California spotted owls, a similar subspecies, the probability for dispersal was higher in younger owls, single owls, paired owls that lost mates, owls at low quality sites, and owls that failed to reproduce in the preceding year (Blakesley *et al.* 2006, p.77). Both males and females dispersed at near equal distances (Blakesley *et al.* 2006, p. 76). In 72 percent of observed cases of dispersal, dispersal resulted in increased habitat quality (Blakesley *et al.* 2006, p. 77).

Dispersal can also be described as having two phases: transience and colonization (Courtney *et al.* 2004, p. 5-13). Fragmented forest landscapes are more likely to be used by owls in the transience phase as a means to move rapidly between denser forest areas (Courtney *et al.* 2004, p. 5-13; USFWS 2012a, p. 14086). Movements through mature and old growth forests occur during the colonization phase when birds are looking to become established in an area (Miller *et al.* 1997, p. 144; Courtney *et al.* 2004, p. 5-13). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting/foraging habitats used by breeding birds (USFWS 2012a, p. 14086). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (USFWS 2012a, p. 14086).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman *et al.* 1984, p. 51; 2004, pp. 222-223; Sovern *et al.* 1994, p. 202). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock forests (Forsman *et al.* 1984, pp. 40-41) in Washington and Oregon, while dusky-footed

wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, California Klamath, and California Coastal provinces (Forsman *et al.* 1984, pp. 40-42; 2004, p. 218; Ward *et al.* 1998, p. 84; Hamer *et al.* 2001, p. 224). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus*, *A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman *et al.* 1984, pp. 40-43; 2004, p. 218; Ward *et al.* 1998; p. 84; Hamer *et al.* 2001, p.224).

Other prey species such as the red tree vole (*Arborimus longicaudus*), red-backed voles (*Clethrionomys gapperi*), mice, rabbits and hares, birds, and insects may be seasonally or locally important (reviewed by Courtney *et al.* 2004, pp. 4-27). For example, Rosenberg *et al.* (2003, p. 1720) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) ($r^2 = 0.68$), despite the fact they only made up 1.6 ± 0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg *et al.* 2003, p. 1723). Ward (1990, p. 55) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman *et al.* 2001, p. 148; 2004, pp. 218-219). In the southern portion of their range, where woodrats are a major component of their diet, spotted owls are more likely to use a variety of stands, including younger stands, brushy openings in older stands, and edges between forest types in response to higher prey density in some of these areas (Forsman *et al.* 1984, pp. 24-29).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman *et al.* 1984; Gutiérrez *et al.* 1995, p. 5). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin *et al.* 2000, p. 576).

In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North *et al.* 2000, p. 805), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (*e.g.*, Franklin *et al.* 1999, p. 1). Annual variation in breeding may be related to weather (*i.e.*, temperature and precipitation) (Wagner *et al.* 1996, p. 74; Zabel *et al.* 1996, p.81 In: Forsman *et al.* 1996) and fluctuation in prey abundance (Zabel *et al.* 1996, pp.437-438).

A variety of factors may influence spotted owl population levels. These factors may be density-dependent (*e.g.*, habitat quality, habitat abundance) or density-independent (*e.g.*, climate). Interactions may occur among factors. For example, as habitat quality decreases, density-

independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin *et al.* 2000, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin *et al.* 2000, pp. 581-582). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin *et al.* 2000, p. 583). Recent findings suggest that competition with barred owls is an important stressor of spotted owl populations, but habitat availability and climatic patterns also appear to influence survival, occupancy, recruitment, and, to a lesser extent, fecundity (Dugger *et al.*, 2016, entire).

Olson *et al.* (2005, pp. 930-931) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). Recently the variable influences of different covariates for particular demographic parameters across study areas were noted by Dugger *et al.*, 2016, entire. Authors noted that the control areas in Green Diamond Study Area (GDR-C), Washington Study Areas, and the Oregon Coast Study Area (COA) had the highest annual rates of population decline.

Threats

Reasons for Listing

The spotted owl was listed as threatened throughout its range “due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms” (USFWS 1990a, p. 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USFWS 1992a, pp. 33-41). These threats were characterized for each province as severe, moderate, low, or unknown (USFWS 1992a, pp. 33-41). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl’s range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional

information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney *et al.* 2004, pp. 11-8 to 11-9). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, p. 84; Laidig and Dobkin 1995, p. 155). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

New Threats

The Service conducted a 5-year review of the spotted owl in 1994 (USFWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney *et al.* 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- “Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects...In their questionnaire responses...6 of 8 panel members identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat” (Courtney and Gutiérrez 2004, pp.11-7).
- “Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3 percent of the range-wide habitat base over a 10-year period)” (Courtney and Gutiérrez 2004, pp.11-8).
- “Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations” (Courtney and Gutiérrez 2004, pp. 11-8).

Threats, as identified in the 2011 Revised Recovery Plan for the Spotted owl, continue to emphasize that habitat loss and barred owls are the main threats to spotted owl recovery (USFWS 2011b, Appendix B).

Barred Owls (*Strix varia*)

Barred owls currently appear to be the primary threat to spotted owls. With its range expansion to as far south as Marin County, California (Gutiérrez *et al.* 2004, pp. 7-12 to 7-13; Steger *et al.* 2006, p.226), the barred owl’s range now completely overlaps that of the spotted owl. Barred owls compete with spotted owls for prey (Hamer *et al.* 2001, p.226, Gutiérrez *et al.* 2007, p. 187; Livezey and Fleming 2007, p. 319, Wiens *et al.*, 2014, pp. 24 and 33) or habitat (Hamer *et al.* 1989, p.55; Dunbar *et al.* 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274). In addition, barred owls have been documented to physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226). And finally, the growing body of evidence demonstrates that barred owls are causing significant negative demographic effects

based on retrospective examination of long-term data collected on spotted owls (Kelly *et al.* 2003, p. 46; Pearson and Livezey 2003, p. 267; Olson *et al.* 2005, p. 921, Forsman *et al.*, 2011, pp. 41-43, 69-70, Dugger *et al.*, 2016, pp. 70-96).

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer *et al.* 1989, p. 34; Iverson 1993, p.39). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Gremel 2005, Schmidt 2006, p. 1; Singleton *et al.* 2010, pp. 290-292). In Western Oregon, Wiens *et al.* (2011, p. 537) found the overall occupancy probability of barred owls was high (.89) in an intensively managed forest landscape, representing an increase in barred owl occurrence in that region over the past 30 years (citing Taylor and Forsman 1976). In this Western Oregon study, barred owls were non-randomly distributed, with a highest proportion of public ownership containing a structurally diverse mixture of mature and old forests (p.537). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton *et al.* 2005, p. 1).

The two species of owls share similar habitats and are likely competing for food resources (Hamer *et al.* 2001, p. 226, Gutiérrez *et al.* 2007, p. 187; Livezey and Fleming 2007, p. 319, Wiens *et al.*, 2014, pp. 24 and 33). Hamer found a strong diet overlap (76 percent) between northern spotted and barred owl diets (pp. 221, 226). Barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats (*e.g.*, fish, invertebrates, frogs, and crayfish), along with more terrestrial and diurnal species (Smith *et al.* 1983; Hamer *et al.* 2001; Gronau 2005, Wiens *et al.*, 2014, p. 24). Even though barred owls appear to be generalists, spotted owls may be affected by a sufficient reduction in the density of these prey when they co-exist in an area, leading to a depletion of prey to the extent that the spotted owl cannot find an adequate amount of food to sustain maintenance or reproduction (Gutiérrez *et al.* 2007, p. 187; Livezey and Fleming 2007, p. 319).

There is scientific consensus on the negative influence barred owls are having on spotted owl detectability, site occupancy, reproduction, and survival. The occupancy of historical territories by spotted owls in Washington and Oregon was found to be significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was “only marginally lower” ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly *et al.* 2003, p. 51). Pearson and Livezey (2003, p. 271) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005, p. 11) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson *et al.* (2005, p. 928) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the

site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area. In contrast, Bailey *et al.* (2009, p. 2983), when using a two-species occupancy model, showed no evidence that barred owls excluded spotted owls from territories in Oregon. Preliminary results from a barred owl and spotted owl radio-telemetry study in Washington reported two spotted owls fleeing their territories and traveling six and 15 miles, believed to be as a result of frequent direct encounters with barred owls (Irwin *et al.* 2010, pp. 3-4). Both spotted owls were subsequently found dead (Irwin and Rock. 2010, p. 4). Yackulic *et al.* (2014) modeled the occupancy dynamics of coexisting barred and spotted owls and found the competitive effects lead to a weaker relationship between habitat and spotted owl occupancy (Yackulic *et al.*, 2014, pp. 271-273). Regarding territory occupancy dynamics, the most recent demographic meta-analysis found a consistent strong positive association between the territory extinction rates of spotted owls and the presence of barred owls and in all 11 study areas. Occupancy rates declined as follows (Dugger *et al.*, 2016, p. 74):

- Washington - 56–100 percent in 1995 to 11–26 percent in 2013;
- Oregon - 61–88 percent in 1995 to 28–48 percent in 2013;
- California - 75–38 percent in NWC and from 79–47percent in HUP between 1995 and 2013
- In the control areas in the GDR study area, occupancy rates declined from 92 percent in 1999 to 55 percent in 2013.

Olson *et al.* (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004, p. 89) was unfounded because of small sample sizes (Livezey 2005, p. 102). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman, pers. comm., as cited in USFWS 2011b, p. B-11). Wiens *et al.* (2014, pp. 35-37) found barred owl demographic variables favoring barred owls. Survival and fecundity was higher in barred owls, with the barred owls producing on average 4.4 times the number of young. Dugger *et al.* 2016 found barred owls and habitat covariates explained small amounts of the year-to-year variation in fecundity (reproduction) in most study areas. Their models suggested fecundity was partially influenced by additive effects of regional and annual time variation, the amount of suitable core area habitat, barred owl presence, and the amount of edge habitat. There is substantial annual variation in fecundity among study areas, with support for declining trends in eight areas (CLE, COA, HJA, TYE, KLA, NWC, HUP, and GDR; (Dugger *et al.* 2016 p.91).

Barred owls are also influencing the survival, extinction, and colonization of spotted owls. Anthony *et al.* (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate. Dugger *et al.* (2011, pp. 2463-2467) confirmed the synergistic effects of barred owls and territory habitat characteristics on extinction and colonization rates of territories by spotted owls in Oregon. Some spotted owl pairs retained their territories and continued to survive and successfully reproduce during their study even when barred owls were present, but

the effects of reduced old growth forest in the core habitat areas were compounded when barred owls were present - extinction rates of spotted owl territories nearly tripled when barred owls were detected. Yackulic and others documented similar findings; the effects of interspecific competition were likely to negatively affect spotted owls, both through its immediate effects on local extinction and by indirectly lowering colonization (Yackulic *et al.*, 2014, pp. 271-273).

Most recently, the key vital rates barred owls are most influencing in spotted owl populations appear to be apparent survival and local extinction rates (Dugger *et al.* 2016, p. 93-98). Additionally, these authors found a *positive* association between barred owl *removals* and spotted owl vital rates. Regional climate cycles were found to be strongly associated with apparent survival across all study areas. These recent results suggested that apparent annual survival rates were declining in eight of eleven study areas, and that declines were most strongly associated with increased detections of barred owls in seven areas. Because adult survival is a critical vital rate influencing the rate of population change in long-lived birds, the authors expressed concern that continued trends as found in this study could threaten the continued persistence of the subspecies.

Monitoring and management of spotted owls has become more complicated due to their possible reduced detectability when barred owls are present (Kelly *et al.* 2003, pp. 51-52; Courtney *et al.* 2004, p. 7-16 ; Olson *et al.* 2005, p. 929; Crozier *et al.* 2006, p.766-767). Olson *et al.* (2005, p. 924) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. In a study evaluating the response behavior and barred owl detection probabilities using spotted owl and barred owl (conspecific) calling, Wiens *et al.* (2011) found that response behavior and detection probabilities of barred owls varied between the types of surveys. These authors found that per-visit barred owl detection probabilities were higher for conspecific surveys. On average, response rates of barred owls were 10 percent lower and single visit detection probabilities were 18 percent lower during surveys for spotted owls compared to conspecific surveys, suggesting that barred owl occurrence is likely higher than what generally was recognized by spotted owl monitoring programs (pp.535-536). Evidence that spotted owls were responding less frequently during surveys led the Service and its many research partners to include updates to the spotted owl survey protocol, which were based on the probability of detecting spotted owls when barred owls are present (USFWS, 2011b).

Hybridization with barred owls may also negatively influence spotted owls, but the overall rangewide impact may not be significant. In an analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004, p. 807). Consequently, hybridization with the barred owl is considered to be “an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space” (Kelly and Forsman 2004, p. 808).

As a result of compelling evidence suggesting that barred owls are exacerbating the spotted owl population decline, the Service initiated an experimental barred owl removal study beginning in 2013. The goal of this experiment is to test the feasibility of barred owl removal to determine whether it improves conditions for spotted owls on a small scale. If the experimental removal of barred owls results in improved spotted owl populations, wider scale treatments as part of a

barred owl management strategy may be considered (USFWS 2013). In 2004, it was noted that there is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on spotted owls have been already fully realized" (Gutiérrez *et al.* 2004, pp. 7-38). This situation to date does not appear to have changed. Without barred owl management continuing competition from barred owls may result in the extirpation of the spotted owl over large portions of its range, and the eventual extinction of the subspecies.

Wildfire

Fire is often considered a primary threat to spotted owls because of its potential to alter habitat rapidly (Bond *et al.* 2009, p. 1116) and is a major cause of habitat loss on Federal lands (Courtney *et al.* 2004, executive summary), particularly in the California Klamath Province (Davis *et al.*, 2015, p. 17-22). At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USFWS 1990a, p. 26183). Information since suggests fire may be more of a threat than previously thought. The most recent Northwest Forest Plan Habitat Monitoring Report indicates that range-wide, the nesting/roosting habitat lost from fire (505,800 acres) represents about 31 percent of the total habitat loss. The rate of habitat loss in the relatively dry East Cascades and Klamath provinces is proportionally higher, comprising about 68 percent of nesting/roosting habitats on federal and non-federal lands lost from fire (Table 7, Davis *et al.*, 2015). This is particularly concerning as most of these acres are located in reserved lands (Table 5, Davis *et al.*, 2015).

It may be possible to influence through forest management how fire prone forests will burn and the extent of the fire when it occurs. Forest fuels are currently being managed throughout the spotted owl's range in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain and debated in the literature (Courtney *et al.* 2004, pp. 12-11, Omi and Martenson 2002, pp. 19-27 Irwin *et al.*, 2004, p. 21; Spies *et al.* 2006p. 359-361; Hanson *et al.*, 2009; pp.3-6; Spies *et al.*, 2009, pp. 331-332; Ager *et al.*, 2012, p.282; Odion *et al.*, 2014 pp. 10-12; Spies *et al.*, 2012, pp. 10-12; Odion 2014, pp. 46-49)). The Northwest Forest Plan (NWFP) recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design and the critical habitat network may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77). Fire is a disturbance factor spotted owls have evolved with; however, studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on site-specific fire intensity, severity, size, and the availability and distribution of suitable habitat (See review of literature in Appendix B). Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities, but these adaptations evolved under a different habitat baseline and different threats than those recognized currently. More research is needed to understand further the relationship between fire and spotted owl habitat use. Overall, we can conclude that fires are a change agent for spotted owl habitat, but there are still many unknowns regarding how much fire benefits or adversely affects spotted owl habitat (USFWS 2011b, p. III-31).

West Nile Virus

West Nile virus (WNV), caused by a virus in the family Flaviviridae, has killed millions of wild birds in North America since it arrived in 1999 (McLean *et al.* 2001; Caffrey 2003; Caffrey and Peterson 2003, pp. 7-8; Marra *et al.* 2004, p. 393). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia *et al.* 2000, p. 3111; Komar *et al.* 2001). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney *et al.* 2004; Blakesley *et al.* 2004, pp. 8-31), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and the mortality rates of infected individuals vary among bird species (Blakesley *et al.* 2004, pp. 8-33), but most owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb pers. comm., as cited in Blakesley *et al.* 2004, pp. 8-33). Barred owls, in contrast, showed lower susceptibility (B. Hunter pers. comm., as cited in Blakesley *et al.* 2004, pp. 8-34). Some level of innate resistance may occur (Fitzgerald *et al.* 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel *et al.* 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., as cited in Courtney *et al.* 2004) or annual changes in vector abundance and distribution.

Blakesley *et al.* (2004, pp. 8-35) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One scenario is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative scenario is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's current range. Thus far, no mortality in wild, spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Blakesley *et al.* 2004, pp. 8-34).

Sudden Oak Death

Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney *et al.* 2004). This disease is caused by the fungus-like pathogen, *Phytophthora ramorum* that was recently introduced from Europe and is rapidly spreading. The disease is now known to extend over 650 km from south of Big Sur, California to Curry County, Oregon (Rizzo and Garbelotto 2003, p. 198), and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 kilometers of the central and northern California coast (Rizzo *et al.* 2002, p. 733). At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic

proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 km of the central and northern California coast (Rizzo *et al.* 2002, p. 733). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen *et al.* 2002, p. 441). It has been found in several different forest types and at elevations from sea level to over 800 m. During a study completed between 2001 and 2003 in California, one-third to one-half of the hiker's present in the study area carried infected soil on their shoes (Davidson *et al.* 2005, p. 587), creating the potential for rapid spread of the disease. Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (*e.g.*, hardwood trees - canopy cover and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney *et al.* 2004, pp. 11-8).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity

Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough *et al.* 1999, p. 922; Haig *et al.* 2004, p. 36). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney *et al.* 2004, pp. 11-9). A 2004 study (Harestad *et al.* 2004, p. 13) indicates that the Canadian breeding population was estimated to be less than 33 pairs and annual population decline may be as high as 35 percent. In 2007, a recommendation was made by the Spotted Owl Population Enhancement Team to remove spotted owls from the wild in British Columbia (USFWS 2012a, p. 14078). This recommendation resulted in the eventual capture of the remaining 16 wild spotted owls in British Columbia for a captive breeding program (USFWS 2012a, p. 14078). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Hybridization of spotted owls with California spotted owls, Mexican spotted owls, and barred owls has been confirmed through genetic research (Funk *et al.* 2008, p. 1; Hamer *et al.* 1994, p. 487; Gutiérrez *et al.* 1995, p. 3; Dark *et al.* 1998, p. 50; Kelly 2001, pp. 33-35).

Climate Change

Climate change, combined with effects from past management practices is influencing current forest ecosystem processes and dynamics by increasing the frequency and magnitude of wildfires, insect outbreaks, drought, and disease (USFWS 2011b, pp. III-5 - III-11). In the Pacific Northwest, mean annual temperatures rose 0.8° C (1.5° F) in the 20th century and are expected to continue to warm from 0.1° to 0.6° C (0.2° to 1° F) per decade (Mote and Salathe 2010, p. 29). Climate change models generally predict warmer, wetter winters and hotter, drier summers and increased frequency of extreme weather events in the Pacific Northwest (Salathe *et al.* 2010, pp. 72-73).

Predicted climate changes in the Pacific Northwest have implications for forest disturbances that affect the quality and distribution of spotted owl habitat. Both the frequency and intensity of wildfires and insect outbreaks are expected to increase over the next century in the Pacific Northwest (Littell *et al.* 2010, p. 130). One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. Westerling *et al.* (2006, pp. 940-941) analyzed wildfires and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period from 1970-1986. The total area burned is more than 6.5 times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling *et al.* 2006, p. 941). The area burned annually by wildfires in the Pacific Northwest is expected to double or triple by the 2080s (Littell *et al.* 2010, p. 140). Wildfires are now the primary cause of spotted owl habitat loss on Federal lands, with over 236,000 acres of habitat loss attributed to wildfires from 1994 to 2007 (Davis *et al.* 2011, p. 123).

Potential changes in temperature and precipitation could have important implications for spotted owl reproduction and survival. Wet, cold weather during the winter or nesting season, particularly the early nesting season, has been shown to negatively affect spotted owl reproduction (Olson *et al.* 2004, p. 1039, Dugger *et al.* 2005, p. 863), survival (Franklin *et al.* 2000 pp. 576-577, Olson *et al.* 2004, p. 1039, Glenn *et al.* 2011b, p. 1279), and recruitment (Glenn *et al.* 2010, pp.2446-2547). Cold, wet weather may reduce reproduction and/or survival during the breeding season due to declines or decreased activity in small mammal populations so that less food is available during reproduction when metabolic demands are high (Glenn *et al.* 2011b, pp. 1288-1289). Cold, wet nesting seasons may increase the mortality of nestlings due to chilling and reduce the number of young fledged per pair per year (Franklin *et al.* 2000, p.557, Glenn *et al.* 2011b, p. 1286). Most recently, the relationships between spotted owl populations and climate was complex and variable, but rangewide, Dugger *et al.* (2016) suggested that survival of young spotted owls and their ability to become part of the breeding population increased when winters were drier. This may become a factor in population numbers in the future given climate change predictions for the Pacific Northwest include warmer, wetter winters.

Drought or hot temperatures during the summer have also been linked to reduced spotted owl recruitment (Glenn *et al.* 2010, p. 2549). Drier, warmer summers and drought conditions during the growing season strongly influence primary production in forests, food availability, and the population sizes of small mammals that spotted owls prey upon (Glenn *et al.* 2010, p. 2549).

In summary, climate change is likely to exacerbate some existing threats to the spotted owl such as the projected potential for increased habitat loss from drought-related fire, tree mortality, insects and disease, as well as affecting reproduction and survival during years of extreme weather. We provide a general overview of climate change effects in Appendix D.

Disturbance

Spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990, p. 925). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on

reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000, pp. 517-518; Saplosky *et al.* 2000, p. 1). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000, p. 517). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser *et al.* 1997, p. 1019). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, p. 698; Tempel and Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (Wasser *et al.* 1997, p.1021; Tempel and Gutiérrez 2004, p. 544).

The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagan 1998, pp. 355-358). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound, and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout and Steidl 2001, p. 314) and helicopter overflights can reduce prey delivery rates to nests (Delaney *et al.* 1999, p. 70). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White and Thurow 1985, p. 14; Andersen *et al.* 1989, p. 296; McGarigal *et al.* 1991, p. 5).

Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke as a result of burning activities during the breeding season.

Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (*i.e.*, survival and recovery) needs:

Habitat-specific Needs

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (*e.g.*, 15 to 20 breeding pairs) throughout the owl's range;
2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the northern spotted owl's range to reduce risk of local or widespread extirpation;

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to understand better the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate wide-ranging strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas *et al.* 1990); they continued with the designation of critical habitat (USFWS 1992a), the Draft Recovery Plan (USFWS 1992b), and the Scientific Analysis Team report (Thomas *et al.* 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); the NWFP (USFS and BLM 1994a), and they culminated with the Revised Recovery Plan (USFWS 2011b) and the revised final critical habitat designation (USFWS 2012a). Each of these strategies was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows:

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.
- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.
- Blocks of habitat that are close together are better than blocks far apart.
- High quality habitat that occurs in contiguous blocks is better than habitat that is more fragmented.
- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Federal Contribution to Recovery

Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (USFS and BLM 1994a, 1994b; USFWS 1994b). The

NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl. Land management under the NWFP was expected to provide for the long term conservation of the spotted owl by including land use allocations which would sustain population clusters of spotted owls (*i.e.*, demographic support) and maintain connectivity between populations. Certain land use allocations in the plan contribute to supporting population clusters: LSRs, Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas, and Administratively Withdrawn areas can provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. To ensure a predictable and sustainable level of timber sales, “matrix” areas were designated to support timber production while also retaining some connectivity and biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USFS and BLM 1994a, USFWS 1994b) which would persist into future managed timber stands.

One of the overall goals of the NWFP was to protect and enhance habitat for the spotted owl on federal lands. The NWFP predicted that over time, the rate of habitat losses would be reduced and the spotted owl population would decline in the Matrix land use allocation, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, p. II-31; USFS and BLM 1994a, 1994b, p.3&4-229).

Periodic assessments monitoring changes in spotted owl habitat on federal and non-federal lands within its geographic range in the United States have been published every five years since 2005 (Lint 2005, Davis *et al.*, 2011; Forsman *et al.*, 2011, Davis *et al.*, 2015). These assessments evaluate assumptions made during development of the NWFP; including the assumption that habitat would not decline faster than five percent per decade. Key points of the 2015 NWFP Monitoring Report (Davis *et al.*, 2015, pp. 20, 36-39):

- Reductions in habitat rangewide have not exceeded expectations. During its first two decades, rangewide losses of nesting/roosting habitat on federal lands were estimated at total rangewide loss of 7.2 percent (5.2 percent (474,300 ac) from wildfire, 1.3 percent (116,100 ac) from timber harvesting, and 0.7 percent (59,800 ac) from insects, disease, or other natural disturbances)
- Rangewide there has been a gross loss of about 650,200 ac of nesting/roosting habitat on federal lands or about 7.2 percent of what was present right before the NWFP was established.
- Most of the losses (73 percent) occurred within the federally reserved land use allocations, or a loss of about 7.5 percent of the habitat reserved by the NWFP.
- Non-reserved federal land use allocations experienced a 6.4 percent rangewide loss of habitat that existed in 1993.
- Wildfires were the primary cause of habitat loss since 1993, accounting for about 82 percent of the loss in reserved allocations and about half of the loss in non-reserved allocations

- Some areas are affected by nesting/roosting habitat loss disproportionately particularly within the Oregon and California Klamath provinces - 56 percent of the rangewide habitat loss on federal lands occurred in these two provinces
- Oregon and California Klamath physiographic provinces experienced the largest amounts (132,000 to 199,800 ac respectively) and double digit percentage losses (13.2 and 10.7 percent respectively) since the plan was implemented.
- Some habitat growth/recruitment is occurring in portions of the range and appears to have begun to help offset losses
- These authors project that if localized habitat losses continue at the current rates within some provinces in the reserved land allocations, the effectiveness of the Plan to maintain the distributed and connected spotted owl populations across the range is in question (Davis *et al.*, 2011, p. 54).

Similar to the periodic assessments monitoring changes in spotted owl habitat on Federal and non-federal lands, population trends are also monitored on eleven study sites in Washington, Oregon, and California. The most recent meta-analysis has determined a mean annual decline of 3.8 percent decline rangewide (Dugger *et al.*, 2016), an increase from the 2.8 percent decline reported in 2011. With the influence of the barred owl it is unlikely that the NWFP assumptions regarding the stabilizing of the spotted owl populations over time would be met. Refer to Population Dynamics and Barred Owl sections above for more information pertaining to recent findings.

On June 28, 2011 the Service published the Revised Recovery Plan for the Spotted owl (USFWS 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, loss or modification of spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of spotted owl habitat as a result of past activities and disturbances (USFWS 2011b, p. II-2 and Appendix B). To address these threats, the current recovery strategy identifies five main steps: 1) development of a range-wide habitat modeling framework; 2) barred owl management; 3) monitoring and research; 4) adaptive management; and 5) habitat conservation and active forest restoration (USFWS 2011b, p. II-2). The recovery plan lists recovery actions that address each of these items, some of which were retained from the 2008 recovery plan. The Managed Owl Conservation Areas and Conservation Support Areas recommended in the 2008 recovery plan are not a part of the recovery strategy outlined in the revised recovery plan. The Service completed a range-wide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (USFWS 2011b, Appendix C).

The revised recovery plan (USFWS 2011b) recommended implementing a robust monitoring and research program for the spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (USFWS 2011b, p. II-5). The revised recovery plan also strongly encourages land managers to be aggressive in the implementation of recovery actions. In other words, land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to conserve the forest

ecosystems that are necessary to the long-term conservation of the spotted owl. But they should also not be so aggressive that they subject spotted owls and their habitat to treatments where the long-term benefits do not clearly outweigh the short-term risks. Finding the appropriate balance to this dichotomy will remain an ongoing challenge for all who are engaged in spotted owl conservation (USFWS 2011b, p. II-12).

Conservation Efforts on Non-Federal Lands

In the report from the Interagency Scientific Committee (Thomas *et al.* 1990, p. 3, p. 272), the draft recovery plan (USFWS 1992b), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993, p. IV-189), it was noted that limited Federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-Federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The Service's primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to Federal lands, or their connectivity with Federal lands. In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are 17 current and ongoing conservation plans (CPs) including Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs) that have incidental take permits issued for spotted owls. Eight of these are located in Washington, three in Oregon, and six in California (USFWS 2011b, p. A-15). The CPs range in size from 76 acres to more than 1.8 million acres, although not all acres are included in the mitigation for spotted owls. In total, the CPs cover approximately 3 million acres (9.4 percent) of the 32 million acres of non-Federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 20 to 100 years. Although each CP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent Federal reserves
- Forest harvest that maintains or develops nesting habitat
- Forest harvest that maintains or develops foraging habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

Washington. In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Hanson *et al.* 1993, pp. 11-15; Buchanan *et al.* 1994, p. ii). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USFWS 1992b, p. 272). There are over 2.1 million acres of land in six HCPs and two SHAs (USFWS 2011b, p. A-15). Some of these CPs focus on providing nesting/roosting habitat throughout the area or in strategic locations, while others focus on providing connectivity

through foraging habitat and/or dispersal habitat. In addition, there is a long term habitat management agreement covering 13,000 acres in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (USFWS 2011b, p. A-15).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (ODF 2007, p. 64). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades (USFWS 2011b, p. A-16). On July 27, 2010, the Service completed a programmatic SHA with the Oregon Department of Forestry that will enroll up to 50,000 acres of non-federal lands within the State over 50 years. The primary intent of this programmatic SHA is to increase time between harvests and to lightly to moderately thin younger forest stands that are currently not habitat to increase tree diameter and stand diversity (USFWS 2011b, p. A-16).

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007, pp. 85-87). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (California Department of Forestry and Fire Protection 2007, pp. 85-87). Currently CALFIRE reviews all timber harvest plans to ensure that take was is not likely to occur. Two industrial timberland owners operate under spotted owl management plans that have been reviewed by the Service and that specify basic measures for spotted owl protection. Four HCPs and two SHAs authorizing take of spotted owls have been approved; these HCPs cover more than 622,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands (USFWS 2011b, p. A-16).

Current Condition of the Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USFWS and USDC NMFS 1998, pp. 4-19).

Range-wide Habitat and Population Trends

Range-wide Habitat Baseline

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for spotted owls on several occasions, since the spotted owl was listed in 1990 (USFS and BLM 1994b, USDI 2001, Lint 2005, Davis *et al.* 2011). The estimate of 7.4 million acres used

for the NWFP in 1994 (USDA and USDI 1994b) was believed to be representative of the general amount of spotted owl habitat on NWFP lands at that time.

Periodic range-wide evaluations of habitat, as compared to the Final Supplemental Environmental Impact Statement (FSEIS; USFS and BLM 1994b), are necessary to determine if the rate of potential change to spotted owl habitat is consistent with the change anticipated in the NWFP: a reduction in suitable habitat of approximately 2.5 percent per decade (USFS and BLM 1994a, p. 46). The most recent mapping effort estimates a range-wide gross loss of about 650,200 ac of nesting/roosting habitat on federal lands, amounting to about 7.2 percent of what was present in 1993 (Davis *et al.* 2015, p. 17). Most of the losses (73 percent) occurred within the federally reserved land use allocations, or a loss of about 7.5 percent of the habitat reserved by the NWFP. The primary cause of habitat loss since 1993 was wildfires, accounting for about 82 percent of the rangewide loss in reserved allocations (388,500 acres) and about half of the loss in non-reserved allocations (85,900 ac) (Davis *et al.* 2015, p. 17).

Although the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, it is informative for tracking provincial and range-wide habitat trends and the Service now considers these data as the best available information on the distribution and abundance of extant spotted owl habitat within its range as of 2006 for Oregon and Washington, and 2007 for California (when the base imagery was collected).

April 13, 2004, marked the start of the second decade of the NWFP. Decade-specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but are consistent with expected habitat changes under the NWFP. In February 2013, the Service adopted the 2006/2007 satellite imagery data on spotted owl habitat as the best available data reflecting the range-wide habitat baseline for Federal lands. On that basis, the assessment of local, provincial and range-wide spotted owl habitat status in this and future Opinions as well as Biological Assessments will rely on these 2006/07 habitat data to characterize changes in the status of spotted owl habitat.

Service's Consultation Database

In general, the analytical framework of these section 7 consultations focuses on the reserve and connectivity goals established by the NWFP land-use allocations (USFS and BLM 1994a), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. To update information considered in 2001 (USDI 2001), the Service designed the Consultation Effects Tracking System database in 2002, which recorded impacts to spotted owls and their habitat at different spatial and temporal scales. In 2011, the Service replaced the Consultation Effects Tracking System with the Consulted on Effects Database located in the Service's Environmental Conservation Online System (ECOS). The ECOS Database corrected technical issues with the Consultation Effects Tracking System. Data are currently entered into the ECOS Database under various categories including; land management agency, land-use allocation, physiographic province, and type of habitat affected.

Range-wide Consultation Effects: 1994 to present

The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis *et al.* 2011, Appendix D, Table D) but at the time of this writing, this had not been updated to reflect the data within the 2015 NWFP 20-year report. The ECOS database reports that on NWFP lands between 1994 and May 11, 2016, the Service has consulted on the proposed removal/downgrade of approximately 210,279 acres (Table 197) or about 2.4 percent of the 8.854 million acres of spotted owl nesting/roosting habitat estimated by Davis *et al.* (2011) to have occurred on Federal lands (Table 197). These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP, which anticipated a rate of habitat harvested at 2.5 percent per decade (USFS and BLM 1994a).

Table 197. Range-wide aggregate of changes to NRF¹ habitat acres from activities subject to section 7 consultations and from other causes. Data covers from 1994 to May 11, 2016.

Land Ownership	Consulted On Habitat Changes ²		Other Habitat Changes ³	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
NWFP (FS,BLM,NPS)	210,279	558,629	272,063	97,136
Bureau of Indian Affairs / Tribes	113,926	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	339,692	14,539	N/A	N/A
Other Federal, State, County, Private Lands	68,813	28,447	2,392	0
Total Changes	732,710	629,987	276,853	97,136

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001 suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.
2. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Spotted owl Consultation Effects Tracking System (web application and database.)
3. Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

The Service also tracks habitat changes on non-NWFP lands through consultations for long-term Habitat Conservation Plans, Safe Harbor Agreements, Tribal Forest Management Plans, and other state, private, or county actions containing a federal nexus. Service consultations conducted on these lands outside of the NWFP since 1994 have documented the eventual removal of over 522,431 acres habitat (about 6 percent of rangewide nesting/roosting habitat) on

non-NWFP lands. Most of these losses have yet to be realized because they are part of large-scale, long-term Habitat Conservation Plans.

Range-wide Consultation Effects: 2006/2007 to present

Because the data developed for the NWFP monitoring program is only current through 2006/2007, the Service continues to rely on information compiled in the spotted owl consultation database to summarize effects to current owl habitat at provincial and range-wide scales (Table 198).

Table 198. Summary of spotted owl suitable habitat (NRF¹) acres removed or downgraded as documented through Section 7 consultations on all Federal Lands within the Northwest Forest Plan area. Environmental baseline and summary of effects by State, Physiographic Province, and Land Use Function from 2006 to May 11, 2016.

State	Physiographic Province ²	Evaluation Baseline (2006/2007) ³			Habitat Removed/Downgraded ⁴							% Provincial Baseline Affected	% Range-wide Effects
					Land Management Effects			Habitat Loss from Natural Events			Total NRF removed/ downgraded		
		Nesting/ Roosting Acres in Reserves	Nesting/ Roosting Acres in Non-Reserves	Total Nesting Roosting Acres	Reserves ⁵	Non-Reserves	Total	Reserves	Non-Reserves	Total			
WA	Eastern Cascades	462,400	181,100	643,500	2,700	2,238	4,938	1,559	132	1,691	6,629	1.03	5.13
	Olympic Peninsula	729,000	33,400	762,400	6	0	6	0	1	1	7	0	0.01
	Western Cascades	1,031,600	246,600	1,278,200	779	877	1,656	3	0	3	1,659	0.13	1.29
	Western Lowlands	24,300	0	24,300	0	0	0	0	0	0	0	0	0
OR	Cascades East	248,500	128,400	376,900	2,994	7,499	10,493	7,639	2,434	10,073	20,566	5.46	15.93
	Cascades West	1,275,200	939,600	2,214,800	1,587	26,202	27,789	761	1,775	2,536	30,325	1.37	23.49
	Coast Range	494,400	113,400	607,800	750	1,891	2,641	0	0	0	2,641	0.43	2.05
	Klamath Mountains	549,400	334,900	884,300	2,999	6,772	9,771	5,736	3,840	9,576	19,347	2.19	14.99
	Willamette Valley	700	2,600	3,300	0	0	0	0	0	0	0	0	0
CA	Cascades	101,700	102,900	204,600	10	1	11	325	0	325	336	0.16	0.26
	Coast	132,900	10,100	143,000	274	1	275	0	175	175	450	0.31	0.35
	Klamath	910,900	501,200	1,412,100	75	1,064	1,139	24,301	21,700	46,001	47,140	3.34	36.51
Total		5,961,000	2,594,200	8,555,200	12,174	46,545	58,719	40,324	30,057	70,381	129,100	1.51	100

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1. **Notes:** Nesting, roosting, foraging (NRF) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale.
2. Defined in the Revised Recovery Plan for the Spotted owl (USFWS 2011) as Recovery Units as depicted on p. A-3.
3. Spotted owl nesting and roosting habitat on all Federal lands (includes USFS, BLM, NPS, DoD, USFWS, etc.) as reported by Davis *et al.* 2011 for the Northwest Forest Plan 15-Year Monitoring Report (PNW-GTR-80, Appendix D). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery and have not yet been updated to incorporate the 20-Year monitoring report.
4. Estimated NRF habitat removed or downgraded from land management (timber sales) or natural events (wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include all acres removed or downgraded from 2006 to present. Effects in California reported here only include effects to Nesting/Roosting habitat. Foraging habitat removed or downgraded in California is not summarized in this table.
5. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

Table 198 summarizes the habitat impacts on Federal lands that have occurred since 2006/2007 through May 11, 2016. Note these data reflect data provided through the section 7 consultation efforts and may not reflect the same data displayed in Davis *et al.*, 2015. This database reports an estimated 129,100 acres of nesting, roosting, and foraging habitat has been removed or downgraded from Federal lands since 2006/2007 due to land management activities and natural events. When overall habitat loss is evaluated as a proportion of provincial baselines, the Oregon Cascades and the California Klamath provinces have proportional losses greater than the loss of habitat across all provinces. Although variable among the individual provinces, the majority of the impacts are caused from natural events (about 70,400 of the 129,100 acres total removed or downgraded), the majority of which also has occurred in the California and Oregon Klamath and Oregon Cascades Provinces. When management-related habitat loss is evaluated as a proportion of the affected acres, Oregon reports the highest proportion, with about 50,700 acres removed. Washington reports about 6,600 acres, and California about 1,425 acres removed. Losses in California Klamath from natural disturbance, primarily wildland fires, represents about 65 percent of the habitat lost from these causes rangewide (about 46,000 of the 70,400 lost from disturbance). These losses in the California Klamath specifically represents about 36 percent of the total habitat lost rangewide (46,000 of 129,100 acres).

Table 199. Summary of spotted owl suitable habitat (NRF)¹ acres removed or downgraded on Federal lands within the Northwest Forest Plan area through timber harvest, natural disturbance, or other management actions as documented through section 7 consultation and technical assistance. Range-wide changes by land-use function from 2006 to May 11, 2016.

Suitable Habitat (NRF) Effects	Reserves (LSR, MLSA, CRA) ³	Non-reserves (AWA, AMA, Matrix) ³	Totals
Evaluation Baseline (2006/2007) ²	5,961,000	2,594,200	8,555,200
Removed/Downgraded (timber harvest only) ⁴	8,514	43,945	52,459
Removed/Downgraded (other management activities) ⁵	3,660	2,600	6,260
Subtotal	12,174	46,545	58,719
Removed/Downgraded (natural disturbance) ⁶	40,324	30,057	70,381
Total Net Change	52,498	76,602	129,100
Baseline Balance	5,908,502	2,517,598	8,426,100
Habitat Maintained ⁷	53,638	72,939	126,577

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale. Effects to spotted

owl habitat in California reported here include effects to Nesting/Roosting habitat only. Foraging habitat removed or downgraded in California is not summarized in this table.

2. Spotted owl nesting and roosting habitat on all Federal lands (includes USFS, BLM, NPS, DoD, USFWS, etc.) as reported by Davis et al. 2011 for the the Northwest Forest Plan 15-Year Monitoring Report (PNW-GTR-80, Appendix D). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) imagery.

3. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

4. NRF habitat removed or downgraded from timber harvest on Federal lands.

5. NRF habitat removed or downgraded from recreation, roads, minerals, or other non-timber programs.

6. NRF habitat losses resulting from wildfires, insect and disease, windthrow or other natural causes.

7. Habitat maintained means that stands have been modified by management, but the habitat function remains the same. Nesting, roosting, foraging (NRF) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale. Effects to spotted owl habitat in California reported here include effects to Nesting/Roosting habitat only. Foraging habitat removed or downgraded in California is not summarized in this table.

Table 199 summarizes the effects to habitat from natural disturbance and management action by land use function. The ECOS database indicates that about 59 percent of total rangewide losses are within non-reserved land allocations (76,600 of total 129,100 acres lost). About 45 percent of the total loss is attributed to management activities (58,700 of 129,100 acres lost). Additionally, natural disturbance factors have affected more reserved land allocations than in non-reserves (40,300 verses about 30,000 acres).

Spotted Owl Population Trends and Distribution

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USFWS 1989, pp. 2-17).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USFWS 1990a, p. 26114). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 24) based on recognized landscape subdivisions exhibiting different physical and environmental features (USFWS 1992a, p. 31). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

Population estimates are difficult to achieve on wide-ranging species such as the Spotted owl. As of July 1, 1994, there were about 5,430 known site-centers of spotted owl pairs or resident singles: about 85 sites (16 percent) in Washington, 2,890 sites (53 percent) in Oregon, and 1,685 sites (31 percent) in California (USFWS 1995, p. 9495). The totals above represent the cumulative number of locations recorded in the three states, not population estimates. Estimated populations were modeled during the 2012 critical habitat designation which projected a steady-state range-wide population size of roughly 3,400 female spotted owls. Population sizes varied regionally from low in the north, especially the northwest (*e.g.*, about 100 in the North Coast Olympics and West Cascades North modeling regions), to high in parts of southern Oregon and northern California (*e.g.*, about 750 each in the Inner California Coast, Klamath East, Klamath West, Redwood Coast, and West Cascades South modeling regions) (Dunk *et al.*, 2012, p. 64). These estimates likely over represent the numbers of females as this modeling effort was based on 2008 spotted owl data and does not reflect subsequent declines over the last seven years. Additionally, the actual number of currently occupied spotted owl locations across the range is unknown because many areas remain un-surveyed (USFWS 2011b, p. A-2) and many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires. Additionally, it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994.

Because the existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, demographic data are used to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the finite rate of population change (λ), which provides information on the direction and magnitude of population change. A λ of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A λ of less than 1.0 indicates a decreasing population, and a λ of greater than 1.0 indicates a growing population. Demographic data are analyzed periodically to estimate trends in the populations of the spotted owl.

As described above, after the implementation of the NWFP, populations were expected to decline in the short term, and then stabilize or increase after 50–100 years (Thomas *et al.* 1990, Lint *et al.* 1999). Previous demographic analyses suggested that populations confirmed this projection; however, the rates of decline began to increase after 2009 (Dugger *et al.*, 2016, Table 26, p.97) although rates have varied among study areas (Franklin *et al.* 1999, Anthony *et al.* 2006, Forsman *et al.* 2011).

The most recent meta-analysis results suggest that the rates of decline have now increased range-wide, as summarized below (Dugger *et al.*, 2016, entire). Estimated declines in annual rates of population change and occupancy rates were found to continue from past reports in all parts of their range (Table 200). That rate of decline was increasing in many areas, including southern Oregon and northern California (Dugger *et al.*, 2016, p. 91).

Table 200. Summary of spotted owl population trends from in demographic study areas (Dugger *et al.*, 2016, Table 25, p.97).

Study Area	Fecundity	Apparent Survival ^a	Occupancy Rates	Mean Population change / population change	% Population Change ¹
Cle Elum	Declining	Declining	Declining	0.916/No trend	-77%
Rainier	No trend	Declining	Declining	0.953/No trend	-61%
Olympic	No trend	No trend	Declining	0.961/No trend	-59%
Coast Ranges	Declining	No trend	Declining	0.949/ Declining	-64%
HJ Andrews	Declining	Declining	Declining	0.965/ Declining	-47%
Tyee	Declining	Declining	Declining	0.976/ Declining	-31%
Klamath	Declining	No trend	Declining	0.972/ Declining	-34%
Southern Cascades	No trend	Declining	Declining	0.963/No trend	-44%
NW California	Declining	Declining	Declining	0.970/ Declining	-55%
Hoopa	Declining	Declining	Declining	0.977/ Declining	-32%
Green Diam. - CB	Declining	Declining	Declining	0.988/ Declining	-31%
Green Diam. - TB	Declining	Declining	Declining	0.961/ Declining	-26%
Green Diam. - CA	**	**	Declining	0.878/**	-41%
Green Diam. - TA	**	**	N/A ²	1.030/**	-9%-

¹ With the exception of the Green Diamond study area, percent population change was based on estimates of *realized population change* in 2011, the last year for which an estimate of population change could be generated.

² Data used for occupancy modeling in the GDR study area excluded treatment areas after Barred Owl removals began in 2009.

** Too few years since Barred Owl removal to evaluate a trend.

CB = control area before barred owl removal; TB=treatment area before removal; CA=control area after removal; TA= treatment area after removal

Individual study area *annual rates of population change* (λ) were based on capture histories for 5,992 territorial owls from all age classes. Almost all study areas showed declining population trends, with strong evidence of declines in all of Washington study areas, the coastal and HJ Andrews study areas in Oregon and three California study areas. Less of a decline was found

Tyee, Klamath, and Cascades study areas of Oregon. The only study area with an increasing population was observed in Green Diamond treatment areas after barred owl removals began in 2009 (GDR-TA). The rates of decline were variable across the range; the highest were in Green Diamond control areas (GDR-CA) after 2009 (12.0 percent annual decline), and the Washington Cle Elum study area (8.4 percent), and the lowest was in the Green Diamond before barred owl removals began in treatment areas in 2009 (1.2 percent annual decline). The weighted mean population change for all study areas (excluding GDR-TB) was an estimated decline of 3.8 percent per year from 1985-2013 (Dugger *et al.*, 2016, p.70-71). This is an increase from 2.8 percent reported by Forsman *et al.*, 2011).

Recent estimates of *realized population change* (change in populations since studies were initiated) showed sharper declines in the northern portion of the range. Populations in Washington declined by 55–77 percent; sites in Oregon ranged from 31 percent in TYE to 68 percent in COA, with two cases more uncertain (KLA and TYE). The 95 percent confidence intervals in these sites widely overlapped 1.0 for most or all of the last several years. Declines in California, ranged from 32 – 55 percent, with exceptions in HUP and treatment areas of GDR T where confidence limits overlapped 1.0 in many years, indicating uncertainty about annual rates of population change in these areas.

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Dugger *et al.*, 2016 (p.58) found strong evidence that barred owls negatively affected spotted owl populations, largely from increasing local territory extinction rates and decreasing apparent survival. The amount of suitable habitat, local weather, and regional climatic patterns also were related to survival, occupancy (via colonization rate), and recruitment. Associated effects to fecundity were weaker. Five of the 11 study areas included either a negative linear or log-linear time trend on survival.

There are few spotted owls remaining in British Columbia. Chutter *et al.* (2004, p. v) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (USFWS 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter *et al.* 2004, p. v). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

Spotted Owl Recovery Units

The 2011 Final Revised Recovery Plan for the Spotted owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (USFWS 2011b, p. III 1-2). The proposed project is within the California Klamath Physiographic Province (Ibid, p. A-2). Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to be achievable through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will take time and is intended to be measured over the life of the plan, not on a short-term basis. The criteria are the same for all 12 identified recovery units. The four recovery criteria are: 1) stable population trend, 2) adequate population distribution, 3) continued maintenance and recruitment of spotted owl habitat, and 4) post-delisting monitoring (USFWS 2011b, p III-3).

As discussed above, demographic data are used to evaluate trends in spotted owl populations. In the recent meta-analysis, California showed similar overall trends as other study areas throughout the range. One Demographic Study Area most resembling the Westside action area occurs within the California Klamath Province (Northwest California study area in Willow Creek (NWC)). The Hoopa Study Area also occurs in the Klamath Province and is composed of mixed-conifer vegetation types, but with a much more significant tanoak component than found in NWC or the Westside action area. Spotted owls in the NWC study area were found to have declining trends in fecundity, apparent survival, and population trends. In particular, strong evidence for declines was found in all areas in California. These findings are similar to other study areas across the range, where the overall results suggest that the influences of barred owls could be the primary cause of spotted owl rangewide population declines. Where barred owls were present, there were corresponding declines in apparent survival and increased local extinction rates of spotted owls, and a positive association between barred owl removals and spotted owl demographic performance. Overall, across the range (California included), apparent survival and local extinction rates appeared to be the key vital rates through which barred owls influenced spotted owl populations. Also, the associations of habitat and demographic rates of spotted owls were similar to findings of previous studies which supported recommendations to preserve as much high-quality habitat in late-successional forests as possible across the range of the subspecies (see Dugger *et al.* 2016, p. 98).

STATUS OF CRITICAL HABITAT – NORTHERN SPOTTED OWL

Conservation Role of Critical Habitat

Critical habitat contains those areas that are essential to the conservation of the species.

The expectation of critical habitat is to ameliorate habitat-based threats. The recovery of the spotted owl requires habitat conservation in concert with the implementation of recovery actions that address other, non-habitat-based threats to the species, including the barred owl (USFWS 2012a, p. 71879). The conservation role of spotted owl critical habitat is to “adequately support the life-history needs of the species to the extent that well-distributed and inter-connected spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales” (USFWS 2012a, p. 71938). The specific conservation role of the subunits included in the action area is described in the Environmental Baseline in the document.

Physical or Biological Features

When designating critical habitat, the Service considers “the physical or biological features [PBFs] essential to the conservation of the species and which may require special management considerations or protection” (50 CFR §424.12; USFWS 2012a, p. 71897). “These include, but are not limited to: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species” (USFWS 2012a, p. 71897). The final critical habitat

rule states that “for the spotted owl, the physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing” (USFWS 2012a, p. 71897). The final critical habitat rule for the spotted owl provides an in-depth discussion of the PBFs, which may be referenced for further detail (USFWS 2012a, pp. 71897-71906).

The primary constituent elements (PCEs) are the specific elements of the PBFs that are considered essential to the conservation of the spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (USFWS 2012a, p. 71904) (In this biological opinion we use the term PBFs rather than PCEs in light of a recent amendment to our regulations. 81 FR 7414 (Feb. 11, 2016)). The PBFs should be arranged spatially such that it is favorable to the persistence of populations, survival, and reproductive success of resident pairs, and survival of dispersing individuals until they are able to recruit into a breeding population (USFWS 2012a, p. 71904). Within areas essential for the conservation and recovery of the spotted owl, the Service has determined that the PBFs are:

- 1) Forest types that may be in early-, mid-, or late-seral stages and that support the spotted owl across its geographic range;
- 2) Habitat that provides for nesting and roosting;
- 3) Habitat that provides for foraging;
- 4) Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (PBFs 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (USFWS 2012a, pp. 72051-72052).

Some critical habitat subunits may contain all of the above PBFs and support multiple life history requirements of the spotted owl, while some subunits may contain only those PBFs necessary to support the species particular use of that habitat. All of the areas designated as critical habitat, however, do contain PBF 1, forest type. Therefore, PBF 1 always occurs in concert with at least one other PBF (PBF 2, 3, or 4; USFWS 2012a, p. 72051). Spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (USFWS 2012a, p. 71918).

PBF 1: Forest Types

The primary forest types that support the spotted owl are: Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and moister ponderosa pine (USFWS 2012a, p. 72051).

PBF 2: Nesting and Roosting Habitat

Nesting and roosting habitat for spotted owl provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. In many cases, the same habitat may also provide for foraging. Nesting and roosting habitats must provide: sufficient habitat for foraging by territorial pairs, moderate to high canopy cover (60 to over 80 percent), multilayered and multispecies canopies with large overstory trees (20 to 30

inches dbh), basal area greater than 240 square feet per acre, high diversity of tree diameters, high incidence of large live trees with various deformities (*e.g.*, large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags and large accumulations of woody debris on the ground, and sufficient open space beneath the canopy for flight (USFWS 2012, p. 72051).

PBF 3: Foraging Habitat

Across the range of the spotted owl, nesting and roosting habitats also provide foraging opportunities; however, spotted owls may use other habitat types for foraging as well. The components of PBF 3 for spotted owl foraging habitat include younger forests with some structural characteristics of older forest (legacy features), stands of nesting and roosting habitat and other forest types with mature and old-forest characteristics, presence of conifer species (such as incense-cedar, sugar pine, and Douglas fir) and hardwood species (such as bigleaf maple, black oak, live oaks, and madrone) as well as shrubs, forest patches within riparian zones of low-order streams and edges between conifer and hardwood forest stands, brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat, high canopy cover (87 percent at frequently used sites), multiple canopy layers, mean stand diameter greater than 21 inches, increasing mean stand diameter and densities of trees greater than 26 inches which increase foraging habitat quality, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for spotted owls to fly (USFWS 2012a, p. 72051-72052).

PBF 4: Dispersal habitat

Spotted owl dispersal habitat is habitat that supports the transience and colonization phases of owl dispersal, and in all cases would optimally be composed of nesting, roosting, or foraging habitat (PBF 2 or 3), but which may also be composed of other forest types that occur between larger blocks of spotted owl nesting, roosting, or foraging habitat. In cases where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal PBFs are: habitat supporting the transience phase of dispersal (protection from avian predators, minimal foraging opportunities, younger and less diverse forests that provide some roosting structures and foraging opportunities) and habitat supporting the colonization phase of dispersal (nesting, roosting, and foraging habitat but in smaller amounts than needed to support a nesting pair) (USFWS 2012a, p. 72052).

Current Condition of Spotted owl Critical Habitat

The current condition of critical habitat incorporates the effects of all past human activities and natural events that led to the present-day status of the habitat (USDI and USDC 1998, p. 4-19). With the revision of spotted owl critical habitat, the range-wide condition has been “reset” as of December 4, 2012.

Range-Wide Critical Habitat Baseline

A number of data sources can be used to evaluate critical habitat baseline. The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis *et al.* 2011, Appendix D, Table D). At the time of this writing, these data have not been updated within the ECOS database to reflect baseline data reported in the NWFP 20-year monitoring report (Davis *et al.*, 2015). The database indicates that approximately 9.577 million acres of spotted owl critical habitat existed in 2006/2007 (Table 201). The tracking database quantifies effects to critical habitat by physiographic provinces rather than designated units and subunits, which makes it problematic to compare incremental changes in specific areas of interest such as subunits. As of May 11, 2016, the database reports consulted on actions that have removed or downgraded about 11,447 acres from 2012 critical habitat range-wide, and an additional 18,300 acres lost from natural events.

Table 201. Summary of spotted owl critical habitat NRF¹ acres removed or downgraded as documented through section 7 consultations on Northwest Forest Plan (NWFP) lands; environmental baseline and summary of effects by State, Physiographic Province and Land Use Function.

Physiographic Province ²	Evaluation Baseline		Habitat Removed/Downgraded					% Provincial Baseline Affected	% Range-wide Effects	
			Land Use Allocations ⁵			Habitat Loss to Natural Events	Total			
	Total Designated Critical Habitat Acres ³	Nesting/Roosting Acres ⁴	Reserves	Non-Reserves	Total					
WA Eastern Cascades	1,022,960	416,069	265	2	267	0	267	0.06	0.90	
	Olympic Peninsula	507,165	238,390	6	0	6	0	6	0.00	0.02
	Western Cascades	1,387,567	667,173	268	43	311	0	311	0.05	1.05
OR Cascades East	529,652	181,065	887	1,277	2,164	0	2,164	1.20	7.27	
	Cascades West	1,965,407	1,161,780	648	3,708	4,356	662	5,018	0.43	16.86
	Coast Range	1,151,874	535,602	1	1,136	1,137	0	1,137	0.21	3.82
	Klamath Mountains	911,681	481,577	1,306	1,215	2,521	3,011	5,532	1.15	18.59
CA Cascades	243,205	98,243	0	0	0	0	0	0.00	0.00	
	Coast	149,044	58,278	0	1	1	2,888	2,889	4.96	9.71
	Klamath	1,708,787	752,131	0	684	684	11,750	12,434	1.65	41.78
Total	9,577,342	4,590,308	3,381	8,066	11,447	18,311	29,758	0.31%	100%	

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component in CA most closely resembles NRF habitat in Oregon and Washington.

2. Defined in the Revised Recovery Plan for the Spotted owl (USFWS 2011b) as Recovery Units as depicted on p. A-3.
3. Spotted owl critical habitat as designated December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (- 627 acres).
4. Calculated from GIS data for spotted owl Nesting/Roosting habitat generated by Davis *et al.* 2011 for the Northwest Forest Plan 15-year Monitoring Report (PNW-GTR-850). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery.
5. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

Zones of Habitat Associations used by Spotted owls

Differences in patterns of habitat associations used by the spotted owl across its range suggest four different broad zones of habitat use, which we characterize as the (1) West Cascades/Coast Ranges of Oregon and Washington, (2) East Cascades, (3) Klamath and Northern California Interior Coast Ranges, and (4) Redwood Coast (Figure 25). We configured these zones based on a qualitative assessment of similarity among ecological conditions and habitat associations within the 11 different regions analyzed during the critical habitat designation process (see USFWS 2012a). These four zones capture the range in variation of some of the PBFs essential to the conservation of the spotted owl. Summarized below are the PBFs for each of these four zones, emphasizing zone-specific features that are distinctive within the context of general patterns that apply across the entire range of the spotted owl.

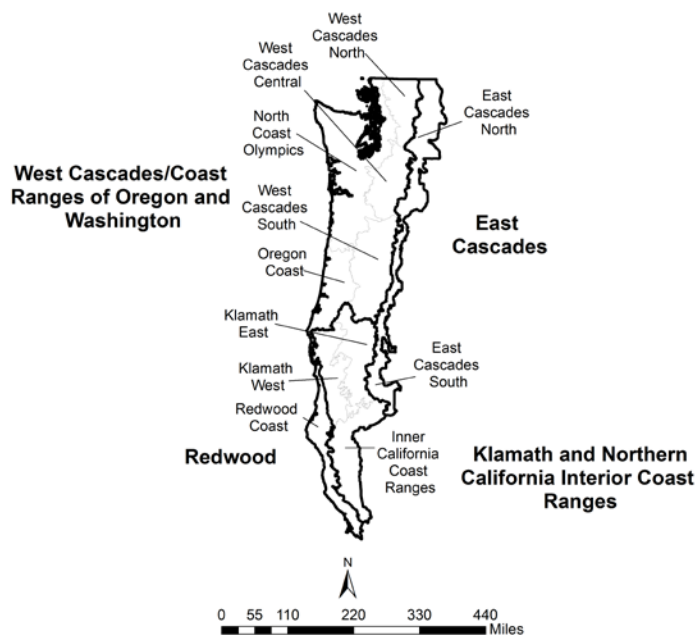


Figure 25. Eleven regions and four zones of habitat associations used by spotted owls in Washington, Oregon, and California.

West Cascade/Coast Ranges of Oregon and Washington

This zone includes five regions west of the Cascade crest in Washington and Oregon (Western Cascades North, Central and South; North Coast Ranges and Olympic Peninsula; and Oregon Coast Ranges; USFWS 2011b, p. C–13). Climate in this zone is characterized by high rainfall and cool to moderate temperatures. Variation in elevation between valley bottoms and ridges is relatively low in the Coast Ranges, creating conditions favorable for development of contiguous forests. In contrast, the Olympic and Cascade ranges have greater topographic variation with many high-elevation areas supporting permanent snowfields and glaciers. Douglas-fir and western hemlock dominate forests used by spotted owls in this zone. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas. Flying

squirrels (*Glaucomys sabrinus*) are the dominant prey, with voles and mice also representing important items in the spotted owl's diet.

Our habitat modeling indicates that vegetation structure has a dominant influence on owl population performance, with habitat pattern and topography also contributing. High canopy cover, high density of large trees, high numbers of sub-canopy vegetation layers, and low to moderate slope positions are all important features.

Nesting habitat in this zone is mostly limited to areas with large trees with defects such as mistletoe brooms, cavities, or broken tops. The subset of foraging habitat that is not nesting/roosting habitat generally had slightly lower values than nesting habitat for canopy cover, tree size and density, and canopy layering. Prey species (primarily the northern flying squirrel) in this zone are associated with mature to late-successional forests, resulting in small differences between nesting, roosting, and foraging habitats.

East Cascades

This zone includes the Eastern Cascades North and Eastern Cascades South regions (USFWS 2011b, p. C–13). This zone is characterized by a continental climate (cold, snowy winters and dry summers) and a high frequency of natural disturbance due to fires and outbreaks of forest insects and pathogens. Flying squirrels are the dominant prey species, but the diet of spotted owls in this zone also includes relatively large proportions of bushy-tailed woodrats (*Neotoma cinerea*), snowshoe hare (*Lepus americanus*), pika (*Ochotona princeps*), and mice (*Microtus* spp. (Forsman *et al.* 2001, pp. 144–145).

Our modeling indicates that habitat associations in this zone do not show a pattern of dominant influence by one or a few variables (USFWS 2011b, Appendix C). Instead, habitat association models for this zone included a large number of variables, each making a relatively modest contribution (20 percent or less) to the predictive ability of the model. The features that were most useful in predicting spotted owl habitat quality were vegetation structure and composition, and topography, especially slope position in the north. Other efforts to model habitat associations in this zone have yielded similar results (*e.g.*, Gaines *et al.* 2010, pp. 2048–2050; Loehle *et al.* 2011, pp. 25–28).

Relative to other portions of the spotted owls' range, nesting and roosting habitat in this zone includes relatively younger and smaller trees, likely reflecting the common usage of dwarf mistletoe (*Arceuthobium douglasii*) brooms (dense growths) as nesting platforms (especially in the north). Forest composition that includes high proportions of Douglas-fir is also associated with this nesting structure. Additional foraging habitat in this zone generally resembles nesting and roosting habitat, with reduced canopy cover and tree size, and reduced canopy layering. High prey diversity suggests relatively diverse foraging habitats are used. Topographic position was an important variable, particularly in the north, possibly reflecting competition from barred owls (Singleton *et al.* 2010, pp. 289, 292). Barred owls, which have been present for over 30 years in the northern portions of this zone, preferentially occupy valley-bottom habitats, possibly compelling spotted owls to establish territories on less productive, mid-slope locations (Singleton *et al.* 2010, pp. 289, 292).

Klamath and Northern California Interior Coast Ranges

This zone includes the Klamath West, Klamath East, and Interior California Coast regions (USFWS 2011b, p. C–13). The action area occurs within the California Klamath physiographic province, but the affected critical habitat subunits, as defined in the critical habitat rule, overlap into the western edge of the Southern Cascades. These areas in northern California and southwestern Oregon are characterized by very high climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and large differences in moisture from west to east. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types that increase to the east into the Cascades. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The mixed-conifer/evergreen hardwood forest types typical of the Klamath region extend into the southern Cascades in the vicinity of Roseburg and the North Umpqua River, where they grade into the western hemlock forest typical of the Cascades. Douglas-fir/dwarf mistletoe is less commonly used for nesting platforms in the western part of the spotted owl's range, but is commonly used in the east. The prey base for spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Spotted owls have been well studied in the western Klamath portion of this zone (Forsman *et al.* 2004, p. 217), but relatively little is known about spotted owl habitat use in the eastern portion of this zone.

Our habitat association models for this zone suggest that vegetation structure and topographic features are nearly equally important in influencing owl population performance, particularly in the Klamath. High canopy cover, high levels of canopy layering, and the presence of very large dominant trees were all important features of nesting and roosting habitat. Compared to other zones, additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size. Low to intermediate slope positions were strongly favored. In the eastern Klamath, the presence of Douglas-fir was an important compositional variable in our habitat model (USFWS 2011b, Appendix C).

Redwood Coast

This zone is confined to the northern California coast, and is represented by the Redwood Coast region (USFWS 2011b, p. C–13). It is characterized by a maritime climate with moderate temperatures and generally mesic conditions. Near the coast, frequent fog delivers consistent moisture during the summer. Terrain is typically low-lying (0 to 3,000 feet). Forest

communities are dominated by redwood, Douglas-fir–tanoak (*Lithocarpus densiflorus*) forest, coast live oak (*Quercus agrifolia*), and tanoak series.

Dusky footed woodrats are the dominant prey items for spotted owls in this zone.

Habitat association models for this zone diverged strongly from models for other zones. Topographic variables (slope position and curvature) had a dominant influence with vegetation structure having a secondary role. Low position on slopes was strongly favored, along with concave landforms. Several studies of spotted owl habitat relationships suggest that stump-sprouting and rapid growth of redwood trees, combined with high availability of woodrats in

patchy, intensively managed forests, enables spotted owls to occupy a wide range of vegetation conditions within the redwood zone. Rapid growth rates enable young stands to develop structural characteristics typical of older stands in other regions. Thus, relatively small patches of large remnant trees can also provide nesting habitat structure in this zone.

Climate Change and Range-wide Spotted Owl Critical Habitat

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth *et al.* 2002, entire; Walther *et al.* 2002, entire; Ådahl *et al.* 2006, entire; Karl *et al.* 2009, entire; Moritz *et al.* 2012, entire; Westerling *et al.* 2011, p. S459; Marlon *et al.* 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions. The potential impact of climate change will affect the environmental baseline for the northern spotted owl, and we provide a general overview of these potential effects in Appendix D.

Climate change will present unique challenges to the future of spotted owl populations and their habitats. Spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin *et al.* 2000, entire; Glenn *et al.* 2010, entire; Glenn *et al.* 2011a, entire; Glenn *et al.* 2011b, entire) may be directly influenced by changes in temperature and precipitation. In addition, changes in forest composition and structure as well as prey species distributions and abundance resulting from climate change may impact availability of habitat across the historical range of the subspecies. The *2011 Spotted owl Revised Recovery Plan* provides a detailed discussion of the possible environmental impacts to the habitat of the spotted owl from the projected effects of climate change (USFWS 2011b, pp. III-5 to III-11).

Because both spotted owl population dynamics and forest conditions are likely to be influenced by large-scale changes in climate in the future, we have attempted to account for these influences in our designation of critical habitat by recognizing that forest composition may change beyond the range of historical variation, and that climate changes may have unpredictable consequences for both Pacific Northwest forests and spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for spotted owl conservation.

ENVIRONMENTAL BASELINE

Except as supplemented by the Service, the following section contains analysis results presented in the BA (BLM 2016a, pp.87-147, Appendix C). Text from the BA is presented in italics. These sections outline the framework used by the BLM to identify current conditions as well as project how conditions will change in the future under the PRMP. We focus on the assessment of current conditions in this section.

Analysis Area and Summary of Analytical Methods

The BLM evaluated the potential effects of the Proposed RMP on the spotted owl according to the specific criteria developed by the U.S. Fish and Service in its Revised Recovery Plan, and used by the Service to evaluate proposed actions in accordance with the ESA of 1973, as amended. Specifically, the BLM designed its spotted owl analyses to determine if the BLM would:

- *Contribute to a landscape in the planning area that meets the four “habitat-dependent” conservation needs of the spotted owl; and*
- *Manage its administered lands in the planning area in a manner that addresses the resources and processes described by Recovery Actions 6, 10, 12 and 32 of the Revised Recovery Plan (USFWS 2011b). RMP planning decisions could affect the implementation and accomplishment of only those four recovery actions.*

Conservation Needs of the Spotted owl

In 1990, Thomas et al. (pp. 23-27) determined that spotted owl conservation required:

- 1. Large blocks of nesting, roosting and foraging habitat that support clusters of reproducing owls, are distributed across a variety of ecological conditions, and are spaced to facilitate owl movement between the blocks, and;*
- 2. Habitat conditions within and surrounding large blocks of nesting, roosting and foraging habitat that facilitate owl movement between the blocks and ensure the survival of dispersing owls.*

In 2004, Courtney et al. (Chapter 9) concluded that, although subsequent spotted owl research had refined these conservation needs, they remained valid. In 2012, the U.S. Fish and Wildlife Service reaffirmed these conservation needs in its final rule on spotted owl critical habitat (77 FR 71908).

After the report by Courtney et al. (2004), the U.S. Fish and Wildlife Service identified two additional habitat-dependent conservation needs for the spotted owl:

- 3. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl’s range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels, and;*
- 4. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.*

The Service considers all four habitat-dependent conservation needs when it evaluates proposed actions. The Service added Conservation Needs 3 and 4 because of findings that the range-wide

losses of spotted owl habitat to wildfire, especially in southern Oregon, posed a greater threat to spotted owl conservation than previously thought (Courtney et al. 2004, Chapter 6) and because of observed declines in the spotted owl population (Anthony et al. 2006). Conservation Need 4 has become increasingly important with continued population declines (Forsman et al. 2011 and Dugger et al. 2016) and recent findings on competitive interactions between spotted owls and barred owls (e.g., Van Lanen et al. 2011, Dugger et al. 2011, Wiens et al. 2014).

Recovery Actions 6, 10, 12 and 32

The U.S. Fish and Wildlife Service issued its Revised Recovery Plan in 2011. Although recovery plans are guidance documents (Stanford Environmental Law Society 2001, p. 76), they describe reasonable actions and criteria that the U.S. Fish Wildlife Service or National Marine Fisheries Service recommend for the recovery of listed species. Thus, the Revised Recovery Plan provided a useful framework for the BLM's analysis. Of the thirty-three recovery actions in the Revised Recovery Plan, four were pertinent to the RMP planning effort in that BLM planning decisions could affect the implementation and accomplishment of only those actions on BLM-administered lands in the planning area (USFWS 2011b):

- “Recovery Action 6: In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery” (p. III-19).*
- “Recovery Action 10: Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population” (p. III-43).*
- “Recovery Action 12: In lands where management is focused on development of spotted owl habitat, post-fire silvicultural activities should concentrate on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood)” (p. III-49).*
- “Recovery Action 32: Because spotted owl recovery requires well distributed, older and more structurally-complex multi-layered conifer forests on Federal and non-Federal lands across its range, land managers should work with the Service as described below to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees” (p. III-67).*

Summary of Analytical Methods

The BLM framed its evaluations of the four habitat-dependent conservation needs of the northern spotted owl and the implementation of Recovery Actions 6, 10, 12 and 32 as analytical questions, stated below. To complete its evaluations, the BLM created a series of northern spotted owl relative habitat suitability data surfaces (i.e., digitized geospatial datasets used in

computer analyses) for all lands in the United States-portion of the northern spotted owl's range. These surfaces reflect current habitat values that represent the baseline and also forecast changes in habitat values at decadal increments for the next 50 years. The forecasts include anticipated changes to northern spotted owl habitat from forest ingrowth, forest treatment including restoration and timber harvest, and wildfire. The BLM describes the creation and validation of these surfaces in Appendix C of the BA. The BLM did not incorporate projections of climate change into the simulation of the growth of stands through time because of the uncertainty in climate change predictions and problems in downscaling the available climate predictions for use in forest stand growth and harvesting models.

The BLM chose a 50-year analytical timeframe for its northern spotted owl analyses, mindful that the Revised Recovery Plan identifies a 30-year timeframe for the recovery of the northern spotted owl (USFWS 2011b, p. viii). However, the 30-year timeframe is unchanged from that of an earlier recovery plan (USFWS 2008a) which the U.S. Fish and Wildlife Service issued before the most recent meta-analyses of northern spotted owl demography (Forsman et al. 2011 and Dugger et al. 2016) and recent findings on competitive interactions between northern spotted owls and barred owls (e.g., Van Lanen et al. 2011, Dugger et al. 2011, Wiens et al. 2014). In addition, on April 3, 2013, the assistant directors for Regions 1 and 8 of the U.S. Fish and Wildlife Service, which include the Proposed RMP planning area, issued agency guidance on implementation of the final rule on 2012 northern spotted owl critical habitat, in which they identified a conservation timeframe of at least 50 years.

The BLM analyses differ from the analyses done by the Service to inform its decisions on northern spotted owl recovery and northern spotted owl critical habitat (USFWS 2011b, Appendix C; USFWS 2012a). These differences arise from differences in planning needs and regulatory requirements, as well as differences in data availability. The Service delineated critical habitat units, in part, assuming that existing Northwest Forest Plan land use allocations and management standards would continue, including on BLM-administered lands. In contrast, the BLM evaluated scenarios in which Northwest Forest Plan land use allocations and management standards would change on BLM-administered lands in the planning area. The Service and BLM also relied on different relative habitat suitability surfaces and different processes to evaluate the effects of habitat change. Prior to deciding on its analytical methods, the BLM reviewed with the Service and other subject matter experts the methods developed by the Service. The BLM then incorporated or augmented those datasets and methods that met its planning needs (see Appendix C).

Conservation Need 1 - Large blocks of nesting, roosting and foraging habitat

To address Conservation Need 1, the BLM identified areas in the **planning area** with the quantity and spatial arrangement of habitat sufficient to support at least one northern spotted owl nesting pair. "Spatial arrangement" is a function of the median annual home range of the northern spotted owl, which varies by physiographic province, and the minimum amount of habitat that must occur within both the median annual home range area and the 500-acre (200-ha) core use area surrounding a potential nest site. Table III-16 shows these values. The BLM based the size of the median annual home range in each physiographic province on Thomas et al. (1990, p. 194). Because Conservation Need 1 addresses reproducing northern spotted owls,

and foraging habitat commonly does not support nesting (USFWS 2011b, p. G-2), the BLM analyses relied on nesting-roosting habitat.

Table 202. Metrics to identify blocks of northern spotted owl nesting-roosting habitat. Table III-16 in BLM (2016a).

Physiographic Province	Median Annual Home Range (Acres)	Radius of a Circle Equal in Size to the Median Annual Home Range (Miles)	Calculated Minimum Quantity of Nesting-Roosting Habitat Within a Median Annual Home Range (Acres)	Calculated Minimum Quantity of Nesting-Roosting Habitat Within a 500-acre Core Area (Acres)
Oregon Western Cascades	2,900	1.2	1,450	250
Oregon Coast Range	4,520	1.5	2,260	250
Oregon Klamath	3,400	1.3	1,700	250

Figure III-19 shows the current locations of large and small habitat blocks in the **planning area**, and areas within 6 miles of large blocks and within 3.5 miles of small blocks. Currently, large habitat blocks, each capable of supporting a cluster of reproducing northern spotted owls (i.e., at least 25 owl pairs), are distributed across the variety of ecological conditions (i.e., in all physiographic provinces). In addition, the large blocks are spaced to facilitate northern spotted owl movement between and through the large blocks in and between the Oregon Western Cascades, Oregon Eastern Cascades and Oregon Klamath provinces, and between the Oregon Klamath Province and the southern half of the Oregon Coast Range Province. However, the northern half of the Oregon Coast Range Province currently supports one large habitat block, which is not spaced properly with any other large habitat block. In addition, the small habitat blocks in this area, when added to the single large habitat block, are insufficient to meet Conservation Need 1.

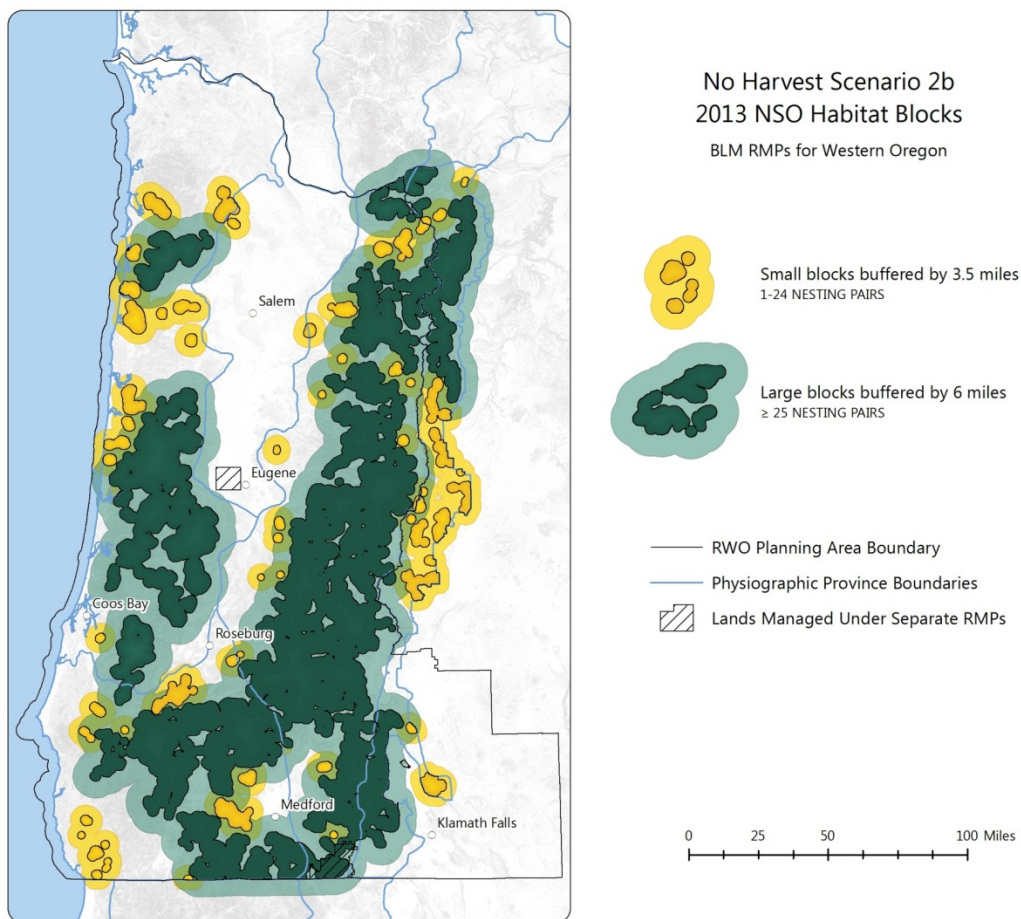


Figure 26. The current (2013) positions of northern spotted owl habitat blocks in western Oregon. Dark green blocks are capable of supporting ≥ 25 pairs; dark yellow blocks are capable of supporting 1-24 pairs. Light green denotes areas within 6 miles of dark green blocks; light yellow denotes areas within 3.5 miles of dark yellow blocks. Figure III-19 in BLM (2016a).

Conservation Need 2 – Facilitation of Movement Between and Through Large Blocks of Nesting, Roosting, and Foraging Habitat to Ensure Survival of Dispersing Owls

To evaluate northern spotted owl movement, the BLM produced decadal maps of habitat in the planning area capable of supporting such movement, relying on the distance and habitat quantity thresholds developed by Davis et al. (2011, p. 40). As described in Appendix C, Sections A and B, to conform to BLM planning needs to forecast habitat change, the BLM northern spotted owl relative habitat suitability surfaces differed from that used by Davis et al. (2011).

Figure III-22 shows those lands in the planning area that support northern spotted owl dispersal. Figure III-23 shows how the forested landscape managed by the BLM is capable of contributing to dispersal capability in 2043 and 2063 according to the No Timber Harvest Reference Analysis. In both figures, the areas of western Oregon that are capable of supporting northern spotted owl dispersal are indicated by stippling. Because the No Timber Harvest Reference Analysis simulates only the effects of forest ingrowth and wildfire on BLM-administered lands,

the BLM shows only these two decadal maps; the intermediate decadal maps show a transition of dispersal-capable lands between those in Figures III-22 and III-23.

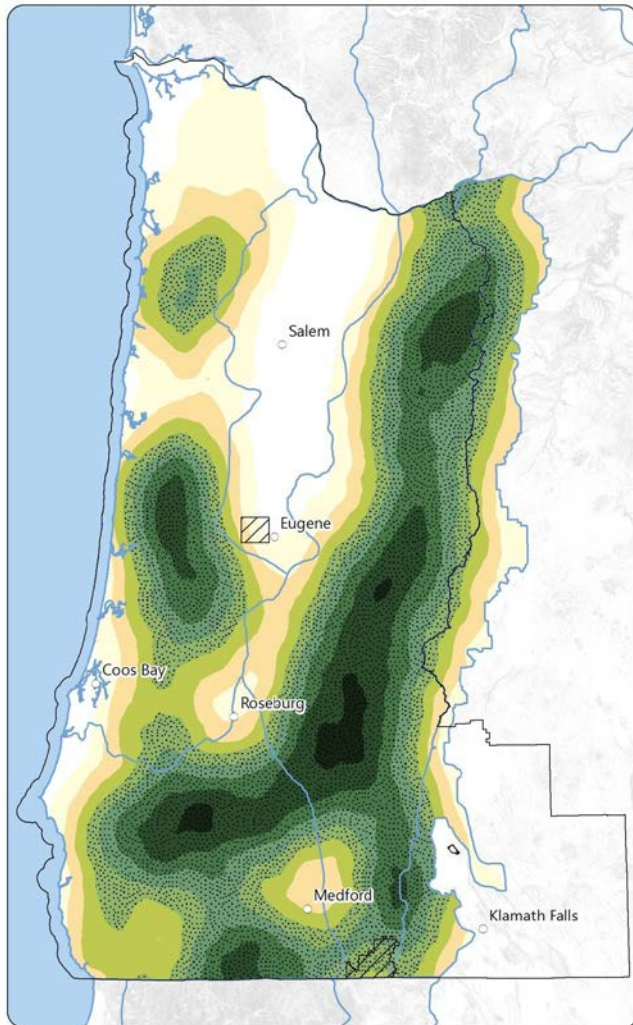


Figure 27. The northern spotted owl dispersal-capable landscape (stippled areas) in 2013, according to the No Timber Harvest Reference Analysis. Figure III-22 in BLM (2016a).

Conservation Need 3 – Reduce Loss of Habitat Due to Catastrophic Wildfire

*The U.S. Fish and Wildlife Service addresses catastrophic wildfire as a separate Conservation Need. However, wildfire is relevant to northern spotted owl conservation only because it modifies northern spotted owl habitat and, consequently, demography, which the BLM addressed by evaluating Conservations Needs 1, 2 and 4. As explained in **Appendix C**, the relative habitat suitability surfaces the BLM developed to address Conservation Needs 1, 2 and 4 incorporate habitat changes from wildfire. The BLM methodology for modeling wildfire is shown in Appendix D of the Draft RMP/EIS (USDI BLM 2015). Thus, the evaluations of Conservation Needs 1, 2 and 4 also address Conservation Need 3. The BLM needed no additional analysis.*

Conservation Need 4 – Sustain Full Range of Survival and Recovery Options for the Northern Spotted Owl in Light of Significant Uncertainty

1). Summary of Analytical Methods

To meet Conservation Need 4, the BLM would contribute to a landscape that supports, in light of current uncertainties, reproductively viable northern spotted owl populations in each western Oregon modeling region (as defined in USFWS 2011b, Appendix C) during the next 50 years or, if the No Timber Harvest Reference Analysis indicates that supporting populations for 50 years is not possible, during the next 30 years. Because this conservation need is not specific to BLM-administered lands, the BLM simulated on all land ownerships the northern spotted owl population responses to habitat changes and competitive interactions with barred owls. The BLM evaluated those population responses in terms of population size and population extirpation risk³⁵.

This issue presents an analysis of the cumulative effects on northern spotted owl population response of past, present, and reasonably foreseeable future actions, including both land management on BLM-administered lands and non-BLM-administered lands in the planning area.

In 2006, the U.S. Fish and Wildlife Service convened seven experts to identify threats to the northern spotted owl (USFWS 2011d). The experts identified past habitat loss, current habitat loss and competition from barred owls as the most pressing threats, even though implementation of the Northwest Forest Plan had reduced the rate of timber harvest on Federal lands. They noted evidence of these threats in the scientific literature. The range of threat scores by the individual experts was narrowest for barred owl competition, indicating more agreement about the threat from barred owls.

*Northern spotted owl populations are declining across their range at an annual rate of 2.9 percent (Forsman et al. 2011, p. 44). Therefore, “areas of significant population decline” include the entire planning area. A principal cause of the decline is competition from barred owls, which have colonized portions of Washington, Oregon and California during the past forty years. Barred owls now occupy the entire range of the northern spotted owl, utilize all northern spotted owl habitats and prey species, displace northern spotted owls from their breeding territories, inhibit northern spotted owls from establishing new territories and outbreed northern spotted owls (Forsman et al. 2011, Van Lanen et al. 2011, Dugger et al. 2011, Wiens et al. 2014). Although BLM-administered lands play a key role in northern spotted owl conservation in some portions of the **planning area** (USDI BLM 2015, pp. 768-769 and 804), current research*

35 For the Draft RMP/EIS (USDI BLM 2015, pp. 782- 783 and 800-804) the BLM also modeled how northern spotted owl population sources would change under each alternative and over time. However, the BLM determined that, under all alternatives, change in simulated northern spotted owl population sources over time primarily was determined by competitive interactions between northern spotted owls and barred owls, as opposed to habitat changes resulting from BLM planning decisions (USDI BLM 2015, p. 804). Therefore, the BLM did not evaluate northern spotted owl population sources for the Proposed RMP.

provides no evidence that the BLM can manage individual forest stands to provide northern spotted owls with a competitive advantage over barred owls (Dugger et al. 2011 and Wiens et al. 2014). Instead, research reaffirms the importance of older forest conditions and managing for large blocks of unfragmented older forest (Dugger et al. 2011, p. 2463; Wiens et al. 2014, pp. 36-38).

*To address Conservation Needs 1 and 2, the BLM examined potential BLM contributions to northern spotted owl habitat in the **planning area**: to the formation of blocks of nesting-roosting habitat, to spacing between the blocks, and to habitat conditions that support northern spotted owl movement and survival between and through the blocks. The BLM northern spotted owl relative habitat suitability surfaces include forecasts, on all land ownerships, of forest ingrowth, forest treatment, and wildfire. Therefore, to address Conservation Need 4, the BLM simulated how northern spotted owl populations would respond to changing habitat conditions on a landscape occupied by barred owls. Even though the BLM analyses focused on the **planning area**, the BLM modeled northern spotted owl population responses throughout the United States-portion of their range because the movement of northern spotted owls across the **planning area** boundaries would affect owl populations in the **planning area**.*

Population Modeling

To address Conservation Need 4, the BLM used a spatially-explicit, individual-based HexSim model (Schumaker 2011) to simulate northern spotted owl demographic responses over time.³⁶ Although computer modeling commonly involves an inherent tension between improved realism and errors associated with increased complexity, HexSim was designed to quantify wildlife population responses to multiple, interacting environmental stressors, as deemed appropriate, without unnecessarily simplifying landscapes, species' life histories, or disturbances. HexSim also can—

- Incorporate environmental stochasticity (i.e., species traits, such as individual fecundity and survival, as probabilities based on observed rates instead of as less-realistic fixed parameters)*
- Operate at relatively fine spatial scales, in this case at a scale of 214-acre (86.6-ha) hexagons;*
- Generate a full set of demographic response data, including simulated numbers and locations of individual northern spotted owls, at any year, which is important for BLM evaluations of northern spotted owl responses to alternatives; and*

³⁶ Due to the number of biological and physical variables that affect northern spotted owl demography, some of which are not fully understood, no model can accurately forecast a northern spotted owl demographic response over 50 years. However, the BLM determined that the individual-based HexSim model developed by the USFWS for the northern spotted owl represented the best analytical tool to simulate northern spotted owl responses to alternative BLM land use scenarios and, thus, help inform BLM decision-making (see **Appendix C**). That said, the BLM does not intend to portray its northern spotted owl population forecasts as absolute values, but only as comparative outcomes of alternate management scenarios in terms of general populations numbers, trends and risk probabilities.

- *Generate both rate-based and count-based matrices for each modeling region during each decade.*
 - *Count-based matrices record the numbers of individuals moving between locations, important for evaluating northern spotted owl movement and survival.*
 - *Rate-based matrices are important for evaluating how habitat change affects the northern spotted owl population in an ecologically meaningful way.*³⁷

*The BLM determined that the HexSim model developed by the U.S. Fish and Wildlife Service to inform its decisions on northern spotted owl recovery and critical habitat (USFWS 2011b, Appendix C, and USFWS 2012a), would meet, and could be adapted to, BLM planning needs with cost and technical efficiency (i.e., this model incorporated appropriate information on northern spotted owl demography and ecology, including barred owl competition, without introducing unnecessary analytical assumptions or complexity). The BLM described its application of the Service’s HexSim model in **Appendix C**.*

Analytical Scales

The BLM evaluated its contributions to conservation needs 1 and 2 using the physiographic provinces (USFS and BLM 1994a, p. A-3), because Thomas et al. (1990, p. 320) defined northern spotted owl median home range sizes—which they used to define large habitat blocks—for each physiographic province. More recently, Davis et al. (2011, pp. 34-36) modeled northern spotted owl relative habitat suitability values according to six modeling regions that were similar to the physiographic provinces but based exclusively on ecological divisions (i.e., unlike the physiographic provinces, two modeling regions crossed state boundaries). And the U.S. Fish and Wildlife Service, during its process to delineate northern spotted owl critical habitat, divided the northern spotted owl range into eleven modeling regions (USFWS 2011b, pp. C-7–C-13) on all land ownerships that reflected “regional differences in forest environments and factors such as important prey species” (USFWS 2011b, p. C-7). Again, the Service modeling regions were similar to the physiographic provinces but four of the regions crossed state boundaries.

*To address Conservation Need 4, the BLM tabulated results at the scales of the physiographic provinces and the U.S. Fish and Wildlife Service modeling regions, because Schumaker et al. (2014, p. 585) found key insights by comparing simulated northern spotted owl responses at different scales. The BLM considered tabulating results only for the **planning area** (i.e., by truncating modeling regions that extended into California or Washington at state boundaries), because BLM planning decisions would affect only BLM-administered lands in the planning area. Additionally, tabulating results for regions that extend into another state—some of which occur mostly in another state—might “dilute” the analytical effects of BLM alternatives. However, the BLM decided to tabulate data by entire modeling regions because those regions*

³⁷ The BLM arrayed parameters driving population change analytically instead of inferring such parameters from habitat patterns, as was done in previous land use planning efforts at this scale (i.e., the 1994 Northwest Forest Plan and the 2008 BLM Western Oregon Plan Revisions).

are most appropriate for examining northern spotted owl population extirpation risk. Aware of the limitations of its model, and that the BLM would use results mainly to compare alternatives, the BLM felt that tabulating results by entire modeling regions more accurately would reflect northern spotted owl responses to BLM alternatives unaffected by biologically-arbitrary divisions at state boundaries. The BLM chose not to tabulate results by the Davis et al. (2011, pp. 34-36) modeling regions, because it felt that their larger modeling regions, only three of which occurred in the planning area, were too coarse to augment the analyses at the other scales.

Barred Owl Encounter Rates

The BLM included the influence of barred owl competition in its modeling of northern spotted owl population response. Barred owl competition is reflected in the HexSim population modeling by a barred owl encounter rate—the estimated probability, based on observation, that a northern spotted owl will encounter a barred owl in the northern spotted owl’s territory—which, in the HexSim model, affects northern spotted owl survival.³⁸

*Between the Draft RMP/EIS and Proposed RMP/Final EIS, the BLM changed how it applied barred owl encounter rates in its HexSim model. As described below, the BLM updated the barred owl encounter rates based on results from the 2015 northern spotted owl meta-analysis provided by Dr. Dugger. In addition, for reasons described below, for the Draft RMP/EIS the BLM completed supplemental analyses of some alternatives using a modified barred owl encounter rate specific to each modeling region, which the BLM applied uniformly to each modeling region. For the Proposed RMP/Final EIS, the BLM delineated a network of barred owl control areas and applied an updated modified barred owl encounter rate in those control areas only, applying the estimated barred owl encounter rates in the remainder of each modeling region (see **Appendix C, Section E**).*

Estimated Encounter Rates

For the Draft RMP/EIS the BLM used estimated barred owl encounter rates (Table III-18, column 3) from USFWS 2011b, p.C-66 and Table C-25. For the Proposed RMP/Final EIS, the BLM updated the estimated encounter rates (Table III-18, column 4) based on the results of the 2015 northern spotted owl meta-analysis (Dugger et al. 2016).

³⁸ Survival, as used in the USFWS HexSim model, and subsequently by the BLM, was derived from Forsman et al. (2011) (see USFWS 2011b:C-59, C-68 and C-69, and 1012:10 and 13) and results from the 2015 northern spotted owl meta-analysis provided by Dr. Katie Dugger (see **Appendix C**). Although survival, as it is used in the model, might not reflect the ecological processes (such as interference competition) that cause northern spotted owls to react to barred owls in specific ways, it is based on scientific research.

Table 203. Estimated (observed) and modified barred owl encounter rates. The estimated encounter rates for the Draft RMP/EIS came from USFWS 2011b, p.C-66 and Table C-25; for the Proposed RMP/Final EIS they came from the results of the 2015 northern spotted owl meta-analysis (Dugger et al. 2016). For the Draft RMP/EIS the modified encounter rates came from USFWS 2012a, p. 27 and Table 4; for the Proposed RMP/Final EIS they came from the U.S. Fish and Wildlife Service (Betsy Glenn, personal communication to Eric Greenquist, 9/1/2015). Table III-18 in BLM (2016a).

Modeling Region*	Acronym	Estimated Encounter Rates		Modified Encounter Rates	
		Draft RMP/EIS	Proposed RMP	Draft RMP/EIS	Proposed RMP
<i>North Coast and Olympics**</i>	<i>NCO</i>	<i>0.505</i>	<i>0.515</i>	<i>0.375</i>	<i>0.150</i>
<i>East Cascades-North</i>	<i>ECN</i>	<i>0.296</i>	<i>0.374</i>	<i>0.375</i>	<i>0.150</i>
<i>West Cascades-North</i>	<i>WCN</i>	<i>0.320</i>	<i>0.405</i>	<i>0.375</i>	<i>0.150</i>
<i>West Cascades-Central</i>	<i>WCC</i>	<i>0.320</i>	<i>0.411</i>	<i>0.375</i>	<i>0.150</i>
<i>Oregon Coast**</i>	<i>ORC</i>	<i>0.710</i>	<i>0.831</i>	<i>0.375</i>	<i>0.150</i>
<i>West Cascades-South**</i>	<i>WCS</i>	<i>0.364</i>	<i>0.442</i>	<i>0.375</i>	<i>0.150</i>
<i>Inner California Coast Range</i>	<i>ICC</i>	<i>0.213</i>	<i>0.269</i>	<i>0.250</i>	<i>0.150</i>
<i>East Cascades-South**</i>	<i>ECS</i>	<i>0.180</i>	<i>0.228</i>	<i>0.250</i>	<i>0.150</i>
<i>Klamath-Siskiyou-East**</i>	<i>KLE</i>	<i>0.245</i>	<i>0.411</i>	<i>0.250</i>	<i>0.150</i>
<i>Klamath-Siskiyou-West**</i>	<i>KLW</i>	<i>0.315</i>	<i>0.398</i>	<i>0.250</i>	<i>0.150</i>
<i>Redwood Coast</i>	<i>RDC</i>	<i>0.205</i>	<i>0.259</i>	<i>0.250</i>	<i>0.150</i>

* The names of some modeling regions differ from those shown elsewhere in USFWS 2011b:C-9–C-13.

** Modeling regions entirely or partially in the **planning area**.

Modified Encounter Rates

The Service, during its final simulations to inform its decisions on northern spotted owl critical habitat, modified barred owl encounter rates to isolate the effects of habitat on simulated northern spotted owl populations and evaluate the relative contributions of different critical habitat configurations to spotted owl recovery (USFWS 2012a, pp. 26-27). If the Service had used estimated barred owl encounter rates in their analysis, the overwhelming negative influence of barred owls on northern spotted owl population responses would have confounded the results (USFWS 2012a, p. 26). These modified encounter rates are shown in Table III-18, column 5.

During preparation of the Draft RMP/EIS, the BLM used the estimated barred owl encounter rates (Table III-18, column 3) derived by the U.S. Fish and Wildlife Service (USFWS 2011b, p. C-66 and Table C-25). At the suggestion of the Service, the BLM also conducted second simulations of Alternative C and the No Timber Harvest Reference Analysis using the Service's modified barred owl encounter rates (Table III-18, column 5) to help parse out the differential

effect of habitat changes over time from the effects of barred owls. The BLM recognized that the relatively high current barred owl encounter rate observed in the Oregon Coast Modeling Region might prevent northern spotted owl persistence in that region regardless of habitat development on BLM-administered lands. Modeling Alternative C and the No Timber Harvest Reference Analysis with both current and modified barred owl encounter rates allowed the BLM to evaluate the influence of barred owls coupled with minimum (Alternative C) and maximum (No Timber Harvest) habitat development on BLM-administered lands, effectively bracketing the possible influence of the alternatives on the northern spotted owl population in a hypothetical scenario of barred owl control.

Application of Encounter Rates

As shown in the northern spotted owl population responses in the Draft RMP/EIS (USDI BLM 2015, pp. 783 – 796), when the BLM simulated estimated barred owl encounter rates, those encounter rates mostly or completely overwhelmed the effects of habitat development on BLM-administered lands in western Oregon. As shown in columns 3 and 4 of Table III-18, in all cases the 2015 barred owl encounter rates exceeded those the BLM used for the Draft RMP/EIS, which means that the influence of the barred owl on the northern spotted owl population response under the Proposed RMP would be even stronger in all parts of the northern spotted owl's range. Therefore, for the Proposed RMP/Final EIS, the BLM saw no utility in simulating northern spotted owl population responses only in the absence of a hypothetical barred owl control program. Instead, the BLM simulated northern spotted owl responses to the Proposed RMP in two ways: (1) using the estimated encounter rates (Table III-18, column 4) throughout each modeling region, and (2) using the modified encounter rate (Table III-18, column 6) in hypothetical barred owl control areas and the estimated encounter rates throughout the remainder of each modeling region.

*Therefore, for the Proposed RMP/Final EIS, The BLM worked with the U.S. Fish and Wildlife Service to model a realistic, albeit hypothetical, barred owl control program. The Service recommended that the BLM evaluate its alternatives by delineating hypothetical barred owl control areas, and using the 2015 estimated barred owl encounter rates (Table III-18, column 4) outside control areas and a modified encounter rate of 0.150 (Table III-18, column 6) within the control areas. (To clarify, for the Draft RMP/EIS, the BLM applied the modified encounter rates [Table III-18, column 5] for each modeling region to the entire modeling region.) The BLM describes its process in **Appendix C, Section E**. The BLM delineated control areas, and modified the barred owl encounter rate within those areas, to forecast the effects of a hypothetical barred owl control program by the Service. The Service recommended the modified encounter rate of 0.150 to reflect the greater effects of barred owl control only in hypothetical control areas, which comprise about 10 percent of each modeling region (see **Appendix C, Section E**).*

Population Change Analysis

As described above, the BLM simulated northern spotted owl demographic responses over 50 years (2013 – 2063), with relative habitat suitability values changing every decade according to BLM forecasts, and then held habitat values constant after 50 years and allowed each of 500 replicate simulations to run to 100 years (2113). This allowed the BLM to evaluate the Proposed

RMP in terms of simulated northern spotted owl population change and trend during years 2013 - 2063 and the ability of habitat conditions in 2063 to support stable northern spotted owl populations. The BLM ran both environmentally stochastic and non-stochastic simulations. In stochastic simulations, the BLM allowed the fecundity and survival of individual northern spotted owls to vary probabilistically according to observed rates. In non-stochastic simulations, the BLM fixed those variables as the mean of observed rates. The stochastic model introduced more variability between replicate simulations (thus, requiring 500 replicates), making it more reliable for evaluating extinction risk over time using quasi-extinction thresholds (described below); the non-stochastic model eliminated that variability (thus requiring only 100 replicates), making it more reliable for evaluating overall population responses to changing habitat conditions.

Population Risk Analysis

In this analysis, the BLM used population thresholds of 250 and 100 females in each modeling region, respectively representing moderate and high population risk. The BLM set these population thresholds consistent with the thresholds used by the U.S. Fish and Wildlife Service during its process to delineate critical habitat for the northern spotted owl.

The HexSim model developed by the U.S. Fish and Wildlife Service, and adapted by the BLM, simulates female northern spotted owls that reproduce probabilistically; i.e., the model does not simulate male northern spotted owls or rely on northern spotted owl pair formation. The Service designed the model this way because female northern spotted owls are more influential on population dynamics (USFWS 2011b, p. C-56). However, this feature also allows simulated females to reproduce independently of population size and density. Thus, simulated northern spotted owl populations could decline independently of an Allee effect; i.e., a decrease in individual fitness (e.g., from inbreeding depression or reduced encounters between potential mates) that can occur at low population levels and cause sudden, local extirpation (Akçakaya 2000, p. 3; Singleton 2012, p. 146). This concerned the BLM because barred owl encounter rates, in the BLM model, affect northern spotted owl survival. Since the BLM model applied estimated barred owl encounter rates uniformly over a modeling region (outside the barred owl control areas of some simulations) because available data do not allow for greater refinement, the affect to northern spotted owl survival might provide no option for long-term northern spotted owl persistence in some regions (i.e., local extirpation might be statistically predetermined by the parameters of the BLM model). Since the BLM did not design its HexSim model to account fully for small population processes, the BLM anticipated situations where regional forecasts of northern spotted owl populations might become so low as to be unreliable.

In previous applications of HexSim, in which modelers did not design their models to account fully for small population processes, modelers relied on quasi- or pseudo-extinction thresholds. The Service, during its process to delineate critical habitat for the northern spotted owl, set quasi-extinction thresholds of 250 and 100 females in each modeling region, respectively representing moderate and high population risk, and range-wide thresholds of 1,250 and 1,000 females, also respectively representing moderate and high population risk (USFWS 2012a, pp. 19-21, 30-32). The Service set these levels based on what constituted a “high risk of extinction” (USFWS 2012a, p. 20) at each scale. The Service based these thresholds on northern

spotted owl biology and general principles of conservation biology (Betsy Glenn, personal communication to Eric Greenquist, 10/15/2014.); the Service did not base these thresholds on empirical evidence of extinction risk, because such data do not exist. Dunk et al. (2014, p. 9), using the Service’s modeling regions, used a similar approach for their evaluation of northern spotted owls in western Washington, stating that a population of 100 individual northern spotted owls “represents a population size below which we believe Spotted Owls would be in danger of becoming extirpated,” and “a population of grave concern.” Again, Dunk et al. (2014, p. 9) did not base their threshold on empirical evidence of extinction risk, stating, “One hundred individuals is not necessarily a ‘tipping point’ population size;” instead, it provides “a quantitative threshold that allows for comparison among the baselines and alternative conservation scenarios.” Heinrichs et al. (2010, p. 2233), in their simulations of a small population of kangaroo rats, developed quasi-extinction thresholds that, again, were based on expert opinion informed by a posteriori analyses that compared how their model performed with alternate thresholds (Julie Heinrichs, University of Washington, personal communication via e-mail to Eric Greenquist, 11/13/2013). And Singleton (2013, p. 146), in his analysis of northern spotted owls in the eastern Cascades of Washington, developed a relative index of pseudo-extinction rate based on the calculated carrying capacity of his study area, estimating that extinction risk was high when simulated northern spotted owl populations fell below 10 percent or 20 percent of the calculated carrying capacity. Relative index is important because Singleton only compared the results of different modeling scenarios and did not attempt to forecast actual extinction events (Singleton 2013, p. 146, and Peter Singleton, Pacific Northwest Research Station, U.S. Forest Service, personal communication via e-mail to Eric Greenquist, 11/13/2013).

For its analyses, the BLM relied on the quasi-extinction thresholds established by the U.S. Fish and Wildlife Service: 250 and 100 females in a modeling region. A regional population of no more than 250 females is at risk for extirpation, because it is vulnerable to small population processes and stochastic events; a regional population of no more than 100 females is de facto extirpated due to the high likelihood that individuals would be too dispersed to form a cluster. Under northern spotted owl Issue 1, the BLM defined a cluster of northern spotted owls—the minimum size of a reproductively-stable population—as 20 to 25 breeding pairs that support each other demographically (i.e., their territories overlap such that their offspring readily would encounter each other). The U.S. Fish and Wildlife Service also considers a regional population of no more than 100 female northern spotted owls to be de facto extirpated (Betsy Glenn, personal communication via phone to Eric Greenquist, 07/29/2014.)

Regarding how to portray extinction risk over time, Akcakaya (2000, p. 2) stated that such risk is communicated best by specifying the entire distribution of extinction time instead of calculating only the mean or median extinction time; i.e., by plotting a cumulative probability distribution that shows the probability of extinction at or before a specific time. “Thus, the result becomes (the distribution of) the time (e.g., number of years) until the population declines below a predetermined threshold” (Akcakaya 2000, p. 3, parentheses in original). Therefore, the BLM plotted a cumulative time to quasi-extinction curve, for the Proposed RMP, using the modeling region-specific quasi-extinction thresholds developed by the U.S. Fish and Wildlife Service (USFWS 2012a, pp. 19-21 and 30-32). This allowed the BLM to evaluate the Proposed RMP in terms of the number of years from present during which the simulated northern spotted owl

population had a certain probability of persisting above these thresholds in each modeling region and range-wide. The BLM did not intend these to be actual forecasts of persistence but only an estimate of the relative contribution of the Proposed RMP to northern spotted owl persistence.

Population Source Analysis

For the Draft RMP/EIS, the BLM evaluated northern spotted owl population sources (USDI BLM 2015, pp. 800 – 804). The BLM did not to evaluate population sources for the Proposed RMP because, although the results for the Draft RMP/EIS helped the BLM refine its network of reserve land use allocations to better protect sources, they also indicated that none of the alternatives appreciably altered mean source values across the **planning area** or limited northern spotted owl production in any part of the **planning area** due to the effects of competitive interactions between northern spotted owls and barred owls under all alternatives.

2). Management Outcome

Population Change

Simulations of northern spotted owl population responses for the No Timber Harvest Reference Analysis indicate that the forested landscape managed by the BLM is capable of contributing to a range-wide northern spotted owl population that would decline from current levels but would stabilize within 40 years (Table III-19). However, as shown in Tables III-20 and III-21, this range-wide stabilization would result mostly from population increases in the California and eastern Cascades-portions of the range.³⁹ In the western Cascades, Olympic Peninsula, Oregon Coast Range and Oregon Klamath-portions of the range, simulated populations decline throughout the next 50 years.

Table 204. No Timber Harvest Reference Analysis: Northern spotted owl range-wide populations (mean of 500 replicate non-stochastic simulations) by year. Table III-19 in (BLM 2016a).

Populations	Simulation Year						
	2013	2023	2033	2043	2053	2063	2113
<i>Number of Territorial Females</i>	3,696	3,510	3,397	3,346	3,317	3,319	3,315
<i>Number of All Females</i>	4,763	4,490	4,332	4,259	4,217	4,224	4,218

³⁹ However, as described in the next section, Population Risk, the forecast of population increase in the eastern Cascades of Oregon is unreliable.

Table 205. No Timber Harvest Reference Analysis: Simulated northern spotted owl populations (mean of 500 replicate non-stochastic simulations), by modeling region and year. Table III-20 in BLM (2016a).

Modeling Region	Simulation Year						
	2013	2023	2033	2043	2053	2063	2113
<i>West Cascades-North</i>	24	21	20	20	19	18	15
<i>East Cascades-North</i>	308	298	302	308	318	324	321
<i>North Coast and Olympic*</i>	159	137	122	109	97	87	53
<i>West Cascades-Central</i>	154	142	135	129	126	122	107
<i>West Cascades-South*</i>	854	770	695	632	578	532	378
<i>Oregon Coast*</i>	153	105	72	52	36	27	13
<i>East Cascades-South*</i>	170	168	171	174	178	185	195
<i>Klamath-Siskiyou-East*</i>	539	502	466	445	425	414	355
<i>Klamath-Siskiyou-West*</i>	616	581	561	547	533	524	489
<i>Redwood Coast</i>	852	844	861	897	939	988	1,172
<i>Inner California Coast</i>	933	922	927	948	969	1,003	1,121

* Modeling regions entirely or partially in the **planning area**.

Table 206. No Timber Harvest Reference Analysis: Simulated northern spotted owl populations (mean of 500 replicate non-stochastic simulations), by physiographic province and year. Table III-21 in BLM (2016a).

Physiographic Province	Simulation Year						
	2013	2023	2033	2043	2053	2063	2113
<i>Washington Eastern Cascades</i>	182	170	166	165	166	164	156
<i>Washington Western Cascades</i>	167	152	142	133	128	122	105
<i>Washington Western Lowlands</i>	2	2	1	1	1	1	1
<i>Washington Olympic Peninsula</i>	142	124	111	100	89	80	49
<i>Oregon Coast Range*</i>	161	110	77	55	38	29	12
<i>Oregon Willamette Valley*</i>	2	2	2	1	1	1	1
<i>Oregon Eastern Cascades*</i>	226	233	250	266	285	302	313
<i>Oregon Western Cascades*</i>	1,117	1,008	913	834	764	709	525
<i>Oregon Klamath*</i>	519	486	455	439	422	409	346
<i>California Cascades</i>	80	80	83	86	90	97	124
<i>California Klamath</i>	1,277	1,241	1,228	1,228	1,230	1,244	1,319
<i>California Coast Range</i>	887	883	905	950	1,003	1,065	1,267

* Physiographic provinces entirely or partially in the **planning area**.

This analysis presents a quantification of current conditions used by the BLM in their assessment of impacts of the PRMP to spotted owl populations over time. We do not present results of their

analyses here as we discuss effects of the action on spotted owls and spotted owl critical habitat in subsequent sections.

Spotted Owl Occupancy

The BLM has been conducting surveys for spotted owls on lands in the action area since the late 1980s/ early 1990s. Survey data indicate that there are approximately 2565 known (occupied and historic) spotted owl sites in the action area or with home ranges that overlap the action area (BLM 2016a, p. 45).

Survey data collected by the BLM indicates that 2013 occupancy rates are approximately 30 percent. In an email to Betsy Glenn, Eric Greenquist (2015, pers. comm.) indicated that 508 of the 1505 spotted owl territories (33 percent) with activity centers in the action area were considered occupied in 2013. Similarly, of the 2464 spotted owl territories that overlap the action area to some extent, 640 (27 percent) were considered occupied in 2013 (BLM 2016a, p. 45). The average occupancy rate across these two datasets is 30 percent. This rate is similar to occupancy rates determined in the demographic analyses conducted by Dugger *et al.* (2016, p. 79) that indicate that the site occupancy rates for demographic study areas in Oregon ranged from approximately 22-42 percent for study areas in the action area.

Population trends

The spotted owl was listed as a threatened species in 1990 because of widespread loss of suitable habitat across the species range and the inadequacy of existing regulatory mechanisms to conserve the species (55 FR 26114 [June 26, 1990]). Many populations of spotted owls continue to decline, especially in the northern parts of the species' range where populations have declined by as much as 80 percent since 1990. Although past and current habitat loss continues to threaten spotted owl populations, and even though loss of habitat due to timber harvest has been greatly reduced on Federal lands for the past 2 decades (USFWS 2011b, p. vi), increasing competition from the non-native barred owl (*Strix varia*) is now the most significant threat to the continued existence of the northern spotted owl (USFWS 2004, USFWS 2011b).

There are no current estimates of the total population size of spotted owls because many areas across the range of the species remain unsurveyed (USFWS 2011b, p. A-2). Spotted owl demography studies use estimates of fecundity (reproduction) and apparent survival to determine if populations within 11 discrete study areas in California (3), Oregon (5), and Washington (3) are increasing, stationary, or decreasing. Spotted owl populations declined range-wide at an estimated rate of 3.8 percent per year from 1985 to 2013 (Dugger *et al.* 2016, p. 57). The rates of population decline vary by study area, with the greatest rates of decline occurring in Washington and northern Oregon (Dugger *et al.* 2016, p. 70). The factors that influence spotted owl demography are not fully understood, but habitat quality and quantity, annual weather patterns, and the presence of barred owls are all factors that affect spotted owl survival, reproduction, and local population trends (Forsman *et al.* 2011, pp. 67-72, Dugger *et al.* 2016, pp. 93-99). An overall decline in apparent survival rates (the probability that an owl will survive from one year to the next) is the most significant factor driving the declining population trends across the range of the species (Forsman *et al.* 2011, pp. 63-64). There is now strong evidence

that barred owls have negatively affected spotted owl populations, primarily by decreasing apparent survival and increasing rates of local territory abandonment (Dugger *et al.* 2016, p. 58).

Both Dugger *et al.* (2016) and Schumaker *et al.* (2014) identified the Klamath-East, Klamath-West, and West Cascades South critical habitat units as important source populations, while the Oregon Coast Ranges and North Coast Olympic units are sink populations (Dugger *et al.* 2016, entire; Schumaker *et al.* 2014, p. 588). Schumaker *et al.* (2014, p. 589) developed a spatially-explicit, individual-based model of spotted owl population dynamics and found that protecting and enhancing performance in both sources and sinks may be essential for population persistence. Because the action area includes large portions of the areas identified as source populations as well as a large portion of the Oregon Coast Range area, the spotted owl population and spotted owl habitat within the action area play an important role in the long-term persistence of spotted owls across their range.

Spotted Owl Habitat

The loss of nesting, roosting, and foraging habitat was a major cause of the spotted owl's decline over the past century. Habitat loss is still considered to be a threat to the spotted owl, as habitat continues to be lost to wildfires, timber harvest, and other natural disturbances (Davis *et al.* 2015, p. 45). Although under the Northwest Forest Plan, an extensive number of Late Successional Reserves have been established and are being managed to maintain, enhance, or restore NRF habitat conditions over the range of the spotted owl, the impacts of past habitat loss and degradation within these areas will require many more decades to once again support high quality spotted owl NRF habitat (Davis *et al.* 2016, pp 35-36). Monitoring of spotted owl habitat in the Northwest Forest Plan area from 1993 to 2012 indicated nesting/roosting habitat declined from 9.09 million acres to 8.95 million acres on Federal lands during the monitoring period, a loss of about 1.5 percent (Davis *et al.* 2015, p. 22). Across all lands (Federal and non-federal), habitat declined from approximately 12.5 million acres to 12.1 million acres, a loss of 3.4 percent (Davis *et al.* 2015, p. 21). Wildfire has been the major cause of habitat loss on Federal lands, while timber harvest is the primary cause of habitat loss on non-federal lands. Although the maintenance, enhancement and restoration of NRF habitat is a key element in the conservation of spotted owls, it may no longer be the primary factor affecting population stability in either the short or long term due to the rapidly increasing trend of barred owl populations (Davis *et al.* 2011, p. 18).

Table 207. Current spotted owl habitat on BLM lands in the action area.

	Congressionally Reserved	Late Successional Reserve	District Designated Reserve	Riparian Reserve	Harvest Land Base	Total
Dispersal	12,397	249,950	50,080	140,052	131,569	584,048
Nesting- Roosting	16,057	249,950	50,080	367,925	167,066	851,078
Total	28,453	499,901	100,159	507,977	298,635	1,435,126

Table 208. Current spotted owl habitat in the action area.

	Dispersal	Nesting-Roosting	Total
BLM	588,254	1,164,283	1,752,537
State	32,044	31,814	63,857
Other Federal	50,032	85,338	135,370
Tribal	1,443	2,260	3,703
Nonfederal	657,964	488,686	1,146,651
Total	1,329,736	1,772,381	3,102,117

Spotted Owl Habitat Trends

Davis *et al.* (2016) reported on changes in amounts, distribution, and spatial arrangement of spotted owl habitats across the NWFP area. They documented how forest conditions have changed as a result of disturbance and ingrowth starting with the year of the NWFP analyses in 1993. Davis *et al.* (2016) reported a net decrease from 9,089,700 ac to 8,954,000 ac (-1.5 percent) of nesting/roosting habitat on NWFP federal lands. Although habitat losses to wildfire of 5.2 percent (474,300 ac), 1.3 percent from timber harvest (116,100 ac), and 0.7 percent from insects or other causes (59,800 ac) were documented, the overall rate of loss indicated that processes of forest succession have compensated for some of the losses resulting from disturbance. Dispersal habitat on NWFP federal lands increased by 2.2 percent (net change), but dispersal-capable landscapes experienced a 5 percent net decrease owing to habitat losses on the surrounding nonfederal lands. Large wildfires continue to be the leading cause for loss of spotted owl habitat on federal lands, and most habitat loss occurred within the network of large reserves designed for spotted owl conservation (Davis *et al.* 2016).

Northwest Forest Plan

Within the action area BLM lands have been managed since 1994 under the direction of the NWFP, which established a conservation strategy for the spotted owl on Federal lands. It is designed around the conservation needs of the spotted owl and based on the designation of a variety of land-use allocations whose objectives are to provide for a north/south and east/west distribution of spotted owl habitat. The Late-Successional Reserves (LSRs) are intended to contribute to supporting “blocked up” habitat.

Recovery Plan for the Spotted Owl

The recovery plan contains four Recovery Actions (RAs) that specifically relate to the proposed action: RA, RA 10, RA 12, and RA 32. RA 6 provides guidance for applying appropriate silvicultural treatments to young, overstocked plantations to accelerate the development of stands that will support spotted owls. BLM addresses this recovery action in its management direction for Late Successional Reserves and Riparian Reserves where management direction emphasizes treatments to speed the development of spotted owl habitat in stands that are not currently functioning as habitat.

The focus of RA 10 is the conservation of spotted owl sites and high value spotted owl habitat. Management direction for all LUAs includes guidance for management near occupied owl sites and areas with high quality spotted owl habitat (BLM 2016a, pp. 46-47)

RA 12 focuses on the conservation and restoration of spotted owl habitat when implementing post-fire treatments. BLM addresses this recovery action in management direction for Fire, Fuels, and Wildfire Response, as well as in management direction for the Harvest Land Base when fire salvage is conducted.

RA32 includes maintaining and restoring older, structurally-complex, multi-layered forest conditions that characterize high quality spotted owl habitat. Management direction for Late Successional Reserves and District Designated Reserves includes protection and maintenance of older, structurally-complex forest.

Role of the Action Area in the Survival and Recovery of the Spotted Owl

The PRMP encompasses 2,478,856 acres within the 57 million acre range of the spotted owl (USFWS 2011, Appendix C). There are 851,078 acres of spotted owl nesting-roosting habitat and 584,048 acres of dispersal habitat within the PRMP, representing approximately 6.7 percent of the range wide nesting-roosting habitat (12,733,533 acres total (Davis *et al.* 2016)) and 6.4 percent of the range wide dispersal habitat (9,120,287 acres total (Davis *et al.* 2016)).

Within the PRMP, there are 1,207,949 acres of designated spotted owl critical habitat, representing 12.6 percent (9,577,969 acres) of designated critical habitat. Of the lands within critical habitat in the PRMP, 272,323 acres are dispersal habitat and 798,552 acres are nesting-roosting habitat.

Spotted owl survey efforts over the past two decades have documented that approximately 2,465 known and historic spotted owl territories overlap the action area. Approximately 640 of these territories have been documented to be occupied by spotted owls in recent years (BLM 2016a, pp. 45-47)

Spotted owl populations within the area encompassed in the PRMP play an important role in the range-wide population dynamics of this species (Dugger *et al.* 2016, Schumaker *et al.* 2014). Spotted owl populations within the Klamath-East, Klamath-West, and West Cascades South critical habitat units have been shown to serve as source populations, while spotted owl populations in the Oregon Coast Ranges and North Coast Olympic units have been identified as sink populations (Dugger *et al.* 2016, entire; Schumaker *et al.* 2014, p. 588). Schumaker *et al.* (2014, p. 589) developed a spatially-explicit, individual-based model of spotted owl population dynamics and found that protecting and enhancing performance in both sources and sinks may be essential for range-wide population persistence. Consequently, BLM actions that result in positive or negative impacts to spotted owls and/or spotted owl habitat in the action area may impact the spotted owl across its range.

Status of Spotted Owl Critical Habitat Within the PRMP

Except as supplemented by the Service, the following section is from the BA (BLM 2016a, pp. 37, 136-147, Appendix C).

Land Use Allocation

Table 209. Acres of spotted owl critical habitat by land use allocation. Table II-3 in BLM (2016a).

<i>Allocation</i>	<i>Designated Critical Habitat (ac)</i>	<i>Nesting Roosting Habitat in Critical Habitat (ac)</i>	<i>Dispersal Habitat in Critical Habitat (ac)</i>	<i>Suitable habitat in Critical Habitat (ac)</i>
<i>Late- Successional Reserve</i>	609,551	414,338	147,595	561,933
<i>Riparian Reserve</i>	338,335	248,224	58,355	306,579
<i>Congressionally Reserved</i>	7,908	3,770	2,446	6,216
<i>District Designated Reserves</i>	70,009	39,508	16,857	56,365
<i>Harvest Land Base</i>	182,146	92,234	46,823	139,057
<i>Totals</i>	1,207,949	798,075	272,075	1,070,150

The BLM provided assessments of the amount of spotted owl habitat by critical habitat unit and subunit for all lands in the planning area and for BLM lands:

Table 210. Acres of northern spotted owl dispersal habitat on **all** land ownerships by northern spotted owl critical habitat sub-unit, as in BLM (2016a, Table III-28). Dispersal habitat includes nesting-roosting habitat. Critical habitat units and sub-unit codes are defined in 77 Fed. Regis. 71920 – 71935. Sub-units in the **planning area** are denoted by an asterisk.

<i>Unit</i>	<i>Sub-unit</i>	<i>2013</i>
1	NCO 1	256,479
	NCO 2	194,844
	NCO 4*	65,830
	NCO 5*	183,152
2	ORC 1*	90,025
	ORC 2*	229,884
	ORC 3*	181,850
	ORC 4*	4,604
	ORC 5*	154,981
	ORC 6*	76,738
3	RDC 1	49,512
	RDC 2	56,030
	RDC 5	11,909
4	WCN 1	225,133
	WCN 2	44,874
5	WCC 1	182,901
	WCC 2	245,923
	WCC 3	360,444
6	WCS 1*	82,089
	WCS 2*	130,560
	WCS 3*	283,580
	WCS 4*	350,090
	WCS 5*	328,542
	WCS 6*	75,590
7	ECN 1	52,846
	ECN 2	26,599
	ECN 3	211,587
	ECN 4	175,727
	ECN 5	149,175
	ECN 6	72,779
	ECN 7	111,404
	ECN 8	70,334
	ECN 9	95,640
8	ECS 1*	116,967
	ECS 2*	52,971
	ECS 3	73,197

Unit	Sub-unit	2013
9	<i>KLW 1*</i>	133,812
	<i>KLW 2*</i>	137,675
	<i>KLW 3*</i>	132,335
	<i>KLW 4*</i>	149,413
	<i>KLW 5</i>	28,480
	<i>KLW 6</i>	104,175
	<i>KLW 7</i>	223,248
	<i>KLW 8</i>	100,366
	<i>KLW 9</i>	129,960
10	<i>KLE 1*</i>	210,728
	<i>KLE 2*</i>	91,256
	<i>KLE 3*</i>	96,605
	<i>KLE 4*</i>	223,204
	<i>KLE 5*</i>	26,934
	<i>KLE 6*</i>	145,764
	<i>KLE 7</i>	56,122
11	<i>ICC 1</i>	296,106
	<i>ICC 2</i>	177,323
	<i>ICC 3</i>	93,532
	<i>ICC 4</i>	107,692
	<i>ICC 5</i>	31,075
	<i>ICC 6</i>	1,339
	<i>ICC 7</i>	104,695
	<i>ICC 8</i>	67,825

Table 211. Acres of northern spotted owl nesting-roosting habitat on all land ownerships by northern spotted owl critical habitat sub-unit, as in BLM (2016a, Table III-29). Critical habitat units and sub-unit codes are defined in 77 Fed. Regis. 71920 – 71935. Sub-units in the **planning area** are denoted by an asterisk.

<i>Unit</i>	<i>Sub-unit</i>	<i>2013</i>
1	NCO 1	188,029
	NCO 2	151,249
	NCO 4*	16,685
	NCO 5*	133,619
2	ORC 1*	57,997
	ORC 2*	170,893
	ORC 3*	137,144
	ORC 4*	1,883
	ORC 5*	119,943
	ORC 6*	64,853
3	RDC 1	27,531
	RDC 2	37,842
	RDC 5	3,903
4	WCN 1	175,554
	WCN 2	33,668
5	WCC 1	137,167
	WCC 2	186,458
	WCC 3	292,646
6	WCS 1*	54,450
	WCS 2*	81,587
	WCS 3*	205,770
	WCS 4*	281,544
	WCS 5*	273,844
	WCS 6*	42,993
7	ECN 1	31,092
	ECN 2	15,725
	ECN 3	143,751
	ECN 4	129,016
	ECN 5	108,113
	ECN 6	61,569
	ECN 7	82,208
	ECN 8	47,184
	ECN 9	70,334
8	ECS 1*	99,309
	ECS 2*	36,336
	ECS 3	36,316

Unit	Sub-unit	2013
9	<i>KLW 1*</i>	85,883
	<i>KLW 2*</i>	96,922
	<i>KLW 3*</i>	73,148
	<i>KLW 4*</i>	106,173
	<i>KLW 5</i>	17,131
	<i>KLW 6</i>	60,174
	<i>KLW 7</i>	133,116
	<i>KLW 8</i>	71,892
	<i>KLW 9</i>	77,376
10	<i>KLE 1*</i>	163,218
	<i>KLE 2*</i>	71,692
	<i>KLE 3*</i>	70,571
	<i>KLE 4*</i>	172,426
	<i>KLE 5*</i>	15,073
	<i>KLE 6*</i>	113,892
	<i>KLE 7</i>	41,486
11	<i>ICC 1</i>	222,669
	<i>ICC 2</i>	137,228
	<i>ICC 3</i>	73,691
	<i>ICC 4</i>	81,307
	<i>ICC 5</i>	25,183
	<i>ICC 6</i>	890
	<i>ICC 7</i>	76,982
	<i>ICC 8</i>	45,434

Table 212. Acres of northern spotted owl dispersal habitat on BLM-administered lands in the **planning area** by northern spotted owl critical habitat sub-unit, as in BLM (2016a, Table III-30). Dispersal habitat includes nesting-roosting habitat. Critical habitat units and sub-unit codes are defined in 77 Fed. Regis. 71920 – 71935.

<i>Unit</i>	<i>Sub-unit</i>	<i>2013</i>
1	NCO 4	6,945
	NCO 5	53,597
2	ORC 1	23,060
	ORC 2	71,441
	ORC 3	125,922
	ORC 4	4,603
	ORC 5	100,763
	ORC 6	76,705
6	WCS 1	1,886
	WCS 2	4,118
	WCS 3	20,120
	WCS 4	20
	WCS 5	41
	WCS 6	75,535
8	ECS 1	16,834
	ECS 2	2,493
9	KLW 1	125,224
	KLW 2	66,093
	KLW 3	5,735
	KLW 4	63,296
10	KLE 1	87
	KLE 2	89,722
	KLE 3	96,259
	KLE 4	2
	KLE 5	26,894
	KLE 6	21,842

Table 213. Acres of northern spotted owl nesting-roosting habitat on BLM-administered lands in the **planning area** by northern spotted owl critical habitat sub-unit, as in BLM (2016a, Table III-31). Critical habitat units and sub-unit codes are defined in 77 Fed. Regis. 71920 – 71935.

<i>Unit</i>	<i>Sub-unit</i>	<i>2013</i>
1	NCO 4	5,807
	NCO 5	43,577
2	ORC 1	19,812
	ORC 2	59,904
	ORC 3	103,985
	ORC 4	1,883
	ORC 5	83,552
	ORC 6	64,830
6	WCS 1	1,388
	WCS 2	2,420
	WCS 3	12,060
	WCS 4	2
	WCS 5	25
	WCS 6	42,948
8	ECS 1	9,516
	ECS 2	1,165
9	KLW 1	79,596
	KLW 2	46,845
	KLW 3	4,514
	KLW 4	48,796
10	KLE 1	64
	KLE 2	70,400
	KLE 3	70,391
	KLE 4	0
	KLE 5	15,069
	KLE 6	16,062

Table 214. Summary of northern spotted owl critical habitat NRF¹ acres removed or downgraded as documented through section 7 consultations on Northwest Forest Plan (NWFP) lands; environmental baseline and summary of effects By State, Physiographic Province and Land Use Function.

Physiographic Province ²		Evaluation Baseline		Habitat Removed/Downgraded					% Provincial Baseline Affected	% Range-wide Effects
				Land Use Allocations ⁵			Habitat Loss to Natural Events	Total		
		Total Designated Critical Habitat Acres ³	Nesting/Roosting Acres ⁴	Reserves	Non-Reserves	Total				
WA	Eastern Cascades	1,022,960	416,069	265	2	267	0	267	0.06	0.88
	Olympic Peninsula	507,165	238,390	6	0	6	0	6	0.00	0.02
	Western Cascades	1,387,567	667,173	268	43	311	0	311	0.05	1.03
OR	Cascades East	529,652	181,065	887	1,277	2,164	0	2,164	1.20	7.16
	Cascades West	1,965,407	1,161,780	648	3,708	4,356	662	5,018	0.43	16.61
	Coast Range	1,151,874	535,602	1	1,136	1,137	0	1,137	0.21	3.76
	Klamath Mountains	911,681	481,577	1,306	1,215	2,521	3,011	5,532	1.15	18.31
CA	Cascades	243,205	98,243	0	127	127	0	127	0.13	0.42
	Coast	149,044	58,278	0	1	1	2,888	2,889	4.96	9.56
	Klamath	1,708,787	752,131	326	684	1,010	11,750	12,760	1.70	42.24
Total		9,577,342	4,590,308	3,707	8,193	11,900	18,311	30,211	0.32%	100%

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component in CA most closely resembles NRF habitat in Oregon and Washington.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl as Recovery Units (USFWS 2011b, p.A-3).

3. Northern spotted owl critical habitat as designated December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (-627 acres).
4. Calculated from GIS data for spotted owl Nesting/Roosting habitat generated by Davis *et al.* 2011 for the Northwest Forest Plan 15-year Monitoring Report (PNW-GTR-850). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery.
5. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

EFFECTS OF THE ACTION—NORTHERN SPOTTED OWL

Effects of the action refer to the permanent or temporary direct and indirect effects of an action on the species and/or its critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

Effects to Spotted Owl

This effects section follows a deconstruction of the proposed action. Effects are divided by: habitat modifications by land-use allocations, effects by resource program, disruption effects, and vehicle collision effects, then a summary of effects that may occur. We evaluate negative as well as positive effects that may result from implementation of the PRMP, and our conclusion is an aggregated determination of all effects.

Designation of Land Use Allocations

Congressionally Reserved Lands and the National Landscape Conservation System

Congressionally Reserved Lands are designated on 40,505 acres of BLM land as part of the PRMP, which is 2 percent of the overall BLM land base (BLM 2016a, p. 34). Congressionally Reserved Lands are those lands that Congress has designated and defined management through law, such as designated Wilderness and designated Wild and Scenic Rivers, and they have the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- *Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.*
- *Preserve the wilderness character of designated Wilderness Areas.*
- *Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (BLM Manual 6330 – Management of BLM Wilderness Study Areas; USDI BLM 2012), until Congress either designates these lands as Wilderness or releases them for other purposes.*
- *Protect and enhance the free-flowing condition, water quality, and outstandingly remarkable values of eligible, suitable, and designated Wild and Scenic River corridors.⁴⁰*
- *Provide protection to Wild and Scenic River corridors¹ that are suitable for inclusion as components of the National Wild and Scenic Rivers system until Congress makes a decision on designation.*

⁴⁰ These corridors include all of the river classifications – Wild, Scenic, and Recreational.

- *Provide protection to Wild and Scenic River corridors¹ that are eligible but have not yet been studied for suitability as components of the National Wild and Scenic Rivers system pending suitability evaluations.*

Management Direction

- *In designated Wilderness Areas, exclude all prohibited uses of Wilderness (as defined in the Wilderness Act of 1964 and BLM Manual 6340 – Management of Designated Wilderness (USDI BLM 2012)), unless they have been demonstrated to be the minimum necessary (using the minimum requirements decision guide) to administer the area for the purposes of the Wilderness Act.*
- *Provide for the enjoyment and appreciation of the resources, qualities, values, and associated settings and primary uses within National Trail rights-of-way (including those classified as Scenic, Historical, and Recreational) and for which National Trails are designated.*
- *Enhance, promote, and protect the scenic, natural, and cultural resource values associated with current and future designated National Scenic and Historic Trails.*
- *Conduct silvicultural treatments in National Trail management corridors (including those classified as Scenic, Historical, and Recreational) only as needed to protect or maintain recreation setting characteristics or to achieve recreation objectives.*
- *Conduct management actions, including but not limited to fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and trail construction, in Wild and Scenic River corridors only if consistent with designated or tentative classifications and if any reductions in outstandingly remarkable values would be temporary and outstandingly remarkable values would be protected or enhanced over the long term.*
- *Do not use ground-disturbing equipment or aerial application of non-fugitive retardant in areas visible from the river within Wild and Scenic River corridors during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property, or where use is essential for wildfire control.*
- *Conserve and develop the scenic, natural, and historic values of the Yaquina Head Outstanding Natural Area, and allow the continued use of the area for the purposes for which it was designated.*

The primary objective of the Congressionally Reserved Lands is to conserve, protect, and restore the characteristics for which these lands were designated.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. Because the goal of Congressionally Reserved Lands is to conserve, protect, and restore the characteristics for which these lands were designated, forest management of these lands is designed to be consistent with the existing natural features and natural processes; however, there are several potential activities that are allowed for logistical and operational reasons in Congressionally Reserved Lands that have the potential to impact individual forest stands.

These activities include fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, trail construction and wildfire suppression activities.

In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts for some subset of projects that can be generally described here. Although the overall management goal for Congressionally Reserved Lands is to maintain the natural conditions, there is some potential to remove or alter spotted owl habitat as these actions are carried out. These impacts will be minimized by incorporating best management practices.

Silvicultural activities in Congressionally Reserved Lands are designed for fuels treatments, invasive species management, riparian or wildlife habitat improvements and forest management activities. These potential activities would generally be designed to enhance, retain and protect the natural landscape and processes, but may result in some short-term effects to spotted owl habitat and critical habitat. Because these activities are designed to protect and enhance the character and cultural, ecological, and scientific values currently associated with these areas, we expect the management of these lands to at least retain the current ecological values over the long-term, and potentially improve on those values through management of these lands.

The reduction of fuels is designed to help protect these areas from high-intensity wildfires and, therefore, retain more forest on the landscape. Treatments for insect infestations are similarly designed to stop or slow the spread of insects that can stress or kill conifer and alter the function of stands. These activities are expected to address specific situations within the Congressionally Reserved Lands when they occur, but are not expected to alter their function. Overall we expect these treatments to provide a net habitat improvement for the spotted owl.

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owls.

Overall, the aggregate effects of these activities in Congressionally Reserved Lands is expected to be small compared to the overall size and distribution of Congressionally Reserved Lands in the action area. Although short-term impacts to spotted owl habitat are expected, these projects will be spread out spatially across the Congressionally Reserved Lands landscape and temporally over the 50 years of the PRMP. All actions will be subject to a more specific section 7 consultation at the time the project is proposed.

Late-Successional Reserve

Late-successional reserves are proposed to be designated on 948,466 acres of BLM land as part of the PRMP, which is 38 percent of the overall BLM land base (BLM 2016a, p. 34). LSRs are proposed to be designated for the moist and dry forests and have the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- *Maintain nesting-roosting habitat for the northern spotted owl and nesting habitat for the marbled murrelet.*
- *Promote the development of nesting-roosting habitat for the northern spotted owl in stands that do not currently support northern spotted owl nesting and roosting.*
- *Promote the development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.*
- *Promote the development and maintenance of foraging habitat for the northern spotted owl, including creating and maintaining habitat to increase diversity and abundance of prey for the northern spotted owl.*

Management Direction

- *Manage for large blocks of northern spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks.*
- *In stands that are currently northern spotted owl nesting-roosting habitat, maintain nesting-roosting habitat function, regardless of northern spotted owl occupancy.*
- *Protect⁴¹ stands of older, structurally-complex conifer forest. Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat.*

41 **Protect older, structurally-complex conifer forest** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and logs for streams, the construction, modification, maintenance and removal of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl and marbled murrelet life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival; and marbled murrelet nesting habitat continues to support marbled murrelet nesting. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and

- *Undertake activities such as individual tree removal, including the felling of hazard trees and stream logs, and the construction of linear and non-linear rights-of-way or other facilities, including communication sites, as long as northern spotted owl nesting-roosting habitat continues to support northern spotted owl nesting and roosting at the stand level, and northern spotted owl dispersal habitat continues to support northern spotted owl movement and survival at the landscape level.*
 - *Protect marbled murrelet occupied stands. In this context, protect marbled murrelet occupied stands means to prohibit activities in the occupied stand except for the following: felling of live or dead hazard trees, felling trees for habitat restoration, and the construction or maintenance of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the occupied stand continues to support marbled murrelet nesting. Implement wildfire management actions and activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, as long as the occupied stand continues to support marbled murrelet nesting.*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *Cut individual green trees in the Late-Successional Reserve and move for placement in streams for fish habitat restoration.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.*
- *In stands that are not northern spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of northern spotted owl nesting-roosting habitat or improve the quality of northern spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens.*

disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat or remove marbled murrelet habitat.

- *Utilize integrated vegetation management⁴² in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*
 - *Promote the development and retention of large, open grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status species.*
 - *Promote or enhance the development of structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In stands ≥ 10 acres treated with selection harvest or commercial thinning,*
 - *Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings⁴³ more than 4 acres in size.*
 - *Do not create group selection openings on more than 25 percent of the stand area.*
 - *Leave untreated skips on at least 10 percent of the stand area.*
- *In stands < 10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.*
- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial*

⁴² **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include but are not limited to vegetation control, planting, snag creation, prescribed fire, thinning, single tree selection harvest, and group selection harvest.

⁴³ **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7 " DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

regeneration to reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.

- *When conducting commercial harvest, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels need not be attained on every acre. When creating the required number of snags, locate them according to the following criteria:*
 - *Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
 - *Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.*
 - *Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years.*

Table 215. Snag creation levels within the Late-Successional Reserve and Riparian Reserve. Table A-3 in BLM (2016a).

District/ Field Office	Province	Snags/Acre		
		> 20" DBH	> 10" DBH	Total Snags
Coos Bay	All	5	5	10
Eugene	OR Coast Range	5	5	10
	Western Cascades	5	20	25
Klamath Falls	All	2	5	7
Medford	All	1	1	2
Roseburg	OR Coast Range	6	7	13
	Western Cascades	6	25	31
	Klamath	1	1	2
Salem	OR Coast Range	5	5	10
	Western Cascades	5	20	25

- *When conducting fuels reduction or prescribed fire treatments, retain down woody material at levels specified in Table A-4 post-treatment. Meet down wood levels as an average at the scale of the treatment area following the treatment; down wood levels need not be attained on every acre.*

Table 216. Down woody material retention levels when implementing fuels reduction or prescribed fire treatments within the Late-Successional Reserve and Riparian Reserve. Table A-4 in BLM (2016a).

District/ Field Office	Province	Down Wood Percent Cover *
Coos Bay	All	6%
Eugene	OR Coast Range	6%
	Western Cascades	10%
Klamath Falls	All	3%
Medford	All	2%
Roseburg	OR Coast Range	6%
	Western Cascades	10%
	Klamath	2%
Salem	OR Coast Range	6%
	Western Cascades	10%

* Percent cover of down wood > 4" diameter.

- *Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*

Late-Successional Reserve – Dry

Management Objectives

- *See Late-Successional Reserve management objectives.*
- *Enable forests to: (1) recover from past management measures, (2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, (3) ensure positive or neutral ecological impacts from wildfire, and (4) contribute to northern spotted owl recovery.*
- *Reduce the risk of loss of key late-successional structure through the development of vertical and horizontal heterogeneity.*
- *Increase diversity of stocking levels and size classes within the stand and the landscape.*

Management Direction

- *See Late-Successional Reserve management direction.*
- *Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the South River Field Office of Roseburg District to at least 4,500 acres per decade.*
- *Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the Medford District to at least 17,000 acres per decade.*
- *When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus spp.*) trees that are ≥ 36 " DBH and were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus spp.*) trees > 24 " DBH, except where removal is necessary for safety or operational reasons.*
 - *Identify Douglas-fir and pine trees established prior to 1850 for retention based on a BLM evaluation of bark, limb, trunk, and crown characteristics.*
 - *Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire related mortality.*
- *Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale crown fire, operationally strategic locations, and potential for hazard reduction near highly valued resources.*
- *Modify fuel beds to produce characteristic fire behavior and fire effects representative of the fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.*
- *Apply prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime). Based on site-specific considerations, take measures to prevent and control fire regime altering species.*
- *Apply prescribed fire and mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain or improve fire-resilient conditions.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, removed through a commercial timber sale, or treated as necessary for fuels reduction.*

A primary objective of the LSRs in both the moist and dry forest is to provide large blocks of spotted owl and murrelet habitat across enough of the landscape to support at least 25 nesting pairs of spotted owls spaced no more than 12 miles apart within each of the physiographic

provinces in the action area. Where blocks this size do not develop within 30-50 years without timber harvest the LSRs were designed to develop small blocks of habitat spaced no more than 7 miles from large blocks or from other small blocks. The proposed LSR management designed to reach these goals includes the retention of existing spotted owl habitat and the development through silvicultural methods of future spotted owl habitat. These proposed LSRs include the mapped areas that are older, structurally complex forest stands as mapped by each individual BLM district which represents the stands described in Recovery Action 32 in the spotted owl recovery plan (USFWS 2011b, p. III-67). LSRs are expected to support the majority of reproductive spotted owl sites within the action area over time.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. Because the goal of LSRs is to provide for large amounts of spotted owl nesting/roosting habitat across a large landscape, stand management of these lands is designed to be consistent with the production of older, larger trees and natural processes. There are several potential activities that are allowed for logistical and operational reasons in LSRs that have the potential to impact individual stands within the LSRs. These activities include timber harvest or silvicultural activities, including fuels treatments, selection harvest, yarding corridors, skid trails, silvicultural treatments, selection harvest or commercial thinning.

In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts for some subset of projects that can be generally described here. Although an overall management goal for Late-successional Reserves is to improve habitat conditions for spotted owls and murrelets, there is some potential to remove or alter spotted owl habitat as these actions are carried out. These impacts will be minimized by incorporating best management practices. Some activities that may have localized impacts on spotted owl habitat include (BLM 2016a, pp. A14 - A19):

- *Felling of hazard trees*
- *Yarding corridors, skid trails, road construction*
- *Construction of linear and non-linear rights-of-way*
- *Cutting or tipping trees for fish habitat restoration*
- *Wildfire suppression*
- *Fuels reduction*

- *Insect and disease control*

Timber activities in LSRs are designed to speed the development of older forest structure, such as spotted owl habitat, retain species and compositional heterogeneity, retain and promote species diversity, treat insect infestations and reduce the threat from wildfires. These activities may target non-Douglas fir species, but are designed to retain these species that are being crowded out in areas where they currently occur and are adapted for persistence.

The reduction of fuels is designed to help protect LSRs from high-intensity wildfires and, therefore, retain greater amounts of older forest on the landscape. In the dry LSRs wildfire can remove spotted owl habitat across vast areas under stand-replacing fire conditions. The intent of treating these acres is to preclude these effects which would result in the development of forest stands starting in the stand initiation phase, which can take 80 years or more. Treatments for insect infestations are similarly designed to stop or slow the spread of insects that can stress or kill conifer and alter the function of stands. These activities are expected to address specific situations within the LSRs when they occur, but are not expected to alter the function of the LSR network or individual LSRs. Spotted owl habitat can be fairly heterogeneous and can withstand such operations at the landscape scale. Overall we expect these treatments to provide a more diverse landscape and protect against losses of habitat and, so, are expected to result in a net habitat improvement for the spotted owl.

The removal of individual or small groups of trees is for aquatic restoration or to address hazards to human health and structures is expected to be a minor component of LSR management and is not expected to alter the function at any scale above the stand, if even that. The majority of aquatic habitat improvement trees are expected to be from the Riparian Reserve allocation (trees in Riparian Reserves can be tipped directly into streams with root wads intact, etc.) and hazard tree management tends to include one or a small group of trees. These activities would need to maintain the function of the stand post-treatment if conducted in spotted owl nesting/roosting habitat.

The construction of linear and non-linear rights-of-way or other facilities is only allowed in spotted owl nesting/roosting habitat when the stand will continue to support spotted owl nesting/roosting. Linear rights of way are not expected to alter the function of a spotted owl home range because spotted owls are capable of crossing over small forest gaps such as roads and clearings without experiencing difficulty. Non-linear rights-of-way will not alter the function of spotted owl nesting/roosting habitat. Facilities such as communication sites generally have a small footprint at the scale of an individual LSR and are not expected to alter the function of an individual LSR, although they have the potential to preclude the development of nesting/roosting habitat and spotted owl critical habitat PBFs due to the construction of small buildings, communication towers, etc.

Except for activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities, management actions in older, structurally-complex conifer forest would be required to retain the function of the stands that existed prior to the treatment. These stands represent Recovery Action 32 stands from the spotted owl recovery plan (USFWS 2011b, p. III-67).

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owls.

Overall the aggregate effects of these activities in LSRs is expected to be small compared to the overall size and distribution of LSRs in the action area, and these effects are not expected to preclude the effectiveness of this long-term ecosystem approach to management of the LSRs. Although short-term impacts to spotted owl habitat are expected, these projects will be spread out spatially across the LSR landscape and temporally over the 50 years of the PRMP. Those actions that may preclude the development of spotted owl habitat and critical habitat are not expected to be of a scale that will impact the function of any particular LSR or the LSR network. All actions will be subject to a more specific section 7 consultation at the time the project is proposed.

Riparian Reserve

Riparian Reserves make up 635,717 acres of the BLM lands within the action area, which is 26 percent of the BLM landbase. Riparian Reserve widths vary across the landscape and are described in the BA (BLM 2016a, p. A21-A29). The Riparian Reserves have the following management objectives (BLM 2016a, p. A19):

- *Contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.*
- *Maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.*
- *Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.*
- *Meet ODEQ water quality criteria.*
- *Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.*
- *Maintain high quality waters within ODEQ designated Source Water Protection watersheds.*

The BLM intends to meet these objectives by implementing the following management direction (BLM 2016a, pp. A19-A31):

Table 217. Riparian Reserve distance by water feature. Table A-5 in BLM (2016a).

Feature	Riparian Reserve Distance*
<i>Fish-bearing streams and perennial streams</i>	<i>One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of a stream</i>
<i>Intermittent, non-fish-bearing streams</i>	<i>Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of a stream</i>
	<i>Class III subwatersheds: 50' from the ordinary high water line on each side of a stream</i>
<i>Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails</i>	<i>The extent of the unstable area. Where there is a stable area between such an unstable area and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.</i>
<i>Lakes, natural ponds > 1 acre, and wetlands > 1 acre</i>	<i>100' extending from the ordinary high water line</i>
<i>Natural ponds < 1 acre and wetlands < 1 acre (including seeps and springs), and constructed water impoundments of any size</i>	<i>25' extending from the ordinary high water line</i>

* Reported distances are measured as slope distance.

Table 218. Zone-specific management direction for streams in Class I subwatersheds for Riparian Reserve - Moist. Table A-6 in BLM (2016a).

<i>Fish-bearing streams and perennial streams</i>
<i>Inner Zone (0–120 feet)</i>
<i>Do not thin stands, except for—</i>
<i>SOD treatments and</i> <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

Outer Zone (120 feet to one site-potential tree height)

Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.

Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:

- Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.*

Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

<i>Intermittent, non-fish-bearing streams</i>
<i>Inner Zone (0–50 feet)</i>
<i>Do not thin stands, except for—</i> <i>SOD treatments; and</i> <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>
<i>Middle Zone (50–120 feet)</i>
<i>Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Remove cut trees only as needed for safety or operational reasons, or to meet the tree-tipping management direction described above.</i>
<i>Outer Zone (120 feet to one site-potential tree height)</i>
<i>Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> <i>Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> <i>Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>

Table 219. Zone-specific management direction for streams in Class II subwatersheds for Riparian Reserve - Moist. Table A-7 in BLM (2016a).

<i>Fish-bearing streams and perennial streams</i>
<i>Inner Zone (0–120 feet)</i>
<i>Do not thin stands, except for—</i> • <i>SOD treatments; and</i> • <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>
<i>Outer Zone (120 feet to one site-potential tree height)</i>
<i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> • <i>Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> • <i>Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>

<i>Intermittent, non-fish-bearing streams</i>
<i>Inner Zone (0–50 feet)</i>
<i>Do not thin stands, except for—</i> <i>SOD treatments</i> <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>
<i>Outer Zone (50 feet to one site-potential tree height)</i>
<i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> <i>Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> <i>Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>

Table 220. Zone-specific management direction for streams in Class III subwatersheds for Riparian Reserve - Moist. Table A-8 in BLM (2015a).

<i>Fish-bearing streams and perennial streams</i>
<i>Inner Zone (0–120 feet)</i>
<i>Do not thin stands, except for—</i> • <i>SOD treatments; and</i> • <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>
<i>Outer Zone (120 feet to one site-potential tree height)</i>
<i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in -3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> • <i>Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> • <i>Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>
<i>Intermittent, non-fish-bearing streams (0-50 feet)</i>
<i>Do not thin stands, except for—</i> • <i>SOD treatments; and</i> • <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

Table 221. Zone-specific management direction for streams in Class I subwatersheds for Riparian Reserve - Dry. Table A-10 in BLM (2016a).

Fish-bearing streams and perennial streams
<i>Inner Zone (0–120 feet)</i>
Do not thin stands, except for— - Fuels treatments as needed to reduce the risk of stand-replacing crown fires; do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and - as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
<i>Outer Zone (120 feet to one site-potential tree height)</i>
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing crown fires. Retain at least 30 percent canopy cover and 60 trees per acre, expressed as an average across the treated portion of the Riparian Reserve. Make available for sale the merchantable timber from thinning and other silvicultural treatments. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3. within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Meet the snag creation amounts as an average at the scale of the portion of the harvest unit within the Riparian Reserve, but may not be attained on every acre. For implementation: - Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. - Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Use trees from any species to meet snag creation levels. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Intermittent, non-fish-bearing streams
<i>Inner Zone (0–50 feet)</i>
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
<i>Middle Zone (50–120 feet)</i>
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Remove cut trees as needed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above. Merchantable timber from thinning, fuels reduction, and other silvicultural treatments that must be removed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above may be made available for sale.

<i>Outer Zone (120 feet to one site-potential tree height)</i>
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3. within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation— • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 222. Zone-specific management direction for streams in Class II subwatersheds for Riparian Reserve - Dry. Table A-11 in BLM (2016a).

Fish-bearing streams and perennial streams
<i>Inner Zone (0–120 feet)</i>
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires; do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning

<i>Outer Zone (120 feet to one site-potential tree height)</i>
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3. within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
<i>Inner Zone (0–50 feet)</i>
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires; do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning

<i>Outer Zone (50 feet to one site-potential tree height)</i>
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3. within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 223. Zone-specific management direction for streams in Class III subwatersheds for Riparian Reserve - Dry. Table A-12 in BLM (2016a).

Fish-bearing streams and perennial streams
<i>Inner Zone (0–120 feet)</i>
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

<i>Outer Zone (120 feet to one site-potential tree height)</i>
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3. within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation— • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams (0–50 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

- *Maintain access to roads and facilities by removing hazard trees and blowdown. Retain logs as down woody material or move for placement in streams for fish habitat restoration, unless removal of logs, including through commercial harvest, is necessary to accomplish removal of hazard trees or blowdown to maintain access to roads and facilities.*
- *Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.*

- Use site-specific BMPs (**Appendix J** of the Proposed RMP) to maintain water quality during land management actions, including discretionary actions of others crossing BLM-administered lands.
- In new recreational developments, install sanitation systems that maintain water quality (e.g., sealed vault or similar).
- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).
- During silvicultural treatment of stands, retain existing—
 - snags $\geq 6''$ dbh
 - down woody material $\geq 6''$ in diameter at the large end and > 20' in length

except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.

- Prohibit timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.
- Implement Sudden Oak Death (SOD) eradication activities that do not exceed (at the watershed scale (HUC 10))—
 - The removal of > 30 percent canopy cover over a contiguous 0.5 mile stream length or removal of > 50 percent canopy cover over a contiguous 0.25 mile stream length for small perennial streams (active channel width < 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained;
 - The removal of > 50 percent canopy cover over a contiguous 0.5 mile stream length for medium-large perennial streams (active channel width > 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained; and
 - A limit of 3 miles of treatment for any 5-year period and 3 percent of the total Federal perennial stream miles.

Implement SOD eradication activities that exceed these limitations only consistent with existing ESA consultation documents that address SOD eradication activities in the decision area.

- Cut or tip individual green trees and move for fish habitat restoration.
- Cut or tip individual trees directly into the stream channel for fish habitat restoration.

- *Tree-tipping: When conducting commercial thinning⁴⁴ in any portion of the Outer Zone in a stand in all watershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the treated stand. Leave felled or tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone.*
- *Promote beaver habitat restoration where the presence of beaver and their associated dams would improve fish and aquatic habitat.*
- *Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.*
- *For constructed water impoundments and constructed ponds:*
 - *Follow inspection guidelines for BLM infrastructure (e.g., dams and spillway structures), and implement maintenance and repair as needed.*
 - *Dredge constructed water impoundments as necessary to maintain capacity.*
 - *Maintain vegetation, access, and plumbing associated with fire water sources for all types of firefighting equipment (e.g., engines, aircraft, and tenders).*
- *Mining operators with an accepted Notice or approved Plan of Operations will comply with performance standards (43 CFR 3809.420), including all applicable State and Federal water quality standards.*

Because the Riparian Reserves are being established to provide for the producing large wood that will contribute to stream habitat structure, protecting cold, clear water, and the conservation and recovery of listed fish, the stand management of these lands is expected to be consistent with the production of older, larger trees and natural processes. These management objectives are expected to provide for the protection and development of high-quality spotted owl habitat across the BLM portion of the action area, which will support spotted owl nesting/roosting, foraging and dispersal. Although spotted owl habitat development was not a goal of management within the Riparian Reserves, the retention and development of large trees for wood in the streams and for stream shading is consistent and compatible with the needs of the spotted owls. The distribution of Riparian Reserves across the landscape is expected to function for maintaining a well-distributed spotted owl population within the action area and to assist in spotted owl movement across the action area. Thinning in the inner zone of fish-bearing streams and perennial streams is only allowed under specific circumstances intended to promote

⁴⁴ In the context of management direction for the Riparian Reserve, **commercial thinning** means stand thinning in which any of the cut trees are removed from the stand for timber volume. Commercial thinning in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. Commercial thinning may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

conservation or restoration of improved riparian conditions (Sudden Oak Death treatments and for Individual tree falling or tipping for restoration), which will allow for the growth and development of large trees in structurally complex stands over time. Where spotted owl habitat does not currently exist we expect it will develop under the proposed management direction. In the outer zone thinning is allowed to develop large trees only when needed to provide trees that would function as stable wood in the stream in Class I subwatersheds or to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence in Class II and III subwatersheds. Stands likely to be treated in this manner include plantations or overstocked stands that are on a trajectory towards stem exclusion. These stands are likely to stagnate before becoming structurally complex; therefore, such treatments are expected to result in a net habitat improvement for the spotted owl. Potential activities along intermittent, non-fish bearing streams are similarly geared towards growing large trees (with the intent that some will eventually fall or be pulled into the rivers or streams and create fish habitat) which should provide a long-term retention and recruitment of complex forested habitat over time. In addition, where thinning is allowed, there is a focus on creating and maintaining snags and downed wood, both of which are important habitat components of spotted owl foraging and dispersal habitat.

As discussed above, the primary intent of BLM's Riparian Reserve management direction is to provide for water quality and the habitat conditions necessary for the conservation of listed fish and other sensitive aquatic species, but will also provide incidental benefits to the conservation of listed upland species such as the spotted owl. The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale.

In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts for some subset of projects that can be generally described here. Although the overall management goal for Riparian Reserves is to improve habitat conditions for fish and upland species of concern, there is some potential to remove spotted owl habitat as these actions are carried out. These impacts will be minimized by incorporating best management practices. Some activities that may have localized impacts on spotted owl habitat include (BLM 2016a, pp. A19-A20):

- *Felling of hazard trees*

- *Yarding corridors, skid trails, road construction, stream crossings where there is no operationally feasible and economically viable alternative*
- *Implement Sudden Oak Death (SOD) eradication*
- *Cutting or tipping trees for fish habitat restoration*
- *Wildfire suppression*
- *Insect and disease control*

The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees. Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The ARBOII consultation does not anticipate any death or injury of spotted owls will result in the form of habitat removal. Because the PRMP will follow the ARBOII consultation we do not anticipate the loss of any spotted owls from these projects. The removal of single or small clumps of trees is not expected to affect the overall function of the Riparian Reserves within the action area. Site-specific section 7 consultation will be conducted when these projects are implemented, which will contain specific information on the anticipated location and effects of these projects.

Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet and are limited temporally. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible. Treatment for insects and other diseases also involves the potential for the removal of canopy and sub-canopy trees at the local scale. Although these treatments, if needed, have the potential to affect spotted owls at the stand scale, they are not expected to alter the function of the Riparian Reserves at any scale greater than the local level, and are not expected to diminish the value of the Riparian Reserves for the conservation of spotted owls.

The potential construction of yarding corridors, skid trails and road construction where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. If these activities are implemented in Riparian Reserves the BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites as they implement the management direction and the guidance in the Proposed RMP (Hardt 2016b, pers. comm.). Yarding corridors, skid trails and road construction create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives of the Riparian Reserve land allocation. Spotted owls are readily able to fly across small openings in the forest canopy and are not expected to suffer demographic consequences from these activities. Stream crossings are subject to the ARBOII consultation (USFWS 2013) PDCs which do not anticipate habitat reduction impacts to spotted owls. Although there could be some disturbance effects from stream crossings, to date there has not been any ARBOII projects that have disrupted these species.

Wildfire suppression has the potential to occur in all land use allocations and is addressed separately below as part of the Fire and Fuels resource program.

District-Designated Reserves

District Designated Reserves are proposed to be designated on 223,142 acres of BLM land as part of the PRMP, which is 9 percent of the overall BLM land base (BLM 2016a, p. 34).

District-Designated Reserves include lands that are reserved from sustained-yield timber production for a variety of reasons, including (BLM 2016c, pp. 39-40):

- *Areas that the BLM has constructed for specific purposes (e.g., roads, buildings, maintenance yards, seed orchards, and other facilities and infrastructure);*
- *Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops);*
- *Areas of Critical Environmental Concern, including Research Natural Areas, that would not overlap the Harvest Land Base; and*
- *Other reserves (e.g., Special Recreation Management Areas that would not overlap the Harvest Land Base, areas protected for Bureau Sensitive species, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics).*

District Designated reserves include the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- *Maintain the values and resources for which the BLM has reserved these areas from sustained-yield timber production.*

Management Direction

- *Manage constructed facilities and infrastructure, such as seed orchards, roads, buildings, quarries, communication sites, pump chances, heliponds, and maintenance yards, as needed for the purposes for which the BLM constructed them.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.*
- *Manage seed orchards consistent with the Seed Orchard Records of Decision for Integrated Pest Management.*

District-Designated Reserve – Timber Production Capability Classification

Management Objectives

- *See District-Designated Reserves management objectives.*

Management Direction

- *Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).*
- *Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system.*
- *Designate additional lands as District-Designated Reserve – Timber Production Capability Classification through updates to the Timber Production Capability Classification system and remove those lands from the Harvest Land Base when examinations indicate that those lands meet the criteria for reservation.*
- *Un-designate lands as District-Designated Reserve – Timber Production Capability Classification and return those lands to the Harvest Land Base through updates to the Timber Production Capability Classification system when examinations indicate that those lands do not meet the criteria for reservation.*

District-Designated Reserve – Lands Managed for their Wilderness Characteristics⁴⁵

Management Objectives

- *Protect wilderness characteristics (i.e., roadlessness, naturalness, opportunities for solitude and primitive unconfined recreation, and identified supplemental values), while allowing competing resource demands that do not conflict with preserving long-term wilderness characteristics.*

⁴⁵ These objectives and direction apply to lands outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is proposing to manage for the protection of those wilderness characteristics.

Management Direction

- *Allow mechanical vegetation treatment consistent with Visual Resource Management Class II for the purpose of improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*
- *Do not construct new buildings or new temporary or permanent roads.*
- *Allow fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and other vegetation management only if any reductions in wilderness characteristics are temporary and wilderness characteristics are protected over the long term.*
- *Do not use ground-disturbing equipment or aerial application of non-fugitive retardant during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property or where use is essential for wildfire control.*
- *For lands identified for protection of wilderness characteristics where the BLM-administered lands rely on adjoining Federal lands being managed to protect the same values to meet the size criteria (BLM Manual 6310 – Conducting Wilderness Characteristics Inventory on BLM Lands; USDI BLM 2012) and the agency managing the adjoining lands revises its land use plan to no longer protect wilderness characteristics, the BLM-administered lands will no longer meet the minimum size criteria and thus will no longer possess wilderness characteristics.*
 - *Wilderness characteristics will no longer be protected on these lands and the accompanying land use plan allocations (e.g., right-of-way exclusion, Visual Resource Management Class II) applied specifically to protect the wilderness characteristics will automatically be dropped as part of plan maintenance.*
 - *These lands will then be managed consistent with the land use allocations, management objectives, and management direction of comparable or adjacent BLM-administered lands.*

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects in District Designated Reserves that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these

individual projects are implemented there may be associated short term or localized adverse impacts for some subset of projects that can be generally described here.

Overall the aggregate effects of these activities in District-Designated Reserves is expected to be small compared to the overall size and distribution of District-Designated Reserves in the action area. Although short-term impacts to spotted owl habitat are expected, these projects will be spread out spatially across the District-Designated Reserve landscape and temporally over the 50 years of the PRMP.

Any future changes in boundaries of District-Designated Reserves – Lands Managed for their Wilderness Characteristics due to changes in management of adjoining Federal lands would require an RMP amendment (Hardt 2016a, pers. comm.) with the appropriate NEPA and ESA compliance, and, so, are not subject to this consultation.

Harvest Land Base

The Harvest Land Base is proposed to be designated on 469,215 acres of BLM land. Although this is 19 percent of the BLM lands in the action area, there are no spotted owls in the Eastside Management Area (7 percent of the BLM lands), making the Harvest Land Base 20 percent of the BLM lands that support spotted owls. This is the land-use allocation where programmed timber harvest will occur. The Harvest Land Base is divided into three categories: the Moderate Intensity Timber Area (180,549 acres), the Low Intensity Timber Area (89,126 acres) and the Uneven-Aged Timber Area (199,541 acres). The potential effects of designation and implementation of the Harvest Land Base LUAs on spotted owls and spotted owl habitat were modeled by BLM and are addressed in the Jeopardy Analysis below. What follows here is a programmatic description of the sub-categories in the Harvest Land Base LUA. The management direction for the Harvest Land Base includes (BLM 2016a, pp. A8-A14):

Management Objectives

- *Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.*
- *Offer for sale the declared Allowable Sale Quantity of timber.*
- *Recover economic value from timber following disturbances, such as fires, windstorms, disease, or insect infestations.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.*
- *Enhance the economic value of timber in forest stands.*

Management Direction

- *Conduct silvicultural treatments to contribute timber volume to the Allowable Sale Quantity.*

- *Conduct silvicultural treatments to enhance timber values and to reduce fire risks and insect and disease outbreaks.*
- *Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.*
- *Employ site preparation methods such as mechanical treatments (e.g., machine piling), manual treatments (e.g., brushing), and prescribed burns to prepare newly harvested and inadequately stocked areas for the regeneration of desirable tree species.*
- *Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.*
- *During commercial thinning, selection harvest,⁴⁶ or regeneration harvest treatments of stands, retain existing—*
 - *Snags > 20" DBH*
 - *Snags 6-20" DBH in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook)*
 - *Down woody material > 20" in diameter at the large end and > 20' in length*
 - *Down woody material 6-20" in diameter at the large end and > 20' in length in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook) except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6 " DBH felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *If not suitable for commercial removal, make felled hazard trees available for habitat restoration purposes in any land use allocation.*
- *When implementing commercial harvest,⁴⁷ except timber salvage, create new snags in the amounts and sizes specified in Table A-2*

⁴⁶ **Selection harvest** is a type of commercial harvesting. Selection harvesting generally involves removing individual trees or groups of trees up to four acres in size and is used as part of an uneven-aged management regime, or to create uneven-aged stands.

⁴⁷ In the context of management direction for the Harvest Land Base, **commercial harvest** means stand harvesting in which some or all of the cut trees are removed from the stand for timber volume and a monetary value assessed. Commercial harvest in this context does not include the following:

- Individual tree falling
- Stand thinning in which all of the cut trees are left in the stand for restoration purposes or the cut trees are removed for firewood or other non-commercial harvest
- Fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber

within 1 year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels are not required to be attained on every acre. When creating the required number of snags, locate them according to the following criteria:

- *Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- *Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.*
- *Concentrate the creation of snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Meet snag creation levels with trees from any species.*

Table 224. Snag creation levels within the Harvest Land Base. Table A-2 in BLM (2016a).

District/ Field Office	Province	Number of Snags/Acre Created Within 1 Year of Yarding the Timber in the Timber Sale		
		> 20" DBH	> 10" DBH	Total Snags
Coos Bay	All	1	-	1
Eugene	OR Coast Range	1	-	1
	Western Cascades	1	-	1
Klamath Falls	All	1	-	1
Medford	All	-	-	-
Roseburg	OR Coast Range	3	-	3
	Western Cascades	3	3	6
	Klamath	-	-	-
Salem	OR Coast Range	1	-	1
	Western Cascades	1	-	1

Commercial harvest may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

Harvest Land Base – Low Intensity Timber Area (LITA)

Management Objectives

- *See Harvest Land Base management objectives.*
- *Provide complex early successional ecosystems.*
- *Develop diverse late-successional ecosystems for a portion of the rotation.*
- *Provide a variety of forest structural stages distributed both spatially and temporally.*

Management Direction

- *See Harvest Land Base management direction.*
- *Apply regeneration harvest for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Adjust the age class distribution in the LITA in each sustained-yield unit.*
 - *Manage insect and disease infestations.*
 - *Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Create growing space for hardwood and pine species persistence and regeneration.*
 - *Produce complex early successional ecosystems.*
 - *Reset stand development in overly dense stands that would not respond well to commercial thinning.*
- *In each regeneration harvest unit, retain 15–30 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both $\geq 40''$ DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.*
- *Conduct commercial thinning for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*

- *Recover anticipated mortality.*
- *Adjust stand composition or dominance.*
- *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *Improve stand merchantability and value.*
- *Increase or maintain vegetative species diversity.*
- *Promote or enhance the development of structural complexity.*
- *Create growing space for the creation or augmentation of Bureau Special Status plant populations.*
- *Create growing space for hardwood and pine persistence and regeneration.*
- *Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.*
 - *Conduct thinning to result in a stand average relative density between 25 percent and 45 percent after harvest.*
 - *Leave untreated areas (skips) and group selection openings⁴⁸ to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.*
 - *Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*
 - *In timber salvage harvest units, retain at least 15 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.*
- *For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre (including surviving green trees) within 10*

⁴⁸ **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7 " DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

years of the disturbance event, to the extent possible given safety and operational constraints.

Harvest Land Base – Moderate Intensity Timber Area (MITA)

Management Objectives

- *See Harvest Land Base management objectives.*
- *Provide complex early successional ecosystems.*
- *Develop diverse late-successional ecosystems for a portion of the rotation.*
- *Provide a variety of forest structural stages distributed both temporally and spatially.*

Management Direction

- *See Harvest Land Base management direction.*
- *Conduct regeneration harvest for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Adjust the age class distribution in the MITA in each sustained-yield unit.*
 - *Manage insect and disease infestations.*
 - *Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Create growing space for hardwood and pine species persistence and regeneration.*
 - *Produce complex early successional ecosystems.*
 - *Reset stand development in overly dense stands that would not respond well to commercial thinning.*
- *In each regeneration harvest unit, retain 5–15 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*

- *After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*
- *Conduct commercial thinning for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Recover anticipated mortality.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
 - *Improve stand merchantability and value.*
 - *Increase or maintain vegetative species diversity.*
 - *Promote or enhance the development of structural complexity.*
 - *Create growing space for the creation or augmentation of Bureau Special Status plant populations.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
- *Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.*
 - *Conduct thinning to result in stand average relative density between 25 percent and 45 percent after harvest.*
 - *Leave untreated areas (skips) and group selection openings to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.*
 - *Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*
 - *In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
 - *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*

- *For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.*

Harvest Land Base – Uneven-aged Timber Area (UTA)

Management Objectives

- *See Harvest Land Base management objectives.*
- *Increase diversity of stocking levels and size classes within and among the stands.*

Management Direction

- *See Harvest Land Base management direction.*
- *Utilize integrated vegetation management⁴⁹ in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Promote the development and retention of large, open grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Promote or enhance the development of structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*

⁴⁹ **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include, but are not limited to, vegetation control, planting, snag creation, prescribed fire, biomass removal, thinning, single tree selection harvest, and group selection harvest.

- *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In forest stands ≥ 10 acres treated with selection harvest or commercial thinning, harvest to result in stand average relative density between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings more than 4 acres in size.*
 - *Do not create group selection openings on more than 30 percent of the stand area.*
 - *Leave untreated areas (skips) on at least 10 percent of the stand area.*
- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the opening of at least 150 trees per acre within 5 years of harvest.*
- *When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus spp.*) trees that are both ≥ 36 " DBH and that the BLM identifies were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus spp.*) trees > 24 " DBH, except where removal is necessary for safety or operational reasons.*
 - *The BLM identification of Douglas-fir and pine trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
 - *Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire-related mortality.*
 - *Apply prescribed fire for any of the following:*
 - *Promote the development and retention of large, open-grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Promote or enhance the development of stand structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*

- *Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale, high-intensity fire, operationally strategic locations, and near highly valued resources and assets.*
- *Modify fuel loading to produce fire behavior and fire effects representative of the natural fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.*
- *Implement prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime).*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*
 - *In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
 - *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*

The objectives of the Harvest Land Base are intended to produce a consistent and reliable source of timber to meet the Allowable Sale Quantity of the BLM districts within the action area. Timber harvest under the PRMP involves the potential planning and implementation of timber sales or groups of timber sales that meet the management direction of the Harvest Land Base category and includes, among other aspects, the layout of units, the survey and scaling of timber, the construction of roads and landings as needed, the advertising, selling and awarding of sales, the harvest of the timber, the hauling of logs and the reforestation activities after the harvest.

Although this potential allocation is not intended to be relied on for demographic support of spotted owls, the management direction includes provisions that would contribute to the development of late-successional habitat over time. This habitat may not remain on the landscape for the long-term, but the presence of spotted owl habitat within the Harvest Land Base would assist in spotted owl movement across the landscape and could potentially provide refugia from barred owls. For example, in the UTA, vegetation management may be used as a tool to promote or enhance the development of structural complexity and heterogeneity. The BLM will retain all trees that are both ≥ 40 inch diameter at breast height (DBH) and that the BLM identifies were established prior to 1850, will meet snag and downed wood retention and creation levels in timber sales and retention levels in salvage sales, will retain untreated portions of harvest units in the MITA and the LITA, and has the option to employ natural reforestation techniques after timber harvest, salvage operations and disturbance events. Natural regeneration techniques are expected to provide for a complex early-seral ecosystem in the short-term and to better emulate natural forest stand development over the long-term. This should result in greater

stand diversity and the need for fewer entries for those stands that are managed for the development of diverse late-successional ecosystems.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. In the BA the BLM was not able to provide any precise estimates of the extent of these aspects of timber harvest that may contribute to the development of structural characteristics useful to the spotted owl over the next 50 years as part of the PRMP. Each individual project will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. When these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of their effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above. The Harvest Land Base portion of the BLM landscape is expected to provide less and less contribution to spotted owl demographics over time, while the reserve portion of the BLM lands (approximately 75 percent) will provide the necessary contributions for spotted owl conservation.

Areas of Critical Environmental Concern

BLM summarizes the proposed designation as (BLM 2016a, p. 38):

- *“Maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.”*

The PRMP includes the potential proposed designations of the Brownson Ridge, Cherry Creek RNA, Elk Creek, Euphoria Ridge, Grassy Mountain RNA, Heceta Sand Dunes ONA, High Peak–Moon Peak RNA, Lake Creek Falls, Mary’s Peak ONA, Nestucca River, North Fork Chetco, North Fork Coquille River, North Spit, Rocky Peak, Saddle Bag Mountain RNA, Upper Rock Creek and Valley of the Giants ACECs, all of which have the spotted owl and/or its critical habitat listed among the “relevant and important values” for each of these ACECs. The BLM proposes to manage these areas to maintain spotted owl habitat and critical habitat, which is beneficial for spotted owls in these areas. According to the BLM (McGraw 2016, pers. comm.) there are 33,777 acres of spotted owl nesting/roosting habitat within ACECs in the action area, and 22,088 acres of dispersal habitat within ACECs in the action area. Areas of Critical Environmental Concern are additional designations which overlay the land-use allocations discussed above. Although the spotted owl is listed among the “relevant and important values” for each of the ACECs, the proposed management direction does not prohibit impacts to spotted owls. Particularly, when managing for spotted owl habitat, as mentioned above, there are often short-term adverse effects that occur for the long-term benefit of developing habitat sooner than if a stand was left unmanaged.

The BLM estimates that the amount of habitat within ACECs will increase over the next 50 years through management and ingrowth to 44,045 acres of nesting/roosting habitat and 22,164 acres of dispersal habitat.

Resource Programs

Resource programs are potentially implemented across all LUAs. We anticipate that the effects from these resource programs will occur on BLM lands within the action area, and potentially on the lands included in the Coquille Tribal forest. Although we do not know how LUAs will be designated on Coquille lands, the management direction are considered to be synonymous with “standards and guidelines” per Title V of the Oregon Resource Conservation Act of 1996 (Public Law 104-208) and, as such, will establish the suite of possible management approaches available for the Coquille Forest. Whether implemented on BLM lands or Coquille lands, these management directions are expected to have similar impacts to spotted owl habitat.

An overall summary of resource program is displayed in Table 225.

Table 225. Habitat modification activities with the potential to adversely affect spotted owl habitat (BLM 2016a, Appendix A, entire).

Potential Actions associated with habitat modification (BLM 2016a,)	Anticipated Frequency	Potential Adverse Effects
Hazard trees	Yearly	The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees. Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The ARBOII consultation does not anticipate any death or injury of spotted owls will result in the form of habitat removal. Because the PRMP will follow the ARBOII consultation we do not anticipate the loss of any spotted owls from these projects. The removal of single or small clumps of trees is not expected to affect the overall function of the Riparian Reserves within the action area. Site-specific section 7 consultation will be conducted when these projects are implemented, which will contain specific information on the anticipated location and effects of these projects.

Trees for instream restoration	Yearly	The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees. Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The ARBOII consultation does not anticipate any death or injury of spotted owls will result in the form of habitat removal. Because the PRMP will follow the ARBOII consultation we do not anticipate the loss of any spotted owls from these projects. The removal of single or small clumps of trees is not expected to affect the overall function of the Riparian Reserves within the action area. Site-specific section 7 consultation will be conducted when these projects are implemented, which will contain specific information on the anticipated location and effects of these projects.
Culvert and bridge replacements	Yearly	Potential removal or downgrading of nesting/roosting and dispersal habitat may occur with bridge and culvert replacement as some trees may need to be removed in order to conduct replacements; however, the amount of removal is expected to be minimal as most bridge/culverts are associated with existing roads. Removal of small numbers of trees around bridges and culverts will have minimal effects on the character of the stands on which it occurs and this action should not alter the functionality of the stand for spotted owls. Potential noise disturbance to owls may occur if bridge and culvert replacements are conducted during breeding season.

Rights-of-ways	Yearly	The potential construction of yarding corridors, spur roads, and road construction in rights-of-way where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites as they implement management direction and the guidance in the PRMP (Hardt 2016b, pers. comm.). Yarding corridors, skid trails and road construction create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives of the Riparian Reserve land allocation. Spotted owls are readily able to fly across small openings in the forest canopy and are not expected to suffer demographic consequences from these activities. Stream crossings are subject to the ARBOII consultation (USFWS 2013) PDCs which do not anticipate habitat reduction impacts to spotted owls. Although there could be some disturbance effects from stream crossings, to date there has not been any ARBOII projects that have disrupted these species.
Spur roads –not with the harvest land base	Yearly	The potential construction of spur roads where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites as they implement management direction and the guidance in the PRMP (Hardt 2016b, pers. comm.). Spur roads create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives land use allocations outside the harvest land base. Spotted owls are readily able to fly across small openings in the forest canopy and are not expected to suffer demographic consequences from these activities.

Yarding corridors—not with the harvest land base	Yearly	The potential construction of yarding corridors outside the harvest land base where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites as they implement management direction and the guidance in the PRMP (Hardt 2016b, pers. comm.). Yarding corridors create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives of the land use allocation. Spotted owls are readily able to fly across small openings in the forest canopy and are not expected to suffer demographic consequences from these activities.
Other facilities	Sporadic, rare	Potential removal or downgrading of nesting/roosting and dispersal habitat may occur; however the areas affected would be small and proposed management direction for Recreation and Visitor Services would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl habitat.
Camp ground (broken out from other facilities)	Sporadic, rare	Potential removal or downgrading of nesting/roosting and dispersal habitat may occur; however the areas affected would be small and proposed management direction for Recreation and Visitor Services would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl habitat. Spotted owls that occupy territories located in close proximity to campgrounds and other recreational areas are expected to be acclimated to the current baseline levels of human activity that have occurred at these sites over time.
Wildfire suppression	Sporadic	Wildfire suppression has the potential to cause short-term impacts to spotted owls if it occurs in currently occupied owl sites. This impact has the potential to downgrade or remove nesting, roosting, foraging and dispersal habitat; however, there should be long term benefits to spotted owls if treatments reduce fire risk and promote development of late successional forest structure. The BLM was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. When these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects to spotted owls.

Fuels reduction	Sporadic	Fuels management has the potential to cause short-term impacts to spotted owls if it occurs in currently occupied owl sites. This impact has the potential to downgrade or remove nesting, roosting, foraging and dispersal habitat; however, there should be long term benefits to spotted owls if treatments reduce fire risk and promote development of late successional forest structure. Fuels reduction is more needed and therefore more likely to impact spotted owl in dry forest than in moist forest. Drier spotted owl nesting habitat represents more of a heterogeneous mosaic structure than wetter west side, which is a result of historic natural disturbances (Olson <i>et al.</i> 2004). These fuel management treatments are likely, to some extent, mimic these stands that have developed under these conditions. Reduction of understory and ladder fuels has the potential to negatively affect spotted owl prey. However, adjacent untreated stands are expected to continue to support spotted owl foraging.
Treating sudden oak death	Yearly	Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet and are limited temporally within Riparian Reserves. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible. Treatment for insects and other diseases also involves the potential for the removal of canopy and sub-canopy trees at the local scale. Although these treatments, if needed, have the potential to affect spotted owls at the stand scale, they are not expected to alter the function of the landscape at any scale greater than the local level, and are not expected to diminish the value of the landscape for the conservation of spotted owls.

Insect and disease control	Yearly	Treatments for insect infestations are designed to stop or slow the spread of insects that can stress or kill conifer and alter the function of conifer stands. These activities are expected to address specific situations within the land use allocations when they occur, but are not expected to alter their function. Although there may be short-term negative impacts to spotted owls and/or spotted owl habitat, we expect these treatments to provide a net habitat improvement for the spotted owls.
Other activities to improve the forest health	Yearly	Other activities to improve forest health are expected to address specific situations within the land use allocations when they occur, but are not expected to alter their function. While there may be short-term negative impacts to spotted owls and/or spotted owl habitat, we expect these treatments to provide a net habitat improvement for the spotted owls.
Timber sales and associated yarding corridors and spur roads	Yearly	Timber sales in the harvest land base and associated yarding corridors and spur roads have the potential to remove nest trees, remove or downgrade nesting/roosting and dispersal habitat and have the potential to disturb nesting spotted owls. Regeneration harvest, salvage, and group and single tree selection harvest will occur in the harvest land base. The harvest land base is not relied upon by the BLM for spotted owl nesting/roosting support. Yarding corridors and spur roads create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives of the land use allocation.
Oak restoration	Sporadic	The potential impact of oak restoration on spotted owls is the use of prescribed fire and selective silvicultural techniques to maintain and restore and maintain oak savannah in an open condition. In general, the management of habitat for rare plants and fungi is consistent with restoring and maintaining historic ecosystems. Spotted owls may occasionally forage in these areas but would not generally use them for nesting or roosting. Oak restoration is not expected to negatively affect spotted owls as these areas typically comprise very small proportions of spotted owl home ranges.

Meadow restoration	Sporadic	The potential impact of this program on spotted owls is the use of prescribed fire and selective silvicultural techniques to maintain populations of rare plants and to restore and maintain meadows in an open condition. Encroaching trees can change the character of a meadow which reduces the suitability for the native plants in that ecosystem. In general, the management of habitat for rare plants and fungi is consistent with restoring and maintaining historic ecosystems. For species such as Gentner's fritillary which exists in open canopy coniferous and oak forestlands, selective harvest and fire are tools to maintain the open canopy. Spotted owls may forage in these areas but would not generally use them for nesting or roosting. Spotted owl foraging opportunities would be likely to be enhanced by these tools since Gentner's fritillary occurs in a fire-adapted ecosystem along with spotted owls (though at differing scales). Management for rare plants that restores meadows is not expected to negatively affect spotted owls as meadows typically comprise very small proportions of spotted owl home ranges and ingrowth is likely to be younger stands at the margins of the forested area.
Pre-commercial thinning	Yearly	Precommercial thinning may result in removal of foraging and dispersal habitat, and while less likely, may also result in removal of nesting/roosting habitat. If thinning of dispersal habitat maintains a post-treatment canopy cover of 50-60 percent as specified in the Effects to the Northern Spotted Owl and its Critical Habitat section of the BA (BLM 2016a, p.198), the ability of these stands to effectively function as dispersal habitat for spotted owls may be reduced in the short term and their ability to support nesting, roosting, and foraging by spotted owls may be reduced considerably.

Road construction	Sporadic	The effects of potential new road construction are unlikely to have major effects on spotted owls based on the existing access network in the planning area and the associated low number of new requests for rights-of-way received by the BLM during the past 10 years, the ability of the BLM to route new rights-of-way to avoid or minimize impacts to other resource values and uses, and the low likelihood that a new road through spotted owl habitat would alter the functionality of the stand. New roads and rights of way are generally narrow, linear gaps in the forest that spotted owls are able to easily navigate and cross. When siting new roads the BLM is generally able to minimize the impacts to spotted owl habitat through the location of the roads and the timing of the construction.

Fire, Fuels and Wildfire Response

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.*
- *Fire management strategies would be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.*
- *Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic, large, high-intensity/high-severity wildfires.*
- *Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.*
- *Participate with communities bordering Federal lands in partnership with local, State, and Federal stakeholders to reduce the risks and threats from wildland fire.”*

The management direction for the Fire, Fuels and Wildfire Response- Response to Wildfire resource program (BLM 2016a, pp. A34-A35) includes:

- *Take immediate action to suppress all human-caused ignitions at the lowest cost commensurate with the protection of firefighter and public safety and welfare, and resulting in the fewest negative consequences to natural and cultural resources.*
- *Apply the full range of fire management options in responding to natural ignitions or escaped prescribed fires. These fires may be used to achieve management objectives when expected fire behavior and potential effects of a fire, or a part of a fire, are aligned with the management direction of the underlying land use allocation and affected resources.*

- *Create fuel beds or fuel breaks that reduce the potential for high-intensity fire spread within the wildland urban interface and in close proximity to other highly valued resources [i.e. NSO habitat].*
- *Treat both management activity fuels and natural hazardous fuels for any of the following reasons:*
 - o Modify the fuel profile (e.g., raise canopy base heights or reduce surface and ladder fuels and crown bulk density)*
 - o Reduce potential fire behavior (e.g., crown fire activity, wildfire spread, and intensity)*
 - o Reduce potential fire severity*
 - o Improve effective fire management opportunities within the Wildland Urban Interface or in close proximity to other highly valued resources*

Large wildfires have been the leading cause for loss of spotted owl habitat (PBFs 2, 3 and 4) on federal lands in recent years (Davis *et al.* 2015, p. 53). Over the past 20 years, 5.2 percent of late successional forest on federal lands in the NWFP area has been lost to wildfire (Davis *et al.* 2015, p. 48). Response to fire involves a number of actions. Fire lines to contain wildfires are typically located in strategic locations such as prominent ridge lines and road systems and are typically long and linear in shape. In some portions of the landscape, the same firelines have been used repeatedly over the years. Some fire lines, particularly direct lines, are occasionally not located on ridge lines or road systems because tactics, location of the fire, and other concerns dictate the most appropriate location for fighting the fire (Volpe 2016, pers. comm.).

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owls.

The Fire, Fuels, and Wildfire Response – Response to Wildfire resource programs the potential to result in the downgrading or removal of spotted owl habitat. However, this action is designed to conserve habitat across large landscapes by slowing or altering fire behavior which can result in stand-replacing fires that can remove spotted owl habitat, and spotted owls. Because actions where spotted owl habitat would be modified will be initiated when these areas are at high risk from impending wildfire, the long-term benefits to spotted owls and spotted habitat are expected to result in more spotted owl habitat across the range over time than if wildfire suppression activities did not occur. Therefore, the Service believes activities associated with fire suppression (*e.g.*, fire crew response, fireline, use of retardant, *etc.*) may potentially result in

short-term adverse effects to spotted owl habitat and spotted owls, but the long-term benefit to spotted owl habitat and spotted owls in areas that are spared high-severity burns are expected to far outweigh those short-term effects.

The BLM did not incorporate the creation of "shaded fuel breaks" and non-commercial hazardous fuel reduction treatments in the stand/forest development modeling. These treatments typically target the surface and ladder fuels (understory) and remove non-commercial sized material, less than 8 inches. "Shaded fuel breaks" are typically located in strategic locations such as prominent ridge lines and along roads where the road prism contributes to the area of no fuels. Spotted owls generally nest in the mid and lower portions of slopes where forest structure conditions are more conducive to developing adequate nesting structure. Spotted owls are also thought to avoid roads when selecting nest sites which will minimize the potential impact of these activities. Non-commercial hazardous fuel treatments are typically located in strategic landscape locations and occur in non-conifer and mixed-conifer/hardwood ecosystems. The reduction of ladder fuels may decrease the suitability of some stands by affecting prey in a long, linear portion of the stand. However, because fuel breaks are not removing overstory trees we do not anticipate these activities will significantly affect spotted owl nesting/roosting habitat at more than a very localized scale.

Fuels management has the potential to cause short-term impacts to spotted owls if it were to occur in currently occupied owl sites. This impact has the potential to downgrade or remove nesting, roosting, foraging and dispersal habitat; however, there should be long term benefits to spotted owls if treatments reduce fire risk and promote development of late successional forest structure. Fuels reduction is more needed and therefore more likely to impact spotted owls in dry forest than in moist forest. Drier spotted owl nesting habitat represents more of a heterogeneous mosaic structure than wetter west side, which is a result of historic natural disturbances (Olson *et al.* 2004). These fuel management treatments are likely, to some extent, mimic these stands that have developed under these conditions. Reduction of understory and ladder fuels has the potential to negatively affect spotted owl prey. However, adjacent untreated stands are expected to continue to support spotted owl foraging.

In dry forest regions, where natural disturbance regimes and vegetation structure, composition, and distribution have been substantially altered since Euro-American settlement, vegetation and fuels management (through influencing fire behavior, severity, and distribution) may be required to retain and recruit spotted owl habitat on the landscape (Buchanan 2009, pp. 114–115; Healey *et al.* 2008, pp. 1117–1118; Roloff *et al.* 2012, pp. 8–9; Ager *et al.* 2007, pp. 53–55; Ager *et al.* 2012, pp. 279–282; Franklin *et al.* 2009, p. 46; Kennedy and Wimberly 2009, pp. 564–565), to conserve other biodiversity (Perry *et al.* 2011, p. 715), and to restore more natural vegetation and disturbance regimes and heterogeneity (*e.g.*, Stephens *et al.* 2012b, pp. 557–558). Special management considerations may be required to maintain adequate spotted owl habitat in the near term, not only to allow spotted owls to persist in the face of threats from barred owl expansion and habitat modifications from fire and other disturbances, but also to restore landscapes to a more resilient state in the face of alterations projected to occur with ongoing climate change (USFWS 2011b, p. III-32).

Although fire lines and fuel breaks have the potential to impact spotted owl nest sites and nesting spotted owls, we do not anticipate this activity will impact the numbers or distribution

of spotted owls within the action area. Indeed, not conducting these activities has a higher potential to modify large landscapes which could reduce both spotted owl occupancy (distribution) and numbers, depending on the severity of the fire. Impacts to reproduction would be expected to be short term as adult spotted owls are able to move away from fireline activities and fires, and would be expected to relocate elsewhere on the landscape and pursue reproducing in subsequent years.

Fisheries

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Improve the distribution and quantity of high quality fish habitat across the landscape for all life stages of ESA-listed, BLM Special Status Species, and other fish species.”*
- *Maintain and restore access to stream channels for all life stages of aquatic species.”*

The management direction for the Fisheries resource program (Appendix A, p. A35) includes :

- *Restore degraded spawning, rearing, and holding habitat for fish using a combination of accepted techniques including but not limited to log and boulder placement in stream channels, tree tipping, and gravel enhancement.*
- *Remove or modify human-caused fish passage barriers to restore stream channels for all life stages of aquatic species.*

Riparian forests have been identified as important habitat for spotted owls. Glenn *et al.* (2004) documented selection of broadleaf riparian forest by spotted owls in the Oregon Coast Ranges and suggested that riparian forest provided structure and cover in areas where late successional forest was less abundant. Glenn *et al.* (2004) also documented selection for edges between riparian and older forest by spotted owls. Irwin *et al.* (2004) found that territory selection by spotted owls was positively influenced by riparian habitat. Clark (2007) found that riparian areas often continued to be used by spotted owls post-fire, as these areas tended to maintain more standing live trees. Dusky-footed woodrats, a primary prey item for spotted owls, also select riparian forests (Thomas *et al.* 1990; Carey *et al.* 1992). Forest management activities that reduce forest cover in riparian reserves have the potential to downgrade nesting-roosting habitat for spotted owls; however, occasional tree tipping should have limited effects on spotted owls as long it does not remove nest trees or significantly alter the structure and function of nest patches.

The management objectives for Fisheries are designed to benefit native fish species and to restore and preserve ecosystem function. In the long term, such actions should benefit spotted owls. While forest management activities for Fisheries may potentially impact spotted owls, such impacts should be minimal because these projects are expected to remove single trees or very small groups of trees and are not expected to change the nesting/roosting function of the affected stand or riparian area. In addition, these activities are likely to have long-term benefits for spotted owls as the objective is to restore and preserve riparian ecosystem function. A properly functioning stream system is likely to result in less erosion and bedload transport, which should reduce impacts to streambanks and riparian vegetation.

Forest Management

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Enhance the health, stability, growth, and vigor of forest stands.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.*
- *Facilitate safe and efficient forestry operations for the BLM, reciprocal right-of-way agreement holders, and permittees.”*

The management direction for the Forest Management resource program (BLM 2016a, p. A-35) includes the following:

- *Promote the establishment and survival of desirable vegetation through stand maintenance treatments.*
- *Apply thinning or prescribed fire to forest stands to achieve appropriate stocking and density levels.*
- *Use genetically improved native trees for reforestation when available.*
- *Fall and move live or dead trees as needed for safety or operational reasons, including, but not limited to, the creation of yarding corridors or skid trails adjacent to nearby harvest units, hazard tree removal, and road construction, improvement, or maintenance.*
- *Allow road construction, maintenance, improvement, and decommissioning as well as construction of skid trails and yarding corridors based on operational needs and consistent with valid existing rights.*
- *Allow management activities in density management study sites (Cissel et al. 2006) that are compatible with study objectives.*

Forest management activities have the potential to create narrow, linear openings in forests for operational reasons, including roads, skid roads and yarding corridors. These types of openings may include localized effects to individual stands but are not anticipated to affect the function of the reserved LUAs at a larger scale. In reserved LUAs this resource program is expected to be implemented in a manner where the objectives of those allocations will continue to be met. Within the Harvest Land Base these potential activities are likely to be associated with timber harvest that are expected to impact the ability of stands to support nesting spotted owls.

Thinnings and individual tree or small group removals are expected to be implemented for the purpose of improving the overall health and structure of the stands. Effects to spotted owl nesting/roosting habitat are expected to be localized and small, and will not impact the function of the reserved LUAs.

Hydrology

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.”*

The management direction for the Hydrology resource program (BLM 2016a, p. A36) includes the following:

- *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.*
- *Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.*
- *Implement road improvements, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.*
 - *Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.*
 - *Decommission roads no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.*

Although this resource program is geared towards protection of aquatic resources, it has the potential to have adverse effects to spotted owls and spotted owl habitat by carrying out projects that could involve the removal of single or small groups of live trees that could contribute to spotted owl habitat. Those projects include stream crossings that meet the standards for a 100-year flood event. The management direction includes the provision to meet the standards and be consistent with existing consultation documents addressing crossings, which includes the ARBOII consultation (USFWS 2013). The ARBO includes a monitoring protocol which tracks impacts to all species, including the spotted owl. To date there have been no projects implemented under this consultation which have resulted in the injury of any spotted owls either

directly or through habitat manipulations (Blundon 2016, pers. comm.). Overall impacts to spotted owls are anticipated to be minor as only individual trees or small groups of trees will be affected. The removal of single or small clumps of trees is not expected to affect the overall function of the individual stands or the LUAs in which they occur.

Invasive Species

BLM summarizes the proposed management objective as (BLM 2016a, p. 40):

- *Prevent the introduction of invasive species and the spread of existing invasive species infestations.*
- *Prevent the introduction and the spread of sudden oak death (*Phytophthora ramorum*) infections.*

The management direction for the Invasive Species resource program (BLM 2016a, p. A36) includes:

- *Implement measures to prevent, detect, and rapidly control new invasive species infestations.*
- *Use manual, mechanical, cultural, chemical, and biological treatments to manage invasive species infestations.*
- *Treat invasive plants and host species for invasive forest pathogens in accordance with the Records of Decision (RODs) for the Northwest Area Noxious Weed Control Program Environmental Impact Statement and the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in Oregon Environmental Impact Statement (USDI BLM 2010).*
- *Apply state-of-the art, integrated pest management prescriptions for the treatment of all identified sudden oak death (*Phytophthora ramorum*) infection sites.*

The Proposed RMP includes treatment at all sudden oak death infection sites.

The invasive species treatment that has the potential to affect spotted owls and spotted owl habitat is the treatment for sudden oak death, which includes the felling of infected trees as soon as possible after the disease is detected. Although the losses of these trees could impact spotted owl nesting-roosting, foraging or dispersal, the removal of single or small clumps of trees is not expected to affect the overall function of the LUAs on which these actions occur.

Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet and are limited temporally within Riparian Reserves. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible. Treatment for insects and other diseases also involves the potential for the removal of canopy and sub-canopy trees at the local scale. Although these treatments, if needed, have the potential to affect spotted owls at

the stand scale, they are not expected to alter the function of the landscape at any scale greater than the local level, and are not expected to diminish the value of the landscape for the conservation of spotted owls.

Lands, Realty, and Roads

BLM summarizes the proposed management objective as (BLM 2016a, pp. 28 and 29):

- *“Make land tenure adjustments to facilitate the management of resources and enhance public resource values.*
- *Provide legal access to BLM-administered lands and facilities to support resource management programs.*
- *Provide needed right-of-ways, permits, leases, and easements over BLM-administered lands in a manner that is consistent with Federal and State laws.*
- *Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.*
- *Provide a road transportation system that serves resource management needs (administrative/commercial) and casual use needs (recreational/domestic) for both BLM-administered lands and adjacent privately-owned lands.*

The management direction for Lands, Realty, and Roads resource program (BLM 2016a, pp.A-38 - A-39) includes:

- *Retain lands in Land Tenure Zone 1 (Zone 1) under BLM administration. Lands in Zone 1 include existing and future:*
 - o Designated and suitable Wild and Scenic River corridors*
 - o Wilderness Areas*
 - o Wilderness Study Areas*
 - o National Trail management corridors*
 - o District-Designated Reserve – Lands managed for their Wilderness Characteristics*
 - o Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)*
 - o Congressionally designated Outstanding Natural Areas*
 - o Lands acquired with Land and Water Conservation Funds*
- *Designate Right-Of-Way Exclusion Areas in—*

- o Lands designated as Wilderness;*
- o District-Designated Reserve – Lands Managed for their Wilderness Characteristics;*
- o Wilderness Study Areas;*
- o Designated and suitable Wild and Scenic Rivers classified as Wild; and*
- o Visual Resource Management Class I areas.*

In right-of-way exclusion areas, do not grant rights-of-way, except when mandated by law.

- Designate right-of-way avoidance areas in—*
 - o Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas);*
 - o Recreation Management Areas (Special and Extensive);*
 - o Designated and suitable Wild and Scenic Rivers classified as Scenic and Recreational; and*
 - o Visual Resource Management Class II areas not included in right-of-way exclusion areas.*

In right-of-way avoidance areas, grant rights-of-way if the BLM determines that the right-of-way proposals are compatible with the protection of the values for which the land use was designated, or when no feasible alternative route or designated right-of-way corridor is available as applicable with BLM laws and policy.

- Grant rights-of-way in utility corridors as the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline. Grant the rights-of-way as the minimum necessary to accommodate a specific request. Do not permit development or management activities that would conflict with the construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor.*
- Construct new permanent or temporary roads, which may include major culverts and bridges, where needed to meet resource management objectives, to established BLM engineering design standards. Apply road location, design, and construction BMPs as needed (Appendix J of the Proposed RMP).*
- Maintain existing roads, including major culverts and bridges, to provide access for both resource management and casual use activities while protecting water quality and facility investments, and providing user safety, to established BLM maintenance standards. Apply road maintenance and wet weather road use BMPs as needed (Appendix J of the Proposed RMP).*

- *Remove hazard and downed trees along roads for safety or operational reasons.*
- *Fully decommission or obliterate (permanent closure) roads with no future resource management need. Decommission (long-term closure) roads not currently needed for resource management but that will be used and maintained again in the future. Apply road closure BMPs as needed (Appendix J of the Proposed RMP). Close roads only with the approval of affected permittees consistent with valid existing rights.*

The effects of potential new road construction are unlikely to have major effects on spotted owls based on the existing access network in the planning area and the associated low number of new requests for rights-of-way received by the BLM during the past 10 years, the ability of the BLM to route new rights-of-way to avoid or minimize impacts to other resource values and uses, and the low likelihood that a new road through spotted owl habitat would alter the functionality of the stand. New roads and rights of way are generally narrow, linear gaps in the forest that spotted owls are able to easily navigate and cross. When siting new roads the BLM is generally able to minimize the impacts to spotted owl habitat through the location of the roads and the timing of the construction. Although this does not mean all adverse impacts to habitat will be avoided, by following the management direction of the reserve land use allocations the BLM is expected to maintain the benefits of the large blocks of nesting habitat the spotted owl relies on. As with all activities these projects will undergo site-specific consultation where the locations and routes of these roads will be discussed in detail and minimizations sought. We anticipate a relatively small portion of the overall new road construction will occur in reserves and that, in the Harvest Land Base, road construction will be associated with timber harvest which is addressed below.

The removal of hazard trees and downed wood is expected to have minimal effects to spotted owl nesting habitat since these projects affect a very small number of trees. Hazard tree removal usually occurs along roads and facilities where noise is at a level that either will be a deterrent to spotted owls or to which owls in the area would be acclimated.

Utility corridors are covered under the existing decision, Approved Resource Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-administered lands in the 11 Western States (USDI BLM 2009), and are not part of this consultation (Hardt 2016a, pers. comm.).

The one activity the BLM has identified that will be implemented immediately and without further section 7 consultation and that may result in the injury or death of a listed species is the non-commercial use of roads within the action area, which is part of this resource program. The potential effect from this road use is the potential impact of non-commercial vehicles striking a spotted owl. Whether a spotted owl that has collided with a car is killed or injured and then taken to a rehab facility, that individual is extremely unlikely to ever contribute to the wild population again.

Data on car strikes are largely anecdotal and are exceedingly rare. While some species are more likely to collide with cars than others, the Service would expect that birds that are active in the day time when the majority of vehicle traffic occurs on forest roads would be at a greater risk than owls that are more active at night. Spotted owls are adapted to foraging at night and are not

known to utilize roadways and headlights to assist in locating prey. Therefore, we do not anticipate that collisions with cars is more than a very rare threat to individual spotted owls. We do not have data on whether juvenile spotted owls are more or less likely to collide with vehicles, but one would anticipate that more experienced adults would more successfully avoid vehicles. The data available on spotted owls and car strikes in Oregon is largely anecdotal.

Because of the rarity of this type of occurrence, the Service is not able to determine with any sort of precision or confidence the amount of car collisions with spotted owls that will occur as a result of use of the BLM roads that are managed under the PRMP.

Because any loss of spotted owls over 50 years due to non-commercial vehicle collisions is expected to be so rare we do not expect this effect to appreciably influence spotted owl numbers, reproduction or distribution across the action area.

Rare Plants and Fungi

BLM summarizes the proposed management objective as (BLM 2016a, p. 41):

- *“Provide for conservation and contribute toward the recovery of plant and fungi species that are listed, or are candidates for listing, under the ESA.*
- *Support the persistence and resilience of natural communities, including those associated with forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands. Support ecological processes and disturbance mechanisms to allow for a range of seral conditions.*
- *Provide for the conservation of Bureau Special Status plant and fungi species.*
- *Support the persistence and resilience of oak species within oak woodlands and within mixed hardwood/conifer communities.*

Under the Proposed RMP, the BLM would manage mixed hardwood/conifer communities to maintain and enhance oak persistence and structure and manage mixed conifer communities to maintain and enhance pine persistence and structure.”

The management direction associated with the Rare Plants and Fungi resource program (BLM 2016a, pp. A47-A48) includes:

- *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of species.*
- *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
- *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components*

(e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.

- *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
- *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives.*

The potential impact of this program on spotted owls is the use of prescribed fire and selective silvicultural techniques to maintain populations of rare plants and to restore and maintain meadows in an open condition. Encroaching trees can change the character of a meadow which reduces the suitability for the native plants in that ecosystem. In general, the management of habitat for rare plants and fungi is consistent with restoring and maintaining historic ecosystems. For species such as Gentner's fritillary which exists in open canopy coniferous and oak forestlands, selective harvest and fire are tools to maintain the open canopy. Spotted owls may forage in these areas but would not generally use them for nesting or roosting. Spotted owl foraging opportunities would likely be enhanced by these tools since Gentner's fritillary occurs in a fire-adapted ecosystem along with spotted owls (though at differing scales). Management for rare plants that restores meadows is not expected to negatively affect spotted owls as meadows typically comprise very small proportions of spotted owl home ranges and ingrowth is likely to be younger stands at the margins of the forested area.

We do not anticipate this resource program will have a negative impact on spotted owl numbers, reproduction or distribution.

Recreation and Visitor Services

BLM summarizes the proposed management objective as (BLM 2016a, p. 41):

- *“Provide a diversity of quality recreational opportunities.*
- *Meet legal requirements for visitor health and safety and mitigate resource user conflicts.*
- *Mitigate recreational impacts on natural and cultural resources. In land-use allocations where management of other resources is dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.*

- *Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if—*
 - *Recreation development is consistent with interdisciplinary land-use plan objectives;*
 - *The BLM has legal public access to the site; and*
 - *The BLM has secured commitments from partners in the form of a cooperative management agreement, adopt a trail agreement, memorandum of understanding, etc.*

The management direction for the Recreation and Visitor Services resource program (BLM 2016a, pp. A48-A50) includes:

- *Manage Special Recreation Management Areas and Extensive Recreation Management Areas, identified in Appendix O of the Proposed RMP, in accordance with their planning frameworks.*
- *Protect recreation setting characteristics within Special Recreation Management Areas to prohibit activities that would degrade identified characteristics.*
- *Pursue and prioritize public access to BLM-administered lands that have high recreational potential consistent with BLM designations and allocations.*
- *Allow the discharge of firearms for recreational target shooting on BLM-administered lands, outside areas with firearm use restrictions described in the RMA frameworks, if the firearm is discharged toward a proper backstop sufficient to stop the projectile's forward progress.*
- *Issue discretionary Special Recreation Permits for a variety of uses that are consistent with resource and program objectives.*
- *Issue vending permits that complement visitor use or contribute to resource protection.*
- *Monitor activity participation and recreation setting characteristics annually during the primary use season of June through October.*
- *Use recreation management tools such as establishing an allocation system, applying group size limits for private and commercial recreation use, or implementing seasonal closures, if monitoring indicates that social recreation setting characteristics are not being protected, resource damage is occurring, or user conflicts need to be addressed.*
- *Develop and maintain partnerships with recreation-based organizations and service providers. These partnerships should engage partners in the planning, implementation and monitoring of recreation opportunities and facilities on BLM-administered public lands.*

The Proposed RMP includes designation of Special Recreation Management Areas at currently developed recreation facilities, and on lands where designation does not conflict with sustained-yield timber harvest. The PRMP includes designation of Extensive Recreation Management Areas where the BLM has developed and currently manages recreation activities outside of developed facilities, primarily where the BLM has authorized motorized and non-motorized trails, and where the BLM currently manages dispersed recreation activities. In addition, the BLM would designate Special Recreation Management Areas and Extensive Recreation

Management Areas to address specific recreation demand and scarcity, or where unique opportunities for activity-specific demands exist. In the rest of the action area, the BLM would not manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands (BLM 2016a, p. 41).

According to the BLM, the implementation of proposed management direction for Recreation and Visitor Services (pp. A-48 to A-50) would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl habitat (BLM 2016a, p. 204). Spotted owls that occupy territories located in close proximity to campgrounds and other recreational areas are expected to be acclimated to the current baseline levels of human activity that have occurred at these sites over time.

Trails and Travel Management

BLM summarizes the proposed management objective as (BLM 2016a, p. 42):

- *“Maintain a comprehensive travel network that best meets the full range of public use, resource management, and administrative access needs.*
- *Protect fragile and unique resource values from damage by public motorized vehicle use.*
- *Provide public motorized vehicle use opportunities where appropriate.”*

Management Direction

- *Develop public motorized and non-motorized travel routes and trails in a manner designed to minimize conflicts between public motorized vehicle use and other existing (or proposed) recreational uses of the same, or neighboring, public lands. Design in a manner to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.*
- *Develop closed or abandoned roads to provide additional public motorized and non-motorized trail opportunities, where feasible and compatible with other resource objectives.*
- *Prohibit public motor vehicle travel within areas designated as closed for public motorized access. Where the BLM has public access, allow public access by means other than motorized vehicle, such as mechanized or non-motorized use. Allow travel required for valid existing rights.*
- *Restrict public motorized vehicle travel within areas designated as limited for public motorized access. Until completion of implementation-level travel management planning, limit public motorized vehicle travel to existing routes where the BLM has public access. After completion of implementation-level travel management planning, limit public motorized vehicle travel in conformance with the resultant Travel Management Plan. Allow travel required for valid existing rights.*

The implementation of proposed management direction for Trails and Travel Management (pp. A-52 to A-53) would reduce potential risks to the species’ habitats. Even though the BLM

would maintain a road and trail network for public, resource management and administrative access needs, the BLM would manage that network to maintain fragile and unique resource values from damage by OHV use, and limit or eliminate OHV use where appropriate. The proposed closure of 156,036 acres would eliminate potential threats from OHV use to spotted owls, and their habitat and critical habitat, associated with those acres. The BLM also would eliminate 319,661 acres of open area and further evaluate and designate limited areas to protect resources.

Overall we anticipate the potential effects of trails and travel management to be reduced through the closing of these acres to OHV use. Where OHV use currently exists any spotted owls would likely be acclimated to the existing noises and disturbances associated with this activity. Trails generally consist of narrow, linear routes that do not create any impediment to spotted owl movement and are often designed to retain canopy trees which would maintain habitat conditions along the route. In addition, the focus on maintaining unique resources provides for BLM to incorporate spotted owls into any future planning efforts. As with all future projects these activities will undergo project-specific consultation and NEPA which provides an opportunity to further minimize impacts to spotted owls.

Wildlife

BLM summarizes the proposed management objective as (BLM 2016a, pp. 42 and 43):

- *“Conserve and recover species that are ESA-listed, proposed, or candidates, and the ecosystems on which they depend.*
- *Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA-listing of these species.*
- *Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.*

Under the Proposed RMP, the BLM would implement the mitigation measure described in the Draft RMP/EIS for BLM participation in barred owl management (see Section II H 1 of this assessment, below). As described in the Draft RMP/EIS, the BLM would cooperate with the Service and provide financial support for their experimental removal of barred owls. Further, when the Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl, the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30. Barred owl management actions on BLM-administered lands within the range of the northern spotted owl could include BLM participation in scheduling, funding, and implementing such actions.

The Proposed RMP includes (BLM 2016a, pp. A8-A14):

- *A requirement to avoid the incidental take of northern spotted owls until implementation of a barred owl management program has begun.*
- *A requirement for surveys for the marbled murrelet prior to management actions in marbled murrelet Zone 1 and protection of habitat within 300 feet around newly discovered occupied sites;*

- *The protection of trees capable of providing marbled murrelet nesting structures in younger stands in marbled murrelet Zone 1; and*
- *A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions north of Highway 20 and protection of habitat areas around newly discovered nest sites north of Highway 20.”*

Management Direction – Wildlife includes (BLM 2016a, pp. A54-A59):

- *Manage species and habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of species.*
- *Manage naturally occurring special habitats to maintain their ecological function including seeps, springs, wetlands, natural ponds, vernal pools/ponds, natural meadows, rock outcrops, caves, cliffs, talus slopes, mineral licks, oak savannah/woodlands, sand dunes, and marine habitats.*
- *Manage human-made special habitats as wildlife habitat when compatible with their engineered function, including bridges, buildings, quarries, pump channels/heliponds, abandoned mines, and reservoirs, to the extent possible consistent with safety and legal requirements.*

Management Direction - Wildlife – Northern Spotted Owl (BLM 2016a, p. A-59)

- *Manage habitat conditions for northern spotted owl movement and survival between and through large blocks of northern spotted owl nesting-roosting habitat.*
- *Do not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun.*

This management direction is implemented in a variety of ways, most notably the potential designation of the LSRs and Riparian Reserves land-use allocations, which provide protections in large areas across the landscape where the BLM has modeled they have the greatest opportunity to develop habitat blocks that support at least 25 spotted owl nesting pairs (BLM 2016a, p. 90). Compared to the NWFP there are an additional approximately 177,000 acres of reserved land in these two allocations (BLM 2016c, pp. 35, 82) within the action area. The distribution of these acres in LSRs across the landscape is specifically designed to facilitate the spotted owl movement and survival between and through large blocks of spotted owl

nesting/roosting habitat. In addition, the BLM has incorporated aspects of the spotted owl recovery plan (USFWS 2011b, entire) into their PRMP, including RA6, moist forest management to accelerate spotted owl habitat development (USFWS 2011b, p. III-19) as noted in the BA (BLM 2016a, pp. A-12, A-13, A-16, A-21). Recovery Action 10, conserving spotted owl sites and high-quality habitat (USFWS 2011b, p. III-43) is included in the BA (BLM 2016a) on pp. 45-47. Recovery Action 12, conserving and restoring habitat elements that take a long time to develop (USFWS 2011b, p. III-49) is incorporated by prohibiting timber salvage in several locations of the BA (BLM 2016a, pp. A-20, A-18), and mapped RA 32 stands have been incorporated into the LSR network (BLM 2016c, p. 82).

Implementation of the Wildlife Resource Program Management Direction for the Northern Spotted Owl in the PRMP

As described in the Status of the Species Section, competition from non-native barred owls is now considered the primary threat to the survival and recovery of the spotted owl. To address this threat, the 2011 Revised Recovery Plan for the Northern Spotted Owl includes 10 recovery actions specific to barred owl competition, including Recovery Action 30 - Manage to reduce the negative effects of barred owls on spotted owls.

In recent years, spotted owl population change has continued to decline at an accelerated rate, attributed primarily to increasing competition from the non-native barred owl. Without proactive management to reduce competition from barred owls, impacts on spotted owl populations are expected to increase. Already, long-term spotted owl demography study areas have seen declines in the spotted owl populations of between 55 and 77 percent in less than 30 years (Dugger *et al.* 2016, p. 71). Even on many of the more southerly study areas, where barred owl populations have not been established for as long, demographic analyses indicate a declining spotted owl population trend on all but one study area (Dugger *et al.* 2016, p 70). The only estimate of population trend that was increasing was for the treatment area of the Green Diamond Study Area (Dugger *et al.* 2016, p 70), where barred owls have been removed as part of an ongoing experiment for several years. Thus, if the negative effects of competition with barred owls is not reduced, spotted owl populations are likely to be extirpated either locally or regionally (*e.g.*, entire physiographic provinces) within the next 50 years.

In September 2013, the Service signed a decision to implement the Barred Owl Removal Experiment (Experiment) to gather the scientifically credible information needed for the future development of a Barred Owl Management Strategy. The Experiment is the implementation of Recovery Action 29 of the Revised Northern Spotted Owl Recovery Plan (USFWS 2011) and is designed to test whether the removal of barred owls will result in an improvement of the spotted owl population, the feasibility of removing barred owls from an area, and the costs of such removal.

The Experiment is being conducted on four study areas, including the Hoopa Reservation in California, Union/Myrtle (Klamath) and Oregon Coast Ranges in Oregon, and Cle Elum in Washington. Both the Union/Myrtle (Klamath) and Oregon Coast Ranges study areas include BLM lands and results from these study areas are anticipated to be applicable to BLM lands in western Oregon. Work began on the Hoopa Study Area in 2013 and is in the third year of post-removal spotted owl surveys. Barred owl surveys began on the remaining three study areas in

2015. Barred owl removal began on the Oregon Coast Ranges and Cle Elum Study Areas in September 2015. Barred owl removal will begin on the Union/Myrtle (Klamath) Study Area in September of 2016.

The duration of the Experiment will depend on the strength of the response of spotted owl populations to the removal of barred owls. Based on information available at the time of the Final EIS for the Experiment, we estimated that we would acquire scientifically-credible information on the effect of the removal of barred owls on spotted owl population dynamics within four years of the initiation of barred owl removal (USFWS 2013, Appendix H). Following three years of removal and spotted owl surveys on each study area, we will conduct preliminary analyses of the data. We will continue to analyze data annually until we reach a level of information that will enable scientifically sound decisions. The Experiment may be curtailed at 3 years if the information is compelling, or it may extend to a maximum of 10 years if required to reach the scientific certainty to reasonably support management decisions (USFWS 2013, pp. 23-25)

The Service has not determined a specific direction for a Barred Owl Management Strategy at this time, and the results of the Experiment are not designed or intended to result in any specific approach to barred owl management. In developing a Barred Owl Management Strategy, the Service will employ the results of the Experiment, along with information from all other relevant sources, including public input. The Service will continue to reach out to the public, stakeholders and the scientific community to develop a full breadth of options and components for managing the barred owl population.

Before implementing any Barred owl Management Strategy, the Service will fully comply with NEPA and the Migratory Bird Treaty Act. As part of the NEPA compliance, the Service will analyze a full range of alternatives for managing the effect of barred owls on spotted owl populations, including soliciting input from the public. The Service will reach a decision on a Barred Owl Management Strategy only after considering all relevant information received. The Service would also complete an intra-service Section 7 Consultation under the Endangered Species Act on any decision reached, to ensure that any action does not jeopardize any listed species or destroy or adversely modify any designated critical habitat for any species.

In the PRMP, BLM commits to “participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30” (2016a, Appendix X, p. 2000). This represents a very important long-term commitment from BLM to support spotted owl conservation. The potential implementation of management to mitigate the impacts of barred owls may be effective for maintaining occupied spotted owl sites and enabling spotted owls to recolonize historic sites that have been occupied by barred owls (Diller *et al.* 2016, p. 11). However, a barred owl management strategy or program is not yet available for BLM to implement. The Service is working to gather the information necessary to develop a barred owl management strategy or program through implementation of the Barred Owl Removal Experiment to test one of the potential tools for managing barred owls (USFWS 2013, entire). The Service has stated its intention to use the results of the Barred Owl Removal Experiment, along with information from all other relevant sources, including public input, to develop a barred owl management strategy.

To address barred owl impacts to spotted owls in the near-term, until a barred owl management strategy is developed and ready for implementation, the BLM PRMP includes the following management direction for Wildlife specific to spotted owls (BLM 2016a, p. A59):

•Do not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun.

The purpose of this management direction is to minimize the near-term (up to the first 8 years) impact of timber harvest under the PRMP on spotted owls while a barred owl management strategy is considered and, if appropriate, implemented.

The threat to the spotted owl from barred owl competition is a more serious near-term threat to spotted owl conservation than is timber harvest on Federal lands. Recent results from Yackulic *et al.* (2014, entire) and Dugger *et al.* (2016, p. 78) show that site occupancy by spotted owls is negatively affected by barred owl presence and positively influenced by increasing amounts of spotted owl habitat within territories. It is worth noting that BLM projects relatively similar rates of spotted owl declines with and without timber harvest due to the overwhelming negative impact of barred owls (BLM 2016a, pp. 112-116). This means that, at the present time, the negative effects of barred owls appear to be more influential than are the positive effects of habitat development. Therefore, managing barred owl impacts is likely the only potential strategy for slowing or reversing spotted owl population declines.

The immediacy of the barred owl threat does not mean that habitat loss is not still a long term threat for spotted owls. The loss of large areas of occupied spotted owl habitat, especially habitat where spotted owls are still successfully reproducing, would still have a significant additive impact on spotted owl recovery potential. BLM addresses the long-term habitat needs of spotted owls through the potential designation of reserved land (see Description of the Proposed Action). On reserved lands on the BLM portion of the action area, the amount of spotted owl habitat is expected to increase over the next five decades due to BLM's management (See Environmental Baseline section). Approximately 88 percent of spotted owl activity centers occur within reserved LUAs and 12 percent occur in the Harvest Land Base.

BLM addressed habitat loss under the PRMP and its impact on spotted owl populations outside of reserved LUAs with 1) Wildlife Management Direction to avoid the incidental take of spotted owls from timber sales until a barred owl management strategy has begun, and 2) a commitment to “participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30” to address the effects of barred owl competition on spotted owls. These direction and guidance operate at different time scales and their effects are analyzed individually.

Avoidance of Incidental Take

The BLM will avoid causing the incidental take of spotted owls as a result of timber harvest while the Barred Owl Removal Experiment is conducted and evaluated, a barred owl management program is considered and, if appropriate, such a program has begun. To

accomplish this goal, the BLM's BA (BLM 2016a, pp. 44-45) includes the following discussion.

As described in Appendix A, the BLM will not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun. Implementation of a barred owl management program includes the existence of a monitoring program that will evaluate whether a barred owl program is having the biological benefits to the northern spotted owl assumed by the Biological Opinion on the RMP.

Whether a specific timber harvest would result in incidental take will be determined on a case-by-case basis. Until implementation of a barred owl management program has begun, the BLM will not authorize any timber harvest that it determines would cause incidental take of northern spotted owls or is determined to cause incidental take through a section 7 consultation process. The BLM will be authorizing timber harvest that does not result in incidental take of northern spotted owls (*e.g.*, harvest in unoccupied home ranges or harvest within occupied home ranges that does not constitute incidental take), provided that such harvest otherwise meets BLM's obligations under ESA section 7.

As part of the process to determine whether a planned timber harvest would result in take of northern spotted owls, the BLM will establish whether the northern spotted owl is actually present in the area that would be affected by the timber harvest using the best available science at that time, such as through pre-project northern spotted owl surveys consistent with Service's 2012 Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls (February 2, 2011; revised January 9, 2012, USFWS 2012b). The Service has updated the northern spotted owl survey protocol to account for the influence of barred owl and may further update it in the future.

If the BLM and the Service jointly determine that implementation of a barred owl management program has begun, the BLM may proceed with implementation of timber harvest consistent with the ROD/RMP that may include incidental take of northern spotted owl territorial pairs or resident singles. Any proposed timber harvest that may include such incidental take would be implemented only after and consistent with appropriate project-level section 7 consultation and incidental take statement.

After implementation of a barred owl management program has begun, the BLM and Service will meet as necessary, at least annually, to review the results of the monitoring program. If the BLM or the Service concludes that the monitoring program shows that the results of such a barred owl management program are not consistent with the assumptions in its Biological Opinion, the BLM will reinitiate section 7 consultation on the RMP.

If the BLM or the Service concludes that implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion has not begun after five years from the effective date of the ROD/RMP, the agencies will meet as necessary, at least annually, and evaluate whether implementation of a barred owl management program consistent with the assumptions of the Biological Opinion is reasonably certain to occur. If both the BLM

and the Service agree that such a barred owl management program is still reasonably certain to occur, the BLM will continue to not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest. If the BLM or the Service concludes that such a barred owl management program is not reasonably certain to occur, the BLM will reinitiate section 7 consultation on the RMP.

If implementation of a barred owl management program has not begun after eight years of the effective date of the ROD/RMP, the BLM will reinitiate section 7 consultation on the RMP.

If reinitiation of section 7 consultation on the RMP is triggered for any of the reasons above, the BLM will comply with ESA section 7(d) and will not authorize timber harvest that is likely to adversely affect the northern spotted owl or likely to adversely affect its critical habitat until consultation is complete.

After implementation of a barred owl management program has begun, the BLM would continue to seek to avoid or reduce negative impacts to northern spotted owl sites, to the extent consistent with the management objectives and management direction for the Harvest Land Base, as detailed below.

Analysis of the Effect of Incidental Take Avoidance

The near-term (5 to 8 years) avoidance of incidental take from timber harvest applies to spotted owl home ranges that occur within, or overlap with, the Harvest Land Base. Therefore, we conducted a programmatic analysis of how implementation of the PRMP timber harvest program, with the implementation of near-term take avoidance of occupied sites may affect spotted owl occupancy.

There are a total of 2,465 current or historic spotted owl home ranges that overlap BLM lands in western Oregon, of which the BLM estimates 640 are currently occupied. Of these current or historic spotted owl home ranges, 1,085 overlap the Harvest Land Base to some degree. Within the Harvest Land Base, there are 175 known current or historic spotted owl site centers (BLM 2016a, p.45). BLM estimates that approximately 50 of these are currently occupied (BLM 2016a, p. 45; Greenquist 2015, pers. comm.). There are an additional 660 known and historic spotted owl sites with core areas (500 acre area, 0.5 mile radius) that overlap the Harvest Land Base. Assuming a 30 percent occupancy rate based on rates of occupancy reported by BLM (2016a, p.45; Greenquist 2015, pers. comm.) and on current site occupancy estimates in Oregon (Dugger *et al.* 2016, BLM 2016a, p. 79), approximately 200 of these sites are likely to be currently occupied. Finally there are 250 spotted owl sites that overlap at only the home range scale (between 0.5 and 1.2 to 1.5 mile radius area depending on location), approximately 75 of which are likely to be occupied by spotted owls. Thus, there are approximately 325 likely occupied spotted owl home ranges that may be affected to some degree by activities within the Harvest Land Base. Based on the management direction, we anticipate no take of spotted owls on these 325 likely occupied home ranges from timber harvest until implementation of a barred owl management program has begun. We anticipate this program could start between 5 to 8 years from adoption of the PRMP. If implementation of a barred owl management program meeting the assumptions outlined in this biological opinion has not begun within 8 years of the effective date of the ROD, BLM will reinitiate consultation on the RMP. During the reinitiation

period, the BLM would comply with ESA Section 7(d) and would not authorize timber harvest that is likely to adversely affect the northern spotted owl or likely to adversely affect its critical habitat until consultation is complete which means, among other things, that it will not authorize timber sales that cause the incidental take of spotted owls.

However, during the first 8 years of PRMP implementation, some small level of incidental take may occur as a result of other land management activities, including but not limited to road building, road maintenance, hazard tree removal, or wildfire response. Based on past annual levels of such activities, we anticipate the prevalence and effects of these actions, and thus the amount of take, will be low. We do not anticipate that the PRMP will result in a significant increase in the level of such activities across the BLM landscape. Although we do not rely on future consultations for our conclusion, we note that any such actions will be subject to future site-specific consultation.

For some of these activities, the take of spotted owls would most likely result from disturbance due to noise during the critical nesting period. These cases may result in nest failure or reduced nesting success for the year of the operation, but are not likely to result in the death of the territorial spotted owls. These spotted owls would have the opportunity to breed in later years.

While some small amount of habitat may be removed or degraded as a result of these non-timber harvest activities, we expect most or all spotted owl incidental take to be sub-lethal for the territorial spotted owls. The small area affected by each activity makes it relatively easy for most territorial spotted owls to avoid the activities and remain on their territories. However, there may be a small decrease in annual survival and reproductive rates as a result of this habitat loss. Even if the activity displaces some spotted owls from their territories, these adult spotted owls could very likely survive this interim period as non-territorial owls and contribute to the spotted owl population when barred owl management has begun to provide available home ranges. Site-specific section 7 consultation will further reduce this impact.

During the interim period until implementation of a barred owl management program has begun, the BLM will continue to implement timber harvest projects in the Harvest Land Base in a manner that does not result in the incidental take of spotted owls. While the harvest of spotted owl habitat throughout the species' range was one of the primary reasons the species was listed under the ESA, the rate of harvest on Federal lands has fallen substantially since 1990 and the timber harvests under the PRMP on BLM lands during the interim period will target areas that are specifically not being used by territorial spotted owls for reproduction. The Harvest Land Base is the portion of the landscape that is not being relied upon for supporting reproducing populations of spotted owls, much like the Matrix under the NWFP. The harvest of unoccupied spotted owl habitat during the interim period will not affect any currently nesting or territorial spotted owls, but does have the potential to preclude the occupancy of these areas by spotted owls in the future. The Harvest Land Base, however, is not where the recovery of the spotted owl will be focused. Future development of spotted owl habitat and management of barred owls in the reserves is expected to provide for territories that will support future spotted owl populations in the action area. The harvest of these unoccupied forests in the Harvest Land Base is consistent with RA10 and RA32 of the spotted owl recovery plan, and exceeds the expectations of the recovery plan by avoiding the take of spotted owls through timber harvest. As described above, we do not expect these specific harvests to influence the numbers or

reproduction of spotted owls at the local, action area or range-wide scales in the long-term because this harvest of unoccupied forest stands during the interim period will not impact territorial or reproducing spotted owls and will avoid impacts to territories that are expected to provide for future populations of spotted owls.

Removal of habitat has the potential to preclude spotted owl dispersal through the harvested or modified stands in the Harvest Land Base. As noted in our spotted owl critical habitat revision (USFWS 2012a), the ability of spotted owls to dispersal is a biological need best assessed at a landscape scale larger than a forest stand. As noted in the effects to spotted owl section in this BO, the spatial configuration of reserves, the management of those reserves to retain, promote and develop spotted owl habitat, the management of the Harvest Land Base and the scheduling of the management of the Harvest Land Base are expected to provide for spotted owl dispersal between physiographic provinces/modeling regions and between and among large blocks of spotted owl habitat designed to support clusters of reproducing spotted owls. Therefore, we do not expect timber harvest during the interim period to influence the distribution of spotted owls at the local, action area or range-wide scales.

Long-term management of Spotted Owl Sites in the Harvest Land Base

In the longer-term, and as part of the proposed action, BLM commits to “participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30” (2016c, Appendix X, p. 2000). This represents a significant contribution to the recovery of the spotted owl.

However, implementation of a barred owl management strategy does not change conditions or trends for spotted owls immediately. In the BA, BLM describes guidance to managers, concerning spotted owls in the Harvest Land Base, to “[a]void management actions that would cause the abandonment of more than 10 percent of such sites during the first decade of plan implementation; 15 percent of such sites during the second decade of plan implementation; and 20 percent of such sites per decade thereafter (BLM 2016a, p. 46).” The PRMP states that this guidance is intended to be implemented to the extent consistent with management direction for the Harvest Land Base, provides background information and explanations of how the BLM will use the PRMP, and does not constitute additional requirements beyond the management direction described in the PRMP. This guidance is not intended to prevent all negative effects to known sites associated with the Harvest Land Base or the eventual loss of known sites in the Harvest Land Base. Instead, this guidance is intended to avoid or delay, to the extent consistent with the management objectives and management direction for the Harvest Land Base, near-term negative effects to known sites as spotted owl habitat continues to develop in the reserved land use allocations and the Service evaluates options for barred owl management.

After discussions with BLM we have agreed that causing the abandonment of more than these decadal percentages of currently occupied spotted owl sites will be a trigger for reinitiation of consultation. Therefore, it is a reasonable assumption that, after barred owl management is implemented, not all impacts to spotted owls in the Harvest Land Base will occur at once and will occur at approximately these rates. This guidance represents BLM’s implementation of Recovery Action 10 from the Northern Spotted Owl Revised Recovery Plan (USFWS 2011b, p. III-43). This harvest sequence is designed to “meter out” the potential take of spotted owls in

the Harvest Land Base, with less potential for take impacts in the early years of implementing the PRMP as a barred owl management strategy is implemented, and more take as barred owl management effects are realized and spotted owl habitat is recruited in the reserve areas over the ensuing decades. The majority of spotted owl sites on BLM lands will be conserved in the reserve areas encompassing approximately 80 percent of the landscape. The effects to the spotted owl from timber harvest in the Harvest Land Base will be staged as described in the following excerpt from the BA (BLM 2016a, p. 45-47).

Known Spotted Owl Sites Located in the PRMP Harvest Land Base

With respect to sites currently occupied by a northern spotted owl territorial pair or resident single at any time during project implementation, to the extent consistent with the management objectives and management direction for the Harvest Land Base, BLM managers would:

- Avoid management actions that would cause the abandonment of more than: 10 percent of such sites during the first decade of plan implementation; 15 percent of such sites during the second decade of plan implementation; and 20 percent of such sites per decade thereafter. These thresholds are intended to reflect site abandonment caused by a BLM action; they are not intended to reflect site abandonment from other causes such as displacement by barred owls or habitat losses on adjacent lands. If the BLM determines that an action would not cause the incidental taking of a territorial pair or resident single, and the U.S. Fish and Wildlife Service concurs with that determination, subsequent abandonment of a site associated with the action would not be considered as resulting from the BLM action.*
- Give priority to maintaining existing spotted owl habitat in the associated nest patch, 500-acre core use area and median provincial home range area, in that order of priority, to support continued site occupancy.*

With respect to sites not currently occupied but known to have been occupied by a territorial pair or resident single within the prior 5 years, BLM managers would give priority to maintaining existing spotted owl habitat conditions in the nest patch and 500-acre core use area, and maintaining existing spotted owl nesting-roosting-foraging habitat in the associated median provincial home range area, to the extent consistent with the management objectives and management direction under the PRMP for the Harvest Land Base. If the BLM cannot maintain all existing spotted owl nesting-roosting habitat in the median provincial home range area, BLM managers would give priority to maintaining nesting-roosting habitat closest to the 500-acre core use area and maintaining at least 50 percent of the median provincial home range area as nesting-roosting-foraging habitat when all lands are considered.

With respect to sites not currently occupied, but known to have been occupied by a territorial pair or resident single within the prior 10 years, BLM managers would give priority to

maintaining existing habitat conditions in the nest patch and maintaining existing nesting-roosting habitat in the 500-acre core use area, or promoting the protection and development of nesting-roosting habitat in the nest patch and 500-acre core use area, to the extent consistent with the management objectives and management direction under the PRMP for the Harvest Land Base.

BLM managers would give priority to implementing management actions that are located outside the median provincial home range area of a spotted owl site, or that would affect sites not known to have been occupied by a territorial pair or resident single within the prior ten years, over actions that would affect sites that have been occupied within the prior ten years.

Known Sites Located Outside the Harvest Land Base

In 2013, approximately 590 known spotted owl sites in other BLM land use allocations under the PRMP were occupied by a territorial pair or resident single within the prior five years and had portions of the Harvest Land Base within their median provincial home range. In addition, if the U.S. Fish and Wildlife Service implements a barred owl management program, the BLM anticipates that northern spotted owls would reoccupy currently unoccupied habitat in areas where barred owls are managed.

As stated above, when designing, locating and implementing actions in the Harvest Land Base, BLM managers would avoid causing the abandonment of northern spotted owl known sites located in other land use allocations, to the extent consistent with the management objectives and management direction under the PRMP for the Harvest Land Base.

BLM managers would give priority to actions that affect sites—

- That are not known to have been occupied by a territorial pair or resident single within the prior 10 years. The longer a site has been unoccupied, the less likely it is to be re-occupied by northern spotted owls.*
- That have less than 50 percent nesting-roosting-foraging habitat within the associated median provincial home range area when all land ownerships are considered. Sites with median provincial home range areas supporting less than 50 percent nesting-roosting-foraging habitat are less likely to be re-occupied by northern spotted owls until habitat conditions recover.*
- With less than 50 percent of the associated median provincial home range area occurring in the Late-successional Reserve, when all land ownerships and Forest Service reserves are considered. Sites associated with more reserved lands are more likely to be re-occupied by northern spotted owls, resist displacement by barred owls and contribute to species recovery.*

BLM managers would avoid actions that—

- *Occur in the nest patch of a site. Habitat modification in the nest patch will negatively affect re-occupancy of the site by northern spotted owls until habitat conditions recover.*
- *Cause the loss of nesting-roosting-foraging habitat in the 500-acre core use area surrounding a site. Sites with core use areas supporting less than 50 percent nesting-roosting-foraging habitat, when all land ownerships are considered, are less likely to be re-occupied by northern spotted owls until habitat conditions recover.*
- *Cause the amount of nesting-roosting-foraging habitat in the median provincial home range area surrounding a site to decline below 50 percent, when all land ownerships are considered.*

Of these 325 likely occupied spotted owl sites that overlap the Harvest Land Base, not all would be potentially impacted at the same level over the 50 year life of the PRMP due to differences in the proportion of their current home ranges that overlap the Harvest Land Base. The Service anticipates that between 50 and 325 occupied spotted owl sites may be potentially affected to varying degrees by timber harvest activities within the Harvest Land Base during the 50 year life of the PRMP. This number will be further refined and potential impacts further reduced, as project-specific section 7 consultation occurs during the next 50 years.

Habitat modification caused by timber harvest activities is likely to have mixed effects on spotted owls over time. Regeneration and commercial thinning that degrade habitat close to activity centers of known spotted owls or in sites already deficient in spotted owl habitat may remove nest trees and may cause sites to become unoccupied or the death of spotted owls. Fuels treatment and uneven-aged management have the potential to enhance future spotted owl habitat conditions if they improve structural diversity and reduce the risk of loss of spotted owl habitat from high-severity fire even though the treated habitat may be degraded in the short-term. Although the specific condition of the site, and the location and type of timber harvest may result in no impact to some of the potentially-affected, currently occupied sites, the framework programmatic nature of the proposed action precludes an evaluation of potential effects at an individual site scale.

In the BA, BLM estimates that approximately 175 spotted owl sites (50 of which we expect to be currently occupied) have site centers in the Harvest Land Base and would be most likely to be affected by actions during plan implementation (BLM 2016a, p. 196). The Service agrees that the 50 likely currently-occupied spotted owl sites with site centers in the Harvest Land Base are likely to be taken over the life of the plan, and are likely to become unoccupied. However, there are an additional 275 spotted owl sites that have site centers within reserved land use allocations, but which include various levels of Harvest Land Base within their home ranges. We analyzed the effects of habitat loss from the 275 sites that have home ranges overlapping the Harvest Land Base, even if their site centers do not. Loss of spotted owl habitat in the core area (500 acre) or home range may affect the ability of spotted owls on these sites to survive and reproduce. Therefore, for the purpose of this analysis, we assume that under the PRMP, timber harvest activities will potentially affect up to 325 spotted owl sites that overlap the Harvest Land Base.

The potential impacts to up to 325 currently occupied spotted owl sites associated with the Harvest Land Base are expected to be mitigated by three factors:

- Barred owl management
- Protection of spotted owl sites in the reserved LUAs
- Recruitment of spotted owl habitat over 50 years

The Service's Barred Owl Removal Experiment is ongoing, but preliminary results from a smaller experiment in California (Diller *et al.* 2016) indicate that barred owl removal may be an effective tool in conserving the spotted owl. Diller *et al.* (2016) reported that following barred owl removal, spotted owl site occupancy and fecundity improved on the removal area and rate of population change increased to 1.029 annual rate of population change on the removal area but continued to decline (0.870 annual rate of population change) on the area where barred owls were not removed. The results of the Barred Owl Removal Experiment will be used, in concert with all other available information to develop a barred owl management strategy. The Service intends to develop this strategy promptly and, if a decision is made to proceed, implement such a strategy expeditiously with the help of other Federal, State, and local partners. Service implementation of any future barred owl management strategy will be subject to full NEPA compliance and ESA section 7 consultation before a decision would be made and any such management would be implemented.

Although we cannot at this time predict the components of any barred owl management program that might be implemented, we can make some reasonable assumptions, as detailed below. This is not a case, however, of relying on uncertain mitigation measures because the BLM has structured its proposed action to avoid negative effects in the short term while providing for adaptation to new information as it emerges. The PRMP does not allow incidental take of spotted owls from timber harvest unless and until implementation of a barred owl management program has begun consistent with the assumptions in this biological opinion and including a monitoring program to determine if the biological benefits for the spotted owl are being achieved. If after 8 years such a program has not begun, for whatever reason, BLM will reinstate ESA section 7 consultation on its PRMP. If a barred owl management program is implemented, the PRMP provides for reinstatement of section 7 consultation at any time if the assumptions regarding the biological benefits for the spotted owl are not being realized in order to re-evaluate the impacts of the PRMP based on the best available information at that time. The specific benchmarks that must be met are listed below in the section entitled "Reinitiation Triggers. If reinstatement occurs either because implementation of a barred owl management program has not begun or is not meeting biological expectations, the PRMP provides that the BLM will not take any actions that are likely to adversely affect the spotted owl or its critical habitat. Timber harvest causing incidental take would be likely to adversely affect the species and thus would not occur during reinstatement.

Analysis of the Effect of Implementing Barred Owl Management

To analyze the potential long-term effect of the PRMP, we estimated the effects of implementing a barred owl management strategy on BLM lands on spotted owl populations. To develop this estimate, we started with the following basic biological and management principles.

Biological Principles

1. Without barred owl management, and regardless of the proposed timber harvest, spotted owl populations will continue to decline at or near their current rate of 3.8 percent per year into the future. This rate was derived from data collected at long-term demographic study areas for the spotted owl (Dugger *et al.* 2016).
2. As a result, the number of occupied sites will continue to decline at or near the current rate until barred owl management is implemented. This decline will occur across all lands including reserved LUAs and harvest areas.
3. The probability that an unoccupied site will become reoccupied by spotted owls following implementation of barred owl management will be influenced by the amount of habitat available on individual sites and barred owl management. The range-wide rate of decline (3.8 percent per year) comes from data collected within forests with some ongoing timber harvest, and thus includes the effects of timber harvest at the rates that occurred on the long-term spotted owl demographic monitoring areas from 1992 to 2013 (Dugger *et al.* 2016). However, many of the study areas contain significant reserve lands under existing Federal land management plans, so timber harvest effects in the Harvest Land Base may exceed those of the study areas at the small scale. To ensure we did not underestimate the potential effect of timber harvest under the PRMP, we assumed that harvest occurring on the Harvest Land Base will have an additive effect. Therefore, for spotted owl home ranges that overlap with, or lie within, the Harvest Land Base, our projection includes both 1) the effects of barred owl management to improve spotted owl population trajectories described above, and 2) an additional estimated impact of numbers of sites that may become abandoned from timber harvest in the Harvest Land Base.

Management Principles

1. The number of spotted owl sites that meet the definition of “occupied” on lands impacted by actions in the Harvest Land Base will decline due to timber harvest over time at the maximum rates described in the BLM BA (10 percent of such sites during the first decade of plan implementation; 15 percent of such sites during the second decade of plan implementation; and 20 percent of such sites per decade thereafter (BLM 2016a, p. 46)).
2. Adverse effects from timber harvest would be additive to the projected decline, but it is clear that impacts from barred owls are the most significant cause of existing and projected spotted owl declines on BLM lands.
3. Managing the influence of barred owls on spotted owls will increase the likelihood of spotted owl occupancy in those areas.
4. Spotted owl territories affected by timber harvest in the Harvest Land Base that have greater amounts of their core areas and home ranges in the barred owl management areas and in reserved land use allocations will be more likely to maintain occupancy or become reoccupied.

Analysis Procedures

It will take time for the Service to collect and analyze data from the current Barred Owl Removal Experiment. Information from the experiment will be used, along with other information, to develop and initiate implementation of a barred owl management strategy. However, to analyze the effects of the PRMP, we developed a reasonable scenario that anticipates that effects of a barred owl management program on spotted owl occupancy. We anticipate that such a program would be implemented sometime between 2021 and 2023 (5 to 8 years after implementation of the PRMP).

There are likely multiple ways to design an effective barred owl management strategy to meet the objectives of reducing the adverse effects of barred owls on spotted owls in the action area. In this document we evaluate the effects of this potential example of barred owl management on BLM lands to improve spotted owl demographic contributions within the action area. Although the details of the location and area of a potential barred owl management strategy may differ from the specifics of this scenario, we believe it represents a reasonable scenario on which to base our analysis of what an effective barred owl management program on BLM lands would be expected to achieve.

Process for Identifying Barred Owl Management Areas

1. In its analysis of effects of the PRMP on spotted owls, BLM described a scenario of a future barred owl management strategy based on barred owl control areas (BLM 2016a, p. C-49) to assess impacts of management actions to spotted owls if barred owl effects were reduced. The BLM made the following assumptions about barred owl management when conducting this analysis: (1) barred owl management would occur across the species' range; (2) on 10 percent of the forested lands in each critical habitat unit/modeling region; (3) only on Federal LSRs, state lands, and in spotted owl critical habitat on state and federal lands; (4) on aggregations of the best spotted owl habitat; and (4) within one mile of an improved road. We started with the map developed by BLM of the lands meeting these criteria as potential areas for removing barred owls (Figure C-18, BLM 2016a, p. C-50). Although our purpose is different from BLM's modeling exercise, we believe these are reasonable criteria to start with in identifying the potential outcome of barred owl management on BLM lands.
2. Barred owl management is likely to be applied on a relatively large scale. BLM's modeling identified all lands that met the criteria, even if in small isolated parcels, while we defined management area based on large, aggregated blocks of the lands identified by BLM. We identified lands on this map within the action area that are managed by BLM and contained large aggregations of the hypothetical barred owl control areas identified by BLM and relatively low amounts of Harvest Land Base. We identified six such potential management areas (see Figure 28).
3. We determined the number of known and historic spotted owl sites on these lands and estimated current occupancy at 30 percent (BLM 2016a, p.45, 79; Greenquist 2015, pers. comm.; Dugger *et al.* 2016, p.79). The six management areas we identified include 599 known and historic spotted owl sites. At 30 percent occupancy, this represents a total of 180 currently occupied sites.
4. Barred owl management on these areas should reduce the influence of barred owls and allow for increased spotted owl site colonization, decreased site abandonment, and overall increased occupancy by spotted owls. Based on occupancy rates prior to and

early on in the barred owl range expansion (Dugger *et al.* 2016, p. 79) and changes in spotted owl occupancy rates following barred owl removal observed in northern California (Diller *et al.* 2016, entire), we assumed that spotted owl occupancy rates could improve to 60 to 70 percent following implementation of a successful barred owl management program.

5. Based on the number of known/historic spotted owl sites on these barred owl management areas, we predicted the number of sites that could be occupied by spotted owls after barred owl management is implemented based on the assumptions about spotted owl occupancy described above.

In creating the six landscape-scale potential management areas, we included a small amount of non-reserved lands. Table 226 provides acres of barred owl management area within each land use allocation. The Harvest Land Base represents only 6 percent of BLM lands within these management areas. Timber harvest activities on the Harvest Land Base within the six management area would not significantly affect the outcome of the analysis because it comprises a low percentage (6 percent) of the total area.

Table 226. Land use allocations in the example of a potential barred owl management design on BLM lands within the planning area shown in Figure 28.

Land Use Allocation	Barred Owl Management Area (Acres)	Percent (%) of Land Base
Late Successional Reserve	492,846	60
Riparian Reserve	234,756	29
District Designated Reserve	33,382	4
Congressionally Reserved	16,128	2
Harvest Land Base	45,790	6
Total	822,903	100

The goal of management of barred owls on the six potential management areas is to maintain spotted owl occupancy at sites that would otherwise likely be colonized by barred owls and to increase spotted owl occupancy of formerly occupied sites. Dugger *et al.* (2016) reported that spotted owl populations are currently declining at a rate of 3.8 percent per year. By committing to contribute to the implementation of an effective barred owl management strategy as part of the PRMP, the BLM would potentially have a stronger positive conservation effect on spotted owls than would be achieved through habitat protection and maintenance alone (Dugger *et al.* 2016).

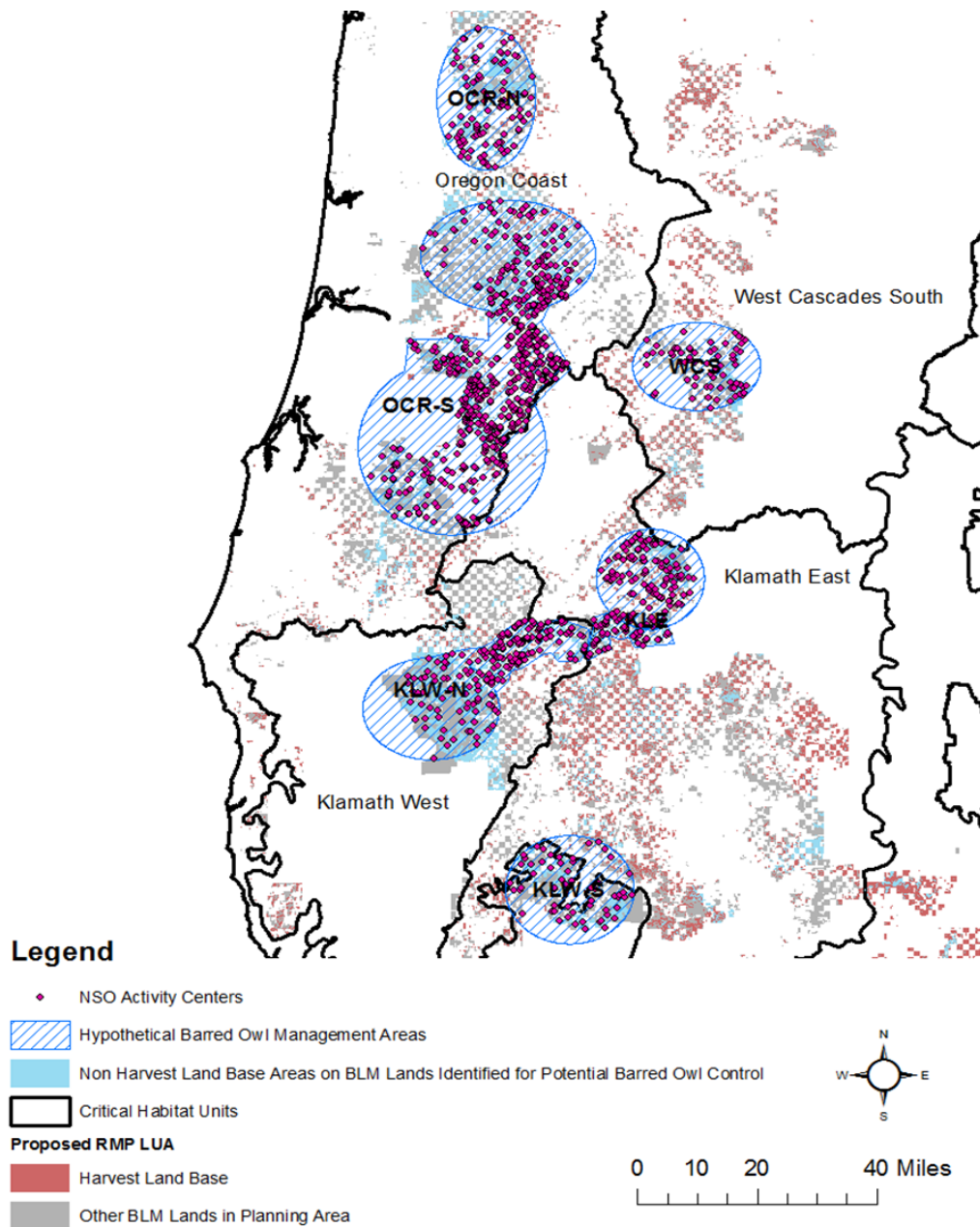


Figure 28. A potential barred owl management design on BLM lands within the planning area.

Although timber harvest may result in negative effects at up to 325 potentially occupied spotted owl territories, effective barred owl management could contribute to maintaining spotted owls on a portion of those 325 sites as well as maintaining and promoting reoccupancy of spotted owl sites outside the Harvest Land Base. Spotted owl territories affected by the harvest land base that have greater amounts of their core areas and home ranges in the barred owl management areas and in reserved land use allocations will be more likely to maintain occupancy or become reoccupied. We believe these potential positive effects would fully mitigate for and exceed the

potential negative impacts of timber harvest in the PRMP. Results from Diller *et al.* (2016, p. 13) indicate that recolonization rates by spotted owls in northern California can be rapid, often occurring within weeks to months following barred owl removal. The Service's ongoing Barred Owl Removal Experiment will provide additional information on spotted owl recolonization and occupancy rates following implementation of barred owl removal as well as an assessment of the effort needed to maintain barred owls at a level that allows spotted owl populations to persist and grow. Although data collection is still occurring under the Experiment, current research (Diller *et al.* 2016, Dugger *et al.* 2016) suggests that when barred owl presence is reduced, historic spotted owl sites are likely to be recolonized by spotted owls, and spotted owl demographic performance can improve with continued barred owl management.

The potential barred owl management strategy considered herein includes lands containing 599 known and historic spotted owl sites, mostly in reserved LUAs. These lands contain both currently occupied and historic, but currently unoccupied, spotted owl sites distributed across the six barred owl management areas shown in Figure 28. Based on current occupancy rates (30 percent) (Dugger *et al.* 2016, BLM 2016a), it is likely that 180 of these spotted owl sites are currently occupied by spotted owls. With successful barred owl management as described above, we would expect spotted owl occupancy within the barred owl management areas to improve to between 359 and 419 spotted owl sites representing an increase of occupancy at 179 to 239 of the 599 spotted owl sites (Table 231). Without a barred owl management strategy, it is likely all 180 of these the currently-occupied spotted owl sites would eventually be lost to barred owl influences during the 50 years of this PRMP. We anticipate that improvements to spotted owl site occupancy resulting from barred owl management is likely to occur gradually over time, starting with a reduction in the overall rate of decline and eventually reaching a level where spotted owl populations could be sustained.

The analytical procedure and the projected outcome of such a barred owl management program is presented below in the Projected Outcome of an Effective Barred Owl Management Program section. This approach is expected to provide for the long-term persistence of spotted owls on BLM lands in the action area.

Effects of the Action on Non-Federal Lands Within the Action Area

As described in the BA, a primary purpose of the PRMP is to provide adequate amounts of suitable, high quality habitat distributed across BLM lands in a dedicated reserve network for the long term conservation of spotted owls, marbled murrelets, and other wildlife species. This basic approach is consistent with previous landscape level conservation planning efforts for the spotted owl implemented during the last 25 years, as described in the Revised Recovery Plan (USFWS 2011b, pp. II-3, II-10). As was identified in the NWFP and the BA (BLM 2016a, p. 89), a robust reserve network of Federal lands in Oregon, Washington, and California is still expected to adequately provide for the long term conservation and recovery of the spotted owl. Conservation on private timber lands – while potentially helpful to long term conservation of listed species – was not relied upon for the recovery of the spotted owl.

In Oregon, state forest lands including portions of the Tillamook, Clatsop, and Elliott State Forests were identified areas as essential for the conservation of spotted owls (USFWS 2012a, p. 71894). The Service is currently working with the state during timber planning to avoid take

of spotted owls and has developed a safe harbor agreement with Oregon Department of Forestry that will contribute to the conservation of the spotted owl by allowing the researchers to implement the Service's Experimental Removal of Barred Owls to Benefit the Threatened Northern Spotted Owl research study on ODF lands in the Oregon Coast Ranges. Information gained from this experiment is critical to the development of a long-term management strategy to address the barred owl threat to the spotted owl.

Although the overall conservation strategy for listed species is dependent upon conservation on Federal lands, the Service is nevertheless required under section 7 of the Act to evaluate the potential direct and indirect effects the proposed action might have on listed species occurring on non-Federal lands. We recognize that indirect effects of the PRMP may occur on non-Federal lands that are accessible by traveling over BLM roads which will be managed under the PRMP. Where access to non-Federal parcels facilitates reasonably foreseeable activities on those parcels, the indirect effects of these activities are considered part of the proposed action for section 7 consultation purposes.

It is not possible to predict precisely where and what actions will occur on these non-Federal lands within the action area during the next 50 years. As future non-federal actions are planned and proposed, and to the extent they are subject to future section 7 consultations, the Service will consult with BLM at the appropriate level of specificity in those analyses. Given this future uncertainty, the Service is nevertheless able to make a general estimate of what non-federal lands to include in the action area at this programmatic scale. We have included non-federal lands that are checkerboarded with the BLM ownership because using a BLM road may be necessary for any non-aerial access to these lands. Although there is no certainty that all or many of these lands will be accessed, or the extent to which they will be accessed during the life of the plan, for the purposes of this analysis the Service is conservatively estimating that all of these non-federal lands will be accessed via BLM roads at one point or another during the 50-year life of the PRMP.

Similarly, there are non-federal lands adjacent to and surrounding BLM lands (not checkerboarded) where potential access to these lands involves BLM roads managed under the PRMP. The distance from BLM property where indirect effects could potentially occur on these lands varies and is dependent on factors such as the adjacent landscape, and the likelihood that these lands will be accessed during the life of the plan. However, where BLM lands are sparse or isolated the likelihood of non-federal lands relying on BLM roads for access diminishes.

For the purposes of this programmatic review, we believe a ½-mile distance around the perimeter of BLM lands is a reasonable distance for assessing the indirect effects for the reasons discussed in the description of the action area. Not all non-federal lands meeting this description will have actions on them during the life of the PRMP, but including them all is the most conservative approach for this programmatic analysis.

Where these non-federal lands contain merchantable timber, the action most reasonably foreseeable that has the potential to affect spotted owls is timber harvest. Information on private timberland stocking levels and future harvest plans is often closely guarded and proprietary. Although the BLM was able to model their planned timber harvest over the 50

years of the PRMP, we do not have any specific information on the likelihood of harvest or timber harvest plans for these non-federal lands over 50 years. Instead, the Service relied on the trends of non-federal timber harvest within the NWFP area (Davis *et al* 2016, pp. 21-22, 31-32) to estimate the rate of loss of habitat on these non-federal lands.

To conduct this analysis of indirect effects on non-federal lands in the action area, we first queried the amount of extant spotted owl habitat that could potentially be affected indirectly by the PRMP. Based on a GIS query using the BLM's "BLM OR RWO Proposed RMP Northern Spotted Owl Relative Habitat Suitability Strength of Selection Classes 2013" layer we estimate the non-Federal acreage of spotted owl habitat within the checkerboarded landscape and within ½ mile of BLM lands to be approximately 1.2 million acres. There are approximately 520,000 acres of spotted owl nesting/roosting habitat and 691,000 acres of spotted owl dispersal habitat on these non-federal acres. The 20-year monitoring report for the spotted owl (Davis *et al* 2016, pp. 21-22, 31-32) estimates that the rate of spotted owl nesting/roosting habitat harvested on non-federal lands between 1993 and 2012 in Oregon was approximately 2.25 percent annually, and the rate of dispersal habitat harvested on non-Federal lands since 1993 in Oregon was 1.5 percent annually. This annual rate of harvest fluctuates due to many factors, such as the market price per board foot of timber and other market forces. It is not possible to accurately predict what future fluctuations might occur during the next 50 years, nor are we able to precisely predict in what specific locations timber harvest will occur on these non-federal lands. Therefore, for the purposes of this programmatic review, we assume the average rate of past non-federal harvest during this time period will continue through the life of the PRMP.

A 2.25 percent annual harvest rate of extant spotted owl habitat would remove approximately 11,700 acres of spotted owl nesting/roosting habitat annually, in which case the majority of spotted owl nesting/roosting habitat on non-federal lands within the action area would be removed within approximately 45 years. At a 1.5 percent annual rate of removal of spotted owl dispersal habitat, most of the extant non-federal dispersal habitat would be removed in approximately 65 years. However, dispersal habitat is much more likely to grow on these non-federal lands over time with normal harvest rotations and thus replace much of the removed dispersal habitat during this time period. We do not have reliable information on spotted owl occupancy across these non-federal lands. It is likely there are some spotted owls supported by this landscape, but the densities are likely to be much lower than on BLM lands within the action area. Unless barred owl management is implemented on these non-federal lands, we expect that any remaining spotted owl sites would be likely to be impacted by the effects of barred owls over time.

This level of impact on non-federal lands is not expected to impede recovery of the spotted owl. For example, as noted in the original 1994 biological opinion on the NWFP (USFWS 1994c, pp. 19-20), Federal lands within the range of the owl "should provide for the survival of a spotted owl population that is stable and self-sustaining on Federal lands throughout the planning area." In the current proposed action, the BLM has built upon this NWFP strategy and increased the total number of acres of LSRs and Riparian Reserves on their lands from the NWFP by approximately 178,000 acres. BLM has also committed to cooperating and contributing to a barred owl management program if the Service deems it an effective and necessary conservation strategy after completion of the barred owl removal experiment that is currently underway (USFWS 2013). This updated strategy in the PRMP will increase the BLM's net contribution to

spotted owl recovery and bolster the effectiveness of the Federal land base contribution to a self-sustaining spotted owl population.

In addition, the Service expects to consult with BLM at the project level pursuant to section 7 when specific actions are proposed on these lands that require involvement by BLM. If there is a potential for take of the spotted owl on these non-federal lands where no section 7 nexus exists, we expect private timber companies to comply with the requirements of the ESA and seek a section 10 permit from the Service as appropriate.

Disturbance

Disturbance, as defined by BLM (2016a, pp. 9-10), includes human-caused noise, human intrusion or human-caused tremor (such as the shaking of a tree canopy from helicopter rotor wash) that is above ambient levels, occurs in occupied habitat but is temporary and does not modify habitat structure. Disturbance, in this context, is distinct from “surface disturbance,” which refers to modified soil or vegetation (BLM 2016a, pp. 9-11).

Disruption is a type of disturbance that creates the likelihood of injury to a listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Disruption is a subset of disturbance.

Disturbance and disruption for spotted owls have both temporal and spatial components. Spatial components for spotted owls are detailed in Table 227. Time periods when spotted owls are sensitive to disturbance include the critical breeding period (March 1-July 15) and the entire breeding period (March 1- September 30).

Disturbance Distance: the distance from the activity outward within which the proposed activity is likely to cause a listed species, if present, to be distracted from its normal activity. Except as stated in Table 227, the Service considers the disturbance distance to be 0.25 mile from nesting spotted owls.

Disruption Distance: the distance from the activity outward within which the noise or activity of the activity is likely to cause spotted owls, if present, to be distracted to such an extent as to significantly disrupt normal behavior and create the likelihood of harm or loss of reproduction. The disruption distance is a subset of the disturbance distance. Proposed activities that would occur within the distances shown in Table 227 might significantly disrupt the normal behavior patterns of individual spotted owls, or breeding spotted owls if present.

Disturbance and disruption occur only if a site is occupied by spotted owls, and not all sites are currently occupied. For spotted owls, effects from disturbance and disruption are associated with activities near known spotted owl or predicted sites because that is where the Service anticipates the potential for injury exists as a result of noise. For those stands that are potentially harvested during the breeding season, noise above ambient levels has the potential to cause adults to leave the nest when there are eggs or chicks in it, or to abort a feeding attempt. Either of these activities leaves the young or eggs unprotected, or in the case of aborted feeding attempts the owlets may be at a diminished capacity due to reduced nutrition and energy stores to be able to successfully fledge or defend themselves against predators. The Service believes

disturbance associated with timber harvest during the breeding season will adversely affect spotted owls and has the potential to result in injury or death of juvenile owls or eggs. However, not all spotted owls are likely to respond the same way to above-ambient noises and spotted owl responses could span the spectrum from a minor annoyance to aborted feedings or leaving the young unattended.

Distances (see Table 227) are measured from the edge of the 300 meter nest patch, unless the nest tree is known. The proposed activities include forest management actions that have the potential to disrupt the normal behavior patterns of individual spotted owls or breeding pairs in known owl sites, known spotted owl nest patches, or predicted spotted owl nest patches within the disruption distances and times shown in Table 227.

Table 227. Disturbance, disruption and/or physical injury distance thresholds for spotted owls from a variety of activities. Distances are to a known occupied spotted owl nest tree or fledging locations, but if no current survey information is available then distances are from predicted nest patches.

Project Activity	No Effect	NLAA “may affect” disturbance distance	LAA early nesting season disruption distance (Mar 1–Jul 15)	LAA late nesting season disruption distance (Jul 16–Sep 30)	LAA direct injury and/or mortality (Mar 1 – Sept. 30)
Light maintenance (e.g., road brushing and grading) at campgrounds, administrative facilities, and heavily-used roads	>0.25 mile	≤ 0.25 mile	NA ¹	NA	NA
Log hauling on heavily-used roads (FS maintenance levels 3, 4, and 5)	>0.25 mile	≤ 0.25 mile	NA ¹	NA	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile -	66 yards to 0.25 mile -	≤ 65 yards ²	NA	NA

Project Activity	No Effect	NLAA “may affect” disturbance distance	LAA early nesting season disruption distance (Mar 1–Jul 15)	LAA late nesting season disruption distance (Jul 16–Sep 30)	LAA direct injury and/or mortality (Mar 1 – Sept. 30)
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	>0.25 mile	66 yards to 0.25 mile	≤ 65 yards ²	NA	NA
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	>0.25 mile	120 yards to 0.25 mile	≤ 120 yards ³	NA	≤ 5 yards(injury) ³
Blasting	>1 mile	0.25 mile to 1 mile	≤ 0.25 mile ⁴	NA	≤ 100 yards (injury) ⁴
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards ⁵	≤ 100 yards ⁶ (hovering only)	NA
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards ⁷	≤ 50 yards ⁶ (hovering only)	NA
Helicopters: K- MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards ⁸	≤ 50 yards ⁶ (hovering only)	NA
Small fixed-wing aircraft (Cessna 185, etc.)	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards	NA	NA
Tree Climbing	>66 yards	26 yards to 65 yards	≤ 25 yards ⁹	NA	NA
Burning (prescribed fires, pile burning)	>1 mile	0.25 mile to 1 mile	≤ 0.25 mile ¹⁰	NA	NA

NLAA = “not likely to adversely affect.” LAA = “likely to adversely affect” $\geq$ is greater than or equal to, $\leq$ is less than or equal to.

Table 227 Footnotes:

1. NA = not applicable. Based on information presented in Temple and Gutiérrez (2003, p. 700), Delaney *et al.* (1999, p. 69), and Kerns and Allwardt (1992, p. 9), we anticipate that spotted owls that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads.
2. Based on Delaney *et al.* (1999, p. 67) which indicates that spotted owl flush responses to above-ambient equipment sound levels and associated activities are most likely to occur at a distance of 65 yards (60 m) or less.
3. Impulsive sound associated with pile-driving is highly variable and potentially injurious at close distances. A review compiled by Dooling and Popper (2007, p. 25) indicates that birds exposed to multiple impulses (*e.g.*, pile driving) of sound at 125 decibels (dBA) or greater are likely to suffer hearing damage. We have conservatively chosen a distance threshold of 120 yards for impact pile-driving to avoid potential effects to hearing and to account for significant behavioral responses (*e.g.*, flushing) from exposure to loud, impulsive sounds. Based on an average maximum sound level of 110 dBA at 50 ft for pile-driving, exposure to injurious sound levels would only occur at extremely close distances (*e.g.*, ≤ 5 yards).
4. Impulsive sound associated with blasts is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 – 0.6 miles from blast sites (Holthuijzen *et al.* 1990, p. 273). Exposure to peak sound levels that are >140 dBA are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pp. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen *et al.* (1990, p. 272), which documented peak sound levels from small blasts at 138 – 146 dBA at a distance of 100 m (110 yards).
5. Based on an estimated 92 dBA sound-contour (approximately 265 yards) from sound data for the Chinook 47d presented in Newman *et al.* (1984, Table D.1).
6. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. The hovering rotor-wash distance for the Chinook 47d is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
8. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (*e.g.*, K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dBA at 100 m)(Grubb *et al.* 2010, p. 1277).
9. Based on Swarthout and Steidl (2001, p. 312) who found that 95 percent of flush responses by spotted owls due to the presence of hikers on trails occurred within a distance of 24 m.

10. Based on recommendations presented in *Smoke Effects to Northern Spotted Owls* (USFWS 2008, p. 4).

As mentioned above, all timber sales and most other actions potentially carried out under the PRMP will receive a subsequent section 7 consultation that will look at the site and project specific aspects of those activities. In order to determine whether spotted owls are present within or near planned timber harvests, the BLM will conduct pre-project surveys consistent with the *2012 Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls* (USFWS 2011b, revised 2012) and include the results of those surveys in any subsequent consultations (BLM 2016a, p. 44). Any disturbance or disruption considered here would result from the activities addressed above as part of the PRMP. Some activities could potentially include both habitat modification and noise disturbance, while some may only include one of those effects. Where injury or death of a listed species results from habitat modification impacts, effects from noise would not be expected to be additive as the habitat impacts are likely to be more certain and long-lasting.

The BLM determined in their BA (BLM 2016a, p. 196) that 175 spotted owl sites would potentially be injured due to noise disruption (BLM used the terms “harmed” or “harassed”) by implementation of the RMP. Their rationale is provided here:

Although management guidance described in Section II H 3 would delay habitat modifications and associated disruptions at these sites, the BLM anticipates that, during the next 50 years, all of these sites would be modified. Although not all of these sites would be occupied by northern spotted owls, the BLM feels that 175 known sites is a reasonable estimate of the number of spotted owl sites that currently exist in the Harvest Land Base and would be harmed or harassed by implementation of the Proposed RMP.

The BLM estimated that the spotted owls likely to be affected through disruption are the same spotted owls that will experience injury or death through habitat modification from timber harvest in the Harvest Land Base. The Service anticipates that only about 50 of these sites in the Harvest Land Base are likely to be occupied, as noted above. The effects from habitat modification are longer-lasting and are considered a greater threat to spotted owl population numbers than noise disturbance. By quantifying disturbance effects to these same spotted owls that will be affected by timber harvest the BLM figure double-counts the number of spotted owls that may experience adverse effects from implementation of the PRMP from timber harvest in the Harvest Land Base. While other activities implemented as part of the PRMP have the potential to disrupt spotted owls the Service expects these situations outside the Harvest Land Base to be sporadic and rare, both temporally and spatially because of the overriding management objectives of those LUAs. We anticipate the effects to adult spotted owls of any disruption to be temporary as an adult nesting spotted owl that has been interrupted during its breeding cycle is not likely to be impacted to the extent that it would not be able to nest in subsequent years. At the scale of this programmatic consultation it is not possible to quantify the potential disruption that may result from non-timber harvest impacts outside the Harvest Land Base. However, these impacts are not expected to have long-lasting effects to the overall spotted owl population or the contribution of the PRMP to the conservation of the spotted owl because of the temporal nature of disturbance effects and because of the objectives of the non-HLB land-use allocations.

Furthermore, the BLM will not implement timber sales that result in the take (injury or death) of spotted owls until a barred owl management program has begun (BLM 2016a, pp. 44-45), which will delay any disruption impacts associated with Harvest Land Base timber sales. After that, the BLM will meter out any impacts to occupied spotted owl sites from timber harvest according to the schedule discussed above, and future project-level section 7 consultations will include discussions to minimize noise impacts on spotted owls at sites where disruption may occur.

In the BA (BLM 2016a p. 45-47), BLM outlines potential actions that will be taken to minimize the impacts on spotted owls including avoiding or delaying negative impacts to spotted owl known sites located in the Harvest Land Base, and avoiding causing the abandonment of spotted owl known sites located in other land use allocations, to the extent consistent with the management objectives and management direction for the Harvest Land Base. Although these guidelines are not mandated to be followed, this is consistent with implementation of Recovery Action 10 of the spotted owl recovery plan. Whenever possible the Service will negotiate through the level one consultation process for the BLM to conduct these harvests outside of the breeding season to reduce the potential impacts to nesting spotted owls. Consistent with the BA (BLM 2016a, pp. 45-47) the Service and BLM have a history of working together to reduce or avoid noise impacts to nesting spotted owls by implementing seasonal restrictions whenever possible.

As part of the guidance designed to avoid or delay negative impacts to spotted owl known sites located in the Harvest Land Base, to the extent consistent with the management objectives and management direction for the Harvest Land Base, BLM managers would avoid the following actions (BLM 2016a, p. 47):

- *Occur in the nest patch of a site. Habitat modification in the nest patch will negatively affect re-occupancy of the site by spotted owls until habitat conditions recover.*
- *Cause the loss of nesting-roosting-foraging habitat in the 500-acre core use area surrounding a site. Sites with core use areas supporting less than 50 percent nesting-roosting-foraging habitat, when all land ownerships are considered, are less likely to be re-occupied by northern spotted owls until habitat conditions recover.*
- *Cause the amount of nesting-roosting-foraging habitat in the median provincial home range area surrounding a site to decline below 50 percent, when all land ownerships are considered.*

Conclusion

The Service concludes that disturbance resulting from implementation of actions consistent with the PRMP has the potential to create the likelihood of injury by significantly disrupting the normal behavioral patterns of spotted owls. Where these effects are associated with timber harvest activities that also cause injury or death through habitat modification, the habitat impacts are considered to be more impacting and longer-lasting, and therefore, should not be double-counted when assessing the number of spotted owls impacted to this degree. While disruption can affect spotted owls locally the Service believes the significance of these impacts

to the overall spotted owl population within the action area will be minimized due to the limited temporal nature of disturbance impacts and because adult spotted owls would be expected to contribute to a reproducing population in subsequent years.

Summary of Effects

Timber Management

Management of the Harvest Land Base is intended to produce a consistent and reliable source of timber to meet the Allowable Sale Quantity of the BLM districts within the action area. Timber harvest under the PRMP involves the potential planning and implementation of timber sales or groups of timber sales that meet the management direction of the Harvest Land Base category and includes, among other aspects, the layout of units, the survey and scaling of timber, the construction of roads and landings as needed, the advertising, selling and awarding of sales, the harvest of the timber, the hauling of logs and the reforestation activities after the harvest.

Although this potential allocation is not intended to be relied on for demographic support of spotted owls, the management direction includes provisions that would contribute to the development of late-successional habitat over time. This habitat may not remain on the landscape in the long-term, but the presence of spotted owl habitat within the Harvest Land Base would assist in spotted owl movement across the landscape and could potentially provide refugia from barred owls. This function would augment the performance of the 75 percent of the BLM landscape that is protected as reserves and where the bulk of spotted owl conservation is expected to occur.

Table 228. Acres of spotted owl habitat estimated to be impacted by timber harvest in the harvest land base over the next 50 years (acreages from BLM 2016a, p.198-201). Note: totals on this table include acres that will be harvested multiple times over the life of the PRMP and salvage may occur on lands that have already been impacted by timber harvest. Therefore, many of these acres are double-counted.

	Nesting-roosting	Dispersal	Total
Standard thinning	81,800	60,600	142,400
Regeneration	129,800	23,200	153,000
Selection (Uneven)	151,100	42,700	193,800
Salvage			16,400
	362,700	126,500	505,600

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. In the BA the BLM was not able to provide any precise locations of specific future projects that are likely to occur over the next 50 years as part of the PRMP. Each individual project will be planned and proposed at a later date and at a finer scale when project-specific information is available. When these projects are proposed the BLM will complete project-specific and site-specific NEPA analyses and section 7 consultation, which will provide a quantitative and

localized analysis of their effects on listed species. The BLM has modeled the landscape-scale effects of their timber harvest program within the Harvest Land Base over the next 50 years of the PRMP. Therefore, the purpose of this programmatic analysis is to evaluate the overall landscape-level impact of the proposed action on spotted owl conservation.

Spotted owl habitat impacts in the Harvest Land Base

In the PRMP, BLM provided acreages in each land use allocation that are likely to be impacted by timber management and other activities in their assessment of effects to the species (BLM 2016a, p. 196-201). These acres, identified to be impacted over the life of the plan, are consistent with the total acreages within each land use allocation.

The BLM also provides projections of forest conditions into the future that demonstrate amounts of mature multiple-canopy and structurally- complex forest; and habitat that is strongly-selected-for by spotted owls; and habitat that is strongly-avoided by spotted owls (BLM 2016a, p. 127-136) that will be present over the life of the PRMP. These changes in forest conditions are presented graphically and in tables as changes in forest habitat types by decade.

In order to develop these projections, the BLM developed a modeling framework to forecast spotted owl habitat change by accounting for effects of timber harvest, ingrowth, and loss of forest to wildfire. Details of these modeling methods are presented in Appendix C (BLM 2016a). BLM used observed changes in spotted owl relative habitat suitability between 1996 and 2006 to project the expected changes in future decades. The methodology BLM used is scientifically sound and is similar to methods used by USFWS for developing critical habitat rule and by USFS for evaluating habitat change for the NWFP 20-year monitoring reports (Davis et al. 2015, Davis et al. 2016).

We consider this to be a reasonable approach to assessing spotted owl habitat change in the planning area resulting from timber harvest, ingrowth, and wildfire because it reflects the application of best available science and the acreages of land that will be subject to the range of management activities in the land use allocations presented in the PRMP.

Regeneration Harvest

In the Moderate Intensity Timber Area (MITA), regeneration harvest is expected to potentially affect 111,800 acres of spotted owl habitat over the next 50 years (BLM 2016a, p.199), or approximately 2,236 acres per year over 50 years. Of these acres, approximately 17,100 acres (15 percent) are dispersal habitat and 94,600 acres (85 percent) are nesting/roosting habitat. Regeneration harvest within the 94,600 acres of nesting/roosting habitat will negatively affect spotted owls on these lands by removing some portion of the existing suitable nest sites. These spotted owls will need to find alternate nesting locations or forgo reproduction. Canopy cover would be reduced to less than 40 percent in all cases (BLM 2016a, p. 199) resulting in the removal of 111,700 acres of spotted owl habitat over 50 years. Regeneration harvest that retains 5-15 percent of pre-harvest stand basal area will likely result in the loss of most of the habitat elements associated with nesting/roosting and foraging habitat, although trees with ≥ 40 inches DBH and that the BLM identifies were established prior to 1850 will be retained except

where removal is necessary for safety or operational reasons. These trees will contribute to the structural diversity of the future stand as it regenerates through either natural or artificial regeneration, but these legacy trees would not be expected to contribute spotted owl nesting/roosting habitat until the forest around them matured. When implemented by BLM, natural regeneration is expected to provide for complex early seral conditions through the early stages of stand development. Canopy cover, amount of large conifers, basal area, and incidence of trees with deformities will likely be reduced below levels necessary to sustain nesting spotted owls following timber harvest.

In the Light Intensity Timber Area (LITA), potential regeneration harvest will affect 41,300 acres of spotted owl habitat over the next 50 years (BLM 2016a, p. 200), or 826 acres per year during the next 50 years. Of these acres, 6,100 (15 percent) is expected to be dispersal habitat and 35,200 acres (85 percent) is expected to be nesting/roosting habitat. Management direction includes 15-30 percent retention of pre-harvest stand basal area in live trees in a variety of spatial patterns and retaining all trees that are both $\geq 40''$ and established prior to 1850 as described above for the MITA (BLM 2016a, p. A-10). Although these harvests will potentially degrade or remove spotted owl habitat, these actions are likely to create more favorable habitat conditions and more rapid re-development of forest capable of supporting spotted owls than will the management direction for the MITA because of the additional habitat features that will be left on the landscape. Areas that are left unharvested will provide pockets of habitat that may contribute to the dispersal of spotted owls across the landscape.

Although the potential regeneration harvest in dispersal stands may be spread across a large landscape allowing spotted owls to continue to disperse across the region, the regeneration harvest that is part of the LITA will reduce the quality of dispersal habitat and potential foraging opportunities for spotted owls within the 6,100 acres of dispersal habitat affected by regeneration harvest. However, spotted owl are still expected to be able to move across the landscape given the presence of LSRs, Riparian Reserves, the stand retention incorporated into timber harvests in the LITA (15-30 percent of the stand), and because these effects will be spread over 50 years. Regeneration harvest within the 35,200 acres of nesting/roosting habitat will negatively affect spotted owls on these lands by removing habitat, potentially removing nest trees, reducing demographic performance of owls, or causing site abandonment. Effects will be greatest when regeneration occurs close to nest trees or core use areas or when habitat is already limited in a particular owl site and will be lesser in outer portions of spotted owl home ranges particularly when habitat is abundant. Retention of 15-30 percent of pre harvest stand basal areas will promote more rapid development of forest likely to support spotted owls than will the 5-15 percent retention that will be applied in the MITA.

Standard Thinning

In the MITA, standard thinning is expected to affect an estimated 96,000 acres of spotted owl habitat over the next 50 years (BLM 2016a, p. 200), or approximately 1,920 acres per year over 50 years. Of these acres, 39,500 acres (41 percent) are dispersal habitat and 56,500 acres (59 percent) are nesting/roosting habitat. If thinning of dispersal habitat maintains a post-treatment canopy cover of 50-60 percent, the ability of these stands to effectively function as dispersal habitat for spotted owls may be reduced in the short term and their ability to support nesting, roosting, and foraging by spotted owls may be reduced considerably.

In the LITA, standard thinning is expected to impact 46,400 acres of spotted owl habitat over the next 50 years. Approximately 21,000 acres (46 percent) is dispersal habitat and 24,500 acres (54 percent) is nesting/roosting habitat. If thinning of dispersal habitat maintains a post-treatment canopy cover of 50-60 percent as specified in the Effects to the Northern Spotted Owl and its Critical Habitat section of the BA (BLM 2016a, p.198), the ability of these stands to effectively function as dispersal habitat for spotted owls may be reduced in the short term and their ability to support nesting, roosting, and foraging by spotted owls may be reduced considerably.

Spotted owls are expected to continue to be able to disperse across the landscape within the action area and to areas outside the action area due to the habitat conditions and protections in the LSRs and Riparian Reserves, the stand retention incorporated into timber harvests in the LITA (15-30 percent of the stand) and UTA, and because these detrimental effects to the spotted owl dispersal capability will be spread over 50 years. In addition, the Harvest Land Base where the most severe impacts to spotted owl dispersal capability are expected to occur, cover only ~20 percent of the BLM landscape within the action area and within the spotted owl range. The other 80 percent of the BLM landscape is expected to provide for spotted owl dispersal and improve in habitat conditions over time.

Thinning prescriptions also will potentially occur in Riparian Reserves, LSR, and District Designated Reserves. These thinnings in overstocked stands and plantations are expected benefit spotted owls by increasing the speed of development of spotted owl habitat compared to not managing these types of stands. Although there may be some short-term impacts in these LUAs from a reduction in canopy cover, the scale of these prescriptions, spatially and temporally, are not expected to result in a loss or noticeable reduction in the function of these LUAs. There may be some short-term impacts to habitat suitability at the stand scale, but not at any larger scale. These thinning prescriptions are consistent with RA 6 of the spotted owl recovery plan.

Salvage

Fire salvage has the potential to negatively affect spotted owls if conducted on lands where owls continue to occupy sites post-fire, even when habitat has been reduced below what is normally considered to be spotted owl habitat. Research indicates variability in the degree to which spotted owls use post-fire sites, depending on fire severity and the function of the site for spotted owls (*i.e.*, nesting, roosting, or foraging)(Clark 2007, Clark *et al.* 2011, Roberts *et al.* 2011, Bond *et al.* 2002). Spotted owl reproduction and nesting have been observed in burned landscapes and in core areas in which some portion was burned by high-severity fire (*i.e.*, fires with typically 70-100 percent overstory mortality). Nest trees have been observed in patches with low to moderate severity burn (Gaines *et al.* 1997, Clark 2007, Bond *et al.* 2009). For spotted owls nesting in territories with some high-severity fires effects, reproductive rates are generally similar to unburned areas (Gaines *et al.* 1997, Bond *et al.* 2002, Clark 2007).

Results from the three radio-telemetry studies of spotted owls in post-fire landscapes indicate that spotted owls use forest stands that have burned, but generally do not use stands that have been burned and logged. For example, California spotted owls tracked four years post-fire in burned, unlogged stands: (1) had 30 percent of their nonbreeding-season roost locations within

the fire's perimeter (Bond *et al.* 2010); (2) selected low-severity burned forests for roosting during the breeding season (Bond *et al.* 2009); and (3) selected low-, medium-, and high-severity burned forests for foraging within 1.5 km of the nest or roost site, with the strongest selection for high-severity burned forest (Bond *et al.* 2009). However, for spotted owls in stands that had been harvested post-fire: (1) infrequent foraging in stands burned with low-, medium-, and high-severity fires was restricted to areas with live trees such as those in riparian areas (Clark 2007), and (2) use shifted away from burned stands during 3 years post-fire (King *et al.* 1998). Salvage operations that occur in burned areas that continue to support spotted owls may adversely affect these owls.

BLM indicates that salvage will not remove or downgrade dispersal or nesting-roosting habitat and would comply with management standards to retain sufficient snags and coarse woody debris in treatment areas (BLM 2016a, p. 200). Except for safety and operational reasons, salvage is not allowed in Riparian Reserves or LSRs which meets the intent of RA12 (USFWS 2011b, p. III-49). This will allow for retention of large, dead and dying snags to be established and remain on the landscape in most of the BLM portion of the action area. This is a departure from the NWFP that allowed for salvage logging in LSRs when burned areas were larger than 10 acres and allowed salvage in the Riparian Reserves if required to attain Aquatic Conservation Strategy objectives (USFS and BLM 1994, pp. C-14, C-32).

Over 50 years, the potential amount of salvage in spotted owl habitat is 700 acres in the MITA, 1,100 acres in LITA, and 14,600 acres in the Uneven-aged Timber Area. Salvage operations that could potentially occur in burned areas that continue to support spotted owls post-fire may adversely affect spotted owls that continue to rely on these burned areas if they no longer meet the definition of nesting-roosting or dispersal habitat but continue to be used by spotted owls post-fire.

Group and Single-tree Selection Harvest (Uneven-aged Timber Management)

In the UTA of the Harvest Land Base, selection harvest is anticipated to affect 193,800 acres of spotted owl habitat over the next 50 years. Approximately 151,000 acres of these lands are nesting-roosting habitat and 42,800 acres are dispersal habitat. Canopy cover will be reduced to < 40 percent (BLM 2016a, p. 200). Uneven-aged management will likely result in the loss of some, but not all of the habitat elements spotted owls rely on in stands where uneven-aged management is applied. Canopy cover, amount of large conifers, basal area, and incidents of trees with deformities will likely be reduced. However, uneven-aged management will promote more rapid development of stands containing the elements associated with nesting-roosting habitat than will the regeneration harvests conducted in the moderate and low intensity timber management areas and may continue to support foraging and dispersal if sufficient large trees, canopy cover, and canopy layers are maintained.

Potential timber harvest practices implemented in the UTA will promote development of forested lands with greater diversity than the Low and Moderate Intensity Timber Management Areas and will promote restoration of natural disturbance regimes. The UTA is primarily in the dry forest areas where more frequent disturbance processes developed heterogeneous forest stand characteristics that are more resilient to natural disturbances. The UTA is designed to somewhat mimic those characteristics.

Effects to spotted owls in the Harvest Land Base

Recent research has documented that the presence of barred owls is the most significant threat to spotted owl persistence and recovery. Spotted owls in all BLM land use allocations are currently being negatively impacted by the presence of barred owls. As demonstrated in the BLM's modeling of the no-harvest scenario, barred owls are the dominant force driving the current spotted owl demographic decline. Timber harvest can also have negative impacts on nesting spotted owls, as does the combination of the two factors. BLM estimated that 175 known sites occurred in the Harvest Land Base under the Proposed RMP in 2013 (BLM 2016a, p.45). In addition, they determined that the 500-acre core use areas of an additional estimated 660 known sites located in other land use allocations, and to the median provincial home range areas of another estimated 250 known sites overlapped the Harvest Land Base. Thus, an estimated 1,085 known sites, or 44 percent of the known sites associated with BLM-administered lands, could potentially be affected to varying degrees by BLM management actions in the Harvest Land Base under the PRMP. However, not all these spotted owl sites are expected to be currently occupied. The Service anticipates that approximately 30 percent of these known and historic sites, or 325, are likely to be currently occupied (Dugger *et al.* 2016, BLM 2016a). Impacts to spotted owls will vary across the three timber areas (MITA, LITA, and UTA) and by the different forest treatments that will be applied in each of these areas. Table 229 provides information on numbers of spotted owl activity centers, core use areas, and home ranges that overlap the harvest land base and each of the timber areas.

Table 229. Spotted owl activity centers, core use areas, and home ranges that overlap the Harvest Land Base, broken out by critical habitat unit (which approximates physiographic provinces) and moderate intensity, low intensity and uneven-aged timber management areas.

Critical Habitat Unit	Harvest Land Base	# spotted owl activity centers in timber management areas ¹	# core use areas overlapping timber management areas by region ²	# Home Ranges overlapping timber management areas ³
North Coast Olympic (NCO)	Low Intensity	3	15	21
	Moderate Intensity		10	20
Oregon Coast Ranges (OCR)	Low Intensity	11	156	270
	Moderate Intensity	6	68	167
	Uneven-aged			3
Klamath East (KLE)	Low Intensity	10	97	211
	Moderate Intensity	6	64	115
	Uneven-aged	70	296	378

Critical Habitat Unit	Harvest Land Base	# spotted owl activity centers in timber management areas ¹	# core use areas overlapping timber management areas by region ²	# Home Ranges overlapping timber management areas ³
Klamath West (KLW)	Low Intensity	3	54	89
	Moderate Intensity	1	14	51
	Uneven-aged	20	103	157
East Cascades South (ECS)	Low Intensity	2	11	21
	Moderate Intensity		3	5
	Uneven-aged	10	25	30
West Cascades South (WCS)	Low Intensity	3	67	99
	Moderate Intensity	27	140	198
Low Intensity		32	400	711
Moderate Intensity		40	299	556
Uneven-aged		100	424	565
Total spotted owl sites across Timber Areas (some sites overlap multiple timber areas)		172	1123	1835
Total Spotted Owl Sites Across Harvest Land Base		175	835	1085
Number of likely currently occupied sites (30% occupancy)⁴		50	250	325

¹ includes all sites regardless of whether they occur in critical habitat

² Includes sites with activity centers within harvest land base

³ includes sites with activity centers within and core areas overlapping harvest land base

⁴ Based on occupancy rates from Dugger *et al.* (2016) and BLM (2016a)

Over the next 50 years in the Harvest Land Base we anticipate that all 325 of these occupied spotted owl sites will be impacted to some degree by timber harvest. This will reduce the numbers, reproduction and distribution of spotted owls within the Harvest Land Base portion of the action area, which is about 20 percent of the BLM landscape that supports spotted owls. It is unknown how many spotted owls currently occupy these sites as some may support a pair of spotted owls or potentially just a single spotted owl. Displaced spotted owls from these sites may move to other spotted owl nest locations that are positively impacted by barred owl management and habitat ingrowth, or they may become non-reproducing “floaters.” Across the range of the species occupied spotted owl sites continue to decline primarily due to the influence of barred owls at an annual rate of approximately 3.8 percent (Dugger *et al.*, 2016). Until the implementation of a barred owl management program, the 325 occupied spotted owl sites will likely continue to decline.

It is not possible to assess the overall effects of timber harvest on spotted owls without also considering the positive effects of the PRMP that offset some of these impacts. Over the 50 years of the PRMP, the reserve LUAs are expected to develop spotted owl habitat through ingrowth and through management actions such as thinnings designed to speed the development of older forest structure. In addition, the BLM will participate in a barred owl management program designed to reduce the effects of barred owls on spotted owls as described in the Wildlife resource program section above. These issues are discussed in more detail later in this section.

From a long-term recovery standpoint, the negative impacts of timber harvest are off-set to some degree by long-term habitat recruitment in reserved land use allocations. The harvest land base encompasses 469,215 acres of which 167,066 acres is nesting/roosting habitat and 131,569 acres is dispersal habitat for a total of 298,635 acres of spotted owl habitat. These acres represent approximately 17 percent of the spotted owl habitat in the action area. The BLM has modeled its potential forest management on vegetation development over the next 50 years and anticipates a 51 percent increase in the amount of “strongly-selected for” spotted owl habitat (BLM 2016a, p. 132) and a 24 percent increase in acres of mature multiple canopy and structurally-complex forest (BLM 2016a, p. 133) on BLM-administered lands in the action area. “Strongly selected for” habitat represents high-quality nesting/roosting habitat (BLM 2016a, Appendix C, p. 34), while “mature multiple-canopy and structurally-complex forest” includes RA32 stands from the spotted owl recovery plan (USFWS 2011b, p. III-67). This overall increase in spotted owl habitat will support population growth and increases in successful breeding that are expected to increase the spotted owl population over time and contribute to spotted owl recovery within the action area.

Other Land Use Allocations

Under the PRMP, the amount of land in reserve status will increase considerably from current land use allocations under the NWFP. Under NWFP land use allocations, approximately 56 percent of BLM lands were Late Successional or Riparian Reserve and 28 percent were Matrix lands managed for multiple uses including timber harvest. Under the PRMP, 64 percent of lands are designated as LSR or Riparian Reserves and 19 percent are within the Harvest Land Base. There are an additional approximately 177,000 acres of land in LSRs and Riparian Reserves under the PRMP than the NWFP (Table 230).

Table 230. Comparison of land allocations between the NWFP (USFS and BLM 1994a, b) and the PRMP (BLM 2015a).

PRMP Allocation	Acres	%	NWFP Allocation	Acres	%
Late Successional Reserve	948,466	38%	Late Successional Reserve	879,031	35%
Riparian Reserve	635,717	26%	Riparian Reserve in Matrix	527,550	21%
Other Reserves	263,647	11%	Other Reserves	233,410	9%
Eastside Management Area	161,801	7%	Eastside Management Area	146,867	6%
Harvest Land Base	469,215	19%	Matrix	691,998	28%
Total	2,488,847	100%		2,478,856	100%

The proposed designation of the LUAs under the PRMP includes these reserved allocations, which will be managed for the development of older or complex forest structure. The BLM has modeled this ingrowth and development of spotted owl habitat over the 50 years of the PRMP (BLM 2016a, p. 126-142). The BLM's data indicate the establishment and management of all the land use allocations will result in net gains in spotted owl nesting/roosting and dispersal habitat, large-blocks of spotted owl habitat (capable of supporting > 25 spotted owls) and dispersal-capable habitat over the next 50 years.

In the graphs below the BLM evaluated the development of “strongly-selected-for” habitat (Figure 29) and mature multiple-canopy and structurally-complex forest (Figure 30) across BLM land over the next 50 years. These graphs indicate a predicted increase of 24 percent from current baseline amounts.

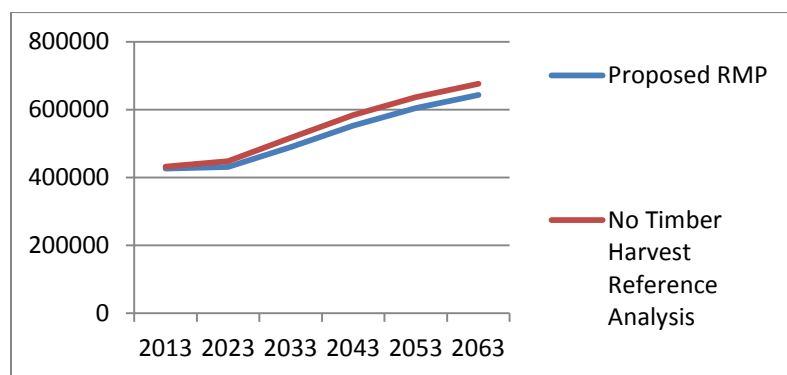


Figure 29. Change in the acres of “strongly-selected-for” habitat on BLM-administered lands in western Oregon under the PRMP and the No Harvest scenario. Under the PRMP this value is expected to increase 51 percent over 50 years on BLM lands. (BLM 2016a, p.135, Figure III-36)

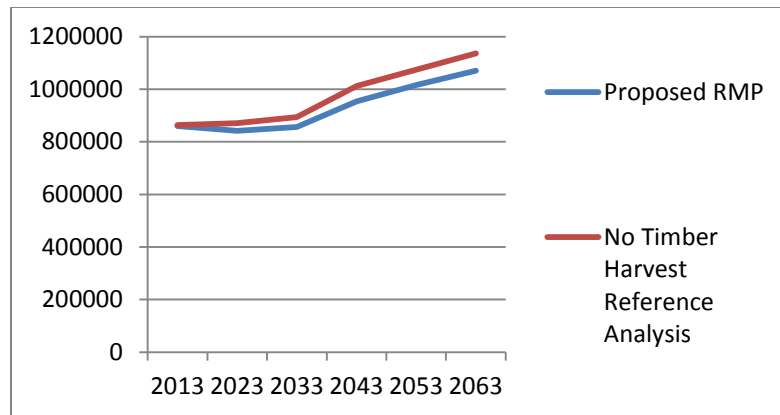


Figure 30. Change in the acres of mature multiple-canopy and structurally-complex forest on BLM-administered lands in western Oregon under the PRMP and the No Harvest scenario. Under the PRMP this value is expected to increase 24 percent over 50 years on BLM lands. (BLM 2016a, p.135, Figure III-37)

Under the NWFP, nesting/roosting habitat for spotted owls has declined 1.5 percent from 1994-2013 (Davis *et al.* 2016, p. 23-24). Large wildfires were the leading cause for loss of NSO habitat on federal lands and most of these losses occurred within the network of large reserves designed for NSO conservation. Losses from wildfire resulted in loss of 5.2 percent, 1.3 percent was lost from timber harvest, and 0.7 percent was lost from insects or other causes. Given the overall loss of 1.5 percent, these findings indicate that processes of forest succession has compensated for some of the losses resulting from disturbance (Davis *et al.* 2016, p.42-43).

Even with the losses of spotted owl habitat within the Harvest Land Base due to timber harvest, the BLM anticipates a significant net increase of spotted owl habitat on BLM lands under the PRMP during the life of the plan. This is largely due to the increased amount of acreage in reserves as compared to the baseline amount in reserves under the NWFP and the proactive management of those reserved acres to achieve late-successional conditions. The BLM established the LSRs in the areas where they were, given current forest conditions, most likely to be able to develop large blocks of habitat capable of supporting more than 25 spotted owl homeranges well-distributed across the BLM lands within the action area (BLM 2016a, p. 90-97) (see Figure 31). Where BLM lands are not well-distributed within the action area (*e.g.*, north coast), the BLM only has the capability to develop small blocks of habitat that support less than 25 spotted owl homeranges. Because the BLM located the reserves in areas with the potential to provide for clusters of reproducing spotted owls, the Service believes the distribution of reserved habitat blocks have the potential to provide for a well-distributed population of spotted owls on BLM lands within the action area.

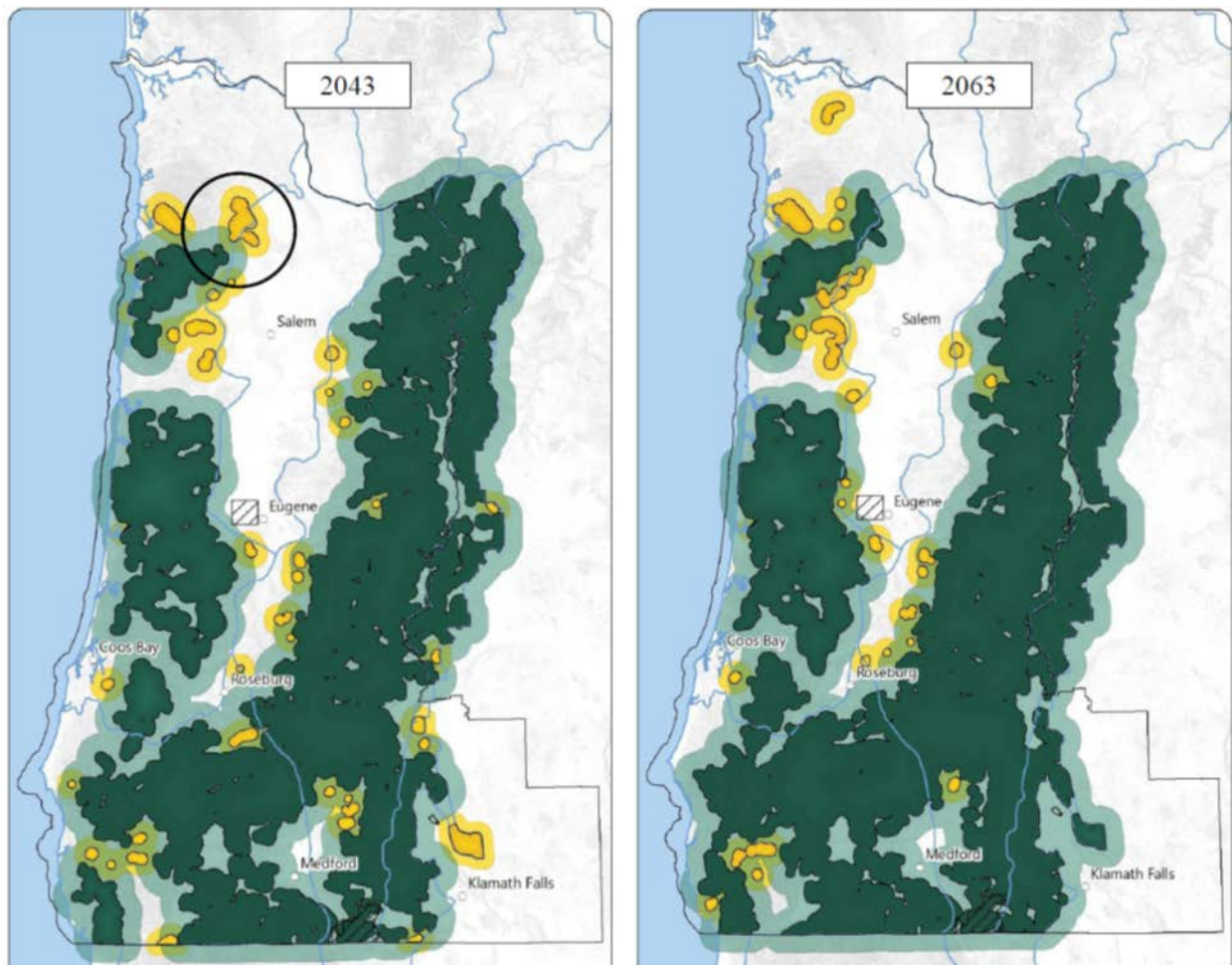


Figure 31. Northern spotted owl habitat block locations in 2043 and 2063 under the Proposed RMP. The circled area is discussed in the text of the BA (BLM 2016a, p. 97, Figure III-21).

Spotted Owl Dispersal

The Service believes spotted owl dispersal is a conservation need best assessed at a landscape scale (USFWS 2012a, p. 71939). Blocks of spotted owl habitat not only support reproducing spotted owls, but also facilitate the movement of spotted owls across the landscape and between blocks of reserved habitat that support clusters of reproducing spotted owls. In addition to the reserved blocks of habitat, the Riparian Reserves are expected to provide well-distributed, high-quality dispersal habitat for spotted owls because a) they occur on all watercourses across the range of the spotted owl on BLM lands, and b) they will be managed to produce large trees that will contribute to fish habitat because of the restrictions on silvicultural activities in the management direction.

The Service anticipates that portions of the Harvest Land Base will also provide an opportunity for spotted owl dispersal in some areas. Because BLM is spacing their timber harvest out over the 50 years of the PRMP, we expect there will be areas that will not be harvested for one to

several decades. Spotted owls will be able to utilize portions of these areas for dispersal. In addition, in the LITA there will be habitat elements left on the landscape that have the potential to assist spotted owls in dispersing across the landscape. The value of these retention areas will largely depend on their proximity to reserves, other retention stands, or yet-to-be harvested stands within the Harvest Land Base. We have no spatial information with which to assess the precise value of these retention stands because these projects have not yet been planned on the ground yet, but in general we anticipate spotted owls will be able to utilize these areas for dispersal.

The BLM analyzed 2013 dispersal capability of spotted owls across their lands and determined that spotted owls could move north/south within the Oregon Western Cascades Province and through much of the Oregon Klamath Province, but that in areas of the Oregon Coast Range Province and between the Oregon Coast Range and the other physiographic provinces “adequate” spotted owl movement would not currently be supported (BLM 2016a, pp. 100-102). The ability of spotted owls to disperse across landscapes is likely influenced by the overall quality of habitat through which they disperse. Although habitat that may be able to support dispersal but is not sufficient to support resident spotted owls (*e.g.*, dispersal-only habitat) has often been characterized as stands with 50 percent of the area containing trees at least 28 cm (11 in) DBH with 40 percent canopy cover (50-11-40), Sovern *et al.* (2015, pp. 257-260) found the majority of roosts used by dispersing owls in the eastern Washington Cascades were in forested habitats with at least some large (>50 cm dbh) trees and they selected stands with high canopy cover (>70 percent) at the landscape scale. These authors suggested the concept of ‘dispersal’ habitat as a lower quality type of habitat (*e.g.*, 50-11-40) may be inappropriate. For the purpose of our analyses of effects of the PRMP to spotted owls, we consider all spotted owl habitat (nesting, roosting, foraging, and dispersal-only) to support dispersal of spotted owls across the landscape. Higher quality habitat will improve the probability that dispersing owls will survive; however, areas of younger forest with smaller trees (*e.g.*, 50-11-40) can provide support for spotted owl dispersal particularly across more fragmented landscapes. Under the PRMP, the BLM’s analyses indicated the establishment and management of the proposed land use allocations will result in net gains in spotted owl nesting/roosting and dispersal habitat and large-blocks of spotted owl habitat (capable of supporting > 25 spotted owls) over the next 50 years. In their analyses, the BLM considered dispersal habitat to include nesting/roosting habitat as well as habitat that may support dispersal but not other life history functions (BLM 2016a, p. 137).

According to BLM’s modeling the ability of spotted owls to move across the landscape is expected to improve significantly under the PRMP (see Figure 32). There is little empirical data on landscape-scale movement of spotted owls in Oregon. However, based on spotted owl radio-telemetry data, Forsman *et al.* (2002, pp. 11, 22) demonstrated that spotted owls were able to move from the Coast Range to the Cascades across highly fragmented forests and across areas with little Federal ownership. Although Sovern *et al.* (2015) observed that dispersing owls selected older forest when available, Forsman *et al.* (2002) demonstrated that spotted owls could disperse across more fragmented landscapes with lower quality habitat. The PRMP includes approximately 177,000 additional acres of reserved lands compared to the NWFP that will contribute additional dispersal capability within the action area. In addition, timber management in the LITA is expected to provide a greater contribution of habitat elements that have the potential to support spotted owl dispersal over time than regeneration harvest

prescriptions under the NWFP. We believe these two factors represent a significant improvement in the capability of the landscape within the action area to provide for spotted owl movement and dispersal.

In addition, Forsman *et al.* (2002, p. 30) concluded that a conservation strategy consisting of numerous, closely spaced reserves of old forest is not likely to result in genetic or demographic isolation of local populations. Based on Forsman *et al.* (2002), the improving landscape conditions reflected in BLM's modeling and the additional acres of reserved LUAs, the Service anticipates that spotted owl genetic interchange between the Oregon Coast Range and the Oregon Western Cascades Provinces is currently facilitated and will improve under the PRMP.

Because the BLM located the reserves in areas with the potential to provide for clusters of reproducing spotted owls and because we believe spotted owls can and will continue to be able to successfully move across the landscape between these blocks, the Service believes the distribution of reserved habitat blocks have the potential to provide for a well-distributed population of spotted owls on BLM lands within the action area.

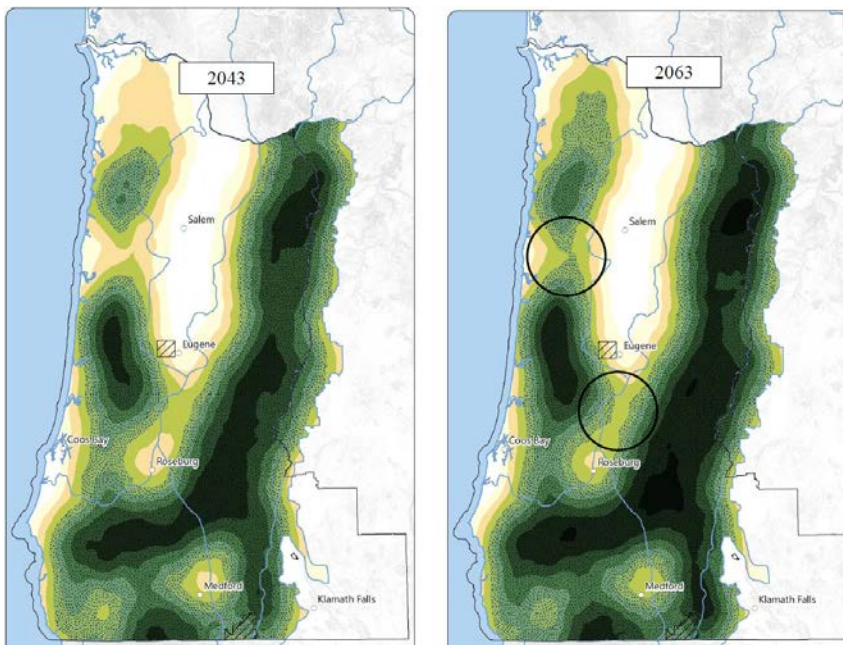


Figure 32. Dispersal-capable lands (stippled areas), as they would exist in 2043 and 2063, under the Proposed RMP. Figure III-24 in BLM (2016a).

Key Considerations Regarding Spotted Owl Population on BLM Lands

- An important long term positive outcome of BLM's proposed management of their lands is that it will result in an increase in the amount of spotted owl habitat over the 50 year term of the PRMP, even when accounting for the timber harvest that will occur on these lands under the plan. However, in the course of this PRMP section 7 consultation process during the last three years, and since publication of the Revised Recovery Plan

for the Northern Spotted Owl (USFWS 2011b; recovery plan), it has become increasingly clear that the spotted owl is currently most threatened by competition with the barred owl. Although habitat loss due to timber harvest and wildfire remains an important long term threat to the spotted owl, the Service now believes this threat is secondary in importance to the conservation of the spotted owl. Based on recent scientific information, it is the Service's opinion that spotted owl populations will continue to decline precipitously and be locally extirpated across the range due to barred owl competition regardless of how much habitat is conserved unless the barred owl threat is addressed. In other words, an approach incorporating just the conservation of habitat and avoiding take of spotted owls will not provide for spotted owl recovery as was originally anticipated during the development of the NWFP during the early 1990's.

To address Conservation Need 4 (in areas of significant population decline sustain the full range of survival and recovery options for the spotted owl in light of significant uncertainty) (BLM 2016a, p. 102), the BLM used a spatially-explicit, individual-based HexSim population model (Schumaker *et al.* 2011) to simulate spotted owl population responses under different scenarios of the PRMP over time (BLM 2016a, p.103). These simulated populations were not developed to predict future spotted owl populations, but rather to compare alternative management practices in terms of general population numbers, trends, and risk probabilities (BLM 2016a, p. 103). As the BLM's modeling demonstrated (BLM 2016a, p. 110-111), even if there is no timber harvest over the next 50 years on BLM lands, spotted owl populations continue to decline at a substantial rate. The BLM recognized (BLM 2016a, p. 105-107) that unless barred owl impacts were managed, spotted owl persistence in a number of modeling regions was unlikely. This modeled result is consistent with other scientific research (*e.g.*, Dugger *et al.* 2016).

As noted in the Wildlife resource program above, the PRMP includes the BLM commitment to "participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30." (BLM 2016a, p. 44). The Service has described in the Wildlife resource program management direction above a potential barred owl management program design that we believe when combined with BLM's contribution to habitat conservation would effectively provide for spotted owl recovery needs on BLM lands within the action area.

Projected Outcome of an Effective Barred Owl Management Program

We outlined the framework and described the biological and management assumptions for a potential barred owl management strategy in the Wildlife resource program section above.

Table 231 shows the number of spotted owl sites where site occupancy could potentially be retained or recovered within the six potential management areas if barred owl management proves effective and allows spotted owls to occupy territories at rates similar to those observed in the late 1990s prior to the barred owl range expansion.

Table 231. Known and historic spotted owl territories on the six potential barred owl management areas with changes in spotted owl occupancy if barred owl management is successfully implemented. We assumed that the improved occupancy rates are achieved by 2063.

Barred Owl Management Areas	Known/Historic Spotted Owl Sites	2013-2016 Estimated Occupancy (30%)	Number of Occupied Spotted Owl Sites if Occupancy Rate Improves to 60 Percent	Number of Occupied Spotted Owl Sites if Occupancy Rate Improves to 70 Percent
OCR-N	59	18	35	41
OCR-S	251	75	151	176
KLW-N	103	31	62	72
KLW-S	48	14	29	34
WCS	56	17	34	39
KLE	82	25	49	57
Totals	599	180	359	419

Barred owl management has two potential positive effects on spotted owls, 1) retention of currently occupied sites, 2) and re-occupancy of sites currently unoccupied by spotted owls. An effective barred owl management program would also promote retention and maintenance of currently occupied sites at a higher rate than would occur without management. For example, even with no timber management activities on BLM lands, in the absence of a barred owl management strategy, the 180 currently occupied sites would decline over time due to barred owl competition (see Figure 33). If barred owl management resulted in the re-occupancy of currently unoccupied sites by spotted owls, resulting in an increase of site occupancy to 60 percent, the total number of occupied spotted owl sites within the barred owl management areas would increase from 180 to 359, or a net gain of 179 sites. If barred owl management increased occupancy rates to 70 percent (close to occupancy rates prior to barred owl invasion), occupied spotted owl sites within the barred owl management area would increase to 419 sites, or a net gain of 239 occupied spotted owl sites.

Combined Effects of PRMP Direction on Spotted Owls

We projected spotted owl occupied sites into the future (an index of spotted owl populations) on BLM lands in the action area under the PRMP taking into consideration: BLM's commitment to support and cooperate with the implementation of a barred owl management strategy by year eight of the PRMP as represented by the information above on the six potential barred owl management; BLM's commitment to avoid incidental take of spotted owls from timber harvest in the Harvest Land Base until that time; and the direction to meter incidental take from timber harvest in the Harvest Land Base over the life of the plan, (Figure 33).

For this projection, we also relied on the following biological principles that have been substantiated in published results from a spotted owl demographic analyses (Forsman *et al.* 2011, Dugger *et al.* 2016) and a barred owl removal experiment in California (Diller *et al.* 2016). We assumed that without barred owl management, spotted owl populations will

continue to decline at their current rate of 3.8 percent per year into the future. We projected that the number of occupied sites will continue to decline consistent with the population rate of decline until barred owl management is implemented.

We estimated that following implementation of barred owl management there would be a short delay of up to three years before spotted owls are able to recolonize enough vacant sites that we can observe an increase in the number of occupied sites. We expect that as spotted owls respond and reoccupy sites, the rate of population decline will be reduced within the first decade, the population trend will reach stability around the second decade, and the population will be increasing by the third decade and thereafter. We conservatively expect for the reasons explained below, that the population annual rate of population change would be increasing by approximately 2.75 percent per year by the end of the fourth decade. These rates of change were applied to all spotted owl sites except those with their site center in the Harvest Land Base. For the 50 spotted owl sites with activity centers within the Harvest Land Base, we assumed a continued annual rate of decline of 3.8 percent per year because barred owl management is unlikely to include most of the Harvest Land Base.

These expectations are based, in part, on the rate of increase detected by Diller *et al.* (2016, p 13) showing recolonization rates by spotted owls following the removal of barred owls in northern California rapidly improved to 3 percent annual rate of increase in spotted owl populations following implementation of barred owl removal in northern California. However, Diller's experiment was initiated 1) at a time and place where barred owl populations were smaller and only recently entrenched when compared to the BLM lands under the PRMP, 2) on a relatively small landscape allowing biologists to maintain vigilance in keeping spotted owl sites clear of barred owls, and 3) in the Redwood zone of California, a relatively unique forest environment. Given the much larger scale of barred owl management analyzed in this consultation and the much denser barred owl population, we assumed a slightly smaller eventual rate of population increase (2.75 versus 3) and a longer period before this rate of increase is fully realized (See Figure 33).

In addition, the probability that an unoccupied site will become reoccupied by spotted owls following implementation of barred owl management will be influenced to some degree by the amount of habitat available on individual sites. Based on the PRMP, we expect that habitat within the reserved LUAs will generally remain stable or increase over time because management direction includes maintaining and developing spotted owl habitat. We believe that spotted owls would be able to recolonize vacant sites in these areas because the majority of these currently unoccupied sites have sufficient habitat to support spotted owls when barred owls are not present.

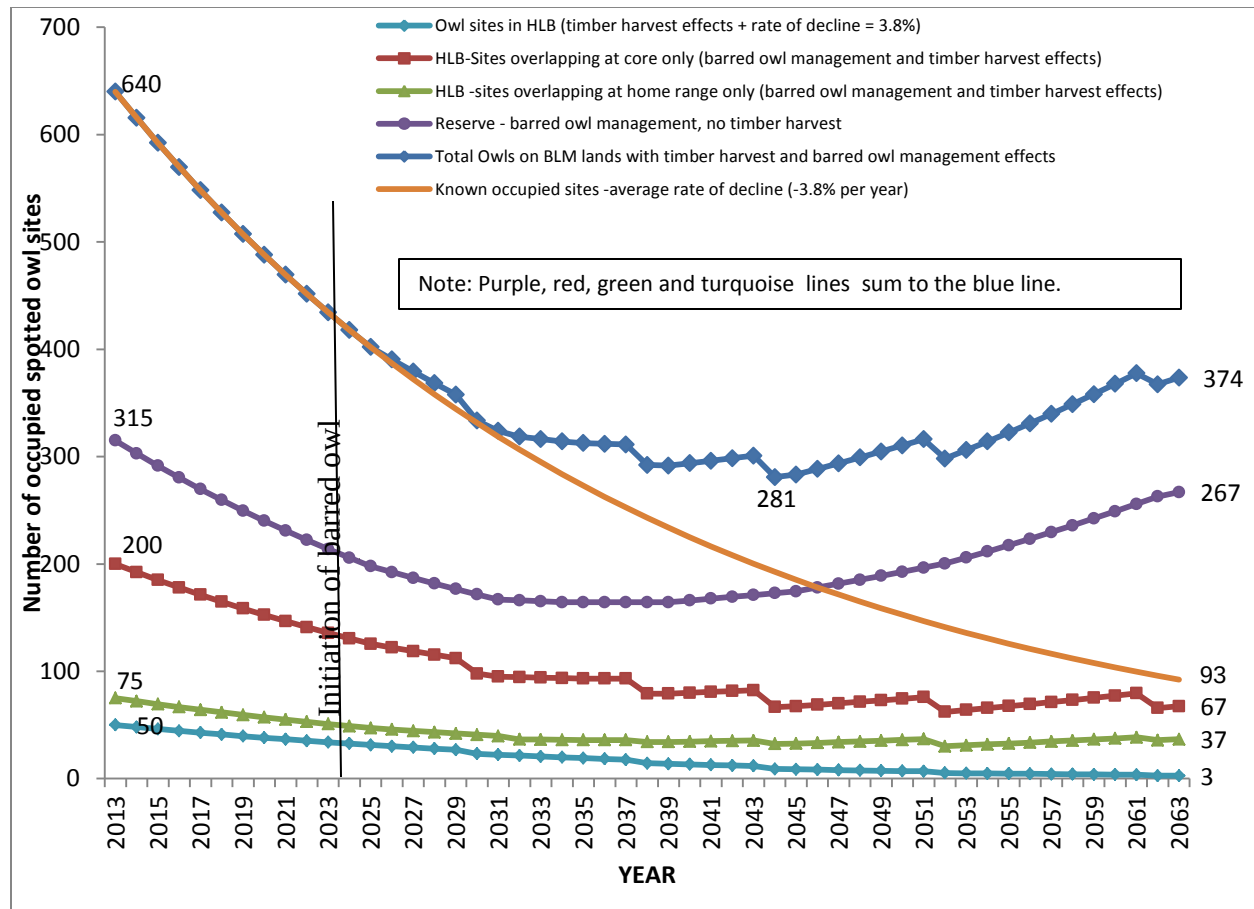
The range-wide population rate of change (*i.e.*, 3.8 percent decline) is based on analysis of populations on the spotted owl demography study sites. These include lands where timber harvest and other causes of habitat loss have occurred during the demography study and thus the study results already incorporate this level of habitat loss. However, many of the study areas contain significant reserve lands under existing Federal land management plans, so timber harvest effects in the Harvest Land Base may exceed those of the study areas at the small scale. To ensure we did not underestimate the potential effect of timber harvest under the PRMP, we assumed that harvest occurring on the Harvest Land Base will have an additive effect beyond

the rate of decline reported by Dugger *et al.* (2016). Therefore, for spotted owl sites that overlap, or are within, the Harvest Land Base, our projection includes both 1) the effects of barred owl management to improve spotted owl population trajectories described above, and 2) an additional estimated impact of timber harvest in the Harvest Land Base.

For spotted owl sites whose home range overlaps the Harvest Land Base, we modified the rate of population change described above to incorporate the effect of site abandonment due to timber harvest. We assumed the abandonment of 10 percent of these sites in the first decade, 15 percent in the second decade, and 20 percent in each subsequent decade following (BLM 2016a, p.46), and applied this at the start of each decade, for the 50 spotted owl sites with site centers in the Harvest Land Base or that 200 sites that overlap the Harvest Land Base at the core area (500 acre area). For the remaining 75 owl sites that overlap the Harvest Land Base on the periphery of their home range (outside the crucial core area), we assumed the impacts would be half as great.

We anticipate that spotted owls will recolonize sites in barred owl management areas with greater amounts of habitat and that not all available sites will be occupied at any given time, even under the best of circumstances. Prior to the presence of barred owls, spotted owl site occupancy rates of over 70 percent were not uncommon. However, site occupancy is dynamic, and occupancy of individual sites will vary over time. We evaluated the number of occupied spotted owl sites using an overall estimate of 60 to 70 percent occupancy within the barred owl management areas following implementation of barred owl management. While implementation of a barred owl management strategy is anticipated to substantially reduce the level of competition from barred owls, we do not expect a complete absence of barred owls. Thus, we chose to use the lower estimate of 60 percent occupancy in the analysis to account for some lingering effect from barred owls. If we assume a 60 percent occupancy rate on the potential barred owl management areas shown in Figure 28, which are predominately reserved lands, we anticipate an overall trend in occupancy across BLM lands similar to the pattern displayed in Figure 33.

Figure 33 shows the total number of spotted owl occupied sites across all BLM lands in response to implementation of a barred owl management program based on the assumptions stated above. Although site occupancy is a different metric than rate of population change, the rate of population change is a reasonable approximation of site occupancy changes over time because the rate of population change reflects territorial spotted owls (Dugger *et al.* 2016, p. 68). Territorial owls, by definition, must occupy a territory. Under the PRMP, spotted owl occupancy declines at the same rate as the rangewide population (2.8 percent per year) until barred owl management is implemented after which time the decline in occupancy rates slows, then becomes stable, and begins a gradual increase by the 2040s as a result of barred owl management. Under the PRMP with both barred owl management and timber harvest, the number of occupied spotted owl sites remains higher at all times than under a no harvest (on federal lands) scenario without barred owl management. Although the number of occupied sites declines from 640 (current) to 282 before barred owl management is implemented, the number of occupied sites is projected to increase to 374 by 2063 relative to a decline to 93 occupied sites if no barred owl management were implemented.



¹2016-2025: site occupancy declines at a rate of 3.8 percent per year; 2026-2031: site occupancy declines at a rate of 2.8 percent per year as barred owl management begins to reduce the negative effects of barred owls on spotted owls; 2032-2034: site occupancy declines at a rate of 0.5 percent per year; 2035-2039: site occupancy remains stable; 2040-2045: site occupancy increases at a rate of 1 percent per year; 2046-2052: site occupancy increases at a rate of 2 percent per year; 2053-2063: site occupancy increases at a rate of 2.75 percent per year.

²Site occupancy declines at 3.8 percent per year across all 50 years.

Figure 33. Projected trajectory of spotted owl site occupancy on BLM lands through 2063. Projected occupancy is displayed for: 1) current (average) rate of spotted owl population change (orange line) in the absence of barred owl management; and 2) spotted owl population trend across all BLM lands if barred owl management improves spotted owl population growth rate consistent with benchmarks listed in the reinitiation triggers (blue line)¹. Also displayed are spotted owl population trends under a successful barred owl management program for spotted owl sites on reserved lands (purple), spotted owl sites with activity centers in Harvest Land Base (green), spotted owl sites with core areas overlapping Harvest Land Base (red), and spotted owl sites with home ranges overlapping Harvest Land Base (turquoise line)². These red, purple, green, and turquoise lines sum to the blue line that displays the overall projected trend in spotted owl occupancy under the PRMP with barred owl management.

Conclusion – Effects of Proposed Action on Spotted Owls

The spotted owl continues to suffer a significant population decline across its range, due primarily in recent years to increasing competition from the invasive and aggressive barred owl. This impact is expected to grow unless proactively managed. At the same time, the Service recognizes that BLM must meet their other statutory legal mandates to provide sustainable quantities of timber and allow other traditional activities on these public lands such as recreation and resource extraction.

We believe the PRMP provides an approach that minimizes negative impacts to spotted owls and offsets these impacts with proactive positive actions that provide for the long-term survival and recovery of the spotted owl. When considered in its entirety, implementation of the PRMP will have both negative and positive effects on the spotted owl. Negative impacts will primarily be due to resource utilization such as timber harvest on less than one quarter of the BLM land base, and other resource programs. Positive effects of the plan will accrue due to an increase in the total area of protected forest reserves on BLM lands (approximately 80 percent of BLM ownership), BLM's management of forest habitat to increase the rate of development of late-successional conditions, and – most importantly for spotted owl conservation – BLM's support for and cooperation in the barred owl removal experiment and a potential barred owl management program. When aggregating these negative and positive impacts with the environmental baseline, it is our conclusion that the impact of the PRMP will be a net conservation gain for the spotted owl during the next 50 years under the plan.

The data supporting this conclusion are clear, but comprehending the implications requires an understanding of environmental baseline of the species. Even in the absence of any timber harvest, failure to implement barred owl management would result in a continuing decline of spotted owl populations on BLM lands at an estimated rate of 3.8 percent per year. Thus, the number of occupied spotted owl sites would drop from 640 sites on BLM lands in 2013 to 92 sites by 2063, and continue to decline. The loss of 548 occupied sites over 50 years (Figure 33, orange line) would likely lead to the extirpation of spotted owls on much of BLM ownership.

In contrast, application of the PRMP, including its timber harvest program and BLM's commitment to support and cooperate in a barred owl management program, is expected to greatly reduce the projected rate of spotted owl decline. With application of barred owl management as described in this document, the number of occupied sites on BLM lands would decline from the 640 estimated in 2013 to approximately 374 in 2063 (Figure 34), and the overall spotted owl population trajectory is expected to be increasing at the end of the 50-year program.

As discussed above, the PRMP would plan timber harvest to avoid incidental take of spotted owls until a barred owl management program is implemented. This means that BLM would avoid timber harvest that would likely result in the incidental take of the approximately 375 likely occupied home ranges during this time period. While there may be some effects to spotted owl habitat in the Harvest Land Base during this period, it is not expected to appreciably reduce the survival or recovery of the spotted owl because spotted owl habitat availability in the action area is not currently, or for the next 8 years with implementation of the proposed action, likely to limit the reproduction, numbers, and distribution of the spotted owl. Under the

proposed action, there is likely to be more suitable spotted owl habitat in the action area than there are spotted owls to fill it. Under the PRMP, BLM maintenance and enhancement of spotted owl habitat in reserves, and avoidance of spotted owl take within the HLB for the next 8 years is not likely to impair or preclude the capability of the action area to support the current estimated spotted owl population in the action area or allow for increases in that population. The distribution, abundance, and quality of spotted owl habitat on BLM lands during this period is likely to be consistent with the recovery needs of the spotted owl as discussed in the final recovery plan and in this opinion.

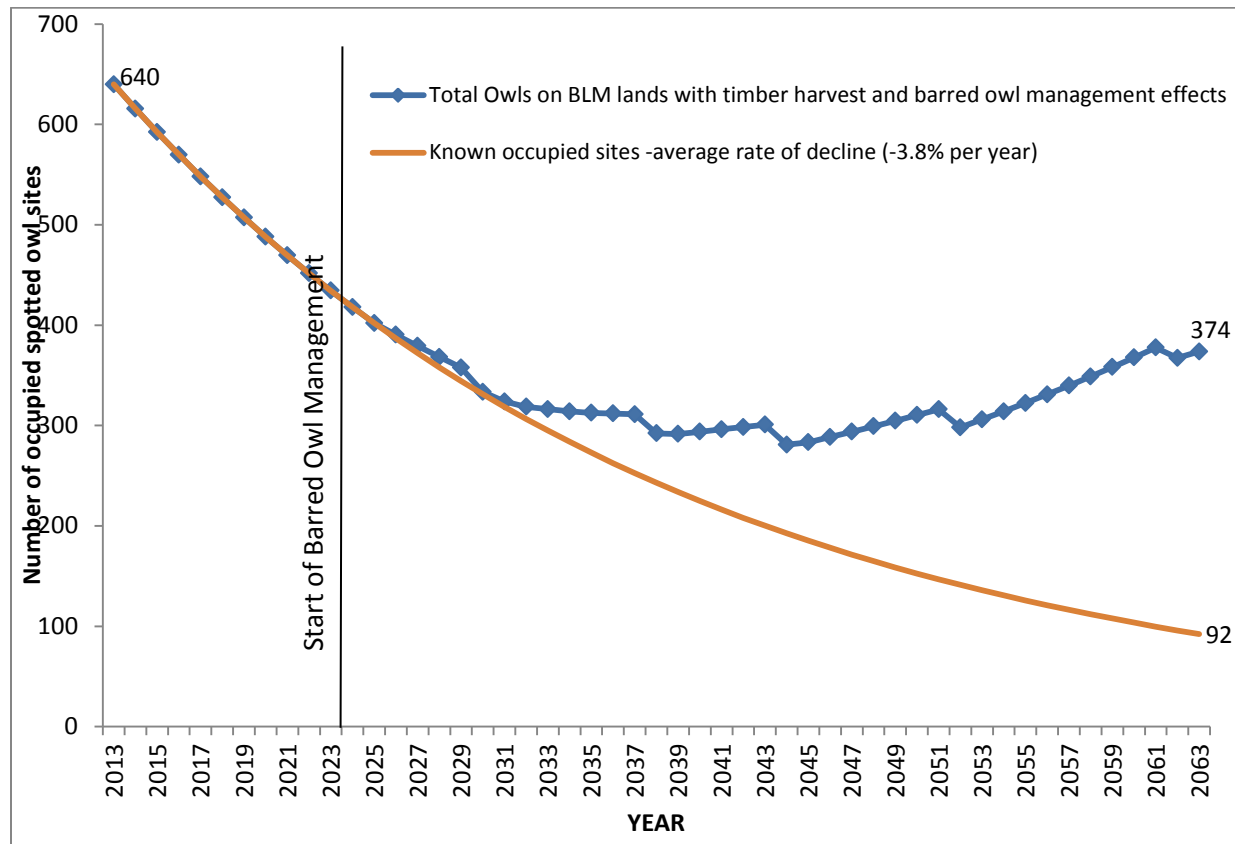


Figure 34. Projected trajectory of spotted owl site occupancy on BLM lands through 2063. Projected occupancy is displayed for 1) current (average) rate of spotted owl population change (orange line), 2) spotted owl population trend across all BLM lands if barred owl management improves spotted owl population growth rate (blue line).

Although the habitat needs of the current (and an expanded) population of the spotted owl are likely to be met during this period, the current population of the spotted owl is likely to further decline due to the presence of the barred owl. The most significant factor currently limiting spotted owl reproduction, numbers, and distribution in the action area and range-wide is the presence of an expanding barred owl population. Implementation of the proposed action is not likely to further enhance the status of the barred owl within the action area over the next 8 years.

If implementation of a barred owl management program has not begun within 8 years, BLM will reinitiate formal section 7 consultation. Until a new section 7(a)(2) determination is made,

BLM will comply with ESA section 7(d). As specified in the PRMP, BLM would not take actions that are likely to adversely affect the spotted owl or its critical habitat. This means that BLM would continue to avoid incidental take of spotted owls from timber harvest and would not take actions involving spotted owl habitat that would have biological effects on the species in other than beneficial or insignificant ways. The requirement to avoid adverse effects to spotted owl critical habitat, including critical habitat designated in the HLB, would also provide protection to spotted owl habitat until reinitiation is completed. For these reasons, the PRMP would not cause an appreciable reduction in the survival or recovery of the spotted owl during the period of reinitiation should it become necessary.

Our analysis projects that barred owl management will result in an improvement in spotted owl site occupancy over time because the positive effects of the barred owl management will offset and outpace the projected adverse effects of the planned rate of timber harvest and other land management activities. This analysis includes step-down assumptions regarding the effectiveness of such a strategy, an anticipated delay in the spotted owl demographic response to barred owl management, and consideration of some adverse impacts associated with timber harvest during this time period. During the period of implementation of a barred owl management strategy, we project the number of occupied sites across BLM lands in the PRMP will continue to decline as barred owl control is implemented, but this rate of decline will slow and then reverse course to a positive trend after approximately 20 years (Figure 33). This slowing of the current rate of decline and its eventual reversal, coupled with the increase in forest reserve lands and the continuing increase in habitat on reserve lands as a result of management and natural ingrowth, will provide for spotted owl populations on BLM lands in the action area to persist and contribute to the overall survival and recovery of the species range wide.

Following implementation of an effective barred owl management strategy by year eight of the PRMP, the rate of decline in the spotted owl population should lessen, stabilize, and start increasing in the treated reserve LUAs. Occupancy on the portion of spotted owl sites that are within or overlap the Harvest Land Base will continue to decline due to impacts from timber harvest and lack of targeted barred owl management in the Harvest Land Base. The combined effects of the proposed action over all BLM lands, when added to a baseline without barred owl management or timber harvest, is expected to be a reduction in the rate of population decline (although still a decline) until approximately 2044, followed by an increasing population trend. Although it is difficult to predict with precision, we project that by the mid-2040s, based on the assumptions we made for our analysis, the number of occupied spotted owl sites would reach a low of approximately 280 sites across all BLM lands as actions consistent with the PRMP are implemented.

With the spotted owl population on BLM lands within the action area at approximately 280 sites in the mid-2040s, the spotted owl populations, with continued barred owl management have the potential to increase from this point as depicted in the graph. Because of the retention and management of these approximately 280 spotted owl sites, we estimate the population would be expected to increase from this point to an approximate population of 374 in 2063. This is a reasonable assumption given that these managed sites will be concentrated in proximity to each other in the barred owl management areas which will facilitate the re-occupancy of currently unoccupied spotted owl sites where barred owl management is also occurring. In addition, the

majority of these barred owl management areas are located in reserved LUAs where land management will provide for the retention and development of spotted owl nesting/roosting, foraging and dispersal habitats, which will also facilitate improved demographic performance of spotted owls in these areas. If no barred owl management were implemented, we project that the number of spotted owl sites would decline to 192 by the mid-2040s (Figure 34), and continue to decline to approximately 92 by 2063. These 192 potential spotted owl sites in the mid-2040s would likely be spread sparsely across the action area in a manner that would not facilitate the re-occupancy of abandoned sites because there would be no concentrated source population.

The projected low point of 283 spotted owl in the mid-2040's should provide an adequate local population of spotted owls to provide for the maintenance and future recovery of the spotted owl on BLM lands, assuming continued implementation of an effective barred owl management strategy and for other reasons described above. We then project that this remaining spotted owl population will begin to increase and will provide a foundation for long term sustainable population growth and persistence on BLM lands. We estimate that by 2063, there will be approximately 374 occupied spotted owl sites on BLM lands with an overall increasing spotted owl population trend due to the combined effect of barred owl management and a net increase in suitable spotted owl habitat on BLM ownership. These remaining spotted owl sites will be clustered on the landscape within reserved LUAs in a manner that will facilitate dispersal of spotted owls both within and between these clusters, which functions to maintain the highest possible occupancy rates. These clusters are expected to function as source populations for both the action area and for lands outside the action area. In the absence of barred owl management the spotted owl population on BLM lands within the action area are projected to decline to approximately 92 occupied sites by 2063. These sites would likely be spread sparsely across the action area in a manner that would not facilitate the re-occupancy of abandoned sites because there would be no concentrated source population.

Over the 50 year life of the PRMP, there will also be a significant net gain over current levels in spotted owl habitat largely within reserves, which cover approximately 80 percent of the BLM landscape where spotted owls exist, that will be managed to maintain and produce high quality spotted owl habitat. This will provide large blocks of habitat of Federal land capable of supporting more than 25 spotted owl sites for reproducing spotted owls. Spotted owl dispersal through these areas is expected to be currently facilitated and to improve over time under the PRMP management. Spotted owl dispersal through these areas is expected to be currently facilitated and to improve over time under the PRMP management. The ability of the Harvest Land Base to facilitate spotted owl dispersal is expected to decline over time at about the same rate as BLM harvests timber on these lands. Therefore, we expect some of the Harvest Land Base stands to currently provide for spotted owl dispersal across the 20 percent of the BLM landscape that supports spotted owls covered by this LUA. In the LITA and UTA we expect the retention areas may support spotted owl dispersal where these patches are near either unharvested stands, other retention patches, or adjacent to a reserved LUA such as LSR or Riparian Reserve. Riparian Reserves within the Harvest Land Base will provide a significant contribution to spotted owl dispersal as they are approximately two site-potential trees wide on perennial or fish-bearing streams (one site-potential tree height on either side of the stream) and managed for the development of large trees and other purposes that provide incidental benefits to spotted owl habitat development. in the action area is likely to occur during years 8-50 of

Plan implementation. During this period, spotted owl habitat availability in the action area is to support a carrying capacity for a spotted owl population that is consistent with recovery objectives set forth in the final recovery plan for the spotted owl. Although there will be impacts to spotted owl habitat in the Harvest Land Base over time, those impacts will be spread out over time to minimize site abandonment as barred owl management is implemented. Given this, and the landscape of reserves providing for blocks of habitat and spotted owl movement consistent with the recovery needs of the spotted owl, the PRMP will not appreciably diminish the ability of the BLM lands in the action area to provide for a well-distributed population of owls.

Thus, if an effective barred owl management program is implemented during this period, as anticipated under the proposed action, the decline of the current spotted owl population in the action area is likely to be reversed. As the geographic scope of barred owl treatment areas increases over time within the action area, the spotted owl population is likely to stabilize then increase in response to barred owl removal and the availability of suitable habitat in large blocks of interconnected older forest. For these reasons, the PRMP is effectively implementing the recovery plan for the spotted owl in the action area.

Because of the expected retention and improvement of spotted owl populations on BLM lands as a result of this barred owl management strategy (where nearly all spotted owls would otherwise be expected to disappear in the absence of barred owl management), the Service hereby concludes that implementation of this PRMP does not represent an appreciable reduction in the likelihood of survival and recovery of the spotted owl in the wild due to reductions in reproduction, numbers or distribution. In fact, BLM's commitment to participate in and support a barred owl management strategy will, combined with the PRMP's allocation of reserves, result in a significant improvement in the spotted owl population's trend, and in the reproduction, numbers and distribution over projected baseline conditions with no barred owl management and no timber harvest. Further, if at any time the assumptions on which this conclusion is based (as described in the reinitiation criteria below) are not realized, the PRMP commits to reinitiate formal section 7 consultation and avoid actions that will likely adversely affect the spotted owl or its critical habitat until a new section 7(a)(2) determination is made.

It is important to note that the BLM lands in this PRMP represent approximately ten percent of the federal lands within the range of the northern spotted owl. The section 7 jeopardy determination is made at the species' range-wide scale. In the absence of barred owl management at this larger landscape scale beyond BLM ownership, spotted owl populations across the range are expected to continue to decline due to the influence of barred owls. As of this writing, there are currently no formal commitments from other partners to support and participate in similar barred owl management programs, although the Forest Service, which manages approximately 19.4 million acres within the range of the spotted owl (nearly eight times more than the BLM lands in the PRMP) is currently providing funding and material support for the on-going barred owl removal experiment that will contribute information to the development of a barred owl management strategy. The Forest Service is also in the early stages of revising their Land and Resource Management Plans within Oregon and Washington, which will include a landscape scale review of spotted owl populations on their lands. As the results of the barred owl removal experiment become available, we anticipate working closely with the Forest Service and other partners to implement the necessary barred owl management

programs in a coordinated and timely manner, and similar to what is being considered as part of this BLM PRMP.

Reinitiation Triggers

In addition to the regulatory triggers for reinitiation of consultation (50 CFR §402.16), the analysis of effects of this potential barred owl management program rely on the following specific assumptions regarding a potential barred owl management program, harvest rate on BLM lands, and the biological results for the spotted owl. Monitoring results will be measured against these assumptions to determine the effectiveness of a barred owl management program. Failure to meet these assumptions will trigger reinitiation of consultation.

4. Implementation of a barred owl management strategy and associated monitoring program that the Service concludes are adequate to achieve and measure the results described in paragraph 3, below, will begin on BLM lands in the action area by year 8 of PRMP implementation.
5. Rates of spotted owl territorial site abandonment resulting from timber harvest in the Harvest Land Base will not exceed 10 percent in the first decade of implementation, 15 percent in the second decade, and 20 percent in each subsequent decade. For decades where BLM impacts are less than these maximums (e.g. 7 percent loss occurs in first decade), the remainder (e.g. 10 percent - 7 percent actual loss = 3 percent remaining) will be added to the following decade (e.g. decade 2 would then have a maximum loss of 15 percent + 3 percent = 18 percent).
6. The following benchmarks for the rate of spotted owl population change on BLM lands within the action area will be met or exceeded (Table 232). These rates of population change were used in estimating the number of occupied owl sites discussed above and meeting them would be expected to achieve similar results. Determination of whether these benchmarks have been met could be achieved in a number of ways; however, we suggest utilizing results from ongoing spotted owl demographic analyses to assess whether benchmarks have been achieved. For the barred owl management scenario we have described in this BO, spotted owl demographic rates from the NWFP Effectiveness Monitoring Program demographic study areas (see Dugger et al. 2016 for details) can be used to assess the effectiveness of barred owl management. There are 3 northern spotted owl demographic study areas (DSAs) (Oregon Coast Ranges, Tyee, Klamath,) (Dugger et al. 2016) and the Union/Myrtle barred owl experiment area that overlap the 5 potential barred owl management areas we described above. DSAs overlap the OCR-N, OCR-S, KLV-N and KLE potential barred owl management areas (Figure 28) and comprise approximately 40 percent (324,398 acres) of these areas. While the KLV-S and WCS barred owl management areas do not include DSAs, we believe that changes in population growth rate obtained from portions of the demographic study areas that do overlap potential barred owl management areas are sufficient to assess the effectiveness of a barred owl management program on BLM lands because the demographic study areas are representative of forest types within the barred owl management areas and provide robust data for estimating rates of population change. Rates of population change should be assessed using estimates of population change for the portions of these demographic study areas that overlap the barred owl management areas. If barred owl management occurs within a portion of a DSA, it is highly likely that the scientists

conducting the analyses will conduct separate demographic analyses for area where barred owl management is occurring and areas where it is not (see analyses for Green Diamond Study Area described in Dugger et al. 2016 for an example). These population parameters have been estimated every five years since the mid-1990s. Anticipated future analyses would occur in 2019, 2024, 2029, 2034, 2039, 2044, 2049, 2054, 2059 and 2064, and results from these analyses can be used to determine whether benchmarks have been met. The first benchmark for evaluating reinitiation of consultation related to this assumption would be 2029, because this would provide the first demographic analysis following implementation of a barred owl management program. If separate analyses are not conducted as part of these 5-year analyses, Service and BLM biologists will work with these scientists to derive estimates of annual rate of population change for the portions of the DSAs within barred owl management areas.

Table 232. Annual rate of population change (λ) for spotted owls in demographic study areas (DSAs) within barred owl management areas on the six potential barred owl management areas if barred owl management is successfully implemented.

	Years after implementation of the PRMP					
	2029	2034	2039	2044	2054	2059
Annual rate of population change (λ) for spotted owls within demographic study areas on the barred owl management areas ⁵⁰	0.9720	0.9950	1.0000	1.0100	1.0200	1.0275

EFFECTS OF THE ACTION—NORTHERN SPOTTED OWL CRITICAL HABITAT

Guidelines for Determining Effects to Critical Habitat

Any activity occurring within designated critical habitat that alters PBFs may affect spotted owl critical habitat. Effects which are discountable, insignificant, or entirely beneficial are not likely to adversely affect critical habitat. Effects that exceed this level are likely to adversely affect critical habitat.

Effects to critical habitat are irrelevant of its occupancy status. Within areas essential for the conservation and recovery of the spotted owl, the Service has determined that the PBFs are:

- 1) Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographic range;
- 2) Habitat that provides for nesting and roosting;
- 3) Habitat that provides for foraging;

⁵⁰ Annual rate of population change (λ) is estimated using methods detailed in Dugger et al. (2016).

- 4) Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (PBFs 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (USFWS 2012a, pp. 72051-72052).

Proposed Management Direction

The following effects section follows a deconstruction of the proposed action. Effects are divided by proposed management objectives for: habitat modifications (by land-use allocations) and then by resource programs which may have effects across all LUAs. Disturbance does not affect critical habitat PBFs for the spotted owl so that is not addressed here.

Habitat Modification in Critical Habitat by Land Use Allocations

Land-use allocations were designated for all BLM lands within the action area. Amounts of spotted owl critical habitat in each land use allocation were presented in the BA (BLM 2016a, p. 37) (Table 233).

Table 233. Acres of spotted owl critical habitat by land use allocation/sub-allocation (BLM 2016a, Table II-3).

Allocation	Sub-Allocation	Acres
Late-Successional Reserve		609,551
Riparian Reserve	Inner Riparian Reserve	185,635
	Outer Riparian Reserve (Moist)	60,323
	Outer Riparian Reserve (Dry)	92,377
Other Reserves	Congressionally Reserved	7,908
	District Designated Reserves	70,009
Harvest Land Base	Moderate Intensity Timber Area	895
	Low Intensity Timber Area	73,022
	Uneven-Aged Timber Area	108,229
Eastside Management Area	-	0

Congressionally Reserved Lands and the National Landscape Conservation System

Congressionally Reserved Lands are proposed to be designated on 40,505 acres of BLM land as part of the PRMP (BLM 2016a, p. 34). Within Congressionally Reserved Lands, there are 7,908 acres of spotted owl critical habitat. Congressionally Reserved Lands are those lands that Congress has designated and defined management through law, such as designated Wilderness and designated Wild and Scenic Rivers, and they have the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.
- Preserve the wilderness character of designated Wilderness Areas.
- Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (BLM Manual 6330 – Management of BLM Wilderness Study Areas; USDI BLM 2012), until Congress either designates these lands as Wilderness or releases them for other purposes.
- Protect and enhance the free-flowing condition, water quality, and outstandingly remarkable values of eligible, suitable, and designated Wild and Scenic River corridors.⁵¹
- Provide protection to Wild and Scenic River corridors¹ that are suitable for inclusion as components of the National Wild and Scenic Rivers system until Congress makes a decision on designation.
- Provide protection to Wild and Scenic River corridors¹ that are eligible but have not yet been studied for suitability as components of the National Wild and Scenic Rivers system pending suitability evaluations.

Management Direction

- In designated Wilderness Areas, exclude all prohibited uses of Wilderness (as defined in the Wilderness Act of 1964 and BLM Manual 6340 – Management of Designated Wilderness (USDI BLM 2012)), unless they have been demonstrated to be the minimum necessary (using the minimum requirements decision guide) to administer the area for the purposes of the Wilderness Act.
- Provide for the enjoyment and appreciation of the resources, qualities, values, and associated settings and primary uses within National Trail rights-of-way (including those classified as Scenic, Historical, and Recreational) and for which National Trails are designated.
- Enhance, promote, and protect the scenic, natural, and cultural resource values associated with current and future designated National Scenic and Historic Trails.
- Conduct silvicultural treatments in National Trail management corridors (including those classified as Scenic, Historical, and Recreational) only as needed to protect or maintain recreation setting characteristics or to achieve recreation objectives.
- Conduct management actions, including but not limited to fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and trail construction, in Wild and Scenic River corridors only if consistent with designated or tentative classifications and if any reductions in outstandingly remarkable values would be temporary and outstandingly remarkable values would be protected or enhanced over the long term.

⁵¹ These corridors include all of the river classifications – Wild, Scenic, and Recreational.

- Do not use ground-disturbing equipment or aerial application of non-fugitive retardant in areas visible from the river within Wild and Scenic River corridors during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property, or where use is essential for wildfire control.
- Conserve and develop the scenic, natural, and historic values of the Yaquina Head Outstanding Natural Area, and allow the continued use of the area for the purposes for which it was designated.

The primary objective of the Congressionally Reserved Lands is to conserve, protect, and restore the characteristics for which these lands were designated.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on critical habitat at this programmatic, landscape-level scale. Because the goal of Congressionally Reserved Lands is to conserve, protect, and restore the characteristics for which these lands were designated, forest management of these lands is designed to be consistent with the existing natural features and natural processes and thus the conservation function of critical habitat. There are several potential activities that are allowed for logistical and operational reasons in Congressionally Reserved Lands that have the potential to impact individual forest stands including spotted owl critical habitat. These activities include fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, trail construction and wildfire suppression activities that may impact PBFs 2, 3 and 4.

In the BA, the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on spotted owl critical habitat.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts on spotted owl critical habitat for some subset of projects that can be generally described here. Although the overall management goal for Congressionally Reserved Lands is to maintain the natural conditions, there is some potential to remove or alter spotted owl habitat including critical habitat as these actions are carried out. These impacts will be minimized by incorporating best management practices.

Silvicultural activities in Congressionally Reserved Lands are designed for fuels treatments, invasive species management, riparian or wildlife habitat improvements and forest management activities. These potential activities would generally be designed to enhance, retain and protect the natural landscape and processes, but may result in some short-term effects to spotted owl critical habitat. Because these activities are designed to protect and enhance the character and

cultural, ecological, and scientific values currently associated with these areas, we expect the management of these lands to at least retain the current ecological values over the long-term, and potentially improve on those values through management of these lands.

The reduction of fuels is designed to help protect these areas from high-intensity wildfires and, therefore, retain more forest on the landscape. Treatments for insect infestations are similarly designed to stop or slow the spread of insects that can stress or kill conifer and alter the function of stands. Natural patterns of wildfire, insect infestation, and other ecological processes are to be expected on the landscape and are encouraged. However, as recommended in the spotted owl recovery plan (USFWS 2011b), active management is encouraged where such patterns are occurring beyond the natural range of variability while taking into account climate change and historical land management influences. These activities are expected to address specific situations within the Congressionally Reserved Lands when they occur, but are not expected to alter the functioning of critical habitat on these lands. Overall we expect these treatments to provide a net habitat improvement for spotted owl critical habitat but there may be short-term impacts to PBFs 2, 3 and 4.

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owl critical habitat.

Overall, the aggregate effects of these activities to spotted owl critical habitat in Congressionally Reserved Lands is expected to be small. Although short-term impacts to spotted owl critical habitat are expected, these projects will be spread out spatially across the critical habitat network and temporally over the 50 years of the PRMP. All actions will be subject to a more specific section 7 consultation at the time the project is proposed.

Late-Successional Reserve

Late-successional reserves are proposed to be designated on 948,466 acres of BLM land as part of the PRMP (BLM 2016a, p. 34). There are 609, 551 acres of spotted owl critical habitat within the LSR land use allocation (BLM 2016a, p. 37). Critical habitat is found in LSRs designated in the moist and dry forests and have the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- *Maintain nesting-roosting habitat for the northern spotted owl and nesting habitat for the marbled murrelet.*

- *Promote the development of nesting-roosting habitat for the northern spotted owl in stands that do not currently support northern spotted owl nesting and roosting.*
- *Promote the development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.*
- *Promote the development and maintenance of foraging habitat for the northern spotted owl, including creating and maintaining habitat to increase diversity and abundance of prey for the northern spotted owl.*

Management Direction

- *Manage for large blocks of northern spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks.*
- *In stands that are currently northern spotted owl nesting-roosting habitat, maintain nesting-roosting habitat function, regardless of northern spotted owl occupancy.*
- *Protect⁵² stands of older, structurally-complex conifer forest. Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat.*
- *Undertake activities such as individual tree removal, including the felling of hazard trees and stream logs, and the construction of linear and non-linear rights-of-way or other facilities, including communication sites, as long as northern spotted owl nesting-roosting habitat continues to support northern spotted owl nesting and roosting at the stand level, and northern spotted owl dispersal habitat continues to support northern spotted owl movement and survival at the landscape level.*
 - *Protect marbled murrelet occupied stands. In this context, protect marbled murrelet occupied stands means to prohibit activities in the occupied stand except for the following: felling of live or dead hazard trees, felling trees for habitat restoration, and the construction or maintenance of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the occupied stand continues to support marbled murrelet nesting. Implement wildfire management actions and activities needed to protect the overall health*

⁵² **Protect older, structurally-complex conifer forest** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and logs for streams, the construction, modification, maintenance and removal of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl and marbled murrelet life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival; and marbled murrelet nesting habitat continues to support marbled murrelet nesting. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat or remove marbled murrelet habitat.

of the stand or adjacent stands, such as fuels reduction and insect and disease control, as long as the occupied stand continues to support marbled murrelet nesting.

- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and $> 20'$ in length except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *Cut individual green trees in the Late-Successional Reserve and move for placement in streams for fish habitat restoration.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.*
- *In stands that are not northern spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of northern spotted owl nesting-roosting habitat or improve the quality of northern spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens.*
 - *Utilize integrated vegetation management⁵³ in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*
 - *Promote the development and retention of large, open grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status species.*

⁵³ **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include but are not limited to vegetation control, planting, snag creation, prescribed fire, thinning, single tree selection harvest, and group selection harvest.

- *Promote or enhance the development of structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In stands ≥ 10 acres treated with selection harvest or commercial thinning,*
 - *Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings⁵⁴ more than 4 acres in size.*
 - *Do not create group selection openings on more than 25 percent of the stand area.*
 - *Leave untreated skips on at least 10 percent of the stand area.*
- *In stands < 10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.*
- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.*
- *When conducting commercial harvest, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels need not be attained on every acre. When creating the required number of snags, locate them according to the following criteria:*
 - *Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*

⁵⁴ **Group selection openings** are defined as areas with ≤ 2 live trees $\geq 7"$ DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

- o *Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.*
- o *Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years.*

Table 234. Snag creation levels within the Late-Successional Reserve and Riparian Reserve. Table A-3 in BLM (2016a).

District/ Field Office	Province	Snags/Acre		
		> 20" DBH	> 10" DBH	Total Snags
Coos Bay	All	5	5	10
Eugene	OR Coast Range	5	5	10
	Western Cascades	5	20	25
Klamath Falls	All	2	5	7
Medford	All	1	1	2
Roseburg	OR Coast Range	6	7	13
	Western Cascades	6	25	31
	Klamath	1	1	2
Salem	OR Coast Range	5	5	10
	Western Cascades	5	20	25

- *When conducting fuels reduction or prescribed fire treatments, retain down woody material at levels specified in Table A-4 post-treatment. Meet down wood levels as an average at the scale of the treatment area following the treatment; down wood levels need not be attained on every acre.*

Table 235. Down woody material retention levels when implementing fuels reduction or prescribed fire treatments within the Late-Successional Reserve and Riparian Reserve. Table A-4 in BLM (2016a).

District/ Field Office	Province	Down Wood Percent Cover*
Coos Bay	All	6%
Eugene	OR Coast Range	6%
	Western Cascades	10%
Klamath Falls	All	3%
Medford	All	2%
Roseburg	OR Coast Range	6%
	Western Cascades	10%
	Klamath	2%
Salem	OR Coast Range	6%
	Western Cascades	10%

* Percent cover of down wood > 4" diameter.

- *Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*

Late-Successional Reserve – Dry

Management Objectives

- *See Late-Successional Reserve management objectives.*
- *Enable forests to: (1) recover from past management measures, (2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, (3) ensure positive or neutral ecological impacts from wildfire, and (4) contribute to northern spotted owl recovery.*
- *Reduce the risk of loss of key late-successional structure through the development of vertical and horizontal heterogeneity.*
- *Increase diversity of stocking levels and size classes within the stand and the landscape.*

Management Direction

- *See Late-Successional Reserve management direction.*
- *Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the South River Field Office of Roseburg District to at least 4,500 acres per decade.*
- *Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the Medford District to at least 17,000 acres per decade.*
- *When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus spp.*) trees that are ≥ 36 " DBH and were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus spp.*) trees > 24 " DBH, except where removal is necessary for safety or operational reasons.*
 - *Identify Douglas-fir and pine trees established prior to 1850 for retention based on a BLM evaluation of bark, limb, trunk, and crown characteristics.*
 - *Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire related mortality.*
- *Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale crown fire, operationally strategic locations, and potential for hazard reduction near highly valued resources.*
- *Modify fuel beds to produce characteristic fire behavior and fire effects representative of the fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.*
- *Apply prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime). Based on site-specific considerations, take measures to prevent and control fire regime altering species.*
- *Apply prescribed fire and mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain or improve fire-resilient conditions.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, removed through a commercial timber sale, or treated as necessary for fuels reduction.*

A primary objective of the LSRs in both the moist and dry forest is to provide large blocks of spotted owl habitat across enough of the landscape to support at least 25 nesting pairs of spotted owls. The proposed LSR management designed to reach these goals includes the retention of existing spotted owl habitat, including critical habitat, and the development through silvicultural methods of future spotted owl habitat (PBFs 2, 3 and 4). LSRs are expected to support the majority of reproductive spotted owl sites within the action area over time.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on designated critical habitat at this programmatic, landscape-level scale. Because the goal of LSRs is to provide for large amounts of spotted owl nesting/roosting habitat (PBF 2) across a large landscape, stand management of these lands is designed to be consistent with the production of older, larger trees and natural processes. There are several potential activities that are allowed for logistical and operational reasons in LSRs that have the potential critical habitat in the LSRs. These activities include timber harvest or silvicultural activities, including fuels treatments, selection harvest, yarding corridors, skid trails, silvicultural treatments, selection harvest or commercial thinning.

In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts to spotted owl critical habitat for some subset of projects that can be generally described here. Although an overall management goal for Late-successional Reserves is to improve habitat conditions for spotted owls, there is some potential to remove or alter spotted owl critical habitat PBFs as these actions are carried out. These impacts will be minimized by incorporating best management practices. Some activities that may have localized impacts on spotted owl critical habitat include (BLM 2016a, pp. A14 - A19):

- Felling of hazard trees
- Yarding corridors, skid trails, road construction
- Construction of linear and non-linear rights-of-way
- Cutting or tipping trees for fish habitat restoration
- Wildfire suppression
- Fuels reduction
- Insect and disease control

Timber activities in LSRs are designed to speed the development of older forest structure, such as spotted owl nesting/roosting habitat (PBF 2), retain species and compositional heterogeneity, retain and promote species diversity, treat insect infestations and reduce the threat from wildfires. These activities may target non-Douglas fir species, but are designed to retain these species that are being crowded out in areas where they currently occur and are adapted for persistence.

The reduction of fuels is designed to help protect LSRs from high-intensity wildfires and, therefore, retain greater quantities of older forest on the landscape. In the dry LSRs, stand-replacing wildfire can remove spotted owl habitat (PBFs 2, 3, and 4) across vast areas. The intent of treating these acres is to preclude these effects which would result in the development of forest stands starting in the stand initiation phase, which can take 80 years or more. Treatments for insect infestations are similarly designed to stop or slow the spread of insects that can stress or kill conifer and alter the function of stands. These activities are expected to address specific situations within the LSRs when they occur, but are not expected to alter the function of the LSR network or individual LSRs. Spotted owl habitat (PBFs 2, 3, and 4) can be fairly heterogeneous and can withstand such operations at the landscape scale. Overall we expect these treatments to provide a more diverse landscape and protect against losses of critical habitat and, so, are expected to result in a net habitat improvement for the spotted owl critical habitat.

The removal of individual or small groups of trees for aquatic restoration or to address hazards to human health and structures is expected to be a minor component of LSR management and is not expected to alter the function at any scale above the stand, if even that. The majority of aquatic habitat improvement trees are expected to be from the Riparian Reserve allocation (trees in Riparian Reserves can be tipped directly into streams with root wads intact, etc.) and hazard tree management tends to include one or a small group of trees. As described in the management direction for LSRs (BLM 2016a, p. A-15), these activities would need to maintain the function of the stand post-treatment if conducted in spotted owl nesting/roosting habitat (PBF 2).

The construction of linear and non-linear rights-of-way or other facilities is only allowed in spotted owl nesting/roosting habitat (PBF 2) when the stand will continue to support spotted owl nesting/roosting. Non-linear rights-of-way will not alter the function of spotted owl nesting/roosting habitat (PBF 2). Facilities such as communication sites generally have a small footprint at the scale of an individual LSR and are not expected to alter the function of an individual LSR, although they have the potential to preclude the development of spotted owl nesting/roosting habitat (PBF 2) and other PBFs due to the construction of small buildings, communication towers, etc.

Except for activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction, insect and disease control, and wildfire management actions/activities, management actions in older, structurally-complex conifer forest (PBF 2) would be required to retain the function of the stands that existed prior to the treatment.

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic

wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owl critical habitat.

Overall the aggregate effects of these activities to critical habitat is expected to be small compared to the overall size and distribution of critical habitat in the action area, and these effects are not expected to preclude the conservation function of the critical habitat network in the LSRs created by this PRMP. Although short-term impacts to spotted owl critical habitat are expected, these projects will be spread out spatially across the LSR critical habitat landscape and temporally over the 50 years of the PRMP. Those actions that may preclude the development of habitat in the LSR critical habitat network are not expected to be of a scale that will impact the function of any particular critical habitat unit. All actions will be subject to a more specific section 7 consultation at the time the project is proposed.

Riparian Reserve

Riparian Reserves make up 635,717 acres of the BLM lands within the action area within Riparian Reserves, there are 338,335 acres of spotted owl critical habitat. Riparian Reserve widths vary across the landscape and are described in the BA (BLM 2016a, p. A21-A29). The Riparian Reserves have the following management objectives (BLM 2016a, p. A19):

- *Contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.*
- *Maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.*
- *Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.*
- *Meet ODEQ water quality criteria.*
- *Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.*
- *Maintain high quality waters within ODEQ designated Source Water Protection watersheds.*

The BLM intends to meet these objectives by implementing the following management direction (BLM 2016a, pp. A19-A24):

Table 236. Riparian Reserve distance by water feature. Table A-5 in BLM (2016a).

Feature	Riparian Reserve Distance*
<i>Fish-bearing streams and perennial streams</i>	<i>One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of a stream</i>
<i>Intermittent, non-fish-bearing streams</i>	<i>Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of a stream</i>
	<i>Class III subwatersheds: 50' from the ordinary high water line on each side of a stream</i>
<i>Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails</i>	<i>The extent of the unstable area. Where there is a stable area between such an unstable area and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.</i>
<i>Lakes, natural ponds > 1 acre, and wetlands > 1 acre</i>	<i>100' extending from the ordinary high water line</i>
<i>Natural ponds < 1 acre and wetlands < 1 acre (including seeps and springs), and constructed water impoundments of any size</i>	<i>25' extending from the ordinary high water line</i>

** Reported distances are measured as slope distance.*

Table 237. Zone-specific management direction for streams in Class I subwatersheds. Table A-6 in BLM (2016a).

<i>Fish-bearing streams and perennial streams</i>
<i>Inner Zone (0–120 feet)</i>
<i>Do not thin stands, except for—</i>
<i>SOD treatments and</i> <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

<i>Outer Zone (120 feet to one site-potential tree height)</i>
<i>Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> <i>• Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> <i>• Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>

Table 238. Zone-specific management direction for streams in Class II subwatersheds. Table A-7 in (BLM 2016a).

<i>Fish-bearing streams and perennial streams</i>
<i>Inner Zone (0–120 feet)</i>
<i>Do not thin stands, except for—</i> <i>• SOD treatments; and</i> <i>• Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

<i>Outer Zone (120 feet to one site-potential tree height)</i> <i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> <i>• Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> <i>• Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>
<i>Intermittent, non-fish-bearing streams</i>
<i>Inner Zone (0–50 feet)</i> <i>Do not thin stands, except for—</i> <i>• SOD treatments</i> <i>• Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

Outer Zone (50 feet to one site-potential tree height)
<i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> <i>• Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> <i>• Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>

Table 239. Zone-specific management direction for streams in Class III subwatersheds. Table A-8 in BLM (2016a).

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
<i>Do not thin stands, except for—</i> <i>• SOD treatments; and</i> <i>• Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

Outer Zone (120 feet to one site-potential tree height) <i>Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.</i> <i>Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in Table A-3 within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:</i> • <i>Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.</i> • <i>Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.</i> <i>Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.</i>
Intermittent, non-fish-bearing streams (0-50 feet) <i>Do not thin stands, except for—</i> • <i>SOD treatments; and</i> • <i>Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.</i>

- *Maintain access to roads and facilities by removing hazard trees and blowdown. Retain logs as down woody material or move for placement in streams for fish habitat restoration, unless removal of logs, including through commercial harvest, is necessary to accomplish removal of hazard trees or blowdown to maintain access to roads and facilities.*
- *Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.*
- *Use site-specific BMPs (Appendix J of the Proposed RMP) to maintain water quality during land management actions, including discretionary actions of others crossing BLM-administered lands.*
- *In new recreational developments, install sanitation systems that maintain water quality (e.g., sealed vault or similar).*

- *Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.*
- *Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).*
- *During silvicultural treatment of stands, retain existing—*
 - *snags $\geq 6''$ dbh*
 - *down woody material $\geq 6''$ in diameter at the large end and > 20' in length*

except for safety, operational, or fuels reduction reasons. Retain snags $\geq 6''$ dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.

- *Prohibit timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.*
- *Implement Sudden Oak Death (SOD) eradication activities that do not exceed (at the watershed scale (HUC 10))—*
 - *The removal of > 30 percent canopy cover over a contiguous 0.5 mile stream length or removal of > 50 percent canopy cover over a contiguous 0.25 mile stream length for small perennial streams (active channel width < 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained;*
 - *The removal of > 50 percent canopy cover over a contiguous 0.5 mile stream length for medium-large perennial streams (active channel width > 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained; and*
 - *A limit of 3 miles of treatment for any 5-year period and 3 percent of the total Federal perennial stream miles.*

Implement SOD eradication activities that exceed these limitations only consistent with existing ESA consultation documents that address SOD eradication activities in the decision area.

- *Cut or tip individual green trees and move for fish habitat restoration.*
- *Cut or tip individual trees directly into the stream channel for fish habitat restoration.*

- *Tree-tipping: When conducting commercial thinning⁵⁵ in any portion of the Outer Zone in a stand in all watershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the treated stand. Leave felled or tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone.*
- *Promote beaver habitat restoration where the presence of beaver and their associated dams would improve fish and aquatic habitat.*
- *Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.*
- *For constructed water impoundments and constructed ponds:*
 - *Follow inspection guidelines for BLM infrastructure (e.g., dams and spillway structures), and implement maintenance and repair as needed.*
 - *Dredge constructed water impoundments as necessary to maintain capacity.*
 - *Maintain vegetation, access, and plumbing associated with fire water sources for all types of firefighting equipment (e.g., engines, aircraft, and tenders).*
- *Mining operators with an accepted Notice or approved Plan of Operations will comply with performance standards (43 CFR 3809.420), including all applicable State and Federal water quality standards.*

Because the Riparian Reserves are being established to provide for the producing large wood that will contribute to stream habitat structure, protecting cold, clear water, and the conservation and recovery of listed fish, the stand management of these lands is expected to be consistent with the production of older, larger trees and natural processes and thus the critical habitat PBFs. Thinning in the inner zone of fish-bearing streams and perennial streams is only allowed under specific circumstances intended to promote conservation or restoration of improved riparian conditions (Sudden Oak Death treatments and for Individual tree falling or tipping for restoration), which will allow for the growth and development of large trees in structurally complex stands over time. Where spotted owl habitat does not currently exist we expect it will develop under the proposed management direction. In the outer zone thinning is allowed to develop large trees only when needed to provide trees that would function as stable wood in the stream in Class I subwatersheds or to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant

⁵⁵ In the context of management direction for the Riparian Reserve, **commercial thinning** means stand thinning in which any of the cut trees are removed from the stand for timber volume. Commercial thinning in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. Commercial thinning may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

communities, and allow for hardwood vigor and persistence in Class II and III subwatersheds. Stands likely to be treated in this manner include plantations or overstocked stands that are on a trajectory towards stem exclusion. These stands are likely to stagnate before becoming structurally complex; therefore, such treatments are expected to result in a net habitat improvement for spotted owls. Potential activities along intermittent, non-fish bearing streams are similarly geared towards growing large trees (with the intent that some will eventually fall or be pulled into the rivers or streams and create fish habitat) which should provide a long-term retention and recruitment of complex forested habitat over time (PBF 2). In addition, where thinning is allowed, there is a focus on creating and maintaining snags and downed wood, both of which are important habitat components of spotted owl foraging and dispersal habitat (PBFs 3 and 4).

As discussed above, the primary intent of BLM's Riparian Reserve management direction is to provide for water quality and the habitat conditions necessary for the conservation of listed fish and other sensitive aquatic species, but will also provide incidental benefits to the conservation of listed upland species such as the spotted owl. The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale.

In the BA, the BLM was not able to provide any precise estimates of the extent of these types of projects that may occur over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects in critical habitat until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects on spotted owl critical habitat.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome for the spotted owl critical habitat network. However, as these individual projects are implemented there may be associated short term or localized adverse impacts on spotted owl critical habitat for some subset of projects that can be generally described here. Although the overall management goal for Riparian Reserves is to improve habitat conditions for fish and upland species of concern, there is some potential to remove spotted owl habitat including critical habitat as these actions are carried out. These impacts will be minimized by incorporating best management practices. Some activities that may have localized impacts on spotted owl critical habitat include. (BLM 2016a, pp. A19-A20):

- Felling of hazard trees
- Yarding corridors, skid trails, road construction, stream crossings where there is no operationally feasible and economically viable alternative
- Implement Sudden Oak Death (SOD) eradication
- Cutting or tipping trees for fish habitat restoration
- Wildfire suppression
- Insect and disease control

The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees (PBF 2, 3, 4). Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The removal of single or small clumps of trees is not expected to affect the overall function of the Riparian Reserves within the action area. Site-specific section 7 consultation will be conducted when these projects are implemented, which will contain specific information on the anticipated location and effects of these projects to critical habitat.

Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet and are limited temporally. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible. Treatment for insects and other diseases also involves the potential for the removal of canopy and sub-canopy trees at the local scale. While these treatments, if needed, have the potential to affect spotted owl critical habitat including PBFs 2,3, and 4 at the stand scale, they are not expected to alter the function of critical habitat at any scale greater than the local level, and are not expected to diminish the value of the critical habitat unit.

The potential construction of yarding corridors, skid trails and road construction where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. If these activities are implemented in Riparian Reserves the BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites including those in critical habitat as they implement the management direction and the guidance in the Proposed RMP (Hardt 2016b, pers. comm.). Yarding corridors, skid trails and road construction create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function or the objectives of any critical habitat units. Stream crossings are subject to the ARBOII consultation (USFWS 2013) PDCs which do not anticipate impacts to spotted owl critical habitat.

Wildfire suppression has the potential to occur in critical habitat in all land use allocations and is addressed separately below as part of the Fire and Fuels resource program.

District-Designated Reserves

District Designated Reserves are proposed to be designated on 223,142 acres of BLM land as part of the PRMP (BLM 2016a, p. 34). Of these lands, 70,009 acres is spotted owl critical habitat.

District-Designated Reserves include lands that are reserved from sustained-yield timber production for a variety of reasons, including (BLM 2016c, pp. 39-40):

- *Areas that the BLM has constructed for specific purposes (e.g., roads, buildings, maintenance yards, seed orchards, and other facilities and infrastructure);*
- *Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops);*
- *Areas of Critical Environmental Concern, including Research Natural Areas, that would not overlap the Harvest Land Base; and*
- *Other reserves (e.g., Special Recreation Management Areas that would not overlap the Harvest Land Base, areas protected for Bureau Sensitive species, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics).*

District Designated reserves include the following management objectives and management direction (BLM 2016a, p. A14-A19):

Management Objectives

- *Maintain the values and resources for which the BLM has reserved these areas from sustained-yield timber production.*

Management Direction

- *Manage constructed facilities and infrastructure, such as seed orchards, roads, buildings, quarries, communication sites, pump chances, heliponds, and maintenance yards, as needed for the purposes for which the BLM constructed them.*
- *Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.*
- *Manage seed orchards consistent with the Seed Orchard Records of Decision for Integrated Pest Management.*

District-Designated Reserve – Timber Production Capability Classification

Management Objectives

- *See District-Designated Reserves management objectives.*

Management Direction

- *Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are*

compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).

- *Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system,*
- *Designate additional lands as District-Designated Reserve – Timber Production Capability Classification through updates to the Timber Production Capability Classification system and remove those lands from the Harvest Land Base when examinations indicate that those lands meet the criteria for reservation.*
- *Un-designate lands as District-Designated Reserve – Timber Production Capability Classification and return those lands to the Harvest Land Base through updates to the Timber Production Capability Classification system when examinations indicate that those lands do not meet the criteria for reservation.*

District-Designated Reserve – Lands Managed for their Wilderness Characteristics⁵⁶

Management Objectives

- *Protect wilderness characteristics (i.e., roadlessness, naturalness, opportunities for solitude and primitive unconfined recreation, and identified supplemental values), while allowing competing resource demands that do not conflict with preserving long-term wilderness characteristics.*

Management Direction

- *Allow mechanical vegetation treatment consistent with Visual Resource Management Class II for the purpose of improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.*
- *Do not construct new buildings or new temporary or permanent roads.*
- *Allow fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and other vegetation management only if any reductions in wilderness characteristics are temporary and wilderness characteristics are protected over the long term.*
- *Do not use ground-disturbing equipment or aerial application of non-fugitive retardant during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property or where use is essential for wildfire control.*

⁵⁶ These objectives and direction apply to lands outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is proposing to manage for the protection of those wilderness characteristics.

- *For lands identified for protection of wilderness characteristics where the BLM-administered lands rely on adjoining Federal lands being managed to protect the same values to meet the size criteria (BLM Manual 6310 – Conducting Wilderness Characteristics Inventory on BLM Lands; USDI BLM 2012) and the agency managing the adjoining lands revises its land use plan to no longer protect wilderness characteristics, the BLM-administered lands will no longer meet the minimum size criteria and thus will no longer possess wilderness characteristics.*
 - *Wilderness characteristics will no longer be protected on these lands and the accompanying land use plan allocations (e.g., right-of-way exclusion, Visual Resource Management Class II) applied specifically to protect the wilderness characteristics will automatically be dropped as part of plan maintenance.*
 - *These lands will then be managed consistent with the land use allocations, management objectives, and management direction of comparable or adjacent BLM-administered lands.*

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. In the BA the BLM was not able to provide any precise estimates of the extent of these types of projects in District-Designated Reserves that may occur in spotted owl critical habitat over the next 50 years as part of the PRMP; such individual projects and activities will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of the effects on spotted owl critical habitat.

During the next 50 years these individual projects will be proposed consistent with the management direction described above, thus it is likely that these projects will have an overall net positive conservation outcome at the landscape scale of the plan. However, as these individual projects are implemented there may be associated short term or localized adverse impacts on spotted owl critical habitat and PBFs for some subset of projects that can be generally described here.

Overall the aggregate effects of these activities on spotted owl critical habitat in District-Designated Reserves is expected to be small. Although short-term impacts to spotted owl critical habitat are expected, these projects will be spread out spatially across the District-Designated Reserves landscape and temporally over the next 50 years under the PRMP. Any future changes in boundaries of District-Designated Reserves – Lands Managed for their Wilderness Characteristics due to changes in adjoining Federal lands would require an RMP amendment (Hardt 2016a, pers. comm.) with the appropriate NEPA and ESA compliance, and, so, are not subject to this consultation.

Harvest Land Base

The Harvest Land Base is proposed to be designated on 469,215 acres of BLM land. Within the Harvest Land Base, there are 182,146 acres of spotted owl critical habitat. This is the land-use allocation where the majority of the programmed timber harvest is planned to occur. The Harvest Land Base is divided into three categories: the Moderate Intensity Timber Area (180,549 acres total, 895 acres of spotted owl critical habitat), the Low Intensity Timber Area (89,126 acres total, 73,022 acres of spotted owl critical habitat) and the Uneven-Aged Timber Area (199,541 acres total, 108,229 acres of spotted owl critical habitat). The potential effects of designation and implementation of the Harvest Land Base LUAs on spotted owls and spotted owl habitat were modeled by BLM and are addressed in the Jeopardy Analysis. What follows here is a programmatic description of the sub-categories in the Harvest Land Base LUA. The management direction for the Harvest Land Base includes (BLM 2016a, pp. A8-A14):

Management Objectives

- *Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.*
- *Offer for sale the declared Allowable Sale Quantity of timber.*
- *Recover economic value from timber following disturbances, such as fires, windstorms, disease, or insect infestations.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.*
- *Enhance the economic value of timber in forest stands.*

Management Direction

- *Conduct silvicultural treatments to contribute timber volume to the Allowable Sale Quantity.*
- *Conduct silvicultural treatments to enhance timber values and to reduce fire risks and insect and disease outbreaks.*
- *Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.*
- *Employ site preparation methods such as mechanical treatments (e.g., machine piling), manual treatments (e.g., brushing), and prescribed burns to prepare newly harvested and inadequately stocked areas for the regeneration of desirable tree species.*
- *Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.*

- *During commercial thinning, selection harvest,⁵⁷ or regeneration harvest treatments of stands, retain existing—*
 - o *Snags > 20" DBH*
 - o *Snags 6-20" DBH in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook)*
 - o *Down woody material > 20" in diameter at the large end and > 20' in length*
 - o *Down woody material 6-20" in diameter at the large end and > 20' in length in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook) except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6" DBH felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.*
- *If not suitable for commercial removal, make felled hazard trees available for habitat restoration purposes in any land use allocation.*
- *When implementing commercial harvest,⁵⁸ except timber salvage, create new snags in the amounts and sizes specified in Table A-2 within 1 year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels are not required to be attained on every acre. When creating the required number of snags, locate them according to the following criteria:*
 - o *Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*

57 **Selection harvest** is a type of commercial harvesting. Selection harvesting generally involves removing individual trees or groups of trees up to four acres in size and is used as part of an uneven-aged management regime, or to create uneven-aged stands.

58 In the context of management direction for the Harvest Land Base, **commercial harvest** means stand harvesting in which some or all of the cut trees are removed from the stand for timber volume and a monetary value assessed. Commercial harvest in this context does not include the following:

- o Individual tree falling
- o Stand thinning in which all of the cut trees are left in the stand for restoration purposes or the cut trees are removed for firewood or other non-commercial harvest
- o Fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber

Commercial harvest may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

- *Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.*
- *Concentrate the creation of snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Meet snag creation levels with trees from any species.*

Table 240. Snag creation levels within the Harvest Land Base. Table A-2 in BLM (2016a).

District/ Field Office	Province	Number of Snags/Acre Created Within 1 Year of Yarding the Timber in the Timber Sale		
		> 20" DBH	> 10" DBH	Total Snags
Coos Bay	All	1	-	1
Eugene	OR Coast Range	1	-	1
	Western Cascades	1	-	1
Klamath Falls	All	1	-	1
Medford	All	-	-	-
Roseburg	OR Coast Range	3	-	3
	Western Cascades	3	3	6
	Klamath	-	-	-
Salem	OR Coast Range	1	-	1
	Western Cascades	1	-	1

Harvest Land Base – Low Intensity Timber Area (LITA)

Management Objectives

- *See Harvest Land Base management objectives.*
- *Provide complex early successional ecosystems.*
- *Develop diverse late-successional ecosystems for a portion of the rotation.*
- *Provide a variety of forest structural stages distributed both spatially and temporally.*

Management Direction

- *See Harvest Land Base management direction.*

- *Apply regeneration harvest for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Adjust the age class distribution in the LITA in each sustained-yield unit.*
 - *Manage insect and disease infestations.*
 - *Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Create growing space for hardwood and pine species persistence and regeneration.*
 - *Produce complex early successional ecosystems.*
 - *Reset stand development in overly dense stands that would not respond well to commercial thinning.*
- *In each regeneration harvest unit, retain 15–30 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.*
- *Conduct commercial thinning for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Recover anticipated mortality.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
 - *Improve stand merchantability and value.*
 - *Increase or maintain vegetative species diversity.*
 - *Promote or enhance the development of structural complexity.*
 - *Create growing space for the creation or augmentation of Bureau Special Status plant populations.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
- *Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.*

- *Conduct thinning to result in a stand average relative density between 25 percent and 45 percent after harvest.*
- *Leave untreated areas (skips) and group selection openings⁵⁹ to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.*
- *Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*
 - *In timber salvage harvest units, retain at least 15 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.*
- *For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.*

Harvest Land Base – Moderate Intensity Timber Area (MITA)

Management Objectives

- *See Harvest Land Base management objectives.*
- *Provide complex early successional ecosystems.*
- *Develop diverse late-successional ecosystems for a portion of the rotation.*

⁵⁹ **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7 " DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

- *Provide a variety of forest structural stages distributed both temporally and spatially.*

Management Direction

- *See Harvest Land Base management direction.*
- *Conduct regeneration harvest for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Adjust the age class distribution in the MITA in each sustained-yield unit.*
 - *Manage insect and disease infestations.*
 - *Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Create growing space for hardwood and pine species persistence and regeneration.*
 - *Produce complex early successional ecosystems.*
 - *Reset stand development in overly dense stands that would not respond well to commercial thinning.*
- *In each regeneration harvest unit, retain 5–15 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*
- *Conduct commercial thinning for any of the following reasons:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Recover anticipated mortality.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
 - *Improve stand merchantability and value.*
 - *Increase or maintain vegetative species diversity.*
 - *Promote or enhance the development of structural complexity.*

- *Create growing space for the creation or augmentation of Bureau Special Status plant populations.*
- *Create growing space for hardwood and pine persistence and regeneration.*
- *Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.*
 - *Conduct thinning to result in stand average relative density between 25 percent and 45 percent after harvest.*
 - *Leave untreated areas (skips) and group selection openings to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.*
 - *Include among retained trees all trees that are both ≥ 40 " DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*
 - *In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*
- *For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.*

Harvest Land Base – Uneven-aged Timber Area (UTA)

Management Objectives

- *See Harvest Land Base management objectives.*

- *Increase diversity of stocking levels and size classes within and among the stands.*

Management Direction

- *See Harvest Land Base management direction.*
- *Utilize integrated vegetation management⁶⁰ in designing and implementing treatments. Conduct integrated vegetation management for any of the following:*
 - *Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.*
 - *Promote the development and retention of large, open grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Promote or enhance the development of structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *In forest stands ≥ 10 acres treated with selection harvest or commercial thinning, harvest to result in stand average relative density between 20 percent and 45 percent after harvest.*
 - *Do not create group selection openings more than 4 acres in size.*
 - *Do not create group selection openings on more than 30 percent of the stand area.*
 - *Leave untreated areas (skips) on at least 10 percent of the stand area.*

⁶⁰ **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include, but are not limited to, vegetation control, planting, snag creation, prescribed fire, biomass removal, thinning, single tree selection harvest, and group selection harvest.

- *When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the opening of at least 150 trees per acre within 5 years of harvest.*
- *When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus* spp.) trees that are both ≥ 36 " DBH and that the BLM identifies were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus* spp.) trees > 24 " DBH, except where removal is necessary for safety or operational reasons.*
 - *The BLM identification of Douglas-fir and pine trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.*
 - *Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire-related mortality.*
 - *Apply prescribed fire for any of the following:*
 - *Promote the development and retention of large, open-grown trees and multi-cohort stands.*
 - *Develop diverse understory plant communities.*
 - *Increase or maintain vegetative species diversity.*
 - *Restore and maintain habitat for Bureau Special Status Species.*
 - *Promote or enhance the development of stand structural complexity and heterogeneity.*
 - *Create growing space for hardwood and pine persistence and regeneration.*
 - *Create and maintain areas for hardwood and shrub dominance.*
 - *Adjust stand composition or dominance.*
 - *Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.*
- *Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale, high-intensity fire, operationally strategic locations, and near highly valued resources and assets.*
- *Modify fuel loading to produce fire behavior and fire effects representative of the natural fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.*
- *Implement prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime).*
- *Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.*

- *In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.*
- *After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.*

The objectives of the Harvest Land Base are intended to produce a consistent and reliable source of timber to meet the Allowable Sale Quantity of the BLM districts within the action area. Timber harvest under the PRMP involves the potential planning and implementation of timber sales or groups of timber sales that meet the management direction of the Harvest Land Base category and includes, among other aspects, the layout of units, the survey and scaling of timber, the construction of roads and landings as needed, the advertising, selling and awarding of sales, the harvest of the timber, the hauling of logs and the reforestation activities after the harvest.

Although this potential allocation is not intended to be relied on for demographic support of spotted owls, the management direction includes provisions that would contribute to the development of late-successional habitat including critical habitat PBFs over time. This habitat may not remain on the landscape for the long-term, but the presence of spotted owl habitat within the Harvest Land Base would assist in spotted owl movement (PBF 4) across the landscape and could potentially provide refugia from barred owls. For example, in the UTA, vegetation management may be used as a tool to promote or enhance the development of structural complexity and heterogeneity (PBFs 2, 3, and 4). The BLM will retain all trees that are both ≥ 40 inch diameter at breast height (DBH) and that the BLM identifies were established prior to 1850, will meet snag and downed wood retention and creation levels in timber sales and retention levels in salvage sales, will retain untreated portions of harvest units in the MITA and the LITA, and has the option to employ natural reforestation techniques after timber harvest, salvage operations and disturbance events. Natural regeneration techniques are expected to provide for a complex early-seral ecosystem in the short-term and to better emulate natural forest stand development over the long-term. This should result in greater stand diversity and the need for fewer entries for those stands that are managed for the development of diverse late-successional ecosystems. As an example of the potential value of the critical habitat in the Harvest Land Base to spotted owls, where there are occupied spotted owl sites in PBF 2 that are not harvested until the 5th decade of the PRMP (and are not impacted by barred owls), then those spotted owls will continue to contribute demographically to the overall spotted owl population over that timeframe.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on listed species at this programmatic, landscape-level scale. In the BA the BLM was not able to provide any precise estimates of the extent of these aspects of timber harvest that may contribute to the development of structural characteristics useful to spotted owl critical habitat PBFs over the next 50 years as part of the PRMP. Each individual project will be planned and proposed at later dates and at finer scales when project-specific information is available. Therefore, it is not possible to know the specific locations and details

of these potential projects until they are proposed sometime in the next 50 years. When these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of their effects on listed species.

During the next 50 years these individual projects will be proposed consistent with the management direction described above. The Harvest Land Base portion of the BLM landscape (which includes 15 percent of the spotted owl critical habitat within the action area) is expected to provide less and less contribution to spotted owl critical habitat over time, while the reserve portion of the BLM lands (approximately 85 percent of the spotted owl critical habitat within the action area) will provide the necessary contributions for spotted owl conservation. Even with the impact of Harvest Land Base timber harvest over the next 50 years, all spotted owl critical habitat units are expected, through management and ingrowth, to increase in PBFs during that time. While several of the critical habitat sub-units will experience a reduction in PBF 4 (habitat for dispersal), all sub-units except for two (WCS-3 and WCS-4) are expected to increase in the amount of PBF 2, 3 and 4. Sub-unit WCS-3 decreases by 97 acres of PBF 2, 3 and 4 and WCS-4 declines by 3 acres of PBFs 2, 3 and 4 over the life of the PRMP. However, all critical habitat units will increase in PBFs 2, 3 and 4 over the life of the PRMP. While there will be some loss of PBFs 2, 3 and 4 within all CHUs in the Harvest Land Base, the increases in the CHUs in reserved allocations will exceed the losses and are expected to occur in the areas managed for barred owls which will increase the functionality of the PBFs in the critical habitat network for territorial spotted owls.

Areas of Critical Environmental Concern

There are 34,340 acres of spotted owl critical habitat within Areas of Critical Environmental Concern (McGraw 2016, pers. comm.). BLM summarizes the proposed designation as (BLM 2016a, p. 38):

- *“Maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.”*

The PRMP includes the potential proposed designations of the Brownson Ridge, Cherry Creek RNA, Elk Creek, Euphoria Ridge, Grassy Mountain RNA, Heceta Sand Dunes ONA, High Peak–Moon Peak RNA, Lake Creek Falls, Mary’s Peak ONA, Nestucca River, North Fork Chetco, North Fork Coquille River, North Spit, Rocky Peak, Saddle Bag Mountain RNA, Upper Rock Creek and Valley of the Giants ACECs, all of which have the spotted owl and/or its critical habitat listed among the “relevant and important values” for each of these ACECs. The BLM proposes to manage these areas to maintain spotted owl habitat and critical habitat, which is beneficial for spotted owls in these areas. According to the BLM (McGraw 2016, pers. comm.) there are 33,777 acres of spotted owl nesting/roosting habitat within ACECs in the action area, and 22,088 acres of dispersal habitat within ACECs in the action area. Areas of Critical Environmental Concern are additional designations which overlay the land-use allocations discussed above. Although the spotted owl is listed among the “relevant and important values” for each of the ACECs, the proposed management direction does not prohibit impacts to spotted owl critical habitat. Particularly, when managing for spotted owl habitat, as

mentioned above, there are often short-term adverse effects to critical habitat that may occur for the long-term benefit of developing habitat sooner than if a stand was left unmanaged.

The BLM estimates that the amount of spotted owl critical habitat PBFs 2, 3 and 4 within ACECs will increase over the next 50 years through management and ingrowth from 29,957 acres to 31,445 acres. Nesting/roosting habitat in critical habitat (PBF 2) is expected to increase from 22,360 acres to 25,463 acres, while dispersal habitat (PBF 4) is expected to decrease from 7,597 acres to 5,982 acres (McGraw 2016, pers. comm.). Physical and Biological Feature 2 (nesting/roosting habitat) functions as nesting/roosting and foraging habitat, and is considered to be the highest quality dispersal habitat (PBF 4) because it provides high canopy cover, appropriate microclimates and foraging opportunities.

Resource Programs

Resource programs are potentially implemented across all LUAs. We anticipate that the effects from these resource programs on spotted owl critical habitat will occur on BLM lands within the action area.

An overall summary of resource program is displayed in Table 241.

Table 241. Habitat modification activities with the potential to adversely affect spotted owl critical habitat (BLM 2016a, Appendix A, entire).

Potential Actions associated with habitat modification (BLM 2016a,)	Anticipated Frequency	Potential Adverse Effects
Hazard trees	Yearly	The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees (PBFs 2, 3 and 4). Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The removal of single or small clumps of trees is not expected to affect the overall function of the critical habitat unit or subunit because the functions of the PBFs at the stand scale are expected to be retained.

Trees for instream restoration	Yearly	The potential felling of hazard trees and cutting or tipping trees for fish habitat restoration actions are expected to involve individual tree removal and small groups of trees and may remove PBFs 2, 3 and 4. Hazard tree removal targets trees that have a likelihood to fall on their own, but removes them in a manner that provides safety for humans and structures. Trees felled or tipped for aquatic restoration projects will follow the ARBOII consultation (USFWS 2013) which provides project design criteria to minimize the effects of the included projects. The removal of single or small clumps of trees is not expected to affect the critical habitat unit or subunit because the functions of the PBFs at the stand scale are expected to be retained.
Culvert and bridge replacements	Yearly	Potential removal or downgrading of nesting/roosting and dispersal habitat (PBFs 2, 3 and 4) may occur with bridge and culvert replacement as some trees may need to be removed in order to conduct replacements; however, the amount of removal is expected to be minimal as most bridge/culverts are associated with existing roads openings in the forest. Removal of small numbers of trees around bridges and culverts will have minimal effects on the character of the stands on which it occurs and this action should not alter the functionality of the critical habitat unit or subunit because the functions of the PBFs at the stand scale are expected to be retained.
Rights-of-ways	Yearly	The potential construction of yarding corridors, spur roads, and road construction in rights-of-way where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to spotted owl sites in critical habitat PBF 2 as they implement the management direction and the guidance in the Proposed RMP (Hardt 2016b, pers. comm.). Yarding corridors, skid trails and road construction create narrow, linear features that may have impacts at the stand scale (PBFs 2, 3 and 4), but are not expected to alter the function of the critical habitat unit or subunit because the functions of the PBFs at any scale larger than the stand are expected to be retained. Stream crossings are subject to the ARBOII consultation (USFWS 2013) PDCs which do not anticipate habitat reduction impacts to spotted owl habitat (PBFs 2, 3 and 4).

Spur roads –not with the harvest land base	Yearly	The potential construction of spur roads where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites and spotted owl critical habitat as they implement the management direction and the guidance in the Proposed RMP (Hardt 2016b, pers. comm.). Spur roads create narrow, linear features that may have impacts at the stand scale. Spotted owls are readily able to fly across small openings in the forest canopy and are not expected to suffer demographic consequences from these activities. These activities are not expected to alter the function of the critical habitat unit or subunit because the functions of the PBFs at any scale larger than the stand are expected to be retained.
Yarding corridors–not with the harvest land base	Yearly	The potential construction of yarding corridors outside the harvest land base where there is no operationally feasible and economically viable alternative is expected to be rare given the priority for other operationally and economically viable alternatives. The BLM will attempt to avoid impacts to occupied and high-quality spotted owl sites and spotted owl critical habitat as they implement the management direction and the guidance in the Proposed RMP (Hardt 2016b, pers. comm.). Yarding corridors create narrow, linear features which spotted owls are readily able to fly across. These projects may have impacts at the stand scale, but are not expected to alter the function of the critical habitat PBFs at the unit or subunit scales because the functions of the PBFs at any scale larger than the stand are expected to be retained.
Other facilities	Sporadic, rare	Potential removal or downgrading of nesting/roosting/foraging habitat (PBF 2, 3) and dispersal habitat (PBF 4) may occur; however the areas affected would be small and proposed management direction for Recreation and Visitor Services would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl critical habitat PBFs.
Camp ground (broken out from other facilities)	Sporadic, rare	Potential removal or downgrading of nesting/roosting/foraging habitat (PBF 2, 3) and dispersal habitat (PBF 4) may occur; however the areas affected would be small and proposed management direction for Recreation and Visitor Services would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl critical habitat PBFs.

Wildfire suppression	Sporadic	Wildfire suppression has the potential to cause short-term impacts to spotted owl critical habitat. This impact has the potential to downgrade or remove nesting/roosting (PBF 2), foraging (PBF 3) and dispersal habitat (PBF 4); however, there should be long term benefits to spotted owl critical habitat if treatments reduce fire risk and thereby promote the retention and development of late successional forest. Wildfire suppression has the potential to cause short-term impacts to spotted owl critical habitat because of the potential to downgrade or remove nesting, roosting, foraging and dispersal habitat; however, there should be long term benefits to spotted owls if treatments reduce fire risk and promote development of late successional forest structure. The BLM was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. When these projects are proposed the BLM will complete project-specific and site-specific NEPA and section 7 consultation, which will provide a quantitative and localized analysis of the effects to spotted owl critical habitat.
Fuels reduction	Sporadic	Fuels management has the potential to cause short-term impacts to spotted owl critical habitat PBFs. This impact has the potential to downgrade or remove nesting/roosting (PBF 2), foraging (PBF 3) and dispersal habitat (PBF 4); however, there should be long term benefits to spotted owl critical habitat if treatments reduce fire risk thereby promoting retention and development of late successional forest structure. Fuels reduction is more needed and therefore more likely to impact spotted owl critical habitat in dry forest than in moist forest. Drier spotted owl nesting habitat represents more of a heterogeneous mosaic structure than wetter west side, which is a result of historic natural disturbances (Olson <i>et al.</i> 2004). These fuel management treatments are likely, to some extent, to mimic these stands that have developed under these conditions. Reduction of understory and ladder fuels has the potential to negatively affect spotted owl prey (PBF 3). However, adjacent untreated stands are expected to continue to support spotted owl foraging.

Treating sudden oak death	Yearly	Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet in Riparian Reserves and are limited temporally. Spotted owl critical habitat PBFs 2, 3 and 4 could be affected by this action at the localized scale. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible.
Insect and disease control	Yearly	Treatments for insects and other diseases involve the potential for the removal of canopy and sub-canopy trees in PBFs 2, 3 and 4 at the local scale. Although these treatments, where necessary, have the potential to affect spotted owl critical habitat PBFs at the stand scale, they are not expected to alter the function of the landscape at any scale greater than the local level because they generally affect small pockets of habitat. Therefore they are not expected to affect the function of the critical habitat unit or subunit.
Other activities to improve forest health	Yearly	Other activities to improve forest health are expected to address specific situations within the land use allocations when they occur, but are not expected to alter their function or the function of the critical habitat unit or subunit because of the small scale at which they are likely to occur. Although there may be short-term negative impacts to spotted owl critical habitat PBFs 2, 3 and 4, we expect these treatments to provide a net habitat improvement for spotted owl critical habitat.

Timber sales and associated yarding corridors and spur roads	Yearly	Timber sales in the harvest land base and associated yarding corridors and spur roads have the potential to remove nest trees (PBF 2), remove or downgrade nesting/roosting/foraging (PBF 2,3), and dispersal habitat (PBF 4). Regeneration harvest, salvage, and group and single tree selection harvest will occur in the harvest land base resulting in the removal of spotted owl habitat (PBFs 2, 3 and 4) in numerous critical habitat subunits. However, BLM has indicated through their habitat modeling analysis, that the net change in suitable spotted owl habitat on these subunits over the life of the PRMP is either positive, neutral (no net change), or involves a minimal loss (<100 acres within any subunit). The harvest land base is not relied upon by the BLM for spotted owl nesting/roosting support (PBF 2). Yarding corridors and spur roads create narrow, linear features that may have impacts at the stand scale, but are not expected to alter the function of critical habitat as noted above.
Oak restoration	Sporadic	The potential impact of oak restoration on spotted owl critical habitat PBFs is from the use of prescribed fire and selective silvicultural techniques to maintain and restore and maintain oak savannah in an open condition. The management of oak savannah is consistent with restoring and maintaining historic ecosystems. Spotted owls may occasionally forage in these areas (PBF 3) but would not generally use them for nesting or roosting (PBF 2). Oak restoration is not expected to negatively affect spotted owl critical habitat to any significant degree because these areas often do not contain spotted owl critical habitat PBFs.
Meadow restoration	Sporadic	The potential impact of this program on spotted owl critical habitat is the use of prescribed fire and selective silvicultural techniques to maintain populations of rare plants and to restore and maintain meadows in an open condition. The management and restoration of meadows is consistent with restoring and maintaining historic ecosystems. Spotted owls may forage in these areas but would not generally be expected to rely on them for nesting or roosting. Spotted owl foraging habitat (PBF 3) would be likely to be enhanced by these tools since Gentner's fritillary occurs in a fire-adapted ecosystem along with spotted owls (though at differing scales). Management for rare plants that restores meadows is not expected to negatively affect spotted owl critical habitat as meadows margins typically contain very few PBFs.

Pre-commercial thinning	Yearly	Pre-commercial thinning may result in removal foraging (PBF 3) and dispersal habitat (PBF 4) and while less likely, may also result in removal of nesting/roosting habitat (PBF 2). Where thinning of dispersal habitat maintains a post-treatment canopy cover of 50-60 percent as specified in effects to the Northern Spotted Owl and its critical habitat section of the BA (BLM 2016a, p.198), the ability of these stands to effectively function as dispersal habitat (PBF 4) for spotted owls may be reduced in the short term and their ability to support nesting, roosting, and foraging by spotted owls may be reduced considerably (PBFs 2, 3).

Fire, Fuels and Wildfire Response

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.*
- *Fire management strategies would be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.*
- *Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic, large, high-intensity/high-severity wildfires.*
- *Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.*
- *Participate with communities bordering Federal lands in partnership with local, State, and Federal stakeholders to reduce the risks and threats from wildland fire.”*

The management direction for the Fire, Fuels and Wildfire Response- Response to Wildfire resource program (BLM 2016a, pp. A34-A35) includes:

- *Take immediate action to suppress all human-caused ignitions at the lowest cost commensurate with the protection of firefighter and public safety and welfare, and resulting in the fewest negative consequences to natural and cultural resources.*
- *Apply the full range of fire management options in responding to natural ignitions or escaped prescribed fires. These fires may be used to achieve management objectives when expected fire behavior and potential effects of a fire, or a part of a fire, are aligned with the management direction of the underlying land use allocation and affected resources.*
- *Create fuel beds or fuel breaks that reduce the potential for high-intensity fire spread within the wildland urban interface and in close proximity to other highly valued resources [i.e. NSO habitat].*

- *Treat both management activity fuels and natural hazardous fuels for any of the following reasons:*

- o Modify the fuel profile (e.g., raise canopy base heights or reduce surface and ladder fuels and crown bulk density)*

- o Reduce potential fire behavior (e.g., crown fire activity, wildfire spread, and intensity)*

- o Reduce potential fire severity*

- o Improve effective fire management opportunities within the Wildland Urban Interface or in close proximity to other highly valued resources*

Large wildfires have been the leading cause for loss of spotted owl habitat on federal lands in recent years (Davis *et al.* 2015, p. 58). Over the past 20 years, 5.2 percent of late successional forest on Federal lands in the NWFP area has been lost to wildfire (Davis *et al.* 2015, p. 58). Response to fire involves a number of actions. Fire lines to contain wildfires are typically located in strategic locations such as prominent ridge lines and road systems and are typically long and linear in shape. In some portions of the landscape, the same firelines have been used repeatedly over the years. Some fire lines, particularly direct lines, are occasionally not located on ridge lines or road systems because tactics, location of the fire, and other concerns dictate the most appropriate location for fighting the fire (Volpe 2016, pers. comm.).

Wildfire suppression is an activity whose effects are particularly difficult to predict because the number, location and intensity of future wildfires is unknown. The BLM included stochastic wildfires in their vegetation growth model to account for the potential habitat alterations, but was not able to provide an estimate of the effects of the response to these wildfires in the BA; such individual projects and activities will be planned and proposed at later dates and at finer scales. Therefore, it is not possible to know the specific locations and details of these potential projects until they are proposed sometime in the next 50 years. However, when these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will at that time provide a quantitative and localized analysis of the effects to spotted owl critical habitat.

The Fire, Fuels, and Wildfire Response – Response to Wildfire resource program has the potential to result in the downgrading or removal of spotted owl critical habitat PBFs. However, this action is designed to conserve habitat across large landscapes by slowing or altering fire behavior which can result in stand-replacing fires that can remove spotted owl critical habitat PBFs. Because actions where spotted owl critical habitat would be modified will be initiated when these areas are at high risk from impending wildfire, the long-term benefits to spotted owl critical habitat are expected to result in more spotted owl habitat/critical habitat across the range over time than if wildfire suppression activities did not occur. Therefore, the Service believes activities associated with fire suppression (*e.g.*, fire crew response, fireline, *etc.*) may potentially result in short-term adverse effects to spotted owl critical habitat, but the long-term benefit to spotted owl critical habitat in areas that are spared high-severity burns are expected to far outweigh those short-term effects.

The BLM did not incorporate the creation of "shaded fuel breaks" and non-commercial hazardous fuel reduction treatments in the stand/forest development modeling. These treatments typically target the surface and ladder fuels (understory) and remove non-commercial sized material, less than 8 inches. "Shaded fuel breaks" are typically located in strategic locations such as prominent ridge lines and along roads where the road prism contributes to the area of no fuels. Non-commercial hazardous fuel treatments are typically located in strategic landscape locations and occur in non-conifer and mixed-conifer/hardwood ecosystems. The reduction of ladder fuels may decrease the suitability of some stands by affecting prey (PBF 3) in a long, linear portion of the stand. However, because fuel breaks are not removing overstory trees we do not anticipate these activities will significantly affect spotted owl nesting/roosting habitat (PBF 2) at more than a very localized scale.

Fuel management has the potential to cause short-term impacts to spotted owl critical habitat. This impact has the potential to downgrade or remove nesting, roosting, foraging and dispersal habitat (PBFs 2, 3 and 4); however, there should be long term benefits to spotted owl critical habitat PBFs if treatments reduce fire risk and promote development of late successional forest structure. Fuels reduction is more needed and therefore more likely to impact spotted owl critical habitat in dry forest than in moist forest. Drier spotted owl nesting habitat (PBF 2) represents more of a heterogeneous mosaic structure than on the wetter west side, which is a result of historic natural disturbances (Olson *et al.* 2004). These fuel management treatments are likely, to some extent, to mimic these stands that have developed under these conditions. Reduction of understory and ladder fuels has the potential to negatively affect spotted owl prey (PBF 3). However, adjacent untreated stands would be expected to continue to support spotted owl foraging.

In dry forest regions, where natural disturbance regimes and vegetation structure, composition, and distribution have been substantially altered since Euro-American settlement, vegetation and fuels management (through influencing fire behavior, severity, and distribution) may be required to retain and recruit spotted owl critical habitat on the landscape (Buchanan 2009, pp. 114–115; Healey *et al.* 2008, pp. 1117–1118; Roloff *et al.* 2012, pp. 8–9; Ager *et al.* 2007, pp. 53–55; Ager *et al.* 2012, pp. 279–282; Franklin *et al.* 2009, p. 46; Kennedy and Wimberly 2009, pp. 564–565), to conserve other biodiversity (Perry *et al.* 2011, p. 715), and to restore more natural vegetation and disturbance regimes and heterogeneity (*e.g.*, Stephens *et al.* 2012b, pp. 557–558). Special management considerations may be required to maintain adequate spotted owl critical habitat in the near term, not only to allow spotted owls to persist in the face of threats from barred owl expansion and habitat modifications from fire and other disturbances, but also to restore landscapes to a more resilient state in the face of alterations projected to occur with ongoing climate change (USFWS 2012a, p. 71908).

Although fire lines and fuel breaks have the potential to impact spotted owl nest sites (PBF 3), we do not anticipate this activity will impact the overall value of the critical habitat for the conservation of the species within the action area. Indeed, not conducting these activities has a higher potential to modify large landscapes which could reduce much greater patches of spotted owl critical habitat depending on the severity of the fire.

Fisheries

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Improve the distribution and quantity of high quality fish habitat across the landscape for all life stages of ESA-listed, BLM Special Status Species, and other fish species.”*
- *Maintain and restore access to stream channels for all life stages of aquatic species.”*

The management direction for the Fisheries resource program (Appendix A, p. A35) includes:

- *Restore degraded spawning, rearing, and holding habitat for fish using a combination of accepted techniques including but not limited to log and boulder placement in stream channels, tree tipping, and gravel enhancement.*
- *Remove or modify human-caused fish passage barriers to restore stream channels for all life stages of aquatic species.*

Riparian forests have been identified as important habitat for spotted owls. Dusky-footed woodrats, a primary prey item for spotted owls, also select riparian forests (PBF 3) (Thomas *et al.* 1990; Carey *et al.* 1992). Forest management activities that reduce forest cover in riparian reserves will downgrade nesting/roosting habitat for spotted owls (PBF 2); however, occasional tree tipping should have limited effects on spotted owl critical habitat as long it is unlikely to remove nest trees or significantly alter the structure and function of nest patches.

The management objectives for the Fisheries resource program are designed to benefit native fish species and to restore and preserve ecosystem function. In the long term, such actions should benefit spotted owl critical habitat PBFs. Given that forest management activities for Fisheries may potentially impact spotted owl critical habitat, impacts to PBFs should be minimal because these projects are expected to remove single trees or very small groups of trees and are not expected to change the nesting/roosting function (PBF 2) of the affected stand or riparian area. In addition, these activities are likely to have long-term benefits for spotted owl PBFs as the objectives are to restore and preserve riparian ecosystem function. A properly functioning stream system is likely to result in less erosion and bedload transport, which should reduce impacts to streambanks and riparian vegetation.

Forest Management

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Enhance the health, stability, growth, and vigor of forest stands.*
- *In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.*
- *Facilitate safe and efficient forestry operations for the BLM, reciprocal right-of-way agreement holders, and permittees.”*

The management direction for the Forest Management resource program (BLM 2016a, p. A-35) includes the following:

- *Promote the establishment and survival of desirable vegetation through stand maintenance treatments.*
- *Apply thinning or prescribed fire to forest stands to achieve appropriate stocking and density levels.*
- *Use genetically improved native trees for reforestation when available.*
- *Fall and move live or dead trees as needed for safety or operational reasons, including, but not limited to, the creation of yarding corridors or skid trails adjacent to nearby harvest units, hazard tree removal, and road construction, improvement, or maintenance.*
- *Allow road construction, maintenance, improvement, and decommissioning as well as construction of skid trails and yarding corridors based on operational needs and consistent with valid existing rights.*
- *Allow management activities in density management study sites (Cissel et al. 2006) that are compatible with study objectives.*

Forest management activities have the potential to create narrow, linear openings in forests for operational reasons, including roads, skid roads and yarding corridors. These types of openings may include localized effects to individual stands but are not anticipated to affect the function of the reserved LUAs at a larger scale. In reserved LUAs this resource program is expected to be implemented in a manner where the objectives of those allocations will continue to be met. Within the Harvest Land Base these potential activities are likely to be associated with timber harvest that are expected to impact the ability of stands to support spotted owl nesting habitat (PBF 2).

Thinnings and individual tree or small group removals are expected to be implemented for the purpose of improving the overall health and structure of the stands. Effects to spotted owl nesting/roosting habitat (PBF 2) are expected to be localized and small, and will not impact the function of the reserved LUAs or any CHUs.

Hydrology

BLM summarizes the proposed management objective as (BLM 2016a, p. 39):

- *“Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.”*

The management direction for the Hydrology resource program (BLM 2016a, p. A36) includes the following:

- *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation*

management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.

- *Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.*
- *Implement road improvements, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.*
 - *Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.*
 - *Decommission roads no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.*

Although this resource program is geared towards protection of aquatic resources, it has the potential to have adverse effects to spotted owl critical habitat by carrying out projects that could involve the removal of single or small groups of live trees that could contribute to spotted owl habitat (PBF 2 and 3). Those projects include stream crossings that meet the standards for a 100-year flood event. The management direction includes the provision to meet the standards and be consistent with existing consultation documents addressing crossings, which includes the ARBOII consultation (USFWS 2013). Overall impacts to spotted owl critical habitat PBFs are anticipated to be minor as only individual trees or small groups of trees will be affected. The removal of single or small clumps of trees is not expected to affect the overall function of the individual stands or the CHUs in which they occur.

Invasive Species

BLM summarizes the proposed management objective as (BLM 2016a, p. 40):

- *Prevent the introduction of invasive species and the spread of existing invasive species infestations.*
- *Prevent the introduction and the spread of sudden oak death (*Phytophthora ramorum*) infections.*

The management direction for the Invasive Species resource program (BLM 2016a, p. A36) includes:

- *Implement measures to prevent, detect, and rapidly control new invasive species infestations.*
- *Use manual, mechanical, cultural, chemical, and biological treatments to manage invasive species infestations.*
- *Treat invasive plants and host species for invasive forest pathogens in accordance with the Records of Decision (RODs) for the Northwest Area Noxious Weed Control Program Environmental Impact Statement and the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in Oregon Environmental Impact Statement (USDI BLM 2010).*
- *Apply state-of-the art, integrated pest management prescriptions for the treatment of all identified sudden oak death (*Phytophthora ramorum*) infection sites.*

The Proposed RMP includes treatment at all sudden oak death infection sites.

The invasive species treatment that has the potential to affect spotted owl critical habitat is the treatment for sudden oak death, which includes the felling of infected trees as soon as possible after the disease is detected. Although the losses of these trees could impact spotted owl nesting/roosting, foraging or dispersal habitat (PBFs 2, 3 and 4), the removal of single or small clumps of trees is not expected to affect the overall function of the CHUs in which these actions occur.

Sudden oak death treatments involve the removal of clumps of trees in a localized area around an infestation. To date, SODS infestations have been small and rare, and treatments appear to be contained in specific areas. As stated in the management direction, these potential treatments will treat, at most, a contiguous ½ mile stretch of stream, as needed. Treatment areas must be separated by 4,600 feet and are limited temporally in Riparian Reserves. It is not possible to know where SODS infestations will occur or to what extent. The BLM has a history of containing these infestations with as minimal a treatment area as possible. Treatment for insects and other diseases also involves the potential for the removal of canopy and sub-canopy trees at the local scale. Although these treatments, if needed, have the potential to affect spotted owl critical habitat PBFs at the stand scale, they are not expected to alter the function of critical habitat at any scale greater than the local level, and are not expected to diminish the value of the critical habitat for the conservation of the spotted owl.

Lands, Realty, and Roads

BLM summarizes the proposed management objective as (BLM 2016a, pp. 28 and 29):

- *“Make land tenure adjustments to facilitate the management of resources and enhance public resource values.*
- *Provide legal access to BLM-administered lands and facilities to support resource management programs.*
- *Provide needed right-of-ways, permits, leases, and easements over BLM-administered lands in a manner that is consistent with Federal and State laws.*

- *Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.*
- *Provide a road transportation system that serves resource management needs (administrative/commercial) and casual use needs (recreational/domestic) for both BLM-administered lands and adjacent privately-owned lands.*

The management direction for Lands, Realty, and Roads resource program (BLM 2016a, pp.A-38 - A-39) includes:

- *Retain lands in Land Tenure Zone 1 (Zone 1) under BLM administration. Lands in Zone 1 include existing and future:*
 - o *Designated and suitable Wild and Scenic River corridors*
 - o *Wilderness Areas*
 - o *Wilderness Study Areas*
 - o *National Trail management corridors*
 - o *District-Designated Reserve – Lands managed for their Wilderness Characteristics*
 - o *Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)*
 - o *Congressionally designated Outstanding Natural Areas*
 - o *Lands acquired with Land and Water Conservation Funds*
- *Designate Right-Of-Way Exclusion Areas in—*
 - o *Lands designated as Wilderness;*
 - o *District-Designated Reserve – Lands Managed for their Wilderness Characteristics;*
 - o *Wilderness Study Areas;*
 - o *Designated and suitable Wild and Scenic Rivers classified as Wild; and*
 - o *Visual Resource Management Class I areas.*

In right-of-way exclusion areas, do not grant rights-of-way, except when mandated by law.

- *Designate right-of-way avoidance areas in—*

- o Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas);*
- o Recreation Management Areas (Special and Extensive);*
- o Designated and suitable Wild and Scenic Rivers classified as Scenic and Recreational; and*
- o Visual Resource Management Class II areas not included in right-of-way exclusion areas.*

In right-of-way avoidance areas, grant rights-of-way if the BLM determines that the right-of-way proposals are compatible with the protection of the values for which the land use was designated, or when no feasible alternative route or designated right-of-way corridor is available as applicable with BLM laws and policy.

- Grant rights-of-way in utility corridors as the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline. Grant the rights-of-way as the minimum necessary to accommodate a specific request. Do not permit development or management activities that would conflict with the construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor.*
- Construct new permanent or temporary roads, which may include major culverts and bridges, where needed to meet resource management objectives, to established BLM engineering design standards. Apply road location, design, and construction BMPs as needed (Appendix J of the Proposed RMP).*
- Maintain existing roads, including major culverts and bridges, to provide access for both resource management and casual use activities while protecting water quality and facility investments, and providing user safety, to established BLM maintenance standards. Apply road maintenance and wet weather road use BMPs as needed (Appendix J of the Proposed RMP).*
- Remove hazard and downed trees along roads for safety or operational reasons.*
- Fully decommission or obliterate (permanent closure) roads with no future resource management need. Decommission (long-term closure) roads not currently needed for resource management but that will be used and maintained again in the future. Apply road closure BMPs as needed (Appendix J of the Proposed RMP). Close roads only with the approval of affected permittees consistent with valid existing rights.*

The effects of new road construction on the spotted owl are unlikely to have major effects on spotted owl critical habitat based on the existing access network in the planning area, the associated low number of new requests for rights-of-way received by the BLM during the past 10 years, the ability of the BLM to route new rights-of-way to avoid or minimize impacts to other resource values and uses, and the low likelihood that a new road through spotted owl critical habitat would alter the functionality of the stand. New roads and rights of way are generally narrow, linear gaps in the forest that are unlikely to alter the function of the stand.

When siting new roads the BLM is generally able to minimize the impacts to spotted owl critical habitat through the location of the roads and the timing of the construction. Although this does not mean all adverse impacts to critical habitat will be avoided, by meeting the objectives of the reserve land use allocations the BLM is expected to maintain the benefits of the large blocks of critical habitat. As with all activities these projects will undergo site-specific consultation where the locations and routes of these roads will be discussed in detail and minimizations sought. We anticipate minimal road construction in reserves and that, in the Harvest Land Base, road construction will be associated with timber harvest which is addressed below.

The removal of hazard trees and downed wood is expected to have minimal effects to spotted owl critical habitat PBF 2 since these projects affect a very small number of trees. Hazard tree removal usually occurs along roads and facilities where noise is at a level that either will be a deterrent to nesting spotted owls or to which owls in the area would be acclimated.

Utility corridors are covered under the existing decision, Approved Resource Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-administered lands in the 11 Western States, and are not part of this consultation (Hardt 2016a, pers. comm.).

Rare Plants and Fungi

BLM summarizes the proposed management objective as (BLM 2016a, p. 41):

- *“Provide for conservation and contribute toward the recovery of plant and fungi species that are listed, or are candidates for listing, under the ESA.*
- *Support the persistence and resilience of natural communities, including those associated with forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands. Support ecological processes and disturbance mechanisms to allow for a range of seral conditions.*
- *Provide for the conservation of Bureau Special Status plant and fungi species.*
- *Support the persistence and resilience of oak species within oak woodlands and within mixed hardwood/conifer communities.*

Under the Proposed RMP, the BLM would manage mixed hardwood/conifer communities to maintain and enhance oak persistence and structure and manage mixed conifer communities to maintain and enhance pine persistence and structure.”

The management direction associated with the Rare Plants and Fungi resource program (BLM 2016a, pp. A47-A48) includes:

- *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of species.*

- *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
- *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
- *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
- *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
- *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives.*

The potential impact of this program on spotted owl critical habitat is the use of prescribed fire and selective silvicultural techniques to maintain populations of rare plants and to restore and maintain meadows in an open condition. Encroaching trees can change the character of a meadow which reduces the suitability for the native plants in that ecosystem. In general, the management of habitat for rare plants and fungi is consistent with restoring and maintaining historic ecosystems across the landscape. For species such as Gentner's fritillary which exists in open canopy coniferous and oak forestlands, selective harvest and fire are tools to maintain the open canopy. Spotted owls may forage in these areas (PBF 3) but would not generally use them for nesting or roosting (PBF 2). Spotted owl foraging opportunities (PBF 3) would be likely to be enhanced by these tools since Gentner's fritillary occurs in a fire-adapted ecosystem along with spotted owls (though at differing scales). Management for rare plants that restores meadows is not expected to negatively affect spotted owl PBFs at any area greater than the very localized scale as meadows typically comprise very small proportions of spotted owl home ranges (PBFs 2, 3 and 4) and ingrowth is likely to be younger stands (PBFs 3 and 4) at the margins of the forested area.

Recreation and Visitor Services

BLM summarizes the proposed management objective as (BLM 2016a, p. 41):

- *“Provide a diversity of quality recreational opportunities.*
- *Meet legal requirements for visitor health and safety and mitigate resource user conflicts.*

- *Mitigate recreational impacts on natural and cultural resources. In land-use allocations where management of other resources is dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.*
- *Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if—*
 - *Recreation development is consistent with interdisciplinary land-use plan objectives;*
 - *The BLM has legal public access to the site; and*
 - *The BLM has secured commitments from partners in the form of a cooperative management agreement, adopt a trail agreement, memorandum of understanding, etc.*

The management direction for the Recreation and Visitor Services resource program (BLM 2016a, pp. A48-A50) includes:

- *Manage Special Recreation Management Areas and Extensive Recreation Management Areas, identified in Appendix O of the Proposed RMP, in accordance with their planning frameworks.*
- *Protect recreation setting characteristics within Special Recreation Management Areas to prohibit activities that would degrade identified characteristics.*
- *Pursue and prioritize public access to BLM-administered lands that have high recreational potential consistent with BLM designations and allocations.*
- *Allow the discharge of firearms for recreational target shooting on BLM-administered lands, outside areas with firearm use restrictions described in the RMA frameworks, if the firearm is discharged toward a proper backstop sufficient to stop the projectile's forward progress.*
- *Issue discretionary Special Recreation Permits for a variety of uses that are consistent with resource and program objectives.*
- *Issue vending permits that complement visitor use or contribute to resource protection.*
- *Monitor activity participation and recreation setting characteristics annually during the primary use season of June through October.*
- *Use recreation management tools such as establishing an allocation system, applying group size limits for private and commercial recreation use, or implementing seasonal closures, if monitoring indicates that social recreation setting characteristics are not being protected, resource damage is occurring, or user conflicts need to be addressed.*
- *Develop and maintain partnerships with recreation-based organizations and service providers. These partnerships should engage partners in the planning, implementation and monitoring of recreation opportunities and facilities on BLM-administered public lands.*

The PRMP includes designation of Special Recreation Management Areas at currently developed recreation facilities, and on lands where designation does not conflict with sustained-

yield timber harvest. The PRMP includes designation of Extensive Recreation Management Areas where the BLM has developed and currently manages recreation activities outside of developed facilities, primarily where the BLM has authorized motorized and non-motorized trails, and where the BLM currently manages dispersed recreation activities. In addition, the BLM would designate Special Recreation Management Areas and Extensive Recreation Management Areas to address specific recreation demand and scarcity, or where unique opportunities for activity-specific demands exist. In the rest of the action area on BLM lands, the BLM would not manage specifically for recreation, but recreation could occur to the extent that the BLM has legal public access and recreation is not in conflict with the primary uses of these lands (BLM 2016a, p. 41).

According to the BLM, the implementation of proposed management direction for Recreation and Visitor Services (pp. A-48 to A-50) would reduce the acres in the action area exposed to such activities, and ensure that Extensive Recreation Management Areas would be managed to maintain spotted owl habitat (PBFs 2, 3 and 4) (BLM 2016a, p. 204).

Trails and Travel Management

BLM summarizes the proposed management objective as (BLM 2016a, p. 42):

- *“Maintain a comprehensive travel network that best meets the full range of public use, resource management, and administrative access needs.*
- *Protect fragile and unique resource values from damage by public motorized vehicle use.*
- *Provide public motorized vehicle use opportunities where appropriate.”*

Management Direction

- *Develop public motorized and non-motorized travel routes and trails in a manner designed to minimize conflicts between public motorized vehicle use and other existing (or proposed) recreational uses of the same, or neighboring, public lands. Design in a manner to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.*
- *Develop closed or abandoned roads to provide additional public motorized and non-motorized trail opportunities, where feasible and compatible with other resource objectives.*
- *Prohibit public motor vehicle travel within areas designated as closed for public motorized access. Where the BLM has public access, allow public access by means other than motorized vehicle, such as mechanized or non-motorized use. Allow travel required for valid existing rights.*
- *Restrict public motorized vehicle travel within areas designated as limited for public motorized access. Until completion of implementation-level travel management planning, limit public motorized vehicle travel to existing routes where the BLM has public access. After completion of implementation-level travel management planning, limit public motorized vehicle travel in conformance with the resultant Travel Management Plan. Allow travel required for valid existing rights.*

The implementation of proposed management direction for Trails and Travel Management (pp. A-52 to A-53) would reduce potential risks to the species' habitats (PBF 2, 3 and 4). Even though the BLM would maintain a road and trail network for public, resource management and administrative access needs, the BLM would manage that network to maintain fragile and unique resource values from damage by OHV use, and limit or eliminate OHV use where appropriate. The proposed closure of 156,036 acres would eliminate potential threats from OHV use to spotted owl critical habitat associated with those acres. The BLM also would eliminate 319,661 acres of open area and further evaluate and designate limited areas to protect resources.

Overall we anticipate the potential effects of trails and travel management to be reduced through the closing of these acres to OHV use which should reduce impacts to spotted owl critical habitat. The effects of OHV use are largely due to loud noises which does not have an effect on spotted owl critical habitat. Trails generally consist of narrow, linear routes that do not create any impediment to spotted owl movement (PBF 4) and are often designed to retain canopy trees which would maintain habitat conditions (PBFs 2, 3 and 4) along the route. In addition, the focus on maintaining unique resources provides for BLM to incorporate spotted owl critical habitat (all PBFs) into any future planning efforts. As with all future projects these activities will undergo project-specific consultation which provides an opportunity to further minimize impacts to spotted owl critical habitat.

Wildlife

BLM summarizes the proposed management objective as (BLM 2016a, pp. 42 and 43):

- *“Conserve and recover species that are ESA-listed, proposed, or candidates, and the ecosystems on which they depend.*
- *Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA-listing of these species.*
- *Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.*

Under the PRMP, the BLM would implement the mitigation measure described in the Draft RMP/EIS for BLM participation in barred owl management (see Section II H 1 of this assessment, below). As described in the BA, the BLM would cooperate with the Service and provide financial support for their experimental removal of barred owls. Further, when the Service determines the best manner in which barred owl management can contribute to the recovery of the spotted owl, the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30. Barred owl management actions on BLM-administered lands within the range of the spotted owl could potentially include BLM participation in scheduling, funding, and implementing such actions.

The PRMP includes—

- *A requirement to avoid the incidental take of northern spotted owls until implementation of a barred owl management program has begun.*

- *A requirement for surveys for the marbled murrelet prior to management actions in marbled murrelet Zone 1 and protection of habitat within 300 feet around newly discovered occupied sites;*
- *The protection of trees capable of providing marbled murrelet nesting structures in younger stands in marbled murrelet Zone 1; and*
- *A requirement for surveys for North Oregon Coast Distinct Population Segment of the red tree vole prior to management actions north of Highway 20 and protection of habitat areas around newly discovered nest sites north of Highway 20.”*

Management Direction – Wildlife

- *Manage species and habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of species.*
- *Manage naturally occurring special habitats to maintain their ecological function including seeps, springs, wetlands, natural ponds, vernal pools/ponds, natural meadows, rock outcrops, caves, cliffs, talus slopes, mineral licks, oak savannah/woodlands, sand dunes, and marine habitats.*
- *Manage human-made special habitats as wildlife habitat when compatible with their engineered function, including bridges, buildings, quarries, pump channels/heliponds, abandoned mines, and reservoirs, to the extent possible consistent with safety and legal requirements.*

Management Direction - Wildlife – Northern Spotted Owl (BLM 2016a, p. A-59)

- *Manage habitat conditions for northern spotted owl movement and survival between and through large blocks of northern spotted owl nesting-roosting habitat.*
- *Do not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun.*

This management direction is implemented in a variety of ways, most notably the proposed designation of the LSRs and Riparian Reserve land-use allocations, which includes 947,886 acres of spotted owl critical habitat. Overlaying critical habitat with a LSR or Riparian Reserve designation will provide protections for spotted owl critical habitat PBFs (all). The protection of these PBFs results from the management direction and objectives to retain and develop late-successional and old-growth forest characteristics (LSR) and large trees for shade and large wood contributions to the aquatic environments (Riparian Reserves).

According to the BLM (BLM 2016c, p. 991) there are approximately 1.2 million acres of spotted owl critical habitat within the action area. Of those acres, 354,524 acres occurred in NWFP LUAs where timber management was either the main or a significant management practice (Matrix, Adaptive Management Areas and Connectivity Blocks). Under the PRMP there are 182,143 acres of spotted owl critical habitat within the Harvest Land Base (BLM 2016a, p. 37), which represents a decrease of approximately 172,000 acres of spotted owl critical habitat in areas managed primarily for timber production. This represents an increase in the amount of spotted owl critical habitat in reserved allocations of the same amount, which will be managed for the retention and development of the PBFs.

The avoidance of conducting timber harvests that result in the incidental take of spotted owls is not expected to alter the effects of the action to spotted owl critical habitat because, while BLM will be avoiding occupied spotted owl sites, timber harvests during this time are expected to remove PBFs in unoccupied spotted owl sites and in unoccupied habitat.

Summary of Effects to Critical Habitat

Table 242. Amount of spotted owl dispersal and nesting/roosting habitat within designated critical habitat in each land use allocation in the PRMP.

Land Use Allocation	Dispersal Habitat (ac)	% of total in PRMP	Nesting/ Roosting Habitat (ac)	% of total in PRMP	Total Habitat (ac)	% of total in PRMP
Congressionally Reserved	2,471	1%	3,803	0%	6,274	1%
District Designated Reserve	17,100	28%	39,291	31%	56,391	5%
Late Successional Reserve	148,187	32%	415,527	26%	563,714	47%
Riparian Reserve	58,597	21%	249,251	31%	307,847	25%
Harvest Land Base - Low Intensity Timber Area	17,352	6%	31,116	4%	48,468	4%
Harvest Land Base - Moderate Intensity Timber Area	190	0%	341	0%	531	0%
Harvest Land Base - Uneven Aged Timber Area	29,385	11%	61,520	8%	90,906	8%
Total	273,285	100%	800,850	100%	1,074,135 ¹	100%

1- The difference between this value and the approximately 1 acres of critical habitat in the action area represents those acres without PBF 2, 3 or 4.

Table 243. Amount of spotted owl dispersal and nesting/roosting habitat within designated critical habitat in the Harvest Land Base.

PRMP Land Use Allocation	Critical Habitat Unit	Critical Habitat Subunit	Dispersal habitat (ac)	Nesting/Roosting Habitat (ac)	Total Habitat (ac)
Harvest Land Base - Low Intensity Timber Area	East Cascades South	ECS 1	1,144	1,651	2,796
	Klamath East	KLE 1	0	1	1
		KLE 2	919	1,374	2,293
		KLE 3	166	783	949
		KLE 5	44	194	238
		KLE 6	8	0	8
	Klamath West	KLW 1	1,633	1,794	3,427
		KLW 3	238	469	707
		KLW 4	11	29	40
	North Coast Olympic	NCO 4	157	319	476
		NCO 5	1,168	2,581	3,750
	Oregon Coast Range	ORC 1	147	596	743
		ORC 2	454	1,820	2,274
		ORC 3	1,045	1,988	3,034
		ORC 4	0	0	0
		ORC 5	2,173	7,472	9,646
		ORC 6	599	1,852	2,451
	West Cascades South	WCS 1	297	467	763
		WCS 2	283	376	659
		WCS 3	701	803	1,504
		WCS 5	0	0	0
		WCS 6	6,163	6,546	12,709
		Total	17,352	31,116	48,468

PRMP Land Use Allocation	Critical Habitat Unit	Critical Habitat Subunit	Dispersal habitat (ac)	Nesting/Roosting Habitat (ac)	Total Habitat (ac)
Harvest Land Base - Moderate Intensity Timber Area	East Cascades South	ECS 1	22	6	29
	Klamath East	KLE 2	7	1	8
		KLE 3	0	1	1
	Klamath West	KLW 1	0	2	3
		KLW 2	0	0	0
		KLW 3	18	8	26
	North Coast Olympic	NCO 4	0	1	1
		NCO 5	38	63	101
	Oregon Coast Range	ORC 1	2	0	2
		ORC 2	3	15	18
		ORC 3	2	3	6
		ORC 5	17	18	36
		ORC 6	2	6	8
	West Cascades South	WCS 1	0	80	80
		WCS 2	61	102	163
		WCS 3	1	1	2
		WCS 4	3	1	4
		WCS 5	2	1	3
		WCS 6	10	28	38
		Total	190	341	531

PRMP Land Use Allocation	Critical Habitat Unit	Critical Habitat Subunit	Dispersal habitat (ac)	Nesting/Roosting Habitat (ac)	Total Habitat (ac)
Harvest Land Base - Uneven Aged Timber Area	East Cascades South	ECS 1	4,726	5,356	10,082
		ECS 2	473	584	1,057
	Klamath East	KLE 1	4	16	19
		KLE 2	3,065	11,584	14,650
		KLE 3	11,240	28,651	39,891
		KLE 4	2	2	4
		KLE 5	3,889	4,857	8,746
		KLE 6	2,884	6,938	9,822
	Klamath West	KLW 1	3,002	2,909	5,911
		KLW 4	100	625	724
		Total	29,385	61,520	90,906
Grand Total			46,927	92,977	139,905¹

2- The difference between this value and the approximately 182,000 acres of critical habitat in the Harvest Land Base represents those acres without PBF 2, 3 or 4.

Timber Management

The objective of the Harvest Land Base is to produce a consistent and reliable source of timber to meet the Allowable Sale Quantity of the BLM districts within the action area. Timber harvest under the PRMP involves the potential planning and implementation of timber sales or groups of timber sales that meet the management direction of the Harvest Land Base category and includes, among other aspects, the layout of units, the survey and scaling of timber, the construction of roads and landings as needed, the advertising, selling and awarding of sales, the harvest of the timber, the hauling of logs and the reforestation activities after the harvest. This timber harvest is expected to result in the loss of spotted owl critical habitat PBFs.

Although this potential allocation is not intended to be relied on for demographic support of spotted owl critical habitat the management direction includes provisions that would contribute to the development of late-successional habitat (PBF 2, 3 and 4) over time. This habitat may not remain on the landscape in the long-term, but the presence of spotted owl habitat within critical habitat in the Harvest Land Base could provide benefits to spotted owls, including assisting in spotted owl movement across the landscape and could potentially provide refugia from barred owls.

The programmatic review provided in this BO is intended to evaluate the overall effect this program of activities will have on spotted owl critical habitat at this programmatic, landscape-

level scale. In the BA the BLM was not able to provide any precise locations of specific future projects that are likely to occur over the next 50 years as part of the PRMP. Each individual project will be planned and proposed at a later date and at a finer scale when project-specific information is available. When these projects are proposed the BLM will complete project-specific and site-specific section 7 consultation, which will provide a quantitative and localized analysis of their effects on spotted owl critical habitat. However, the BLM has modeled the landscape-scale effects of their timber harvest program within the Harvest Land Base over the next 50 years of the PRMP.

Regeneration Harvest

In the MITA, regeneration harvest is expected to potentially affect 895 acres of spotted owl critical habitat over the next 50 years (BLM 2016a, p.199). Of these acres, 341 acres are nesting/roosting habitat and 190 acres are dispersal habitat (Tables 242 and 243). At this time, we do not know where regeneration harvest will be implemented in the MITA relative to other timber management practices. It is likely the PBFs on all these acres will be removed as a result of this timber harvest. Retention levels for regeneration harvest in the MITA are 5-15 percent of harvest units. This retention has the potential to contribute some elements to future spotted owl critical habitat PBFs, but continued timber harvest in the MITA would not be expected to retain these elements on the landscape with any certainty.

In the LITA, potential regeneration harvest will affect 73,002 acres of spotted owl critical habitat over the next 50 years (BLM 2016a, p.200) or 6 percent of the 1,201,949 acres of critical habitat in the action area. Within the LITA, there are 17,352 acres of dispersal habitat and 31,116 acres of nesting/roosting habitat designated as critical habitat (Tables 242 and 243). At this time, we do not know where regeneration harvest will be implemented in the MITA relative to other timber management practices. Management direction includes 15-30 percent retention of pre-harvest stand basal area in live trees in a variety of spatial patterns and retaining all trees that are both ≥ 40 inches DBH and established prior to 1850 (BLM 2016a, p. A-10). Although these harvests will potentially degrade or remove spotted owl habitat within critical habitat, these actions are likely to create more favorable habitat conditions and more rapid re-development of PBFs capable of supporting spotted owls than will the management direction for the MITA because of the additional amounts of habitat features that will be left on the landscape.

Although the potential regeneration harvest in dispersal habitat (PBF 4) may be spread across a large landscape allowing spotted owls to continue to disperse across the region, the regeneration harvest that is part of the LITA will reduce the quality of dispersal habitat (PBF 4) in the Harvest Land Base and potential foraging opportunities (PBF 3) for spotted owls within the areas affected by regeneration harvest. Regeneration harvest within the nesting/roosting habitat (PBF 2) in critical habitat will negatively affect spotted owl critical habitat on these lands by potentially removing nest trees and altering stand conditions so they no longer support conditions for nesting, roosting, or foraging by spotted owls. Retention of 15-30 percent of pre harvest stand basal areas in the LITA will promote more rapid development of forest likely to support spotted owls than will the 5-15 percent retention that will be applied in the MITA.

Standard Thinning

In the MITA, standard thinning is expected to affect spotted owl critical habitat over the next 50 years (BLM 2016a, p. 200). At this time, we do not know where regeneration harvest will be implemented in the MITA relative to other timber management practices; however, thinning is most likely to occur in younger stands. Of the 895 acres of critical habitat in MITA, 341 acres are nesting/roosting habitat, 190 acres are dispersal habitat, and the remaining 364 acres are younger and poor quality owl habitat. Thinning will most likely affect the 554 acres of dispersal and currently unsuitable habitat.

In the LITA, standard thinning may impact up to 73,002 acres of spotted owl critical habitat over the next 50 years. Of these lands, 31,116 acres is currently nesting/roosting habitat, 17,352 acres is currently dispersal habitat, and 24,534 acres is are younger forest. At this time, we do not know where standard thinning will be implemented in the MITA relative to other timber management practices; however, thinning is most likely to occur in younger stands. Standard thinning will most likely affect the 41,886 acres of dispersal and younger forest

Thinning prescriptions also will potentially occur in Riparian Reserves, LSR, and District Designated Reserves. These thinnings in overstocked stands and plantations are expected to increase the speed of development of spotted owl critical habitat compared to not managing these types of stands. Although there may be some short-term impacts to critical habitat in these LUAs from a reduction in canopy cover, the scale of these prescriptions, spatially and temporally, are not expected to result in a loss or noticeable reduction in the function of these LUAs. There may be some short-term impacts to PBFs at the stand scale, but not at any larger scale. These thinning prescriptions are consistent with RA 6 of the spotted owl recovery plan.

Salvage

Fire salvage has the potential to negatively affect spotted owl critical habitat if conducted on lands where PBF 2 supports spotted owl occupancy post-fire. Fires do not necessarily remove spotted owl critical habitat PBFs. Research indicates variability in the degree to which spotted owls use post-fire sites, depending on fire severity and the function of the site for spotted owls (*i.e.*, nesting, roosting, or foraging, PBFs 2 or 3)(Clark 2007; Clark *et al.* 2011; Roberts *et al.* 2011; Bond *et al.* 2002). Spotted owl reproduction and nesting, supported by PBF 2, have been observed in burned landscapes and in core areas in which some portion was burned by high-severity fire (*i.e.*, fires with typically 70-100 percent overstory mortality). Nest trees have been observed in patches with low to moderate severity burn (Gaines *et al.* 1997, Clark 2007, Bond *et al.* 2009). For spotted owls nesting in PBF 2 in territories with some high-severity fires effects, reproductive rates are generally similar to unburned areas (Gaines *et al.* 1997, Bond *et al.* 2002, Clark 2007).

Results from the three radio-telemetry studies of spotted owls in post-fire landscapes indicate that spotted owls use forest stands that have burned (PBF 2), but generally do not use stands that have been burned and logged. However, for spotted owls in stands that had been harvested post-fire: (1) infrequent foraging (PBF 3) in stands burned with low-, medium-, and high-severity fires was restricted to areas with live trees such as those in riparian areas (Clark 2007), and (2) use shifted away from burned stands during 3 years post-fire (King *et al.* 1998). Salvage

operations that occur in burned areas that continue to support spotted owls may adversely affect the functionality of those lands for these owls.

BLM indicates that salvage will not remove or downgrade dispersal or nesting-roosting habitat (PBFs 4 and 2) and would comply with management standards to retain sufficient snags and coarse woody debris in treatment areas (BLM 2016a, p. 200). Except for safety and operational reasons, salvage is not allowed in Riparian Reserves or LSRs which meets the intent of RA12 (USFWS 2011b, p. III-49). This will allow for retention of large, dead and dying snags to be established and remain on the landscape in most of the BLM portion of the action area (PBFs 2, 3 and 4). This is a departure from the NWFP that allowed for salvage logging in LSRs when burned areas were larger than 10 acres (USFS and BLM 1994a, p. C-14).

Over the next 50 years under the PRMP, the modeled amount of salvage in spotted owl habitat is 700 acres in the MITA, 1,100 acres in LITA, and 14,600 acres in the Uneven-aged Timber Area. The BLM was not able to provide estimates of amount of critical habitat likely to have salvage operations; however, some portion of the acreages listed above will be critical habitat. Salvage operations that could potentially occur in burned areas that are spotted owl critical habitat may adversely affect critical habitat if they no longer meet the standard definition of nesting-roosting or dispersal habitat but continue to be used by spotted owls post-fire.

Group and Single-tree Selection Harvest (Uneven-aged Timber Management)

In the Uneven-aged Timber Management Area of the Harvest Land Base, selection harvest is anticipated to affect 108,229 acres of spotted owl critical habitat over the next 50 years. Approximately 61,520 acres of these lands are nesting-roosting habitat and 29,385 acres are dispersal habitat. Canopy cover will be reduced to < 40 percent (BLM 2016a, p. 200). Uneven-aged management will likely result in the loss of some, but not all of the PBFs spotted owls rely on in stands where uneven-aged management is applied. Canopy cover, amount of large conifers, basal area, and incidents of trees with deformities will likely be reduced (PBFs 2 and 3). However, uneven-aged management will promote more rapid development of stands containing the elements associated with nesting-roosting habitat than will the regeneration harvests conducted in the moderate and low intensity timber management areas and may continue to support foraging and dispersal (PBFs 3 and 4) if sufficient large trees, canopy cover, and canopy layers are maintained.

Potential timber harvest practices implemented in the UTA will promote development of forested lands with greater diversity than the Low and Moderate Intensity Timber Management Areas and will promote restoration of natural disturbance regimes. The UTA is primarily in the dry forest areas where more frequent disturbance processes developed heterogeneous forest stand characteristics that are more resilient to natural disturbances. The UTA is designed to somewhat mimic those characteristics.

Summary of effects to spotted owl critical habitat in the Harvest Land Base

Timber harvest has negative impacts on PBFs 2, 3 and 4. Timber harvest in the PRMP has the potential to affect 182,146 acres of critical habitat in the Harvest Land Base. Impacts to spotted owl critical habitat PBFs will vary across the three timber areas (MITA, LITA, and UTA) and

by the different forest treatments that will be applied in each. In all areas the Service anticipates spotted owl critical habitat PBFs will be lost or degraded over time.

Timber harvest within these 182,146 acres of critical habitat are expected to adversely affect these acres for the conservation of the spotted owl, which is approximately 15 percent of spotted owl critical habitat acres in the action area. However, during this same time span that these adverse effects will occur, the critical habitat in reserved LUAs are expected to develop spotted owl habitat through ingrowth and through management actions such as thinnings designed to speed the development of critical habitat PBFs.

While the BLM did not separate out vegetation development over the life of the plan within just critical habitat, they do anticipate a 51 percent increase in the amount of strongly-selected for spotted owl habitat (BLM 2016a, p. 132) and a 24 percent increase in acres of mature multiple canopy and structurally-complex forest (BLM 2016a, p. 133) on BLM-administered lands in the action area. While these data were not specific to LUAs, it is likely that the vast majority of this ingrowth and habitat development will occur in the reserved LUAs because of the objectives and management direction of those LUAs as noted above. There are over one million acres of spotted owl critical habitat in these reserved LUAs, which represents an increase of approximately 172,000 acres of spotted owl critical habitat within reserved LUAs over the NWFP. This expected overall increase in spotted owl habitat within spotted owl critical habitat within reserves is likely to support population growth and increases in successful breeding that will improve the spotted owl population trajectory over time. On balance they exceed the adverse impacts associated with the timber harvest in critical habitat that will be occurring during the life of the plan. While the loss of the PBFs within spotted owl critical habitat within the Harvest Land Base is an adverse effect and cannot be discounted, the protection, ingrowth and development of PBFs within spotted owl critical habitat within reserved LUAs is expected to improve the function of all CHUs within the action area, and has the additional advantage of improving critical habitat conditions in areas where we expect to conduct barred owl management. As noted above, where barred owl management is expected to be conducted is where we anticipate the future core of the spotted owl population to reside within the action area and where critical habitat can provide the greatest value.

All Land Use Allocations

Under the PRMP, the amount of critical habitat in reserve status will increase considerably when compared to the NWFP. As noted above, there are over one million acres of spotted owl critical habitat in these reserved LUAs, which represents an increase of approximately 172,000 acres of spotted owl critical habitat within reserved LUAs over the NWFP.

In the graphs below the BLM evaluated the development of “strongly-selected-for” habitat (Figure 35) and mature multiple-canopy and structurally-complex forest (Figure 36) across BLM land over the next 50 years. “Strongly selected for” habitat represents high-quality nesting/roosting habitat (PBF 2, 3 and 4)(BLM 2016a, Appendix C, p. 34), while “mature multiple-canopy and structurally-complex forest” includes RA32 stands from the spotted owl recovery plan (PBF 2, 3 and 4)(USFWS 2011b, p. III-67). These graphs indicate a predicted increase of 51 percent for “strongly-selected-for” habitat and 24 percent for mature multiple-canopy and structurally-complex forest from current baseline amounts.

While the BLM did not separate out vegetation development over the life of the plan within just critical habitat it is likely that the vast majority of this ingrowth and habitat development will occur in the reserved LUAs because of the objectives and management direction of those LUAs as noted above. Approximately 85 percent of spotted owl critical habitat in the action area occurs in reserved LUAs, so we expect that there will be substantial ingrowth in critical habitat on these BLM lands. This includes over one million acres of spotted owl critical habitat in these reserved LUAs, which represents an increase of approximately 172,000 acres of spotted owl critical habitat within reserved LUAs over the amount of critical habitat in reserved designations under the NWFP. This expected overall increase in spotted owl habitat within spotted owl critical habitat in reserved LUAs is likely to support population growth and increases in successful breeding that will improve the spotted owl population trajectory over time. On balance they exceed the adverse impacts associated with the timber harvest in critical habitat that will be occurring during the life of the plan. The protection, ingrowth and development of PBFs within spotted owl critical habitat within reserved LUAs is expected to improve the function of all CHUs within the action area, and has the additional advantage of improving critical habitat conditions in areas where we expect to conduct barred owl management. As noted above, where barred owl management is expected to be conducted is where we anticipate the future core of the spotted owl population to reside within the action area and where critical habitat can provide the greatest value.

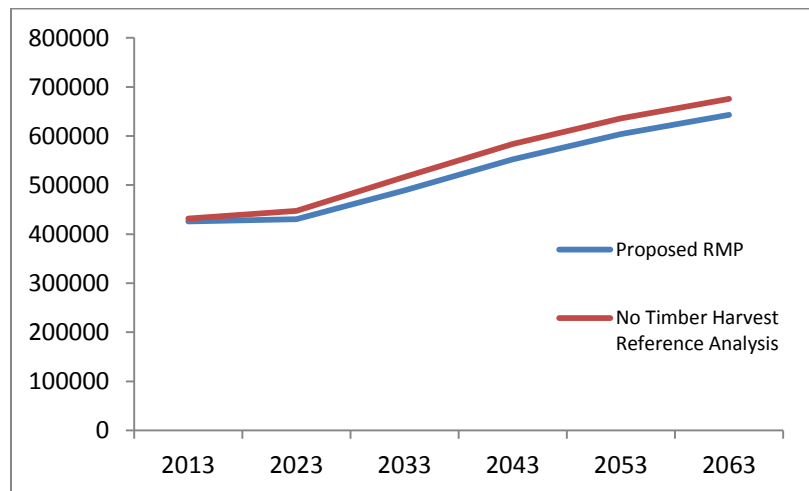


Figure 35. Change in the acres of “strongly-selected-for” habitat on BLM-administered lands in western Oregon under the PRMP and the No Harvest scenario. Under the PRMP this value is expected to increase 51 percent over 50 years on BLM lands. (BLM 2016a, p.135, Figure III-36)

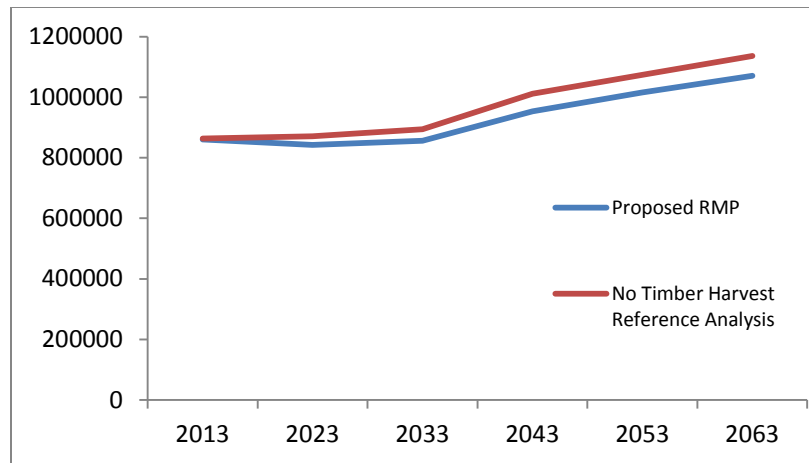


Figure 36. Change in the acres of mature multiple-canopy and structurally-complex forest on BLM-administered lands in western Oregon under the PRMP and the No Harvest scenario. Under the PRMP this value is expected to increase 24 percent over 50 years on BLM lands. (BLM 2016a, p.135, Figure III-37)

The graphs above demonstrate ingrowth of “strongly-selected for” habitat and mature multiple-canopy and structurally-complex forest over the life of the PRMP in all BLM acres (graphs are not available for the amount of spotted owl habitat only in critical habitat). The BLM modeled the development of spotted owl habitat within designated critical habitat under the PRMP by critical habitat subunit within the action area as shown in the tables below (BLM 2016a, p. 141-142).

As demonstrated by the BLM’s modeling in the tables below, the net amount of nesting/roosting habitat (PBF 2) in critical habitat within the action area increases from the current baseline in every decade under the PRMP from 804,611 acres in 2013 to 959,303 acres in 2063. This is an increase of 154,692 acres of PBF 2, or 19 percent. BLM’s modeling shows that all but two critical habitat subunits increase in the acreage of nesting/roosting habitat (PBF 2) over the life of the PRMP. WCS 1 declines by eight acres (0.6 percent decrease) at 2063 while WCS3 declines by 97 acres at 2063 (0.8 percent decrease). These extremely small decreases in PBF 2 are not expected to reduce the value of these critical habitat subunits for the conservation of the species. In addition, the BLM portion of the CHUs these subunits are part of will increase in PBFs in all decades and over the life of the PRMP.

Tables 244 and 245 (below) provide changes in the amounts of nesting/roosting habitat (PBF 2) and dispersal habitat (PBF 4) in critical habitat within the action area by critical habitat subunit and by decade from management actions and ingrowth. Because Table 245 includes both nesting/roosting and dispersal habitats, foraging habitat (PBF 3) is incorporated by design. The amount of suitable spotted owl habitat (PBFs 2, 3 and 4) within critical habitat increases every decade under the PRMP from 1,079,237 acres in 2013 to 1,148,196 acres in 2063. This is a total increase in PBFs within spotted owl critical habitat of 68,958 acres, or 6 percent, over the life of the PRMP. BLM’s modeling shows that all but two critical habitat subunits increase in the acreage of suitable spotted owl habitat (PBF 2, 3 and 4) over the life of the PRMP. Spotted owl habitat in the action area in WCS 3 declines by 97 acres (0.4 percent decrease) at 2063

while spotted owl habitat in the action area in WCS 4 declines by three acres at 2063 (15 % decrease). In WCS 4, the BLM manages only 76 acres of the 379,130 acres within this subunit. These extremely small decreases in PBFs 2, 3 and 4 are not expected to reduce the value of these critical habitat subunits for the conservation of the species. From the 3rd decade to the 5th decade under the plan, subunit KLE 6 loses approximately 1,564 acres of spotted owl nesting/roosting habitat, although by 2063 there are more acres of spotted owl nesting/roosting habitat than it currently has. This reduction within this subunit is expected to have an adverse effect on the ability of the subunit to support spotted owl nesting/roosting, foraging and dispersal. The Klamath East (KLE) CHU, however, will continue to function as intended for spotted owl recovery as it will increase in PBFs in each decade under the PRMP.

Table 244. Forecasted changes under the PRMP in the acres of spotted owl nesting-roosting habitat (PBF 2) in critical habitat on BLM-administered lands in the action area by spotted owl critical habitat sub-unit. Critical habitat units and sub-unit codes are defined in (USFWS 2012, pp. 71920 – 71935). Negative changes from the previous decade are highlighted. Table from BLM (2016a, Table III-31).

Unit	Sub-unit	Acres by Decade					
		2013	2023	2033	2043	2053	2063
1	NCO 4	5,807	5,818	5,939	6,173	6,235	6,300
	NCO 5	43,577	44,977	46,117	47,371	48,189	48,607
2	ORC 1	19,812	19,922	20,306	20,873	21,022	21,023
	ORC 2	59,904	60,442	62,864	64,934	65,525	65,551
	ORC 3	103,985	103,564	106,154	111,682	113,898	116,240
	ORC 4	1,883	2,051	2,664	3,163	3,632	3,845
	ORC 5	83,552	83,658	85,036	89,130	92,030	93,905
	ORC 6	64,830	65,090	66,456	67,860	68,366	68,824
6	WCS 1	1,388	1,384	784	774	1,029	1,380
	WCS 2	2,420	2,510	2,710	2,790	2,893	2,840
	WCS 3	12,060	11,906	13,004	12,857	12,203	11,963
	WCS 4	2	2	4	6	5	4
	WCS 5	25	26	37	38	38	38
	WCS 6	42,948	46,628	53,811	57,263	59,037	59,208
8	ECS 1	9,516	9,223	13,760	14,495	15,767	17,172
	ECS 2	1,165	1,260	1,565	1,726	2,222	2,446
9	KLW 1	79,596	82,076	88,906	93,747	99,358	102,214
	KLW 2	46,845	44,879	50,056	51,281	53,758	55,534
	KLW 3	4,514	4,673	4,803	4,870	4,930	5,022
	KLW 4	48,796	50,064	52,756	55,031	56,885	58,423

Unit	Sub-unit	Acres by Decade					
		2013	2023	2033	2043	2053	2063
10	KLE 1	64	67	71	74	77	79
	KLE 2	70,400	72,525	78,067	81,385	83,772	84,131
	KLE 3	70,391	71,721	80,728	84,894	88,815	89,250
	KLE 4	0	1	1	1	1	2
	KLE 5	15,069	15,723	21,811	24,234	26,162	28,268
	KLE 6	16,062	16,389	17,857	17,647	16,293	17,034
Totals		804,611	816,579	876,267	914,299	942,142	959,303

Table 245. Forecasted changes under the PRMP in the acres of all spotted owl critical habitat including dispersal habitat (PBF 4) on BLM-administered lands in the action area by spotted owl critical habitat sub-unit. Critical habitat units and sub-unit codes are defined in (USFWS 2012, pp. 71920 – 71935). Negative changes from the previous decade are highlighted. Table from BLM (2016a, Table III-30).

Unit	Sub-unit	Acres by Decade					
		2013	2023	2033	2043	2053	2063
1	NCO 4	6,945	6,979	7,037	7,088	7,097	7,103
	NCO 5	53,597	54,432	55,101	55,634	56,231	56,610
2	ORC 1	23,060	23,196	23,376	23,681	23,761	23,841
	ORC 2	71,441	71,712	72,832	73,787	74,154	74,226
	ORC 3	125,922	126,215	127,783	130,085	130,836	131,757
	ORC 4	4,603	4,824	5,881	6,340	6,802	6,983
	ORC 5	100,763	101,060	102,054	104,174	106,329	106,968
	ORC 6	76,705	77,040	77,872	78,511	78,807	79,058
6	WCS 1	1,886	1,850	1,457	1,523	1,879	1,901
	WCS 2	4,118	4,149	4,199	4,227	4,292	4,282
	WCS 3	20,120	19,913	20,323	20,362	20,077	20,023
	WCS 4	20	22	25	24	20	17
	WCS 5	41	41	42	42	42	42
	WCS 6	75,535	78,549	83,110	84,571	85,437	85,513
8	ECS 1	16,834	16,707	19,834	20,214	20,641	20,972
	ECS 2	2,493	2,528	2,952	3,158	3,721	3,896

Unit	Sub-unit	Acres by Decade					
		2013	2023	2033	2043	2053	2063
9	KLW 1	125,224	125,798	127,650	128,066	129,196	129,866
	KLW 2	66,093	64,174	66,162	66,653	67,096	67,586
	KLW 3	5,735	5,816	5,885	5,870	5,863	5,904
	KLW 4	63,296	63,634	64,287	64,832	65,058	65,290
10	KLE 1	87	90	90	91	91	92
	KLE 2	89,722	90,611	92,453	93,832	94,593	94,584
	KLE 3	96,259	96,852	101,671	103,107	104,795	104,920
	KLE 4	2	2	3	3	3	4
	KLE 5	26,894	27,433	31,280	32,104	33,093	34,108
	KLE 6	21,842	22,131	22,929	22,741	22,406	22,649
Totals		1,079,237	1,085,758	1,116,288	1,130,720	1,142,320	1,148,195

The tables above show a net gain of 68,958 acres of spotted owl habitat within spotted owl critical habitat overall (Table 245) and a net gain of 152,692 acres of spotted owl nesting/roosting habitat within spotted owl critical habitat (Table 244). These tables account for both habitat gains from ingrowth as well as habitat loss from timber harvest, wildfire, and insect/disease outbreaks. The larger gain in nesting/roosting habitat relative to the smaller gain in overall spotted owl habitat reflects that the amount of high quality spotted owl habitat will have large gains over the life of the PRMP while the amount of habitat that functions only for dispersal will decline. The overall increase in amount of spotted owl habitat within spotted owl critical habitat, particularly in the increase in high-quality (nesting/roosting) spotted owl habitat should provide an overall net benefit for spotted owls. It is important to note that nesting/roosting habitat provides the highest quality habitat for dispersing spotted owls. The Service expects that spotted owls dispersing through nesting/roosting habitat will have higher survival rates than spotted owls dispersing through lower quality habitat.

These increases in spotted owl habitat and PBFs within spotted owl critical habitat in the action area are expected to improve the value of the critical habitat for spotted owls, particularly in the reserved LUAs where we anticipate barred owl management will occur. Where barred owl management overlaps spotted owl critical habitat we anticipate the value of the critical habitat to the spotted owl will be maximized. With the overall increases in spotted owl habitat/PBFs within spotted owl critical habitat the Service believes the PRMP will adequately provide for the critical habitat's contribution to spotted owl recovery within the action area.

In addition to impacts to critical habitat that have the ability to remove or modify PBFs, activities (including timber harvest) have the ability to significantly delay or preclude the development of PBFs, which can also adversely affect critical habitat. Of the approximately 182,000 acres of spotted owl critical habitat within the Harvest Land Base, 139,905 acres (76 percent) contain PBFs 2, 3 or 4. The other 42,241 acres do not contain these PBFs. It is our

assumption that in the Harvest Land Base those acres of spotted owl critical habitat that do not contain PBFs 2, 3 or 4 are unlikely to develop them because of the impacts of timber harvest. The Service (USFWS 2012a, p. 71908) acknowledged that not all acres within the critical habitat designation contained PBFs 2, 3 or 4. This is true for all the LUAs within the PRMP, so the LSRs and Riparian Reserves also include acres of critical habitat that do not contain PBFs 2, 3 or 4 (59,197 acres and 24,990 acres, respectively). Because of the objectives and management direction of these LUAs the Service anticipates that these acres are likely to develop these PBFs over time, which is included in the BLM's projections of spotted owl habitat ingrowth within critical habitat in the action area (BLM 2016a, p.128-136). Because the critical habitat network is currently functioning for spotted owl conservation and because the condition of the critical habitat units is expected to improve in all cases and the condition of the critical habitat subunits is expected to improve or experience minimal reductions in PBFs, the Service does not anticipate the PRMP will reduce the ability of the critical habitat network to function.

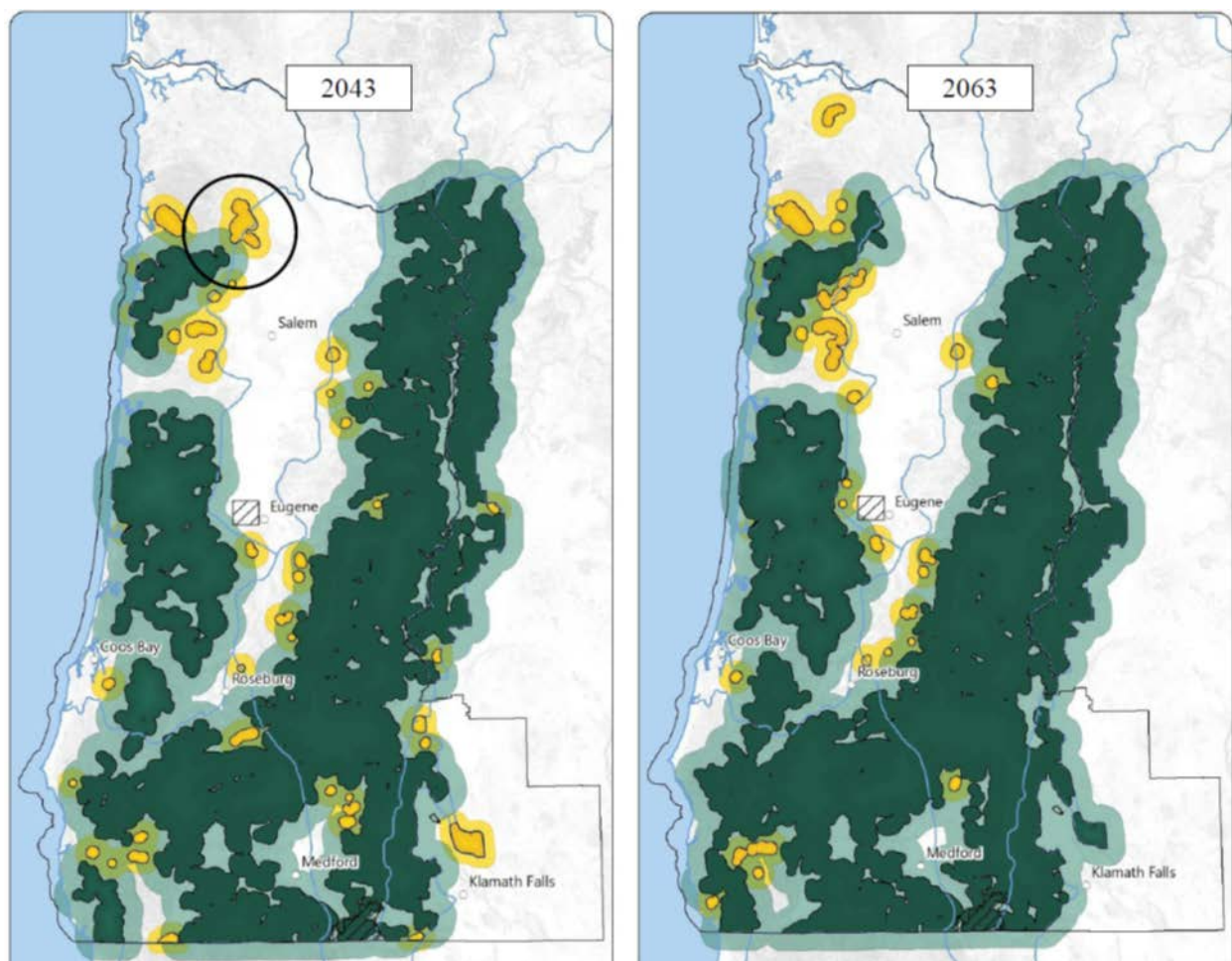


Figure 37. Northern spotted owl habitat block locations in 2043 and 2063 under the Proposed RMP. The circled area is discussed in the text of the BA (BLM 2016a, p. 97, Figure III-21).

Despite the delayed development or the prevention of the development of PBFs on this subset of critical habitat acres, the Service anticipates that the critical habitat network within the action

area will continue to provide for a functioning critical habitat network across the entire designation.

Spotted Owl Dispersal

The Service believes spotted owl dispersal is a conservation need best assessed at a landscape scale (USFWS 2012a, p. 71939). Blocks of spotted owl habitat not only support reproducing spotted owls, but also facilitate the movement of spotted owls across the landscape and between blocks of reserved habitat that support clusters of reproducing spotted owls. Spotted owl critical habitat occurs within the reserved LUAs and Harvest Land Base. Approximately 85 percent of the spotted owl critical habitat within the action area occurs within the reserved LUAs. This is an increase over the NWFP of nearly 15 percent, or approximately 172,000 acres. The Service anticipates that portions of the Harvest Land Base that include critical habitat will provide an opportunity for spotted owl dispersal in some areas. Because BLM is spacing their timber harvest out over the next 50 years under the PRMP, we expect there will be areas of critical habitat that will not be harvested for one to several decades. Spotted owls will be able to utilize portions of these critical habitat areas for dispersal. In addition, in the LITA there will be critical habitat elements left on the landscape that have the potential to assist spotted owls in dispersing across the landscape. The value of these retention areas will largely depend on their proximity to reserves, other retention stands, or yet-to-be harvested stands within the Harvest Land Base. We have no spatial information with which to assess the precise value of these critical habitat retention stands because these projects have not yet been planned on the ground, but in general we anticipate spotted owls will be able to utilize these critical habitat areas for dispersal.

In addition to the critical habitat in the reserved blocks of habitat, the Riparian Reserves are expected to provide well-distributed, high-quality dispersal habitat within critical habitat for spotted owls because a) they occur on all watercourses across the range of the spotted owl on BLM lands, and b) they will be managed to produce large trees that will contribute to fish habitat because of the restrictions on silvicultural activities in the management direction.

In 2012 the Service (USFWS 2012a) revised spotted owl critical habitat and designated a network that we believe facilitates the movement of spotted owls within, between and among the physiographic provinces and from the Coast Range to the Cascades. There are five critical habitat subunits in the south Willamette/north Umpqua drainage areas where spotted owls would be expected to disperse between the Coast Range and the Cascades. These subunits are OCR-4, OCR-5, WCS-4, WCS-5, and WCS-6. As noted in the tables above, nesting/roosting habitat increases in every decade in each of these subunits. For all PBFs, all of these subunits except for WCS-4 increase in all decades of the plan. WCS-4, however, decreases in PBFs 3 and 4 by three of the BLM-managed 20 acres. This represents 15 percent of the BLM-administered lands in this critical habitat subunit. However, the total size of the subunit is approximately 379,000 acres, most of which is on USFS land (USFWS 2012a, pp. 71926-27). The loss of three acres will have a negligible impact to the functionality of this subunit; therefore the Service does not anticipate that the PRMP will hinder the current ability of the critical habitat network to provide for spotted owl dispersal across the action area. Based on Forsman *et al.* (2002), the improving landscape conditions on spotted owl critical habitat that are reflected in BLM's modeling, and the additional acres of critical habitat in the reserved

LUA, the Service anticipates that spotted owl genetic interchange between the Oregon Coast Range and the Oregon Western Cascades Provinces is currently facilitated and will improve under the PRMP compared to the NWFP. As a result of the PRMP, the critical habitat network is expected to continue to facilitate spotted owl dispersal across the action area.

Contribution to Recovery

Spotted owl critical habitat was designated to provide for adequate amounts of habitat to allow for recovery of the species across the range. Although most of the designated network occurs on Federal lands managed by the USFS, 12 percent of the overall network is managed by BLM in the action area. Of this total on BLM lands, 15 percent (or 1.8 percent of the overall spotted owl critical habitat designation) is within the Harvest Land Base and is potentially adversely affected by the proposed action. This critical habitat network is expected to provide for nesting/roosting, foraging and dispersal of spotted owls across the BLM lands within the action area. The BLM has located their LSRs where modeling demonstrates that large blocks of PBF 2 (nesting/roosting habitat) can form in a well-distributed manner across the BLM lands within the action area. Because the critical habitat network was designed in the same manner, there is substantial overlap of critical habitat and the reserved LUAs. We expect a substantial improvement in the condition of spotted owl critical habitat PBFs in these reserves. By distributing the reserved LUAs to incorporate blocks of high-quality critical habitat across the action area, the role of critical habitat in providing spotted owl immigration and emigration with areas outside the action area will be facilitated.

This distribution of critical habitat within these reserved blocks of PBF 2 also facilitates spotted owl movement across the landscape. Demographic and genetic interchange are both vital to the conservation of spotted owls, and PBF 2 represents the highest quality dispersal habitat. Spotted owls are expected to be able to utilize spotted owl critical habitat that is PBFs 2, 3 and 4 within these reserves for movement within and between reserves. In addition, portions of the Harvest Land Base that are critical habitat may also provide areas of support for spotted owl movement. Although PBFs 2, 3 and 4 will be lost in critical habitat across the Harvest Land Base where timber management occurs, these losses will occur over the next 50 years which will retain some of those habitat elements in declining amounts over the next five decades. The closer these retained elements in critical habitat are to reserved lands the more likely they will contribute to spotted owl dispersal (PBF 4). During that time the improvement and development of habitat within critical habitat in the reserves will improve conditions for spotted owl dispersal across the action area.

In their models of change in spotted owl habitat over the first 50 years of the PRMP, BLM demonstrated an overall increase of 68,958 acres of nesting/roosting and dispersal habitat in critical habitat on BLM lands within the action area. Although some habitat loss occurs in some subunits between intermediate decades (Tables 244 and 245), the net amount of spotted owl habitat within critical habitat is expected to increase from current conditions in all subunits except WCS-3 and WCS-4 which had declines of 97 acres and 3 acres between 2013 and 2063, respectively. These declines are extremely small in relation to the overall size of these subunits, and the Service does not anticipate these reductions will affect the function of the critical habitat subunit or unit at any time during the life of the PRMP. Although the capability of 182,146 acres of CH in the Harvest Land Base LUA to support spotted owl NRF and dispersal habitat is

likely to be progressively precluded during the 50-year term of the PRMP, the capability of the critical habitat subunits and units containing those affected acres to adequately provide for spotted owl demographic support and dispersal is likely to be enhanced and adequate to support, in part, spotted owl recovery over the 50-year term of the PRMP.

Indirect Effects of the PRMP on Spotted Owl Critical Habitat

There is no designated spotted owl critical habitat on private or tribal lands in Oregon, including the Coquille Tribal forest lands. In Oregon, state forest lands including portions of the Tillamook, Clatsop, and Elliott State Forests were identified areas as essential for the conservation of spotted owls (USFWS 2012a, p. 71894). The Service is currently working with the state during timber planning to avoid take of spotted owls and has developed a safe harbor agreement with Oregon Department of Forestry that will contribute to the conservation of the spotted owl by allowing the researchers to implement the Service's Experimental Removal of Barred Owls to Benefit the Threatened Northern Spotted Owl research study on ODF lands in the Oregon Coast Ranges. Information gained from this experiment is critical to the development of a long-term management strategy to address the barred owl threat to the spotted owl.

JEOPARDY AND ADVERSE MODIFICATION CONCLUSIONS—NORTHERN SPOTTED OWL AND ITS CRITICAL HABITAT

After reviewing the current status of the spotted owl, the status of spotted owl critical habitat, the environmental baseline for the action area (including the concurrent effects of climate change), the direct and indirect effects of the proposed action on the spotted owl and its critical habitat and any cumulative effects, it is the Service's biological opinion that the PRMP, as proposed, is not likely to jeopardize the continued existence of the spotted owl, and is not likely to adversely modify spotted owl critical habitat.

The Service reached these conclusions for the following reasons:

1. The conservation needs of the spotted owl will continue to be met because the proposed action is consistent with the guidance of the Spotted Owl Recovery Plan, at the landscape scale over 50 years, because:

- The PRMP will conform to the Spotted Owl Recovery Plan, including the location and function of large blocks of habitat for reproducing spotted owls and the ability of the landscape to support spotted owl movement between those blocks.
- The PRMP will include approximately 177,000 more acres of LSR and Riparian Reserves than in the NWFP, which will be managed for the retention and development of large trees and complex forests across the PRMP landscape.
- The PRMP will improve the amount, quality and distribution of nesting habitat on BLM lands over the first 50 years modeled under that PRMP through management of these increased reserves.
- The PRMP will facilitate and improve spotted owl dispersal capability across the landscape through the management of the increased reserves and through management

of the LITA and UTA portions of the Harvest Land Base distributed both temporally and spatially.

- The PRMP will actively include and address Recovery Action 6 (moist forest management to accelerate spotted owl habitat development), Recovery Action 10 (conserving spotted owl sites and high-quality habitat), Recovery Action 12 (conserving and restoring habitat elements that take a long time to develop), Recovery Action 30 (manage to reduce the negative effects of barred owls on spotted owls), and Recovery Action 32 (maintain and restore structurally complex multi-layered conifer forests).

2. The PRMP will not appreciably reduce the likelihood of survival or recovery for the spotted owl population within the action area or at the listed range scale because the proposed action includes participation and cooperation in a barred owl management strategy that is expected to provide for significant increases in the spotted owl population on the BLM lands within the action area from baseline without barred owl management or timber harvest.

- In aggregate, the PRMP provides for the net conservation and recovery of the spotted owl on BLM lands over the life of the plan by contributing to barred owl management and by minimizing adverse impacts associated with timber harvest and other activities. The positive contributions of barred owl management offset the adverse impacts of the PRMP to spotted owls and enable long-term spotted owl recovery on BLM lands.
- Reducing and managing the adverse impact of barred owls on spotted owls is currently the single most important conservation action necessary for spotted owl recovery. Under the PRMP the BLM will support barred owl management as informed by the outcome of the barred owl removal experiment that is currently underway. This support is intended to mitigate for the adverse effects associated with timber harvest and other resource programs consulted on in this BO, and will likely result in a net positive impact on the recovery of spotted owls.
- In addition to the positive impact of barred owl management, there will be a net increase in suitable habitat for spotted owls during implementation of the plan. The proposed action will result in a net increase in designated forest reserve acreage from the current baseline and the overall forest ingrowth will outpace the amount of habitat lost to harvest during the life of the PRMP. This program component will both protect the majority of extant spotted owls, while also providing more habitat for spotted owls to reoccupy in the future as their recovery continues.
- The BLM will avoid take of spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program has begun. This will protect extant spotted owls in the near term as longer term activities are implemented.
- As individual projects are proposed in the future under this PRMP and there is potential to adversely affect spotted owls, the BLM will consult at the project-specific level with the Service. This will provide a required and predictable nexus to ensure jeopardy is avoided and minimize take of spotted owls as on-the-ground actions are implemented.
- The BLM has agreed to reinitiate section 7 consultation on the PRMP with the Service if our projections described in this BO are not realized. That reinitiation will consider the best available scientific information at that time, including the updated

environmental baseline for the spotted owl and the feasibility or effectiveness of a barred owl management strategy.

For these reasons, the Service expects an overall net improvement in spotted owl populations on BLM lands under the PRMP when from the projected baseline for owl populations, including when taking into account any take or adverse impacts to spotted owls due to timber harvest and other resource programs occurring under this plan.

3. The Service believes the PRMP will not appreciably diminish the conservation value of spotted owl critical habitat:

- Most of the designated spotted owl critical habitat network occurs on Federal lands managed by the USFS. Twelve percent of the overall network is managed by BLM in the action area. Of this total on BLM lands, 15 percent, or 1.8 percent of the overall spotted owl critical habitat designation, is within the Harvest Land Base and is potentially adversely affected by the proposed action. This is a relatively small percentage of the overall designated network.
- Even accounting for projected timber harvest on up to approximately 182,000 acres of spotted owl critical habitat over 50 years (3,640 acres/year on average), the overall amount of spotted owl habitat (PBFs) within spotted owl critical habitat is expected to increase by 68,958 acres over 50 years of the PRMP.
- Critical habitat in Late-Successional and Riparian Reserves (which include approximately 79 percent of the critical habitat within the action area) will be managed for developing large trees and late-successional conditions (PBFs 2, 3 and 4), including recruitment of habitat PBFs on currently lower quality designated critical habitat.
- Nesting/roosting habitat (PBF 2) is expected to increase in all but one critical habitat subunit over the life of the PRMP. Although three subunits will experience decreases in some decades, these losses represent a small percentage of the subunits and these losses are recovered in subsequent decades. These losses are negligible to the function of the subunits or CHUs as noted above, and are not expected to affect the function of the subunits or CHUs for their intended conservation roles in the short-term or long-term.
- Every CHU is expected to improve its functionality as a result of the PRMP's management. The retention and ingrowth of spotted owl habitat within critical habitat is expected to exceed any losses in the Harvest Land Base which should improve on an already functional critical habitat network.
- Of the approximately 182,000 acres of spotted owl critical habitat within the Harvest Land Base, 139,905 acres (76 percent) contain PBFs 2, 3 or 4. The other 42,241 acres do not contain these PBFs. Those acres of spotted owl critical habitat that do not contain PBFs 2, 3 or 4 are unlikely to develop them because of the impacts of timber harvest. The development of PBFs 2, 3, or 4 on up to 59,197 acres of LSR and up to 42,241 acres of Riparian Reserve within these same CHUs is expected to offset the effects of delaying or precluding the development of PBFs in the Harvest Land Base. Because the critical habitat network is currently functioning for spotted owl conservation and because the condition of the critical habitat units is expected to improve in all cases and the condition of the critical habitat subunits is expected to improve or experience minimal

reductions in PBFs, the Service anticipates the PRMP will improve the functionality of the critical habitat network within the action area and rangewide.

4. The PRMP provides measures that will ameliorate the projected impacts of climate change on forest conditions and that should provide for the long term persistence of the murrelet and its critical habitat, including a net increase in older forest habitat over time and the application of ecological forestry management practices that will improve local forest conditions.
5. No known cumulative impacts change the analysis outcomes under the effects of the proposed action.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by implementing conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or designated critical habitat, to assist in the implementation of recovery plans or to obtain information.

The Service believes the following conservation recommendation will reduce the impact of the proposed action on nesting spotted owls within the action area:

1. Delay activities that may disturb spotted owls as late as possible into the nesting season. This will provide the maximum opportunity for juveniles to successfully fledge prior to any habitat manipulation or noise disturbance.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification regarding the implementation of any conservation recommendation.

The Service does not anticipate that adoption of the PRMP will result in the incidental take of any spotted owls without subsequent consultation and site-specific project planning and analysis. Therefore, no incidental take of spotted owls is exempted as part of this consultation.

Reinitiation Triggers- Spotted Owl

In addition to the regulatory triggers for reinitiation of consultation (50 CFR §402.16), the analysis of effects of this potential barred owl management program rely on the following specific assumptions regarding a potential barred owl management program, harvest rate on BLM lands, and the biological results for the spotted owl. Monitoring results will be measured against these assumptions to determine the effectiveness of a barred owl management program. Failure to meet these assumptions will trigger reinitiation of consultation.

1. Implementation of a barred owl management strategy and associated monitoring program that the Service concludes are adequate to achieve and measure the results described in paragraph 3, below, will begin on BLM lands in the action area by year 8 of PRMP implementation.

2. Rates of spotted owl territorial site abandonment resulting from timber harvest in the Harvest Land Base will not exceed 10 percent in the first decade of implementation, 15 percent in the second decade, and 20 percent in each subsequent decade. For decades where BLM impacts are less than these maximums (e.g. 7 percent loss occurs in first decade), the remainder (e.g. 10 percent - 7 percent actual loss = 3 percent remaining) will be added to the following decade (e.g. decade 2 would then have a maximum loss of 15 percent + 3 percent = 18 percent).
3. The following benchmarks for the rate of spotted owl population change on BLM lands within the action area will be met or exceeded (Table 226). These rates of population change were used in estimating the number of occupied owl sites discussed above and meeting them would be expected to achieve similar results. Determination of whether these benchmarks have been met could be achieved in a number of ways; however, we suggest utilizing results from ongoing spotted owl demographic analyses to assess whether benchmarks have been achieved. For the barred owl management scenario we have described in this BO, spotted owl demographic rates from the NWFP Effectiveness Monitoring Program demographic study areas (see Dugger et al. 2016 for details) can be used to assess the effectiveness of barred owl management. There are 3 northern spotted owl demographic study areas (Oregon Coast Ranges, Tyee, Klamath) (Dugger et al. 2016) and the Union/Myrtle barred owl experiment area that overlap the 5 potential barred owl management areas we described above. DSAs overlap the OCR-N, OCR-S, K LW-N and KLE potential barred owl management areas (Figure 28) and comprise approximately 40 percent (324,398 acres) of these areas. While the K LW-S and WCS barred owl management areas do not include DSAs, we believe that changes in population growth rate obtained from portions of the demographic study areas that do overlap potential barred owl management areas are sufficient to assess the effectiveness of a barred owl management program on BLM lands because the demographic study areas are representative of forest types within the barred owl management areas and provide robust data for estimating rates of population change. Rates of population change should be assessed using estimates of population change for the portions of these demographic study areas that overlap the barred owl management areas. If barred owl management occurs within a portion of a DSA, it is highly likely that the scientists conducting the analyses will conduct separate demographic analyses for area where barred owl management is occurring and areas where it is not (see analyses for Green Diamond Study Area described in Dugger et al. 2016 for an example). These population parameters have been estimated every five years since the mid-1990s. Anticipated future analyses would occur in 2019, 2024, 2029, 2034, 2039, 2044, 2049, 2054, 2059 and 2064, and results from these analyses can be used to determine whether benchmarks have been met. The first benchmark for evaluating reinitiation of consultation related to this assumption would be 2029, because this would provide the first demographic analysis following implementation of a barred owl management program. If separate analyses are not conducted as part of these 5-year analyses, Service and BLM biologists will work with these scientists to derive estimates of annual rate of population change for the portions of the DSAs within barred owl management areas.

Table 246. Annual rate of population change (λ) for spotted owls in demographic study areas (DSAs) within barred owl management areas on the six potential barred owl management areas if barred owl management is successfully implemented.

	Years after implementation of the PRMP					
	2029	2034	2039	2044	2054	2059
Annual rate of population change (λ) for spotted owls within demographic study areas on the barred owl management areas ⁶¹	0.9720	0.9950	1.0000	1.0100	1.0200	1.0275

⁶¹ Annual rate of population change (λ) is estimated using methods detailed in Dugger et al. (2016).

OREGON SPOTTED FROG

STATUS OF THE SPECIES - OREGON SPOTTED FROG

Listing Status

The Oregon spotted frog (spotted frog) was a candidate for listing under the Endangered Species Act beginning in 1993. On August 29, 2013, the spotted frog was proposed for listing as threatened under the Act (USFWS 2013a) and critical habitat was proposed on that same date (USFWS 2013b). The Oregon spotted frog was federally listed as a threatened species on August 29, 2014 (USFWS 2014, p. 51658).

Taxonomy

The scientific name *Rana pretiosa* (order Anura; family Ranidae) was first applied to a series of five specimens collected in 1841 by Baird and Girard (1853) from the vicinity of Puget Sound. Subsequently, the “spotted frog” was separated into two species, *Rana pretiosa* (Oregon spotted frog) and *Rana luteiventris* (Columbia spotted frog) based on genetic analyses (Green *et al.* 1996, 1997).

Phylogenetic analyses, conducted on samples of spotted frogs collected from three locations in Washington and 13 locations in Oregon, indicate that there are two well-supported clades (a group of biological taxa (as species) that includes all descendants of one common ancestor) nested within the Oregon spotted frog: the Columbia clade (Trout Lake Natural Area Preserve (NAP) and Camas Prairie) and the southern Oregon clade (Wood River and Buck Lake in the Klamath Basin) (Funk *et al.* 2008).

Blouin *et al.* (2010) performed genetic analyses on spotted frogs from 23 locations in British Columbia, Washington, and Oregon for variation at 13 microsatellite loci and 298 base pairs of mitochondrial DNA. Their results indicate that *Rana pretiosa* comprised six major genetic groups: (1) British Columbia; (2) the Chehalis drainage in Washington; (3) the Columbia drainage in Washington; (4) Camas Prairie in northern Oregon; (5) the central Cascades of Oregon; and (6) the Klamath basin (Blouin *et al.* 2010). Within the northern genetic groups, the British Columbia (Lower Fraser River) and Chehalis (Black River) populations form the next natural grouping (Blouin *et al.* 2010). Recently discovered locales in the Sumas, South Fork Nooksack, and Samish Rivers occur in between these two groups. While no genetic testing has been done on these newly found populations, it is reasonable to assume that they are likely to be closely related to either the British Columbia or Chehalis group, or both, given their proximity and use of similar lowland marsh habitats (USFWS 2014, p. 51658).

Physical description

The spotted frog is named for the black spots that cover the head, back, sides, and legs. The dark spots are characterized by ragged edges and light centers that grow and darken with age (Hayes 1994). Body color also varies with age. Juveniles are usually brown or, occasionally, olive green on the back and white, cream, or flesh-colored with reddish pigments on the underlegs and abdomen developing with age (McAllister and Leonard 1997). Adults range

from brown to reddish brown but tend to become redder with age. The spotted frog is a medium-sized frog, ranging from 1.74 to 4 in (44 to 100 millimeters (mm)) in body length. Females are typically larger than males and can reach up to 4 in (100 mm) or more (Rombough *et al.* 2006).

Life history

Adult spotted frogs begin to breed by one to three years of age, depending on sex, elevation, and latitude. Male spotted frogs are not territorial and often gather in large groups of 25 or more individuals at specific locations (Leonard *et al.* 1993). Breeding occurs in February or March at lower elevations and between early April and early June at higher elevations (Leonard *et al.* 1993). The majority of egg masses are laid communally in groups of a few to several hundred (Licht 1971; Nussbaum *et al.* 1983; Cooke 1984; Hayes *et al.* 1997; Engler and Friesz 1998). Females may deposit their egg masses at the same locations in successive years. Eggs masses are observed in shallow, often temporary, pools of water; gradually receding shorelines; on benches of seasonal lakes and marshes; and in wet meadows. These sites are usually associated with the previous year's emergent vegetation and are generally no more than 14 in (35 cm) deep (Pearl and Hayes 2004). Most of these sites dry up later in the season (Engler 1999, pers. comm.), but are connected via surface water to permanently-wetted areas, such as creeks, wetlands, and springs. Shallow water is easily warmed by the sun, and warmth hastens egg development (McAllister and Leonard 1997). However, laying eggs in shallow water can result in high mortality rates for eggs and hatchling larvae due to desiccation or freezing.

Eggs usually hatch within three weeks after oviposition. Tadpoles metamorphose into froglets during their first summer. Tadpoles are grazers, having rough tooth rows for scraping plant surfaces and ingesting plant tissue and bacteria. They also consume algae, detritus, and probably carrion. Post-metamorphic spotted frogs feed on live animals, and primarily insects.

Similar to many North American pond-breeding anurans (belonging to the Order Anura, which contains all frogs), predators can strongly affect the abundance of larval and post-metamorphic spotted frogs. The heaviest losses to predation are thought to occur shortly after tadpoles emerge from eggs, when they are relatively exposed and poor swimmers (Licht 1974). However, the odds of survival appear to increase as tadpoles grow in size and aquatic vegetation matures, thus affording cover (Licht 1974).

The timing of egg laying varies with elevation, latitude, and rate of snowpack thaw (Cushman and Pearl 2007). Breeding in higher elevations generally begins within days to weeks after breeding areas are clear of ice. While specific triggers for the initiation of breeding are incompletely known, observations from central Oregon, including Jack Creek, suggests they may include some combination of day length and water temperatures of 10° C (50° F; Cushman and Pearl 2007). At other Oregon sites, breeding does not start until after water temperature has exceeded 10° C (50° F), so it is likely that this trait varies between populations, or that other cues are involved (Cushman and Pearl 2007).

The time between eggmass oviposition and metamorph development is approximately four months (USFWS 2013a). Under different climatic conditions at Jack Creek, eggmass oviposition has the potential to occur during different months. In seasons when these climatic

conditions are met earlier in the year, breeding and oviposition can begin as early as mid-March to early April, with transformation occurring in mid-August (Adams 2015, pers. comm.). However, oviposition has been documented at Jack Creek as late as May with subsequent transformation occurring in September (Adams 2015, pers. comm.). Therefore, assuming conditions that result in both early and late season breeding will occur, there is the potential for tadpoles from early breeders in the early season to be present on the allotment during grazing implementation.

Licht (1974) documented the highly variable mortality rates for spotted frog life-history stages in marsh areas in the lower Fraser Valley, BC: embryos (30 percent), tadpoles (99 percent), and post-metamorphic (after the change from tadpole to adult, or “metamorphosis”) frogs (95 percent). Licht (1974) estimated mortality of each life stage and predicted only a 1 percent chance of survival of eggs to metamorphosis, a 67 percent chance of juvenile survival for the first year, and a 64 percent adult annual survival, with males having a higher mortality rate than females. An average adult between-year survival of 37 percent was estimated by a mark-recapture study at Dempsey Creek, Washington, between 1997 and 1999 (Watson *et al.* 2000).

Habitat

The spotted frog is highly aquatic; it is almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and cover. Watson *et al.* (2003) summarized the conditions required for completion of the spotted frog life cycle as shallow water areas for egg and tadpole survival, perennially deep, moderately vegetated pools for adult and juvenile survival in the dry season, and perennial water for protecting all age classes during cold wet weather.

Spotted frogs breed in shallow pools (<14 in (35 cm) deep) that are near flowing water, or which may be connected to larger bodies of water during seasonally high water or at flood stage. Characteristic vegetation includes grasses, sedges, and rushes, although eggs are laid where the vegetation is low or sparse, such that vegetation structure does not shade the eggs (McAllister and Leonard 1997). While native vegetation is the preferred substrate, the frog may also use short, manipulated reed canarygrass/native vegetation mix (Engler 1999, pers. comm.). Full solar exposure seems to be a significant factor in breeding habitat selection (McAllister and White 2001; Pearl and Hayes 2004). The availability of the unique characteristics of traditional egg-laying sites is limited, and adults may have limited flexibility to switch sites (Hayes 1994). This may make the spotted frog particularly vulnerable to modification of egg-laying sites (Hayes 1994).

After breeding, during the dry season, spotted frogs move to deeper, permanent pools or creeks (Watson *et al.* 2003). They are often observed near the water surface basking and feeding in beds of floating and submerged vegetation (Watson *et al.* 2003; Pearl *et al.* 2005).

Known overwintering sites are associated with flowing systems, such as springs and creeks, that provide well-oxygenated water (Hallock and Pearson 2001; Hayes *et al.* 2001; Tattersall and Ultsch 2008) and sheltering locations protected from predators and freezing (Risenhoover *et al.* 2001; Watson *et al.* 2003). Spotted frogs burrow in mud, silty substrate, clumps of emergent vegetation, woody accumulations within the creek, and holes in creek banks when inactive

during periods of prolonged or severe cold (Watson *et al.* 2003; Hallock and Pearson 2001; McAllister and Leonard 1997); however, they are intolerant of anoxic (absence of dissolved oxygen) conditions and are unlikely to burrow into the mud for more than a day or two (Tattersall and Ultsch 2008) because they can survive under anoxic conditions for only 4–7 days (Tattersall and Ultsch 2008). This species remains active during the winter and selects microhabitats that can support aerobic metabolism and minimize exposure to predators (Hallock and Pearson 2001; Hayes *et al.* 2001; Tattersall and Ultsch 2008). In central Oregon, where winters generally result in ice cover over ponds, spotted frogs follow a fairly reliable routine of considerable activity and movement beneath the ice during the first month following freeze-up. Little movement is observed under the ice in January and February, but activity steadily increases in mid-March, even when ice cover persists (Bowerman 2006, pers. comm.; Hallock 2009, pers. comm.; Hayes *et al.* 2001).

Movement studies specific to spotted frogs are limited in number and scope. Results of a habitat utilization and movement study at Dempsey Creek in Washington indicate that adult frogs made infrequent movements between widely separated pools and movements that are more frequent between pools in closer proximity (Watson *et al.* 2003), but remained within the study area throughout the year. Home ranges averaged 5.4 ac (2.2 ha), and daily movement was 16–23 ft (5–7 m) throughout the year (Watson *et al.* 2003). During the breeding season (February–May), frogs used about half the home range. During the dry season (June–August), frogs moved to deeper, permanent pools, and occupied the smallest range of any season. They moved back toward their former breeding and overwintering range during the wet season (September–January) (Watson *et al.* 2003). Individuals equipped with radio transmitters stayed within 2,600 ft (800 m) of capture locations at the Dempsey Creek site (Watson *et al.* 1998) and within about 1,312 ft (400 m) at the Trout Lake NAP (Hallock and Pearson 2001).

Recaptures of spotted frogs at breeding locations in the Buck Lake population in Oregon indicated that adults often move less than 300 ft (100 m) between years (Hayes 1998). However, longer travel distances, while infrequent, have been observed between years and within a single year between seasons. Three adult spotted frogs (one male and two females) marked in a study at Dempsey Creek and the Black River in Washington moved a distance of 1.5 mi (2.4 km) between seasons along lower Dempsey Creek to the creek's mouth from the point where they were marked (McAllister and Walker 2003). An adult female spotted frog traveled 1,434 ft (437 m) between seasons from its original capture location at the Trout Lake Wetland NAP (Hallock and Pearson 2001). Two juvenile frogs at the Jack Creek site in Oregon were recaptured the next summer 4,084 ft (1,245 m) and 4,511 ft (1,375 m) downstream from where they were initially marked, and one adult female moved 9,183 ft (2,799 m) downstream (Cushman and Pearl 2007). Spotted frogs at the Sunriver site routinely make annual migrations of 1,640 to 4,265 ft (500 to 1,300 m) between the major egg-laying complex and an overwintering site (Bowerman 2006, pers. comm.).

Although these movement studies are specific to spotted frogs, the number of studies and size of the study areas are limited and have not been conducted over multiple seasons or years. In addition, the ability to detect frogs is challenging because of difficult terrain and the need for the receiver and transmitter to be in close proximity. Hammerson (2005) recommends that a 3.1-mile (5-km) dispersal distance be applied to all ranid frog species, because the movement data for ranids are consistent. The preponderance of data indicates that a separation distance of

several kilometers may be appropriate and practical for delineation of occupancy, despite occasional movements that are longer or that may allow some genetic interchange between distant populations (for example, the 6.2-mi (10-km) distance noted by Blouin *et al.* (2010)). Based on the best available scientific information, the Service considers that spotted frog habitats are connected for purposes of genetic exchange when occupied/suitable habitats fall within a maximum movement distance of 3.1 mi (5 km; USFWS 1999).

Distribution

Historically, the spotted frog ranged from British Columbia to the Pit River basin in northeastern California (Hayes 1997; McAllister and Leonard 1997). Spotted frogs have been documented at 61 historical localities in 48 watersheds (3 in British Columbia, 13 in Washington, 29 in Oregon, and 3 in California) in 31 sub-basins (McAllister *et al.* 1993; Hayes 1997; McAllister and Leonard 1997; COSEWIC 2011).

Currently, the spotted frog is found within 15 sub-basins ranging from extreme southwestern British Columbia south through the Puget Trough, and the Cascades Range from south-central Washington at least to the Klamath Basin in southern Oregon (USFWS 2014, p. 51658). Spotted frogs occur in lower elevations in British Columbia and Washington and are restricted to high elevations in Oregon (Pearl *et al.* 2010). In addition, spotted frogs currently have a very limited distribution west of the Cascade crest in Oregon, are considered to be extirpated from the Willamette Valley in Oregon (Cushman and Pearl 2007), and may be extirpated in the Klamath and Pit River basins of California (Hayes 1997).

In British Columbia, spotted frogs no longer occupy the locations documented historically, but they currently are known to occupy four disjunct locations in a single sub-basin, which is the Lower Fraser River (Canadian Oregon Spotted Frog Recovery Team 2012).

In Washington, spotted frogs are known to occur only within six sub-basins/watersheds: the Sumas River, a tributary to the Lower Chilliwack River watershed and Fraser River sub-basin; the Black Slough in the lower South Fork Nooksack River, a tributary of the Nooksack River; Samish River; Black River, a tributary of the Chehalis River; Outlet Creek (Conboy Lake), a tributary to the Middle Klickitat River; and Trout Lake Creek, a tributary of the White Salmon River. The Klickitat and White Salmon Rivers are tributaries to the Columbia River. The spotted frogs in each of these sub-basins/watersheds are isolated from frogs in other sub-basins (USFWS 2014, p. 51658).

In Oregon, spotted frogs are known to occur only within eight sub-basins (scale equivalent to Hydrologic Unit Code 8): Lower Deschutes River, Upper Deschutes River, Little Deschutes River, McKenzie River, Middle Fork Willamette, Upper Klamath, Upper Klamath Lake, and the Williamson River. The spotted frogs in most of these sub-basins are isolated from frogs in other sub-basins, although Oregon spotted frogs in the lower Little Deschutes River are aquatically connected with those below Wickiup Reservoir in the Upper Deschutes River sub-basin. Spotted frog distribution west of the Cascade Mountains in Oregon is restricted to a few lakes in the upper watersheds of the McKenzie River and Middle Fork Willamette River sub-basins, which represent the remaining two out of 12 historically occupied sub-basins west of the Cascades in Oregon (USFWS 2014, p. 51658).

In California, this species has not been detected since 1918 (California Academy of Science Museum Record 44291) at historical sites and may be extirpated (Hayes 1997). However, there has been little survey effort of potential habitat since 1996, so this species may still occur in California (USFWS 2014, p. 51658).

Population Dynamics

The Service's final rule to list the spotted frog estimated the total minimum breeding adult populations within each of the 15 occupied sub-basins using egg mass counts from known breeding locations (USFWS 2014, p. 51658). However, there are weaknesses to using egg mass data to evaluate population size and status at the site level and sub-basin scale. Egg mass counts do, however, indicate that many breeding locations within sub-basins have small numbers of breeding adults. Adams *et al.* (2013) recommends assessing trends in amphibian populations by documenting the change in the number of populations rather than a change in abundance using occupancy modeling. However, population trends for spotted frog using occupancy modeling are not yet available.

Modeling across a variety of amphibian taxa suggests that pond-breeding frogs have high temporal variances of population abundances and high local extinction rates relative to other groups of amphibians, with smaller frog populations undergoing disproportionately large fluctuations in abundance (Green 2003). The vulnerability of spotted frog egg masses to fluctuating water levels (Hayes *et al.* 2000; Pearl and Bury 2000), the vulnerability of post-metamorphic stages to predation (Hayes 1994), and low overwintering survival (Hallock and Pearson 2001) can contribute to relatively rapid population turnovers, suggesting spotted frogs may be vulnerable to local extirpations from stochastic events and chronic sources of mortality (Pearl and Hayes 2004). The term "rapid population turnovers" refers to disproportionately large fluctuations in abundance.

Spotted frogs concentrate breeding efforts in relatively few locations (Hayes *et al.* 2000; McAllister and White 2001). For example, Hayes *et al.* (2000) found that 2 percent of breeding sites accounted for 19 percent of the egg masses at the Conboy Lake National Wildlife Refuge. Similar breeding concentrations have been found elsewhere in Washington and in Oregon. Moreover, spotted frogs exhibit relatively high fidelity to breeding locations, using the same seasonal pools every year and often using the same egg-laying sites. In years of extremely high or low water, the frogs may use alternative sites. For example, the Trout Lake Creek and Conboy Lake frogs return to traditional breeding areas every year, but the egg-laying sites change based on water depth at the time of breeding. A stochastic event that impacts any one of these breeding locations could significantly reduce the spotted frog population associated with that sub-basin.

Egg mass count data suggests a positive correlation and significant link between site size and spotted frog breeding population size (Pearl and Hayes 2004). Larger sites are more likely to provide the seasonal microhabitats required by spotted frogs, have a more reliable prey base, and include overwintering habitat. The observation that extant spotted frog populations tend to occur in larger wetlands led Hayes (1994) to hypothesize that a minimum size of 9 ac (4 ha) may be necessary to reach suitably warm temperatures and support a large enough population to persist despite high predation rates. However, spotted frogs also occupy smaller sites and are

known to occur at sites as small as 2.5 ac (1 ha) and as large as 4,915 ac (1,989 ha) (Pearl and Hayes 2004). Smaller sites generally have a small number of frogs and, as described above, are vulnerable to extirpation. Pearl and Hayes (2004) believe that these smaller sites were historically subpopulations within a larger breeding complex and spotted frogs may only be persisting in these small sites because the sites exchange migrants or seasonal habitat needs are provided nearby.

Most species' populations fluctuate naturally in response to weather events, disease, predation, or other factors. However, these factors have less impact on a species with a wide and continuous distribution. Small, isolated populations are generally more likely to be extirpated by stochastic events and genetic drift (Lande 1988).

Funk *et al.* (2008) found low genetic variation in spotted frogs, which likely reflects small effective population sizes, historical or current genetic bottlenecks, and/or low gene flow among populations. Genetic work by Blouin *et al.* (2010) indicates low genetic diversity within and high genetic differentiation among each of the six Oregon spotted frog groups (British Columbia, Chehalis and Columbia drainages, Camas Prairie, central Oregon Cascades, and the Klamath Basin). This pattern of genetic fragmentation is likely caused by low connectivity between sites and naturally small populations sizes. Gene flow is very limited between locations, especially if separated by 6 mi (10 km) or more, and at the larger scale, genetic groups have the signature of complete isolation (Blouin *et al.* 2010). At least two of the locations (Camas Prairie and Trout Lake) sampled by Blouin *et al.* (2010) show indications of recent genetic drift.

Movement studies suggest spotted frogs are limited in their overland dispersal and potential to recolonize sites. Spotted frog movements are associated with aquatic connections (Watson *et al.* 2003; Pearl and Hayes 2004). Spotted frogs rely on an aquatic connection between breeding sites to maintain population viability.

Threats at the Range-wide Level

Large historical losses of wetland habitat have occurred across the range of the spotted frog. Wetland losses are estimated from between 30 to 85 percent across the species range, with the greatest percentage lost having occurred in British Columbia. These wetland losses have directly influenced the current fragmentation and isolation of remaining spotted frog populations.

Loss of natural wetland and riverine disturbance processes as a result of human activities has and continues to result in degradation of spotted frog habitat. Historically, a number of disturbance processes created early successional wetlands favorable to spotted frogs throughout the Pacific Northwest: (1) Rivers freely meandered over their floodplains, removing trees and shrubs and baring patches of mineral soil; (2) beavers created a complex mosaic of aquatic habitat types for year-round use; and (3) summer fires burned areas that would be shallow water wetlands during the spotted frog breeding season the following spring. Today, all of these natural processes are greatly reduced, impaired, or have been permanently altered as a result of human activities, including stream bank, channel, and wetland modifications; operation of water control structures (*e.g.*, dams and diversions); beaver removal; and fire suppression.

The historical loss of spotted frog habitats and lasting anthropogenic changes in natural disturbance processes are exacerbated by the introduction of reed canarygrass, by nonnative predators, and potentially by climate change. In addition, current regulatory mechanisms and voluntary incentive programs designed to benefit fish species have inadvertently led to the continuing decline in quality of spotted frog habitats in some locations. The current wetland and stream vegetation management paradigm is generally a no-management or restoration approach that often results in succession to a tree- and shrub-dominated community that unintentionally degrades or eliminates remaining or potential suitable habitat for spotted frog breeding. Furthermore, incremental wetland loss or degradation continues under the current regulatory mechanisms. If left unmanaged, these factors are anticipated to result in the eventual elimination of remaining suitable spotted frog habitats or populations. The persistence of habitats required by the species is now largely management dependent.

In the Final Rule to list the spotted frog as threatened (USFWS 2014, p. 51658), the Service determined that the spotted frog is impacted by one or more of the following factors to the extent that the species meets the definition of a threatened species under the Act:

- Habitat necessary to support all life stages is continuing to be impacted and/or destroyed by human activities that result in the loss of wetlands to land conversions; hydrologic changes resulting from operation of existing water diversions/manipulation structures, new and existing residential and road developments, drought, and removal of beavers; changes in water temperature and vegetation structure resulting from reed canarygrass invasions, plant succession, and restoration plantings; and increased sedimentation, increased water temperatures, reduced water quality, and vegetation changes resulting from the timing and intensity of livestock grazing (or in some instances, removal of livestock grazing at locations where it maintains early seral stage habitat essential for breeding);
- Predation by nonnative species, including nonnative trout and bullfrogs;
- Inadequate existing regulatory mechanisms that result in significant negative impacts such as habitat loss and modification; and
- Other natural or manmade factors including small and isolated breeding locations, low connectivity, low genetic diversity within occupied sub-basins, climate change, and genetic differentiation between sub-basins.

Climate Change

The Service also believes climate change is likely to further exacerbate some existing threats such as the projected potential for increased wetland habitat loss from hydrologic changes, shrub encroachment, continued expansion of reed canarygrass, etc. Oregon spotted frogs are highly aquatic, and reductions in summer flows may result in summer habitat going dry, potentially resulting in increased mortality or forcing frogs to seek shelter in lower quality wetted areas, and may increase water temperature and provide more suitable habitat for bullfrogs, increasing the threat of predation. The interplay between Oregon spotted frogs and their aquatic habitat will ultimately determine their population response to climate change. These potential impacts will affect the environmental baseline for spotted frogs and other listed

species in the Pacific Northwest, and we provide a general overview of these potential effects in Appendix D. Despite the potential for future climate change throughout the range of the species, we have not identified, nor are we aware of any data on, an appropriate scale to evaluate habitat or population trends for the Oregon spotted frog or to make predictions about future trends and whether the species will be significantly impacted (cite final listing rule). However, the PRMP provides measures that will ameliorate these impacts and that should provide for the long term persistence of the spotted frog and other wetland dependent species including the Tunnel Creek ACEC that will be managed to maintain, enhance or restore spotted frog habitat at this location. In addition, the Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including wetlands and riverine habitats and maintain water quality attributes that support the species.

Also, there are cumulative effects of the several threats that the spotted frog faces. All occupied sub-basins are subjected to multiple threats, which cumulatively pose a risk to individual populations (Table 247). Many of these threats are intermingled, and the magnitude of the combined threats to the species is greater than the individual threats (USFWS 2014, p. 51658).

Table 247. Range-wide threats to Oregon spotted frog operating within each sub-basin (USFWS 2014, p. 51658). *

Sub-basin	Factor A	Factor C	Factor E
Lower Fraser River	Wetland loss; hydrologic changes; development; grazing, reed canarygrass; water quality	Introduced warmwater fish; bullfrogs	Small population size; breeding locations disconnected; contaminants; cumulative effects of other threats; climate change
Lower Chilliwack River	Grazing; reed canarygrass; water quality	Introduced warmwater fish	Small population size; breeding locations disconnected; contaminants; cumulative effects of other threats; climate change
South Fork Nooksack	Grazing; reed canarygrass; shrub encroachment/planting; loss of beavers; water quality	Introduced coldwater fish	Small population size; cumulative effects of other threats; contaminants; climate change

Sub-basin	Factor A	Factor C	Factor E
Samish River	Wetland loss; grazing; reed canarygrass; shrub encroachment/planting; water quality	Introduced warmwater fish; introduced coldwater fish	Breeding locations disconnected; contaminants; cumulative effects of other threats; climate change
Black River	Wetland loss; reed canarygrass; shrub encroachment/planting; development; loss of beaver; water quality	Introduced warmwater fish; introduced coldwater fish; bullfrogs	Small population size; breeding locations disconnected; contaminants; cumulative effects of other threats; climate change
White Salmon River	Wetland loss; reed canarygrass; water quality	Introduced coldwater fish	Cumulative effects of other threats; climate change
Middle Klickitat River	Wetland loss; hydrologic changes; loss of beaver; development; grazing; reed canarygrass; shrub encroachment; water management	Introduced warmwater fish; introduced coldwater fish; bullfrogs	Cumulative effects of other threats; climate change
Lower Deschutes	Shrub encroachment		Small population size; single occupied site within sub-basin; isolated from frogs in other sub-basins; cumulative effects of other threats; climate change
Upper Deschutes	Wetland loss; reed canarygrass; shrub encroachment; hydrological changes (water management)	Introduced warmwater fish; introduced coldwater fish, bullfrogs	Breeding locations disconnected; cumulative effects of other threats; climate change
Little Deschutes	Wetland loss; hydrological changes (water management); development; grazing; reed canarygrass; shrub encroachment	Introduced coldwater fish; bullfrogs	Breeding locations disconnected; cumulative effects of other threats; climate change

Sub-basin	Factor A	Factor C	Factor E
McKenzie	Shrub encroachment	Introduced coldwater fish	Only two breeding locations in sub-basin, which are disconnected; cumulative effects of other threats; climate change
Middle Fork Willamette	Shrub encroachment	Introduced coldwater fish	Single occupied site in sub-basin; disconnected from other sub-basins; cumulative effects of other threats; climate change
Williamson	Development; grazing; shrub encroachment; loss of beaver	Introduced warmwater fish; introduced coldwater fish	Small population size; breeding locations disconnected; cumulative effects of other threats; climate change
Upper Klamath Lake	Water management; development; shrub and reed canarygrass encroachment; grazing	Introduced warmwater fish; introduced coldwater fish; bullfrogs	Small population size; breeding locations disconnected; cumulative effects of other threats; climate change
Upper Klamath	Wetland loss; water management; development; grazing; shrub encroachment; loss of beaver	Introduced warmwater fish; introduced coldwater fish	Small population size; breeding locations disconnected; cumulative effects of other threats; climate change
* Existing regulatory mechanisms (Factor D) have been insufficient to significantly reduce or remove the threats to the Oregon spotted frog. * Factors A, C, and E are operative within some to several occupied sites within each sub-basin, to differing degrees. To clarify, these threats apply to locations within each sub-basin, and do not necessarily apply to the sub-basin in its entirety.			

ENVIRONMENTAL BASELINE

The spotted frog (*Rana pretiosa*) has been lost from 48 of the 61 localities in which it historically occurred, and the species may no longer occur in 76 to 90 percent of its historical range (USFWS 2013a). Historically, the spotted frog occurred from British Columbia, Canada, to northeastern California (USFWS 2013a). It is currently found in five sub-basins within the planning area: the McKenzie River, Middle Fork Willamette, Upper Klamath, Upper Klamath Lake and Williamson River sub-basins. The Service listed the spotted frog as a threatened species under the ESA on August 29, 2014 (USFWS 2014).

Phylogenetic analyses were conducted on samples of spotted frogs collected from three locations in Washington and 13 locations in Oregon (Funk *et al.* 2008). Results indicate two well-supported clades (a group of biological taxa (as species) that includes all descendants of one common ancestor) nested within the Oregon spotted frog: the Columbia clade (Trout Lake Natural Area Preserve (NAP) and Camas Prairie) and the southern Oregon clade (Wood River and Buck Lake in the Klamath Basin). Thus, the Upper Klamath and Upper Klamath Lake spotted frog sub-populations provide unique genetic diversity within the range of the species.

Recent surveys conducted at Buck Lake have documented small numbers of egg masses (38 egg masses in 2010, or the equivalent of 76 breeding individuals (male and female) (BLM 2012). Survey data for the Upper Klamath sub-basin suggests that the Buck Lake population is in decline (USFWS 2013a). Egg mass surveys at the BLM Wood River wetlands have detected relatively stable numbers of spotted frog egg masses, averaging 60 between 2007 and 2012; in 2013, 123 spotted frog egg masses were found in the Wood River wetlands (USFWS 2013c). These populations are important within the entire range of the species as they represent the southernmost extent of spotted frogs and occur within a unique geologic setting.

Spotted frog habitat includes perennial bodies of warm water such as ponds, reservoirs, wetlands, and irrigation canals (USFWS 2013a). They inhabit available wetland sites up to 4,915 acres, although sites greater than 9 acres in size may be necessary to support stable, local populations (USFWS 2013a). Spotted frogs lay their eggs in wetland areas with low amounts of herbaceous cover, but rarely at bare or rocky sites (USFWS 2011). Breeding and egg-laying occurs during February to March at lower elevations and during early April to early June at higher elevations; tadpoles metamorphose into froglets during the first summer (USFWS 2014). The maximum movement distance for spotted frogs between habitats is 3.1 miles (USFWS 2014).

Threats to spotted frogs include loss of wetland habitat due to human development or conversion to agriculture, livestock grazing, and introduction of nonnative plant and animal species (USFWS 2013a). Heavy livestock grazing can consume and trample riparian vegetation, compact soil in riparian and upland areas, and introduce urine and feces to water sources. The resulting increases in temperature, sediment production, and changes in water quality can negatively affect spotted frog habitat (USFWS 2011). Infestations of invasive reed canary grass create dense areas of vegetation that would be unsuitable for spotted frog egg-laying and reduce the biological and structural diversity. Removal or reduction of reed canary grass can improve the quality of the breeding habitat for spotted frogs (*ibid.*).

The BLM assumed that spotted frog habitat includes wetlands of any size within 3.1 miles of habitats occupied, or formerly occupied, by spotted frogs and that occupied and formerly occupied habitats are represented by the extent of proposed critical habitat for the spotted frog (BLM 2016a, p. 54). The BLM characterized wetlands smaller than 9 acres in size as small habitat patches, and wetlands at least 9 acres in size as large habitat patches.

Since the Service identified livestock grazing as a threat, the BLM tabulated how much spotted frog habitat in the action area was coincident with BLM-administered grazing allotments. BLM consulted the riparian portions of the rangeland health assessments to determine if grazing management in those particular allotments would be contributing adverse effects to spotted frog habitat.

The BLM has documented spotted frogs in the Klamath Falls Field Office (GeoBOB 2013). There are 99,743 acres of spotted frog habitat within the planning area, and 99 percent of that habitat occurs in large habitat patches (Table 248). There are 286 acres of habitat on BLM-administered lands, and 67 percent of that habitat occurs in large habitat patches. The remaining 99,458 acres of habitat in the planning area occur on lands managed by the private landowners (55 percent), the Service (40 percent), Forest Service (4 percent), the USBR (<1 percent), and other landowners (1 percent). The Service expects that habitat losses will continue on private lands but at much lower rates than in the past because of Federal and State regulations that pertain to wetlands (USFWS 2011).

Table 248. Oregon spotted frog habitat in the action and planning areas.

Oregon Spotted Frog Habitat	Action Area (Acres)	Planning Area (Acres)
Small Habitat Patches	94	1,315
Large Habitat Patches	191	98,428
Totals	286	99,743

There are 285 acres of spotted frog habitat within four grazing allotments in the **action area** (Buck Mountain [#00103], Buck Lake [#00104], Buck Point [#10114], and Keene Creek [#10115]). Of these four grazing allotments, the BLM identified that all four were meeting rangeland health standards. The season-of-use in these grazing allotments varies, but begins in May and ends between August and October, depending on the individual allotment.

The spotted frog is identified as one of the “relevant and important values” of the proposed Tunnel Creek ACEC and there are 38 acres of habitat in the proposed ACEC.

EFFECTS OF THE ACTION - OREGON SPOTTED FROG

Although numerous resource programs under the PRMP have the potential to adversely affect the spotted frog, the BLM (2016a, pp. 171-177) has included three resource programs and specific measures to protect this species. These measures will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the spotted frog under those programs except where necessary for the conservation of the species. These resource programs

and conservation measures are:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61), which includes:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
 - *Existing conservation agreements include:*
 - *Conservation Agreement for the Oregon Spotted Frog (*Rana pretiosa*) in the Klamath Basin of Oregon (USDA & USDI 2010).*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*
- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Manage livestock grazing at sites occupied by Oregon spotted frogs to prevent direct impacts to eggs, tadpoles, or adults.*

2. *The Hydrology Resource Program (BLM 2016a, p. A-36), which includes:*

- *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.*
- *Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.*
- *Implement road improvements, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.*
- *Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.*

- *Decommission roads no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights; and*

3. *The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33), which includes:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*

Absent the above constraints, many resource programs under the PRMP would have the potential to adversely affect spotted frogs depending on how the BLM implements the particular program in areas occupied by this species. For example, grazing cattle has the potential to change water quality in spotted frog-occupied ponds and wetlands with their feces and urine, or to crush frogs or egg masses by walking in shallow frog-occupied pools. However, under the PRMP's management direction, BLM would not allow adverse effects to the spotted frog from grazing unless it was necessary for a conservation action, and even then would not allow direct impacts to any life-form of the spotted frog. Building bridges and other stream crossings have the potential to kill or injure spotted frogs during construction with heavy machinery in spotted frog-occupied wet areas, or to introduce toxins into waterways through fuel and hydraulic fluid spills. However, under the PRMP's management direction, BLM would not allow adverse effects to the spotted frog from these activities unless they were necessary for conservation of the species and would also maintain water quality attributes that support the species. Thus, with the above conservation measures, none of these potential adverse effects would be expected to occur under the PRMP because of the constraints on activities noted in the management direction above.

Implementation of the management direction described above has the potential to maintain, enhance, and restore spotted frog populations on BLM lands within the action area. Such an outcome underlies the basis for which the Tunnel Creek ACEC will be designated under the PRMP. Implementation of the management direction described above will insure that: water quality will be maintained; livestock will be managed to prevent direct impacts to eggs, tadpoles, or adult spotted frogs; and no actions that would adversely affect the spotted frog would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

The role of a recovery plan is to provide a roadmap of recommended actions that the Service believes are necessary to conserve and recover the listed species. Although the Service has not yet prepared a recovery plan for the spotted frog, once it is developed all BLM actions that have the potential to adversely affect the spotted frog will have to be consistent with that plan, per the management direction under the Wildlife resource program (BLM 2016a, pp. A54-A61) described above. There is currently in place a conservation agreement (USDA and USDI 2010) to which the Service is a partner and signatory, and a critical habitat rule (USFWS 2016) to guide the development of future actions in a manner that is most compatible with the conservation needs of the spotted frog. The conservation agreement (USDA and USDI 2010, pp. 13-14) includes activities such as enhancing ephemeral and permanent wetlands within and

adjacent to occupied spotted frog sites, restore and maintain open water habitats and provide early seral vegetation communities close to occupied spotted frog sites. The critical habitat rule (USFWS 2016, pp. 29354-55) includes the following special management considerations for spotted frog critical habitat, which is all considered occupied, that may adversely affect the frog: treatment or removal of exotic and encroaching vegetation (through mowing, burning, grazing, herbicide treatment, shrub/tree removal), nonnative predator control and restoration of habitat features. Considering this information and based on the management direction in the PRMP, the Service concludes that all actions to be implemented by the BLM under the PRMP that may have the potential to adversely affect the spotted frog will be consistent with these documents and will be “necessary for the conservation of the species.”

Therefore, implementation of PRMP resource programs with the potential to adversely affect the spotted frog will be consistent with the conservation and recovery needs of the species. For example, numerous types of habitat restoration and enhancement projects have the potential to disturb spotted frogs and cause short-term degradation of habitat. The removal of the invasive reed canary grass and cattails involves digging, pulling and hauling of materials, and is sometimes conducted by hand or with heavy machinery. These activities provide or maintain open water habitat for the spotted frog, but may involve short-term degradation of water quality or disturbance of individual spotted frogs. Removal of encroaching vegetation maintains the necessary amount of exposure to spotted frog wetland pools, but may cause minor amounts of sedimentation depending on how close the vegetation is to the wetland. Removal of encroaching shrubs may have the same benefits and the same effects. Control of non-native predators (bullfrogs and fish) could cause disruptions to spotted frogs, but is a vital tool to providing for the conservation of the species.

Therefore, since the PRMP would require BLM to avoid any adverse effects to the spotted frog except where necessary for the conservation of the species, and all actions will be consistent with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, the only potential adverse effects will result from actions that are consistent with the conservation and recovery needs of the spotted frog. Implementation of such actions will have the potential to improve the habitat and population condition of the spotted frog in the action area over the long-term and to move the species’ condition closer to recovery.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

At the Buck Lake site there is a private parcel of land adjacent to the BLM ACEC that contains about 202 acres of occupied spotted frog habitat that can only be accessed by traveling across

BLM's land. Because the access of this parcel is dependent on a BLM road, which is potentially managed under the PRMP, any future non-Federal actions that are reasonably foreseeable on that parcel could not occur if not for the PRMP management of that road. Therefore, those reasonably foreseeable actions are indirect effects of the proposed action making that parcel part of the action area, and those future non-federal actions part of the cumulative effects.

This parcel has a long history of private grazing. Grazing has the potential to affect spotted frog habitat through grazing of vegetation and changes in water quality from inputs of urine and cow feces. This private parcel of occupied habitat has a deeper open water area than the adjacent BLM occupied habitat which is likely to reduce the amount of use the wetted area gets from cattle, although these nutrient inputs can result from cattle presence adjacent to the wetted area, as well. The spotted frog habitat on this parcel is expected to receive detrimental effects from cattle grazing that are about the same as the effects this area has experienced in recent history. Any changes in the amount or impacts from grazing are not reasonably foreseeable. Therefore, we expect the condition of this parcel of occupied habitat to remain about the same as it is currently. Because the baseline condition of this private spotted frog habitat and the population it supports is not expected to change in the foreseeable future, we do not expect the existing numbers of spotted frogs, distribution of spotted frogs or spotted frog reproduction to change as a result of the PRMP.

While the potential exists for spotted frog populations to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon, we do not have any information on such populations beyond what is mentioned above. Therefore the Service does not anticipate that activities on non-federal lands within the action area will change spotted frog numbers, reproduction or distribution.

CONCLUSION

After reviewing the current status of the spotted frog, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the Oregon spotted frog.

The key basis for this conclusion is the BLM's explicit management direction under the PRMP to not approve, fund, or implement actions that would adversely affect the Oregon spotted frog, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. While there is a potential under this management direction for BLM actions that may have short-term impacts to the spotted frog, the long-term effects would be beneficial and support the species' recovery. Activities on non-federal lands within the action area are not expected to change spotted frog populations or habitat conditions from baseline conditions.

STATUS OF CRITICAL HABITAT – OREGON SPOTTED FROG

The Service designated critical habitat for spotted frog on 68,501 ac (27,726 ha) and 24 stream miles (39 km) in Washington and Oregon on June 10, 2016 (USFWS 2016). Critical habitat for

spotted frog is designated within 14 units, delineated by river sub-basins where spotted frogs are extant: (1) Lower Chilliwack River; (2) South Fork Nooksack River; (3) Samish River; (4) Black River; (5) White Salmon River; (6) Middle Klickitat River; (7) Lower Deschutes River; (8) Upper Deschutes River; (9) Little Deschutes River; (10) McKenzie River; (11) Middle Fork Willamette River; (12) Williamson River; (13) Upper Klamath Lake; and (14) Upper Klamath. The final rule for critical habitat provides descriptions of ownership, acreages and threats for each Unit (USFWS 2016, 29357-60).

Physical or Biological Features

When designating critical habitat, the Service considers “the physical or biological features [PBFs] essential to the conservation of the species and which may require special management considerations or protection” (50 CFR §424.12). “These include, but are not limited to: 1) space for individual and population growth and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing (or development) of offspring; and 5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species”. The critical habitat designation identifies the PBFs that are essential to the conservation of spotted frog (USFWS 2016, pp. 29375-76).

The following are the PBFs of designated critical habitat for the spotted frog:

1. Nonbreeding (N), Breeding (B), Rearing (R), and Overwintering Habitat (O). Ephemeral or permanent bodies of fresh water, including, but not limited to natural or manmade ponds, springs, lakes, slow-moving streams, or pools within or oxbows adjacent to streams, canals, and ditches, that have one or more of the following characteristics:
 - a. Inundated for a minimum of 4 months per year (B, R) (timing varies by elevation but may begin as early as February and last as long as September);
 - b. Inundated from October through March (O);
 - c. If ephemeral, areas are hydrologically connected by surface water flow to a permanent water body(*e.g.*, pools, springs, ponds, lakes, streams, canals, or ditches) (B, R);
 - d. Shallow water areas (less than or equal to 12 inches (30 centimeters), or water of this depth over vegetation in deeper water (B, R);
 - e. Total surface area with less than 50 percent vegetative cover (N);
 - f. Gradual topographic gradient (less than 3 percent slope) from shallow water toward deeper, permanent water (B, R);
 - g. Herbaceous wetland vegetation (*i.e.*, emergent, submergent, and floating-leaved aquatic plants), or vegetation that can structurally mimic emergent wetland vegetation through manipulation (B, R);
 - h. Shallow water areas with high solar exposure or low (short) canopy cover (B, R);
 - i. An absence or low density of nonnative predators (B, R, N)
2. Aquatic movement corridors. Ephemeral or permanent bodies of fresh water that have one or more of the following characteristics:
 - a. Less than or equal to 3.1 miles (5 kilometers) linear distance from breeding areas; and

- b. Impediment free (including, but not limited to, hard barriers such as dams, impassable culverts, lack of water, or biological barriers such as abundant predators, or lack of refugia)
3. Refugia habitat. Nonbreeding, breeding, rearing, or overwintering habitat or aquatic movement corridors with habitat characteristics (*e.g.*, dense vegetation and/or an abundance of woody debris) that provide refugia from predators (*e.g.*, nonnative fish or bullfrogs).

Special management considerations

Threats to the PBFs that are essential to the conservation of this species and that may warrant special management considerations or protection include, but are not limited to: (1) habitat modifications brought on by nonnative plant invasions or native vegetation encroachment (trees and shrubs); (2) loss of habitat from conversion to other uses; (3) hydrologic manipulations; (4) removal of beavers; (5) livestock grazing; and (6) predation by invasive fish and bullfrogs. These threats also have the potential to affect the PBFs if conducted within or adjacent to designated units.

ENVIRONMENTAL BASELINE – OREGON SPOTTED FROG CRITICAL HABITAT

On June 10, 2016, the Service designated critical habitat for the spotted frog on 16,715 acres in the planning area, eight acres of which occurs on BLM-administered lands in the Klamath Falls Field Office (USFWS 2016).

There are 8 acres of spotted frog critical habitat in the proposed ACEC. All of the PBFs are found within the unit, but are impacted by woody vegetation succession, nonnative predators, lack of beaver, and hydrological changes. The essential features within this unit may require special management considerations or protection to ensure maintenance or improvement of the existing nonbreeding, breeding, rearing, and overwintering habitat, aquatic movement corridors, or refugia habitat, and to address any changes that could affect these features.

The BLM's Klamath Falls Field Office has initiated several habitat restoration projects within their Wood River wetland property, including installation of water control structures, construction of breeding ponds, and canal restructuring for additional breeding areas. To date, 3,000 ac (1,214 ha) of wetland habitats associated with the Wood River Canal have been restored. However, for reasons unknown, spotted frogs have not been detected in the restored wetlands, but rather, have only been associated with the canal system. BLM actively manages the water in the canal during the breeding season to prevent stranding and inundating spotted egg masses (USFWS 2014, p. 51676).

The BLM has been controlling and reducing bullfrogs and analyzing the gut contents of bullfrogs at all life stages on their Wood River wetland property in Oregon for eight years. Bullfrog detections and collection have decreased in different areas of the canal in recent years. The number of bullfrogs removed and seen at this site has decreased, and in the last few years, the bulk of the bullfrog removal has been from the north canal and Sevenmile canal areas (outside the spotted frog site), which is considered to be the strongest source areas for movement into the spotted frog site. However, despite these efforts, bullfrogs continue to

persist in these spotted frog habitats (USFWS 2014, p. 51681). These actions are anticipated to improve the baseline conditions of critical habitat in the action area and for the rangewide status of critical habitat for the spotted frog.

EFFECTS OF THE ACTION – OREGON SPOTTED FROG CRITICAL HABITAT

Although the management direction of numerous resource programs and land-use allocations under the PRMP have the potential to adversely affect spotted frog critical habitat, the BLM (2016a, pp. 171-177) has included specific measures in three resource programs to protect this species. These measures will apply to all PRMP resource programs and land use-allocations and avoid the potential for adverse effects to occur to spotted frog critical habitat under those programs and allocations except where necessary for the conservation of the species. These three programs and the associated conservation measures are:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61) which includes:*
 - *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
 - *Existing conservation agreements include:*
 - *Conservation Agreement for the Oregon Spotted Frog (*Rana pretiosa*) in the Klamath Basin of Oregon (USDA & USDI 2010).*
 - *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*
 - *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
 - *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
 - *Manage livestock grazing at sites occupied by Oregon spotted frogs to prevent direct impacts to eggs, tadpoles, or adults*
2. *The Hydrology Resource Program (BLM 2016a, p. A-36) which includes:*
 - *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.*

- *Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.*
 - *Implement road improvements, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.*
 - *Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.*
 - *Decommission roads no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.*
3. *The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33) which includes:*
- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*

Absent the above constraints, many resource programs under the PRMP would have the potential to adversely affect spotted frog critical habitat depending on how the BLM implements the particular program in areas occupied by this species. For example, grazing cattle has the potential to change water quality in spotted frog critical habitat ponds and wetlands with their feces and urine which could alternative aquatic vegetation (PBFs 1 and 3). Building or replacing bridges and other stream crossings has the potential to block movement corridors or facilitate the introduction of non-native predators (PBFs 1 and 2), while building a road can isolate small ephemeral wetlands from surface flow (PBF 1). With the above conservation measures, none of these potential adverse effects would be expected to occur under the PRMP because of the constraints on activities noted in the management direction above.

Implementation of the management direction described above has the potential to maintain, enhance, and restore spotted frog critical habitat PBFs on BLM lands within the action area. Such improvements to spotted frog habitat (which benefits spotted frogs) underlie the basis for which the Tunnel Creek ACEC will be designated under the PRMP. Implementation of the management direction described above will insure that: water quality will be maintained; livestock will be managed to only allow for adverse effects if they are used for management purposes; and no actions that would adversely affect spotted frog critical habitat would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

The role of a recovery plan is to provide a roadmap of recommended actions that the Service believes are necessary to conserve and recovery the listed species. Although the Service has not yet prepared a recovery plan for the spotted frog, once it is developed all BLM actions that have the potential to adversely affect spotted frog critical habitat will be consistent with that plan, per the management direction under the Wildlife resource program (BLM 2016a, pp. A54-A61)

described above. There is currently in place a conservation agreement (USDA and USDI 2010) to which the Service is a partner and signatory, and a critical habitat rule (USFWS 2016) to guide the development of future actions in a manner that is most compatible with the conservation of the spotted frog. The conservation agreement (USDA and USDI 2010 pp. 13-14) includes activities such as enhancing ephemeral and permanent wetlands (PBF 1) within and adjacent to occupied spotted frog sites, restore and maintain open water habitats (PBF 1) and provide early seral vegetation communities close to occupied spotted frog sites (PBFs 1 and 3) (all critical habitat in the action area is occupied, so this will be beneficial to the PBFs). The critical habitat rule (USFWS 2016, pp. 29354-55) includes the following special management considerations for spotted frog critical habitat that may adversely affect the frog: treatment or removal of exotic and encroaching vegetation (through mowing, burning, grazing, herbicide treatment, shrub/tree removal) (PBFs 1 and 3), nonnative predator control (PBF 2) and restoration of habitat features (PBFs 1, 2 and 3). Considering this information and based on the management direction in the PRMP, the Service concludes that all actions to be implemented by the BLM under the PRMP that may have the potential to adversely affect the frog will be consistent with these documents and will be “necessary for the conservation of the species.”

Therefore, implementation of PRMP resource programs with the potential to adversely affect spotted frog critical habitat will be consistent with the conservation and recovery needs of the species. For example, numerous types of habitat restoration and enhancement projects have the potential to cause short-term degradation of spotted frog critical habitat PBFs. The removal of the invasive reed canary grass and cattails involves digging, pulling and hauling of materials, and is sometimes conducted by hand or with heavy machinery. These activities provide or maintain open water habitat (PBF 1), but may involve short-term degradation of water quality or disturbance of individual spotted frogs. Removal of encroaching vegetation maintains the necessary amount of exposure to wetland pools (PBF 1), but may cause minor amounts of sedimentation depending on how close the vegetation is to the wetland. Removal of encroaching shrubs may have the same benefits and the same effects.

Therefore, since the PRMP would require BLM to avoid any adverse effects to spotted frog critical habitat except where necessary for the conservation of the species, and all actions will be consistent with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, the only potential adverse effects will result from actions that are consistent with maintaining or improving the conservation value of the critical habitat for the conservation of the spotted frog. Implementation of such actions will have the potential to improve the PBFs of critical habitat in the action area over the long-term and to move the species' condition closer to recovery.

Non-Federal lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-Federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon. Many of these lands are forested and those that are forested are largely managed for timber production.

At the Buck Lake site there is a private parcel of land adjacent to the BLM critical habitat that contains about 202 acres of spotted frog critical habitat and can only be accessed by traveling across BLM's land. Because the access of this parcel is dependent on a BLM road, which is potentially managed under the PRMP, any future non-federal actions that are reasonably foreseeable on that parcel could not occur if not for the PRMP management of that road. Therefore, those reasonably foreseeable actions are indirect effects of the proposed action making that parcel part of the action area, and those future non-federal actions part of the cumulative effects.

This parcel has a long history of private grazing. Grazing has the potential to affect critical habitat PBFs through grazing of vegetation and changes in water quality from inputs of urine and cow feces. This private parcel of critical habitat has a deeper open water area than the adjacent BLM critical habitat which is likely to reduce the amount of use the wetted area gets from cattle, although these nutrient inputs can result from cattle presence adjacent to the wetted area, as well. The spotted frog critical habitat on this parcel is expected to receive detrimental effects from cattle grazing that are about the same as the effects this area has experienced in recent history because any changes in management are not reasonably certain to occur. Any changes in the amount or impacts from grazing are not reasonably foreseeable. Therefore, we expect the condition of this parcel of critical habitat and the value of the critical habitat for the conservation of the species to remain the same as it is currently, which is the same as when it was designated as critical habitat on May 11, 2016 (USFWS 2016).

CONCLUSION

After reviewing the current status of spotted frog critical habitat, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to destroy or adversely modify spotted frog critical habitat.

The key basis for this conclusion is the BLM's explicit management direction under the PRMP to not approve, fund, or implement actions that would adversely affect spotted frog critical habitat, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. While there is a potential under this management direction for BLM actions that may have short-term impacts to the spotted frog critical habitat, the long-term effects would be beneficial and improve the conservation value of the critical habitat for the species' conservation. On non-federal lands within the action area we anticipate the value of spotted frog critical habitat for the conservation of the species will remain the same as the baseline conditions.

ROUGH POPCORNFLOWER

STATUS OF THE SPECIES – ROUGH POPCORNFLOWER

Listing

Rough popcornflower (popcornflower) was listed as federally endangered without critical habitat designation on February 24, 2000 (USFWS 2000). A recovery plan was published for the species on July 28, 2003 (USFWS 2003). Popcornflower is on the state of Oregon's State Endangered Plant list, and only occurs in Douglas County, Oregon.

Population Trends and Distribution

At the time of its final listing (USFWS 2000), popcornflower was known from 17 naturally-occurring habitat patches and two successfully established populations. These habitat patches occurred in 8 extant Element Occurrences (or occurrences or EOs) at that time. A "habitat patch", "patch" or "sub-population" as described in the final listing rule, represents a patch. A "reserve" is a habitat patch that occurs on protected property and is not likely to be developed in the near future.

At present, 36 distinct patches, within 14 extant popcornflower occurrences, are distributed discontinuously from Yoncalla Creek, near Rice Hill, Oregon, south to the Sutherlin Creek, near Wilbur, in the Umpqua River watershed (Maddux and Meyers 2008, USFWS 2010). Of the 14 occurrences, five introduced populations have been established in the southern range of the population; two of these populations may exceed 5,000 plants in the next 5 years. Two naturally occurring populations have also been augmented with additional popcornflower. The average population size for 10 known occurrences as of 2014 was 8,480 plants; 8 estimates were in excess of 1,600 plants (Amsberry 2014, pers. comm.). At present, six protected popcornflower reserves have approximately 5,000 plants or more.

TNC owns property with a popcornflower occurrence in Wilbur (the Popcorn Swale Preserve). This population has been declining for several years for unknown reasons, but believed to be attributed to invasive non-native and native plant invasion. In 2003, TNC counted 13,065 plants at the Popcorn Swale Preserve, but by June 2012 the number was down to about 1,000 plants and has continued to decline. Apart from the TNC population in Wilbur, most popcornflower populations are fairly abundant and stable throughout its range (Friedman 2015, pers. comm.).

Life History and Ecology for Popcornflower

Popcornflower can be a perennial, growing to 70 cm tall (27.5 inches), with dozens of flowering stems and hundreds of flowers, or can be a diminutive annual with only a few flowers (Amsberry and Meinke 2001). At Popcorn Swale Preserve, rough popcornflower generally reaches peak growth and flowering by mid-June. By July 1, many plants have dropped seed and are senescing. By July 15, rough popcornflower generally appears gray-brown and crispy although a rare flower or two may be found low to the ground in moister, shaded areas.

Although most plants are dormant by mid-July, perhaps around 1 percent of individuals may still be green and actively growing and flowering.

Rough popcornflower, like most borages, can potentially produce four nutlets per flower. In most sites, copious numbers of mature seeds were observed from mid-June through early September, but plants in a few wetter habitats delayed seed maturation until the beginning of August. The number of seeds produced by individual plants is largely controlled by the number of flowers produced, and correspondingly, large plants produce more flowers.

Habitat Characteristics for Popcornflower

Popcornflower is endemic to seasonal wetlands in the interior valley of the Umpqua River in southwestern Oregon between Yoncalla and Wilbur in Douglas County (USFWS 2000). The wetland plant community at rough popcornflower habitats may include red-root yampa, a Federal species of concern, great camas (*Camassia leichtlinii* var. *leichtlinii*), Douglas meadowfoam (*Limnanthes douglasii*), California oatgrass, one-sided sedge (*Carex unilateralis*), pointed rush (*Juncus oxymersis*), meadow barley (*Hordeum brachyantherum*), and Cusick's checkermallow (*Sidalcea cusickii*). Known occurrences for the plant are associated with North Umpqua drainage. Rough popcornflower is found in open seasonal wetlands at elevations ranging from 30 to 270 m (98 to 886 feet). Suitable habitat for rough popcornflower includes open, vernal wet meadows, seasonally-ponding mud-flats, or Oregon ash-swale openings dominated by native wetland-associated herbs and graminoids in valley lowlands. Populations are known to occur on six different soil types (Conser silty clay loam, Bashaw silty clay loam, Brand silty clay loam, Nonpareil loam, Oakland silt loam, and Sibold fine sandy loam) but there is a positive correlation only for Conser silty clay loam (USFWS 2000). The taxon depends on seasonal flooding and/or fire to maintain open habitat and to limit competition with invasive native and non-native plant species (USFWS 2010).

Threats/Reasons for Listing for Popcornflower

Popcornflower is threatened by habitat loss or degradation and competition from native and non-native plant species. Most of the mapped historic occurrences of the species have been destroyed or deteriorated by development in the vicinity of the town of Sutherlin in the last twenty years. Habitat loss and degradation can be attributed to the following: destruction of wetlands due to drainage for agricultural uses; pools adjacent to altered land may also be affected due to the changes in hydrology (USFWS 2003); wetland destruction due to urban development (USFWS 2010); and invasive exotic weeds such as teasel (*Dipsacus fullonum*), knapweed (*Centaurea* sp.), Armenian blackberry (*Rubus armeniacus*), and pennyroyal (*Mentha pulegium*); native plants such as spreading rush (*Juncus patens*) and Oregon ash (*Fraxinus latifolia*) (USFWS 2010).

Fire suppression resulting in encroaching native oaks and ash trees that shade popcornflower and reduced gene flow due to habitat fragmentation are considered to be other threat factors (USFWS 2010).

Cattle grazing was once considered to be a threat, due to loss of several populations in small livestock pastures (USFWS 2003), but from more recent observations, popcornflower is thought

to be compatible with several different types of grazing practices (Friedman 2015, pers. comm.). One of the largest documented populations occurs in a pasture grazed yearlong by both horse and cattle (USFWS 2010).

Climate Change

The Service believes climate change has the potential to exacerbate some existing threats or stresses such as the potential for increased habitat loss due to increased variability in precipitation (McLaughlin *et al.* 2002), increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999) which may exacerbate effects due to drought, and habitat shifts due to changes in precipitation. Changes to vegetation structure due to variable precipitation and temperature cycles could favor faster growth of non-native invasive plants and have the potential to result in encroachment of suitable rough popcornflower wet meadow habitat. These potential impacts may affect the environmental baseline for rough popcornflower and a general overview of these potential effects is provided in Appendix D. Although it appears likely that rough popcornflower could be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. However, the PRMP provides measures that will ameliorate these impacts within the BLM's NBHMA ACEC and which should provide for the long term persistence of rough popcornflower where it occurs on BLM managed land. In addition, the Rare Plants and Fungi Management Direction in the PRMP, will ensure that natural processes, native species composition, and vegetation structure within plant population sites are maintained or restored, in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, maintaining water flow to wetlands, and planting or seeding native species. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including wetlands and natural meadows. These measures will increase the ability of rough popcornflower to persist and recover in the face of climate change effects within BLM lands.

Recovery Measures for Popcornflower

Of the eleven populations of popcornflower currently protected from development, six meet recovery criteria (Amsberry 2014, pers. comm.). One robust plant population is on land owned and managed by Douglas Soil and Water Conservation District. Two occur on ODOT right-of-ways, and two occur on land managed by TNC at the Popcorn Swale Preserve. One population, estimated to have nearly 8,000 plants, occurs on the City of Sutherlin's Red Rock Park (USFWS 2009). Two populations were reintroduced on Roseburg BLM land prior to listing; two additional populations were reintroduced on ODOT land, and one was reintroduced on County land at the Orenco Ponds mitigation site in 2013.

Inventories for new and known populations of popcornflower were conducted throughout the species range in 2005 and 2014 by ODA (Amsberry 2014, pers. comm.). Documentation of the distribution and abundance of popcornflower began in 1995 and has continued annually at most sites in most years; the exceptions are 2001 for BLM populations and 2008 to 2011 for TNC populations.

ENVIRONMENTAL BASELINE – ROUGH POPCORNFLOWER

There are no naturally-occurring populations of rough popcornflower on BLM-administered lands. The ODA, in cooperation with the BLM, planted three sites within the North Bank Habitat Management Area (NBHMA) ACEC sporadically from 1998 to 2006. One of these populations, Westgate, is thriving, has expanded to fill the potential habitat within the area, and meets recovery criteria as a recovery reserve in quantity and density. The Westgate Reserve is one of the most robust populations of rough popcornflower throughout the range of the plant. The most recent population estimate at the reserve was 7,070 plants (Brown 2016, pers. comm.). The second site, Soggy Bottoms, is still extant; however, the number of plants has declined drastically over the years, likely due to a change in the site's hydrology, and thus does not meet criteria as a recovery reserve. The BLM planted additional plants adjacent to the original site in 2006. The third population, powerline, occurs in marginal habitat that was too dry for the species, and has since become extirpated. It is unlikely that the species still occurs there. A fourth population is planned for introduction in 2017, at the NBHMA at a location that appears to meet hydrology conditions necessary to support a large-sized population and have potential to meet reserve quantity and density criteria.

The BLM's Roseburg District Office manages the two extant populations at the NBHMA ACEC through protective provisions under the Act. BLM and ODA have conducted annual population censuses and reproductive assessment evaluations since 2001. All extant populations are included in an area-wide management plan for the NBHMA. The management direction includes recommendations for invasive weed control and allows for the potential to introduce grazing to this site. BLM routinely enacts area-wide invasive plant control efforts. Threats to the introduced populations are overcrowding from invasive plants and loss of hydrology. Of the 37 known patches, only two occur, or five percent on BLM land; although one of the six recovery level populations is part of the action area. The relevance of the PRMP in the action area to the species as a whole is therefore slight, but not insignificant.

EFFECTS OF THE ACTION TO ROUGH POPCORNFLOWER

Although several resource programs under the PRMP have the potential to adversely affect the rough popcornflower, the BLM (2016a, pp. 158) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the rough popcorn flower under those programs except where necessary for the conservation of the species. The specific measures are:

1. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*

- *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
 - *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
 - *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives;*
2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*
- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*
3. *Invasive Species (BLM, 2016a, p. A-36), which includes the following management direction:*
- *Implement measures to prevent, detect, and rapidly control new invasive species infestations.*

Absent the above constraints, some resource programs under the PRMP would have the potential to adversely affect the rough popcornflower depending on how the BLM implements the particular program in areas occupied by this species. For example, individual management actions within the ACEC may have the potential to injure or kill individual plants while the plants are above ground, but these actions are designed to protect and maintain the species on the site.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the rough popcornflower to an extent that is compatible with the conservation of this species. This is because the measures described above would require pre-project surveys for rough popcornflower and preclude implementation of future activities under the PRMP that may affect rough popcornflower that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

The management direction described above has a high potential to protect and restore rough popcornflower habitat, maintain known populations, and facilitate surveys to discover and protect additional populations of this species prior to implementation of PRMP-associated management actions.

The three rough popcornflower known sites in the action area are in the proposed North Bank Habitat Management Area ACEC. This ACEC would be managed to maintain, enhance or restore rough popcornflower at these locations.

The Service has published a recovery plan for the rough popcornflower (USFWS 2003). The recovery plan provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include: (1) protect habitat to be included in reserves; (2) improve management of existing sites; and (3) evaluate techniques to reduce competition from native and nonnative species (USFWS 2003, p28-31). This is further defined as permanent reduction or elimination of the threats and application of appropriate and adaptive management to ensure species survival and recovery.

Although the effect on rough popcornflower of such losses has the potential to be adverse, the Service concludes that implementation of the PRMP has a high potential to result in the retention, management, enhancement and augmentation of two existing known populations of this species within the action area (which is ~14 percent of the known species' populations), along with the establishment of new populations. Such potential effects would be consistent with the rough popcornflower recovery plan (USFWS 2003, p. 26) and are sufficient to positively contribute to the recovery needs of the species on BLM lands within the action area.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon.

The potential exists for rough popcornflower populations to occur on non-federal lands that are interspersed with BLM lands within the ownership pattern that is characteristic of the O&C lands of Oregon. On timber lands interspersed within the action area the Service is not aware of any rough popcornflower habitat, although it is likely surveys have not been conducted in most or all cases. The Service has no information to indicate that changes in the management of any potential rough popcornflower populations from the current practices which have produced potential populations on non-federal lands within the action area is reasonably certain to occur. Therefore, we anticipate that potentially existing populations on non-federal land within the action area are likely to remain at about current levels.

CONCLUSION

After reviewing the current status of the rough popcornflower, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service’s biological opinion that the PRMP is not likely to jeopardize the continued existence of the rough popcornflower.

The key basis for this conclusion is the three PRMP resource programs above and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on rough popcornflower to an extent that is compatible with the conservation of this species. There may be potential adverse effects associated with unknown populations and on non-federal lands, if they occur, where habitat conditions may not be maintained. The proposed management of these known populations on BLM lands is expected to improve the status and condition of the overall population by maintaining and increasing rough popcornflower’s viability without restricting the species’ range. The Service expects that improvements in these populations are likely to contribute positively to the recovery needs of the species within the action area. This is not likely to jeopardize the species because under the PRMP the BLM will protect, maintain and enhance all known and newly discovered populations within the action area which is expected to provide a well-distributed and robust meta-population within the action area. On non-federal lands within the action area we do not anticipate any significant change in potential populations from baseline levels.

VERNAL POOL FAIRY SHRIMP

STATUS OF THE SPECIES - VERNAL POOL FAIRY SHRIMP

Listing

The Service listed the vernal pool fairy shrimp (fairy shrimp) as a threatened species on September 19, 1994, along with three other fairy shrimp species, primarily due to the present or threatened destruction, modification, or curtailment of their habitat or range (USFWS 1994). The vernal pool fairy shrimp has a recovery priority number of 2C (based on a 1-18 ranking system where 1 indicates the highest recovery priority and 18 the lowest priority), which signifies that the species is subject to a high degree of threat, but also has a high potential for recovery (USFWS 2007).

Species Description

The vernal pool fairy shrimp are aquatic members of the Crustacean order Anostraca in the Branchinectidae family (USFWS 1992). They are endemic to ephemeral freshwater habitats, such as vernal pools and swales. The fairy shrimp is a thin “shrimp like” invertebrate that ranges in size from 10.2 to 25.4 mm (0.4 to 1.0 inch) (Eng *et al.* 1990).

Fairy shrimp have delicate elongate bodies which are encased in a translucent shell, which can be whitish or dusky colored. They have large stalked compound eyes, no carapace, and 11 pairs of orange-colored swimming legs. Fairy shrimp swim or glide gracefully upside down by means of complex beating movements of their legs that pass in a wave-like anterior to posterior direction. Fairy shrimp have two pairs of antennae. The second pair of antennae in the adult females is cylindrical and elongate, but the males’ antennae are greatly enlarged and specialized for clasping the females during copulation. The females carry the fertilized eggs in a discernible oval or elongate ventral brood sac.

The fairy shrimp is endemic to California and the Agate Desert of southern Oregon in Jackson County. Of the federally-listed vernal pool crustaceans, this fairy shrimp has the widest geographic range, but it is seldom abundant where found, especially where it co-occurs with other species (Eng *et al.* 1990; Eriksen and Belk 1999).

Life History and Habitat Requirements

Vernal pool fairy shrimp have an ephemeral life cycle and exist only in vernal pools or vernal pool-like habitats; the species does not occur in riverine, marine, or other permanent bodies of water. They are ecologically dependent on seasonal fluctuations in their habitat, such as absence or presence of water during specific times of the year, duration of water, and other environmental factors including specific pH levels, salinity, temperature, and quantities of dissolved oxygen. Water chemistry is one of the most important factors in determining the distribution of fairy shrimp (Belk 1977). Roughly 80 percent of observations of the shrimp are from vernal pools (Helm 1998; Helm and Vollmar 2002). Vernal pools are a prominent feature of the Agate Desert landform in the Agate Desert.

Fairy shrimp inhabit vernal pools with clear to tea-colored water, most commonly in grass-or mud-bottomed swales, or basalt flow depression pools in unplowed grasslands (USFWS 2011). This species has a sporadic distribution within vernal pool complexes wherein the majority of pools in a given complex typically are not inhabited by the species. Fairy shrimp typically are found at low population densities. Eggs (or cysts) are speculated to be dispersed by “hitching a ride” on the legs or feet of wading birds or other animals passing through the pool, or by animals that ingest the eggs. They can mature quickly, with populations persisting in short-lived shallow pools, but they also can persist later into the spring where pools are longer lasting.

Fairy shrimp first hatch at the bottom of the vernal pool when water temperatures reach 10 °C (50 °F) (USFWS 2011). Under optimal conditions they undergo a series of molts before reaching maturity in about 2 1/2 weeks, when they are approximately 5 to 20 mm (0.2 inches to 0.8 inches) in length. They have been reported to live anywhere from 2 to 4 1/2 months, depending on many environmental factors (Eriksen and Belk 1999). These fairy shrimp often disappear early in the season long before the vernal pools dry up. Many species of insects, amphibians, waterfowl and crustaceans prey on fairy shrimp, making this species an important link in the food web, particularly as a supply of energy for migratory birds. Variation in environmental conditions such as precipitation amount, precipitation timing, and temperature, influence vernal pool species including hatching and reproduction of fairy shrimp from year to year (Eriksen and Belk 1999, Helm 1998).

When the pools refill in the same or subsequent seasons some, but not all, of the cysts/eggs may hatch. Fairy shrimp respond to inherent variability in climatic conditions by producing eggs with different diapause characteristics in each clutch. Some hatch after a single wet and dry cycle; while others may go through several wet/dry cycles before they hatch. The egg bank in the soil may also be comprised of individuals from several years of breeding. Fairy shrimp typically produce only one clutch of eggs each year and then dies (Belk 1977).

Rangewide Status and Distribution

At the time they were listed, there were 32 known populations of the fairy shrimp including a total of 178 occurrence records, all within California (USFWS 2007). In 1998, fairy shrimp were subsequently discovered in two distinct vernal pool habitats in Jackson County Oregon. After in depth mapping and assessment surveys were conducted across the Rogue Valley in 1997 and 1998, 17 population centers are known in the Klamath Mountains Vernal Pool Region, corresponding to 17 critical habitat subunits, all located approximately 209.2 km (130 miles) north of the species’ previously known range (ONHP 1999, Service 2006). As of 2007, there were 400 occurrence records posted on the California Natural Diversity Database. However, the number of “occurrence” records overstates the number of separate localities that have been recorded for the shrimp due to re-documenting in areas where the shrimp were already known to exist. Conservatively there are between 178 and 300 occurrences in California and 17 in Oregon.

The range-wide status of the fairy shrimp was assessed in the 2005 Recovery Plan (USFWS 2005b) and the 2007 Five-Year Review (USFWS 2007). In Oregon, status of the Klamath Mountains Vernal Pool Region was assessed in the Recovery Plan for Rogue and Illinois Valley Vernal Pool and Wet Meadow Ecosystems (USFWS 2012). The Service is in the process of

finalizing its most current Five-Year review for fairy shrimp (USFWS 2015). Within the range of the vernal pool fairy shrimp, required surveys for federally-listed crustaceans have increased the recorded observations of the shrimp (USFWS 2007), but no new observations have been documented in Oregon outside of the 17 critical habitat units.

The Recovery Plan delineates a total of 85 core recovery areas that are based on mapped areas of extant vernal pool habitat and that are deemed necessary to recover one or more listed vernal pool species (USFWS 2007). As of 2007, the vernal pool fairy shrimp is presumed to occur in at least one pool in 45 of the core recovery areas. The occurrences are few, small, and/or fragmented. Ten core recovery areas in California have relatively large areas of extant vernal pool habitat where known records of the shrimp are located within or near to the core area (USFWS 2007).

No change in the fairy shrimp listing status was recommended in the Five-Year review (USFWS 2007). Threats such as the loss of vernal pool habitat primarily due to wide spread urbanization were evaluated and have continued to act on the fairy shrimp since 2007 (USFWS 2015). The construction of infrastructure associated with urbanization has also contributed greatly to the loss and fragmentation of vernal pool species. Habitat loss exacerbates the highly fragmented distribution of this species. Direct losses of habitat generally represent an irreversible damage to vernal pools. The alternative and destruction of habitat disrupts the physical processes conducive to functions vernal pool ecosystems. Vernal pool hydrology may be altered by further changes to the patterns of surface and subsurface flow due to the increase in the runoff associated with infrastructure. While there have been continued losses of vernal pool habitat through the various vernal pool regions identified in the 2005 Recovery Plan (USFWS 2005b), to date, no project has posed a level of effect for which the Service issued a biological opinion of jeopardy to fairy shrimp (USFWS 2015).

Threats, Reasons for Listing

In the 1994 listing rule, fairy shrimp were listed as threatened due to habitat loss in the form of human-caused activities, primarily urban development, water supply/flood control activities, and conversion of land to agricultural use. Habitat loss can occur from direct destruction and modification of pools due to filling, grading, disking, leveling, and other activities, as well as modification of surrounding uplands that alters vernal pool watersheds. Although progress has been made in protecting remaining large expanses of land from development in some regions, threats such as habitat loss and fragmentation have continued in every vernal pool region (USFWS 2007).

Vernal pool fairy shrimp occurrences continue to be threatened by conversion of natural habitat for urban and agricultural uses (USFWS 2007). Fragmentation of habitat due to these causes results in isolated occurrences of this species in some core areas. Highly fragmented populations are thought to be highly susceptible to extirpation due to environmental disturbance. If an extirpation event occurs in a population that has been fragmented, the opportunities for natural re-colonization will be greatly reduced due to physical isolation from source populations.

In addition to direct habitat loss, fairy shrimp populations have declined from a variety of activities that degrade existing vernal pools by altering pool hydrology (water regime). Vernal pool hydrology can be altered by a variety of activities, including the construction of roads, trails, ditches, or canals that can block the flow of water into, or drain water away from, the vernal pool complex.

Vernal pool hydrology can also be altered by the nonnative grasses that occur commonly in vernal pool complexes. Nonnative grasses maintain dominance at pool edges, sequestering light and soil moisture, promoting thatch build-up, and shortening inundation periods. Although the mechanism responsible for the change in inundation is not documented, reduction in inundation period is thought to be due to increased evapo-transpiration at the vernal pools (Marty 2005).

Cessation of cattle grazing has been found to exacerbate the negative effects of invasive nonnative plants on vernal pool inundation period, presumably due to the positive effects of grazing on evapo-transpiration rates. The change in vernal pool inundation due to loss of grazing is an emerging threat for vernal pool species (Martz 2006, pers. comm.). Vernal pool inundation has been reduced by 50-80 percent in the southeastern Sacramento Valley when grazing is discontinued (Marty 2005). Vernal pool habitat in southwest Oregon has similar climate and dominance of annual invasive plants as the Sacramento Valley vernal pool habitat; accordingly this could apply to Oregon vernal pools as well (Friedman 2014, pers. comm.). The smaller and shallower vernal pools that were not mowed or grazed were observed to lose their wetland characteristics over relatively short periods of time (Marty 2005). Borgias (2004) considered that mowing or burning, if performed at the appropriate time, like grazing, can reduce annual accumulated thatch growth which stifles native plant seedling emergence and plant recruitment.

Climate Change

Climate change has the potential to adversely affect the vernal pool fairy shrimp through changes in vernal pool inundation patterns and temperature regimes (USFWS 2007). Drought is likely to decrease reproductive output as pools fail to flood, or dry up before reproduction is complete. Weather conditions which cause vernal pool inundation followed by quick drying patterns would promote hatching, but then drying could occur before fairy shrimp are fully developed. This might lead to a long term decline in the resistance and resilience of vernal pool fairy shrimp populations and depletion of the egg banks. Vernal pool crustaceans have developed life history strategies to survive drought periods (USFWS 2007). They are, however, adapted to complete their life cycles within limited temperature ranges and require a minimum length of inundation to reach maturity and reproduce. Although vernal pool fairy shrimp mature relatively fast, they are able to produce more eggs when water conditions are suitable for a longer period of time (see Eriksen and Belk 1999; Helm 1998). Climate change is expected to lead to increased variability in precipitation (McLaughlin *et al.* 2002), and to increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999), which may exacerbate effects due to drought. Although it appears likely that vernal pool fairy shrimp will be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the species. These potential impacts may affect the environmental baseline for vernal pool fairy shrimp and a general overview of these potential effects is provided in Appendix D. However, the PRMP provides measures that will

ameliorate these impacts on Table Rocks ACEC and should provide for the long term persistence of vernal pool fairy shrimp where it occurs on BLM managed land. In addition, the Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including vernal pools. These measures will increase the ability of the vernal pool fairy shrimp to persist and recover in the face of climate change effects within the species occurrences that are subject to BLM management on Table Rocks ACEC.

Vernal Pool Conservation Strategy

The Service recently prepared a recovery plan for the listed species of the Rogue Valley Vernal Pool and Illinois Valley Wet Meadow Ecosystems (USFWS 2012). This recovery plan sets out specific goals, objectives and tasks to direct recovery efforts for Cook's desert parsley and large-flowered woolly meadowfoam and included specific goals, objectives and tasks to direct recovery efforts for the fairy shrimp in Oregon.

Strategies to protect and recover the fairy shrimp rely primarily on preservation and restoration/creation of vernal pool habitat (USFWS 2005b, USFWS 2012). In Oregon, approximately 2,550 acres of vernal pool habitats, including mitigation banks, have been set aside for the fairy shrimp. The fairy shrimp is protected on BLM, USBR, Oregon State lands (such as ODOT managed properties) and receives protection on TNC's Agate Desert, Rogue River Plains, and Whetstone Savannah Preserves (USFWS 2012) in Oregon.

The overall recovery goal for fairy shrimp in this area is to protect 85 percent of the 5,000 acres of remaining suitable vernal pool habitat (4,250 acres) (USFWS 2011). To date, approximately 2,583 acres are currently protected (Table 249) (Friedman 2015, pers. comm.). Management plans for several of these protected areas need to be finalized and implemented. The Klamath Mountain vernal pool region is expected to be a significant contributor to the recovery of fairy shrimp (USFWS 2011). As such, the Service has developed the following guidance for vernal pool conservation in this area:

- A minimum of 4,300 acres of vernal pool habitat should be protected through ownership, management; or conservation easement or agreement.
 - A minimum of 1,500 acres should be protected in the form of conservation banks.
 - Conservation banks should be a minimum of 150 acres. Banks can be composed of discontinuous parcels, with a core parcel of a minimum of 100 acres. Banks smaller than 100 acres can be approved on a case-by-case basis.
 - Conservation banks or bank parcels shall be located within the historical range of the agate-winlo soil type. Existing vernal pool habitat can be conserved, restored and enhanced. Re-creation of vernal pool habitat (re-creation of surface topography where the underlying duripan layer is intact), may be considered on a case-by-case basis.
 - Creation of vernal pools (making vernal pool habitat in upland area) is considered a possible option at this time. Consideration of creating vernal pools will be on a case-by-case basis.
- A minimum of 1,100 acres should be protected in the form of conservation easements or

agreements.

- This conservation effort should be distributed throughout the Agate Desert and Table Rocks area. The arrangement of the protected parcels will allow for a network of protected parcels with a maximum distance of 3.2 km (2 miles) from the nearest parcel.

This includes approximately:

- 180 acres of conservation banks in various stages of establishment,
- 130 acres in conservation easements,
- 550 acres administered by Federal agencies,
- 800 acres in state ownership,
- 660 acres owned by TNC.

Approximately 1,700 acres still need to be protected to meet the recovery objective for the Klamath Mountain Vernal Pool region.

ENVIRONMENTAL BASELINE – VERNAL POOL FAIRY SHRIMP

Habitat for the vernal pool fairy shrimp is considered to be vernal pools as identified in the 2012 GNN as “northern California claypan vernal pool” ecological systems. There are 7,574 acres of vernal pool fairy shrimp habitat within the planning area, of which 307 acres occur on BLM-administered lands. Under the Proposed RMP, all of the designated vernal pool fairy shrimp critical habitat on BLM-administered lands would be within the Table Rocks Outstanding Natural Area/ACEC (ONA/ACEC). The fairy shrimp and its habitat would be among the “relevant and important values” of the ONA/ACEC. Approximately 96 percent of vernal pool fairy shrimp habitat (293 of 307 acres) would be within the Table Rocks ONA/ACEC as well; the 14 acres of habitat that would not be included in the Table Rocks ONA/ACEC would be allocated to the Riparian Reserve under the Proposed RMP.

As of 2007, there are 597,821 acres of vernal pool fairy shrimp habitat and approximately 317 sites across the range of the species. The critical habitat unit (Unit 4) within the PRMP action area totals 307 acres and constitutes two occurrences. Acreage wise, this area is less than 1 percent of the total critical habitat, but it is also 3 percent of all the critical habitat units. The two occurrences constitute approximately 0.06 percent of all occurrences throughout the range. The PRMP actions affecting the action area would have a small relevance to the species as a whole.

EFFECTS OF THE ACTION - VERNAL POOL FAIRY SHRIMP

Although numerous resource programs under the PRMP have the potential to adversely affect the fairy shrimp, the BLM (2016a, pp. 167-171) has included specific management direction under three resource programs and one land use allocation to protect this species. This management direction will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the fairy shrimp under those programs except where necessary for the conservation of the species. These four programs and this management direction are as follows:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61), which includes the following management direction:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*
- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*

Wildlife – Vernal Pool Fairy Shrimp

- *Do not authorize or construct additional discretionary roads and trails within designated critical habitat for the vernal pool fairy shrimp or within vernal pool fairy shrimp habitat.*

2. *The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values*

3. *Hydrology Resource Program (BLM 2016a, p.36), which includes the following management direction:*

- *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.*

4. *Riparian Reserve Program (BLM 2016a, p. 19), which includes the following management direction:*

- *Contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.*

- *Maintain and restore natural channel dynamics and processes and the proper functioning condition of riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimate.*

Absent the above constraints, several resource programs under the PRMP would have the potential to adversely affect fairy shrimp in areas occupied by this species. For example, Lands, Realty and Roads has the potential to fill in vernal pools if roads were built in occupied habitat, killing fairy shrimp and modifying the vernal pools they rely on. OHV use has the potential to crush individuals and contaminate vernal pool hydrology. However, under the PRMP's management direction, BLM would manage these resource programs to avoid these adverse effects to the fairy shrimp unless it was necessary for the conservation of the species. Thus, with the above conservation measures, none of these potential adverse effects would be expected to occur under the PRMP because of the constraints on activities noted in the Wildlife, Hydrology, ACEC and Riparian Reserve management directions above.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on vernal pool fairy shrimp critical habitat to an extent that is compatible with the conservation of this species. This is because the measures described above would preclude implementation of future activities under the PRMP that may affect fairy shrimp critical habitat that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

Implementation of the management directions described above has the potential to maintain, enhance, and restore fairy shrimp populations on BLM lands within the action area. Such an outcome underlies the basis for which the Table Rocks ACEC will be designated under the PRMP. Implementation of the management direction described above will insure that: vernal pools will be protected from OHV use and road building; cattle will not graze in vernal pool habitats altering the water quality and chemistry; and no actions that would adversely affect the vernal pool fairy shrimp would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

The ACEC resource program requires the implementation of "activities as necessary to maintain, enhance, or restore relevant and important values" which has the potential to include controlling invasive plant species. This can cause disruption of vernal pools, and therefore fairy shrimp, due to humans walking in and around the pools. This can potentially alter water quality

and potentially result in the crushing of fairy shrimp. Reducing Wildfire Risk and Severity could impact water quality if conducted through controlled burning or grazing, or impact individual shrimp if conducted through manual reductions in the fuel base. The role of a recovery plan is to provide a roadmap of recommended actions the Service believes necessary to conserve and recover the listed species. The vernal pool fairy shrimp recovery plan (USFWS 2012 VPFS) identifies recovery actions, including protect and restore fairy shrimp habitat, establish new conservation preserves, assist in establishment of new populations, and develop inoculation techniques. Some aspects of these measures have the potential to cause adverse effects to the fairy shrimp, but they are considered necessary for the conservation of the species. Considering this information and based on the management direction in the PRMP, the Service concludes that all actions to be implemented by the BLM under the PRMP that may have the potential to adversely affect the fairy shrimp will be consistent with the recovery plan and will be “necessary for the conservation of the species.” Implementation of such actions will have the potential to improve the habitat and population condition of fairy shrimp in the action area over the long-term and to move the species’ condition closer to recovery.

Non-federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon.

The potential exists for vernal pool fairy shrimp populations to occur on non-federal lands that are interspersed with BLM lands within the checkerboard ownership pattern characteristic of the O&C lands of southwest Oregon. There are known populations on lands managed by ODOT and Oregon Department of Fish and Wildlife, however these populations are disjunct from, and are not interspersed with, BLM lands in a manner such that they are within the action area. The Service has no information to indicate that a departure of management of non-federal lands within the action area from what has occurred in the past is reasonably certain to occur. Therefore, we expect populations on these lands to remain about the same as the baseline populations. Therefore, the Service does not anticipate that activities on non-federal lands within the action area will change fairy shrimp numbers, reproduction or distribution from baseline conditions.

CONCLUSION

After reviewing the current status of the vernal pool fairy shrimp, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service’s biological opinion that the PRMP is not likely to jeopardize the continued existence of the fairy shrimp.

The key basis for this conclusion is the BLM’s explicit management direction under the PRMP to not approve, fund, or implement actions that would adversely affect the fairy shrimp, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule and when the action is

necessary for the conservation of the species. While there is a potential under this management direction for BLM conservation actions that may have short-term adverse impacts to the fairy shrimp, the long-term effects are expected to be beneficial and support the species' recovery. Activities on non-federal lands within the action area are not expected to change fairy shrimp populations or habitat conditions from baseline conditions.

STATUS OF CRITICAL HABITAT – VERNAL POOL FAIRY SHRIMP

Critical habitat for fairy shrimp, along with 14 other vernal pool species, was originally designated in a final rule published on August 6, 2003 (USFWS 2003). A revised final rule for critical habitat, with a re-evaluation of non-economic exclusions, was published in 2005 (USFWS 2005a). Administrative revisions with species-by-unit designations were published on February 20, 2006, providing 35 critical habitat units for fairy shrimp totaling 597,821 acres in Oregon and California (USFWS 2006). The Oregon units occur approximately 201.2 km (125 miles) north of the nearest unit designated for this species in California. The Service identified critical habitat areas essential to the conservation of fairy shrimp to reflect the species geographic distribution and varying habitat types and species associations across its range.

In Oregon, 7,574 acres of vernal pool habitat were designated as critical habitat for fairy shrimp, all in Jackson County. These habitats were selected due to the high probability of long term sustainability of the function and habitat value, based on current biological and physical conditions present at the site. Approximately 80 percent of currently existing vernal pool habitat is contained within designated critical habitat for fairy shrimp.

Four critical habitat units in Oregon, along with 29 units in California, are designated as essential to the conservation of fairy shrimp. The Oregon units are comprised of 7,574 acres in Jackson County. These units occur approximately 125 miles north of the nearest unit designated for this species in California. The designated critical habitat areas reflect the species geographic distribution, varying habitat types and species associations across its range. Maintaining fairy shrimp across their full geographic distribution would make the species less susceptible to environmental variation or negative impacts associated with human disturbances or natural catastrophic events across the species entire range at any one time.

Critical Habitat Units

The following critical habitat unit descriptions are taken from the Service's final rule designating critical habitat for vernal pool species in California and southern Oregon (USFWS 2003):

Unit 1A, B, C, D, E, F, and G, North Agate Desert Unit, Jackson County (2,130 ac)

This unit consists of seven subunits, all located to the north of Little Butte Creek. This unit represents the northern limit of the species' distribution. It is of sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat, and is separated from the nearest other unit designated for Oregon, Unit 4, by over two miles. Three of the subunits are west of the Rogue River, and the remaining four are to the east. All but one of these subunits is located to the south of U.S. Route 234 (Sam's Valley Highway).

The one remaining unit is located to the east of the Rogue River, about 1.5 miles north of the confluence with Reese Creek.

Unit 2A, B, C, D, and E, White City East Unit, Jackson County (2,251 ac)

This unit consists of five subunits, located east of U.S. Route 62 (Crater Lake Highway) and south and southeast of Dutton Road. This unit provides the easternmost extent of the species' range in Oregon. It represents a significant component of the species' original range in the State and is of a sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat. The largest and easternmost of the subunits occurs just to the east and north of Agate Lake. It is separated by more than 1 mile from Unit 3, White City West, and by approximately 3.5 miles from the North Agate Desert Unit.

Unit 3A, B, and C, White City West Unit, Jackson County (2,301 ac)

This unit consists of three subunits, located west of Agate Road, south of the Rogue River, and east of Bear Creek. This unit contains the least fragmented intact examples of the original Agate Desert mounded vernal pool grassland habitat. It is of sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat; it is separated from the White City East Unit by more than one mile and from the Table Rocks Unit by over one and a half miles. Taken together, the designated Agate Desert units (Units 1–3) comprise a functional vernal pool complex consisting of vernal pools, mounded grassland and associated uplands, where natural processes, including connectivity, function within or near the natural range of variability. Each of the three designated Agate Desert units is essential to the conservation of vernal pool fairy shrimp in the Agate Desert area.

Unit 4A and B, Table Rocks Unit, Jackson County (892 ac)

This unit consists of two subunits, located on two flat-topped mesas known as Upper and Lower Table Rocks, situated north and west of the Rogue River. These rimrock features are remnants of ancient lava flows that filled portions of the Rogue River nearly 10 million years ago. Subsequent erosion of softer geologic layers has left these harder andesite (volcanic rock) formations rising some 800 feet above the present Rogue Valley. Vernal pools on the Table Rocks differ from those of the Agate Desert, in that they are formed over an impervious layer of bedrock. This unit represents a unique habitat for vernal pool fairy shrimp in Oregon. The Table Rocks Unit is disjunct from the North Agate Desert Unit by over 2 miles, and from the White City West Unit by approximately 1.5 miles.

The vernal pool habitat within these four units was selected based on information provided by a wetland function and values assessment and habitat integrity analysis completed in 1999. Information describing the physical (*i.e.*, parcel size, presence of intact hydrology) and biological (*i.e.*, species diversity, presence and composition of native vegetation) condition of the vernal pool habitat, species inventory information detailing the presence fairy shrimp, Cook's desert-parsley and meadowfoam, and parameters describing the potential long term sustainability of habitat (defensibility of the parcel, ownership, and positioning of the parcel relative to nearby habitat parcels) was used to identify specific parcels for inclusion as critical habitat.

The Service cannot quantify in any meaningful way exactly what proportion of each critical habitat unit may actually be occupied by the fairy shrimp (USFWS 2011). Therefore, areas of unoccupied habitat are probably interspersed with areas of occupied habitat in each unit. The inclusion of unoccupied habitat in critical habitat units reflects the dynamic nature of the habitat and the life history characteristics of the fairy shrimp. Unoccupied areas provide areas into which populations might expand, provide connectivity or linkage between groups of organisms within a unit, and support populations of pollinators and seed dispersal organisms. Both occupied and unoccupied areas that are designated as critical habitat are essential to the conservation of the species.

The Physical and Biological Features

The following two PBFs of designated critical for fairy shrimp are:

- 1) Vernal pools, swales, and other ephemeral wetland features of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for the fifteen species to complete their life cycle.
- 2) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands when taken together form hydrologically and ecologically functional units called vernal pool complexes. These features contribute to the filling and drying of the vernal pool, maintain suitable periods of pool inundation, and maintain water quality and soil moisture to enable the fifteen vernal pool species to carry out their lifecycles (USFWS 2006).

Conservation Measures

Table 249 provides a summary of efforts to protect, conserve or restore fairy shrimp critical habitat by CHU and ownership; and the type of efforts underway. CHU #1, at the present time, contains 100 acres benefiting from a conservation easement between TNC and a private landowner. CHU #2, #3 and #4 have varying amounts of habitat protected by current ownership or land use restrictions. Approximately 31 designated critical habitat acres within CHU #2 and 14 acres within CHU #3 are being restored, enhanced, and conserved under the terms and conditions of various wetland fill and removal permits, pursuant to section 404 of the Clean Water Act.

As described in the vernal pool critical habitat description section above, the 7,574 acres of vernal pool habitat designated as critical habitat in Oregon was selected due to the high probability of long term sustainability of the function and habitat value, based on current biological and physical conditions present at the site.

Approximately 2,300 acres of fairy shrimp critical habitat are protected through ownership or conservation easement by Federal, State or municipal agencies or TNC, or as compensatory mitigation for wetland impacts associated with the filling of vernal pool habitat within the Agate Desert area (Table 249).

The Service is working with the BLM, USBR, Oregon Department of Fish and Wildlife (ODFW) and ODOT to finalize management plans for these areas which will provide more

protections for listed species and their associated habitats. Species and habitat surveys, wetland function and value assessments and restoration efforts are currently underway on these land parcels as part of efforts to conserve and protect critical habitat and the associated PBFs.

Table 249. Amount of vernal pool fairy shrimp critical habitat receiving protective measures, by CHU and type of protective measure.

Unit	Size (acres)	Acres Protected	Type of Protection
CHU 1	2,130	350	-100 acre TNC conservation easement -250 acre Wildlands Conservation Bank
CHU 2	2,251	196	-34 acres protected as compensatory mitigation under section 404 of the CWA -154 acres managed by USBR -8 acres managed by ODOT
CHU 3	2,301	1,168	-197 acres owned by TNC -720 acres managed by ODFW with final management plan -36 acres protected as compensatory mitigation under section 404 of the CWA -8 acre ODOT bank
CHU 4	892	892	-Managed by BLM and TNC, management plans under consideration
Total	7,574	2,606	

Climate Change – Critical Habitat

Climate change has the potential to adversely affect vernal pool fairy shrimp critical habitat through changes in vernal pool inundation patterns and temperature regimes (USFWS 2007). Drought is likely to decrease reproductive output as pools fail to flood, or dry up before reproduction is complete. Weather conditions which cause vernal pool inundation followed by quick drying patterns would promote hatching, but then drying could occur before fairy shrimp are fully developed. This might lead to a long term decline in the resistance and resilience of vernal pool fairy shrimp populations and depletion of the egg banks. Vernal pool crustaceans have developed life history strategies to survive drought periods (USFWS 2007). They are, however, adapted to complete their life cycles within limited temperature ranges and require a minimum length of inundation to reach maturity and reproduce. Although vernal pool fairy shrimp mature relatively fast, they are able to produce more eggs when water conditions are suitable for a longer period of time (see Eriksen and Belk 1999; Helm 1998). Climate change is expected to lead to increased variability in precipitation (McLaughlin *et al.* 2002), and to

increased loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999), which may exacerbate effects due to drought. Although it appears likely that vernal pool fairy shrimp critical habitat will be adversely affected by long term consequences of climate change, we are not able to specifically quantify the magnitude of effects to the habitat. However, the PRMP provides measures that will ameliorate these impacts on Table Rocks ACEC and should provide for the long term persistence of vernal pool fairy shrimp critical habitat where it occurs on BLM managed land. For example, the ACEC Resource Program (BLM 2016a, p. A33), in the PRMP, will implement activities as necessary to maintain, enhance, or restore relevant and important values. The Wildlife resource program (BLM 2016a, p. A54) includes managing naturally occurring special habitats to maintain their ecological function, including vernal pools. These measures are expected to enable vernal pool fairy shrimp critical habitat to persist and recover in the face of climate change effects within the area managed by the BLM.

ENVIRONMENTAL BASELINE – VERNAL POOL FAIRY SHRIMP CRITICAL HABITAT

There are 7,574 acres of vernal pool fairy shrimp critical habitat within the planning area, of which, 307 acres occur on BLM-administered lands in CHU 4. Under the PRMP, all of the designated vernal pool fairy shrimp critical habitat on BLM-administered lands would be within the Table Rocks ONA/ACEC. The fairy shrimp and its habitat would be among the “relevant and important values” of the ONA/ACEC. Approximately 96 percent of vernal pool fairy shrimp critical habitat (293 of 307 acres) would be within the Table Rocks ONA/ACEC as well; the 14 acres of critical habitat that would not be included in the Table Rocks ONA/ACEC would be allocated to the Riparian Reserve under the Proposed RMP.

Recreational use and encroachment by invasive non-native plants threaten fairy shrimp critical habitat on Table Rocks. Under the Proposed RMP, the BLM livestock grazing would not be authorized in the ONA/ACEC.

As of 2007, there are 35 CHUs for fairy shrimp totaling 597,821 acres across the range of the species. Within CHU 4, 307 acres occur within the PRMP action area on Table Rocks. Acreage-wise, this area represents less than 1 percent of the total critical habitat, but it also constitutes 3 percent of all the critical habitat units. The PRMP actions affecting the action area would have a small relevance to the species as a whole.

EFFECTS OF THE ACTION - VERNAL POOL FAIRY SHRIMP CRITICAL HABITAT

Although several resource programs under the PRMP have the potential to adversely affect 422 acres of vernal pool fairy shrimp critical habitat, the BLM (2016a, pp. 168) has included specific measures to protect this habitat. These measures will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the vernal pool fairy shrimp critical habitat under those programs except where necessary for the conservation of the species. The specific measures are:

1. *The Wildlife Resource Program (BLM 2016a, p. A-54-A-61), which includes the following management direction:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*
- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. Do not authorize or construct additional discretionary roads and trails within designated critical habitat for the vernal pool fairy shrimp or within vernal pool fairy shrimp habitat.*

Wildlife – Vernal Pool Fairy Shrimp

- *Do not authorize or construct additional discretionary roads and trails within designated critical habitat for the vernal pool fairy shrimp or within vernal pool fairy shrimp habitat.*
2. *The Area of Critical Environmental Concern (ACEC) Resource Program (BLM 2016a, p. A33), which includes the following management direction:*
 - *Implement activities as necessary to maintain, enhance, or restore relevant and important values; and*
 3. *Hydrology Resource program (BLM 2016a, p.36), which includes the following management direction:*
 - *Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.*

This management direction would have the potential to adversely affect vernal pool fairy shrimp critical habitat depending on how the BLM implements the particular actions.

However, based on our consideration of the above management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures

will constrain potential adverse effects of PRMP-associated resource programs on vernal pool fairy shrimp critical habitat to an extent that is compatible with the conservation of this species. This is because the measures described above would preclude implementation of future activities under the PRMP that may affect fairy shrimp critical habitat that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities; and
- Would be inconsistent with maintaining, enhancing, or restoring relevant and important values.

Implementation of the management direction described above has the potential to maintain, enhance, and restore vernal pool fairy shrimp critical habitat PBFs on BLM lands within the action area. Such an outcome underlies the basis for which the Table Rock ACEC will be designated under the PRMP because the PBFs of fairy shrimp critical habitat match the habitat needs of the species, which is one of the relevant and important values for which this ACEC will be designated (BLM 2016c, p.1282). Implementation of the management direction described above will insure that: vernal pool fairy shrimp habitat will be protected from noxious weed encroachment or inappropriate silvicultural activities; and no actions that would adversely affect fairy shrimp would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule.

The ACEC resource program requires the implementation of “activities as necessary to maintain, enhance, or restore relevant and important values;” such activities can include mowing non-native annual grasses to permit more native vegetation to occupy vernal pool habitat and using controlled burns to reduce non-native thatch and allow for native plants to seed, germinate and grow as necessary to reproduce. Some aspects of these measures have the potential to cause adverse effects to vernal pool fairy shrimp critical habitat, but are consistent with the critical habitat rule and recovery plan and are considered necessary for the conservation of the species.

The management direction described above has a high potential to protect and restore vernal pool fairy shrimp critical habitat PBFs. Based on our consideration of the above three programs and their management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on vernal pool fairy shrimp critical habitat to an extent that is compatible with maintaining the value of the critical habitat for the conservation of the species. For example, vernal pools, swales, and other ephemeral wetland features of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for vernal pool fairy shrimp to complete its life cycle (PBF 1) and the geographic, topographic, and edaphic features that support hydrologically interconnected pools would be maintained (PBF 2).

The Service has published a recovery plan for the fairy shrimp (USFWS 2012). The recovery plan provides recommended actions that the Service believes will result in the conservation and

recovery of this species and, in turn, the PBFs of vernal pool fairy shrimp critical habitat. The development of future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. For example, provisions of the recovery plan include (USFWS 2010, p. IV-38), protect and restore vernal pool fairy shrimp habitat, develop habitat management plans, and identify and prioritize areas of historically occupied habitat with potential suitable habitat for restoration and management of vernal pool fairy shrimp.

Non-federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of Oregon.

The Service is not aware of any non-federal land properties adjacent to the BLM lands that contain vernal pool fairy shrimp critical habitat. There is vernal pool fairy shrimp critical habitat on land managed by the ODOT and ODFW, however these lands are disjunct from, and are not interspersed with, BLM lands in a manner such that they are within the action area. Because no vernal pool fairy shrimp critical habitat occurs on adjacent lands we do not anticipate effects to vernal pool fairy shrimp critical habitat from activities on non-federal lands within the action area.

CONCLUSION

After reviewing the current status of the vernal pool fairy shrimp critical habitat, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service’s biological opinion that the PRMP is not likely to adversely modify vernal pool fairy shrimp critical habitat.

The key basis for this conclusion is the three PRMP resource programs and their associated measures that will apply to all PRMP resource programs and will constrain potential adverse effects of PRMP-associated resource programs on fairy shrimp critical habitat to an extent that they are compatible with the conservation of this species. The proposed management of critical habitat on BLM lands is expected to improve habitat conditions and in turn will maintain and increase fairy shrimp viability without restricting the species’ range. The Service expects that improvements to this habitat are likely to contribute positively to the recovery needs of the species within the action area. This is not likely to adversely modify fairy shrimp critical habitat because under the PRMP the BLM will not diminish the value of critical habitat for the conservation of the species.

WESTERN SNOWY PLOVER

STATUS OF THE SPECIES - WESTERN SNOWY PLOVER

Legal Status

The Pacific coast population of the western snowy plover (*Charadrius nivosus nivosus*) was federally listed as threatened on March 5, 1993, in California, Oregon, and Washington (USFWS 1993). The snowy plover is defined as those individuals nesting adjacent to tidal waters within 80 km (50 miles) of the Pacific Ocean, including all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries and coastal rivers of the United States and Baja California, Mexico (USFWS 1993, p. 12864 and 12874). Primary threats to the species included loss and modification of habitat resulting from European beachgrass (*Ammophila arenaria*) encroachment and human development, extensive recreational activity in snowy plover habitat, and predation exacerbated by human disturbance. A final recovery plan for the snowy plover was published on September 24, 2007 (USFWS 2007).

Species Description

Taxonomy

The snowy plover is a small shorebird in the family Charadriidae, and was formerly considered a subspecies of the Kentish plover (*C. alexandrinus*). In 2010, the American Ornithologist's Union (AOU), the recognized body on ornithological naming and scientific nomenclature, adopted a proposal to recognize the snowy plover as a species separate from the Kentish plover (AOU 2010, p. 2; Chesser *et al.* 2011, p. 603). The proposal cited genetic, morphological, and behavioral differences between *C. alexandrinus* and *C. nivosus* (Funk *et al.* 2007, pp. 1294-1299; Küpper *et al.* 2009, pp. 843-847). The Kentish plover now consists of Palearctic populations (zoogeographical region consisting of Europe, Africa north of the Sahara, and most of Asia north of the Himalayas), and the snowy plover consists of the populations in South, Central and North America. There are three recognized subspecies, ranging in three distinct areas of the Americas: *C. nivosus nivosus* (all of the continental United States and portions of Mexico), *C. nivosus tenuirostris* (Cuba, Puerto Rico, the Caribbean and the Yucatan Peninsula) and *C. nivosus occidentalis* (South America) (Funk *et al.* 2007, p. 1303; AOU 2010, p. 2).

Physical Description

The snowy plover is a small shorebird weighing between 34 to 58 grams and ranges in length from 15 to 17 centimeters (Page *et al.* 2009, p. 2). It is pale gray-brown above and white below, with a white hindneck collar and dark lateral breast patches, forehead bar, and eye patches. The bill and legs are blackish. In breeding plumage, males usually have black markings on the head and breast; in females, usually one or more of these marking are dark brown. Early in the breeding season a rufous crown may be evident on breeding males, but it is not typically seen on females. In non-breeding plumage the sexes cannot be distinguished because the breeding markings disappear. Fledged juveniles have buffy edges on their upper parts and can be distinguished from adults until approximately July through October, depending on when in the

nesting season they hatched. After this period, molt and feather wear makes fledged juveniles indistinguishable from adults.

Current and Historical Range

The snowy plover breeds from southern Washington, to southern Baja California, Mexico, and winters mainly in coastal areas from southern Washington to Central America (Page *et al.* 2009, p. 3). Historically, six areas supported nesting snowy plovers in Washington (WDFW 1995, p. 3). In recent years they have nested at three sites (Pearson *et al.* 2014, p. 8). In Oregon, the majority of snowy plovers breed at locations between Heceta Head and Cape Blanco (Lauten *et al.* 2015, pp. 39-50), though historic sites at Nehalem Bay State Park and Sitka Sedge State Natural Area have recently become re-occupied by small numbers of snowy plovers since 2015 (OPRD unpublished data). In California, the majority of snowy plovers are present from San Francisco Bay southward (USFWS unpublished data).

Reproductive Biology

Along the west coast of the United States, the breeding period of the snowy plover extends from early March through late September (Page *et al.* 2009, p. 19). Nests consist of a depression in the sand, and are lined with small pebbles, shell fragments, vegetation fragments, and other beach debris (Page *et al.* 2009, p. 20). Clutches are usually comprised of three small eggs with cryptic markings that help to camouflage them on the sand (Page *et al.* 2009, p. 21). Incubation begins at the laying of the final egg and continues for 26 to 31 days, when hatching begins (Warriner *et al.* 1986, p. 24). Snowy plover chicks are precocial, leaving the nest within hours after hatching to search for food (Boyd 1972 p. 53). Adult snowy plovers do not feed their chicks but lead them to suitable feeding areas (Page *et al.* 2009, p. 24). Fledging requires 28 to 33 days (Warriner *et al.* 1986, p. 26). During this time, broods and the attending male may move away from the nesting territory; movement of up to 9.7 km (6 miles) from the natal area has been reported (Castelein *et al.* 2001, p. 10).

Population Structure

Warriner *et al.* (1986, pp. 29-30) reported on the snowy plover's serially polygamous mating system. They suggested that males have slightly higher survival rates than females, estimated the male to female sex ratio to be 1.40:1, and discussed the possibility that female serial polyandry may be a response to this skewed sex ratio. Local hatching success rates (percentage of nests in a study area hatching at least one egg) have been reported to range from 0 to 90 percent (USFWS 2007, p. 14). The fledging success of snowy plovers (percentage of hatched young that reach flying age) varies greatly by location and year, and has ranged between 10 and 75 percent (USFWS 2008, pp. 15-16). The variability of these estimates is most likely due to differences in beach management, recreational pressure, predation pressure, and localized natural events such as high tides coinciding with heavy surf.

Breeding Population (Numbers, Distribution, and Reproduction)

Historical records indicate that nesting snowy plovers were once more widely distributed throughout the listed range. Six areas supported nesting snowy plovers in Washington (WDFW

1995, p. 3) and more than twenty locations were identified in Oregon (ODFW 1994, Figure 2a). Annual surveys of snowy plovers began in Oregon in 1978, with counts prior to Federal listing ranging from a high in 1981 of 139 at 13 sites to a low in 1992 of 30 observed at nine sites (USFWS 2007, p. 25).

In California, coast-wide breeding period surveys in 1977-80 totaled 1,593 adult snowy plovers (USFWS 2007, p. 28). Follow up surveys in 1989 and 1991 produced 1,371-1,376 snowy plovers (USFWS 2007, p. 28). A survey of breeding snowy plovers along the Pacific coast of Baja California, Mexico between 1991 to 1992 found 1,344 adults, mostly at four coastal wetland complexes: Bahia San Quintin (25 percent), Lagunas Ojo de Liebre (28 percent), Laguna San Ignacio (28 percent), and Bahia Magdalena (7 percent) (Palacios *et al.* 1994, p. 491). Annual window surveys are a one-time pass of a single surveyor or team of surveyors through potential snowy plover nesting habitat during May or June, and have been conducted across the U.S. Pacific coast range since 1993 (USFWS 2007, p. J-10 – J-23). The survey does not include the interior (greater than 80 km (50 miles) inland) population of the species. Based on the annual breeding window survey, the estimated 2015 snowy plover was 2,260 (USFWS unpublished data).

Within the recovery plan, the recovery criteria recommend that the snowy plover be maintained at 3,000 breeding birds along the U.S. Pacific coast (USFWS 2007, p. 141). The Washington and Oregon coast populations are intensively monitored throughout the breeding period, with many of the adults and chicks being uniquely color-banded, and the breeding adult population can be estimated based on nesting records and daily observational data. Using these methods, an estimated 449 breeding adults were observed in Washington and Oregon in 2015 (Table 250).

Table 250. Estimated breeding adult population observed in Washington and Oregon (2011 to 2015) (Lauten *et al.* 2015, WDFW unpublished data).

Year	Washington	Oregon	WA/OR combined
2011	31	233	278
2012	33	274	326
2013	43	299	347
2014	41	327	368
2015	75	449	524

The increase in the numbers of snowy plovers observed in recent years has corresponded with intensive management that began at the time of Federal listing (USFWS 2007, pp. 87-127). Integrated predator management is an essential component of snowy plover recovery (USFWS 2007, pp. 90-93, 178-183). Productivity has improved following the implementation of integrated predator management, averaging 1.31 fledglings per male across all Oregon nesting sites from 2004-2014 (Lauten *et al.* 2015, p. 12).

The annual number of young fledged per adult male is an important measure of the reproductive success of the snowy plover. One of the primary recovery criteria is to maintain a yearly average productivity of at least one fledged chick per male in each recovery unit in the last five years prior to delisting (USFWS 2007, p. 141). Males are used in measuring reproductive

success because their population parameters can be estimated with greater certainty than for females (USFWS 2007, p. D-7). In addition, the availability of males limits reproductive success because they are responsible for post-hatching parental care, and females can lay clutches for more than one male (Warriner *et al.* 1986, p. 27-29). Biologists monitored 396 nests in Washington and Oregon in 2014 that fledged a minimum of 304 chicks (Lauten *et al.* 2014b, p. 24; Pearson *et al.* 2015, p. 12). In recent years, the overall number of fledglings per male within Washington and Oregon has come close to or exceeded the recovery goal of 1.0 fledgling per male in Recovery Unit 1 (Table 251).

Table 251. Estimated number of snowy plover chicks fledged per adult male in Washington and Oregon (Lauten *et al.* 2014b, p. 26; Pearson *et al.* 2015, p. 13).

Year	Washington	Oregon
2010	0.57	0.97
2011	1.70	1.61
2012	0.68	1.41
2013	1.04	1.04
2014	1.88	1.68

In addition to Oregon and Washington (Recovery Unit 1), coastal northern California (Del Norte, Humboldt, and Mendocino counties (Recovery Unit 2) and Monterey Bay region (Recovery Unit 4) are two areas in California where snowy plovers are intensively monitored through long-term banding studies.

In northern California, monitoring occurs in Humboldt County at eight locations including: Gold Bluffs Beach, Stone Lagoon, Big Lagoon, Clam Beach, Mad River Beach, Eel River Wildlife Area, Centerville Beach, and Tenmile Beach. The breeding population in northern California increased slightly from 2014 to 2015 (51 to 61 adults), and population size has increased for the sixth consecutive year largely owing to immigrants originating from other Recovery Units (Colwell *et al.* 2015, p. 4). Males fledged 27 chicks in 2015, averaging 0.90 fledged chicks per male, and continuing a pattern of low productivity over the past 13 years (Colwell *et al.* 2015, p. 13), and below the level needed to prevent the population from declining. Snowy plovers nesting on river gravel bars consistently achieved greater fledging success in previous years (3.00 +/- 0.00) relative to those nesting on ocean beaches (0.31 +/- 0.63) (Colwell *et al.* 2010, p. 5). Snowy plovers, however, have not nested on river gravel bars since 2010 (Colwell *et al.* 2015, p. 5), and partially accounts for an overall lower productivity level in northern California.

The Monterey Bay region staff and research associates of Point Blue Conservation Science (formerly Point Reyes Bird Observatory) have monitored nesting snowy plovers annually on the shores of Monterey Bay since 1984 and on small pocket beaches in northern Santa Cruz County since 1988. In 2015, at least 469 snowy plovers nested in the Monterey Bay area (Page *et al.* 2016, p. 5). The 2015 fledging success rate of 1.30 young per male was identical to the 1999-2014 average (Page *et al.* 2016, p. 7).

Population Viability

A population viability analysis was conducted to aid the recovery team in developing recovery criteria for the recovery plan (USFWS 2007, pp. D-1 – D-25). The analysis makes the following conclusions. “Under status quo scenarios, even with intensive management in some areas, the population is almost certain to decline. Without question, ceasing current management efforts (area closures, predator exclosures, and predator control) would be disastrous for the Pacific coast population.... Recovery is plausible. It will require, however, short-term intensive management and long-term commitments to maintaining gains.” These conclusions emphasize the immediate need for intensive management. The most direct means to increase population size is to enhance reproductive success throughout the listed range.

The population viability analysis suggests that reproductive success between 1.2 to 1.3 fledglings per male per year, with adult survival of 76 percent and juvenile survival of 50 percent, provides a 57 to 82 percent probability of reaching a population of 3,000 or more snowy plovers within 25 years (USFWS 2007, pp. D-1 – D-25). Enhancing productivity is critical to population growth. Once the population size criterion is met, a lower rate of productivity can sustain the population (USFWS 2007, p. 141).

Habitat Description

Nesting habitat

The snowy plover breeds primarily on coastal beaches from southern Washington to southern Baja California, Mexico. Snowy plovers nest in depressions in open, relatively flat areas, near to tidal waters but far enough away to avoid being inundated by daily tides. Snowy plovers primarily breed above the high tide line on sandy or pebbly beaches, but may also lay their eggs in existing depressions on harder ground such as salt pan, cobblestones, or dredge tailings (USFWS 2012, pp. 36746-36747). This habitat is variable because of unconsolidated soils, high winds, storms, wave action, and colonization by plants.

Foraging habitat

Snowy plovers typically forage in open areas by locating small invertebrates visually and capturing with their beaks (Page *et al.* 1995, p.12). Deposits of tide-cast wrack such as kelp or driftwood tend to attract certain invertebrates, and so provide important foraging sites for snowy plovers (Page *et al.* 1995, p. 12). Snowy plovers forage both above and below high tide, but not while those areas are underwater. Therefore, foraging habitats consist of open, sandy areas which may contain tide-cast wrack or other vegetative debris to attract prey (USFWS 2012, pp. 36746-36747).

Wintering habitat

Some snowy plovers nesting on the Pacific coast migrate north or south to other Pacific coastal wintering sites, while other stay at their breeding sites year round (USFWS 2006, p. 20610). Snowy plovers winter on many of the beaches used for nesting as well as on beaches where they do not nest including manmade salt ponds and on estuarine sand and mud flats (USFWS 2012,

p. 36746). In Washington, Oregon, and California, the majority of wintering snowy plovers concentrate on sand spits and dune-backed beaches.

In the recovery plan (USFWS 2007, pp. B-1 – B-17), we identified 130 wintering locations that are important for recovery. The snowy plover population has experienced widespread loss and degradation of wintering habitat due to human disturbance, development, and encroachment of introduced European beachgrass (USFWS 2007, pp. 33-45). Small changes in the adult survival rate can have relatively large effects on population stability (USFWS 2007, p. D-13), so the maintenance of quality overwintering habitat is important to conservation (USFWS 2012, p. 36746).

The number of snowy plovers wintering on the Washington coast has increased to approximately 70 birds, which are concentrated at just two locations in Pacific County, Midway Beach and Leadbetter Point (USFWS unpublished data). The number of Oregon locations used by wintering snowy plovers between the Columbia River in Clatsop County, however, has increased to over 20 sites (USFWS unpublished data). The majority of wintering snowy plovers on the California coast are found from Bodega Bay, Sonoma County, southward (USFWS unpublished data). The 2015 winter window survey numbers for Washington, Oregon, and California totals 3,762 individuals (USFWS unpublished data).

Threats

Permanent or long-term loss of nesting habitat through destruction, modification, or curtailment of habitat or range has led to a decline in active nesting areas, as well as an overall decline in the breeding and wintering population. Development has resulted in the loss of many historic snowy plover locations in Oregon. For example, of the more than 20 historic nesting locations listed in the recovery plan (USFWS 2007, p. 24), only ten still support snowy plovers and suitable nesting habitat (Lauten *et al.* 2015, p. 6). Many unoccupied historic locations are located near urban areas or have been developed to promote ATV use or camping.

Colonization of non-native plant species, particularly European beachgrass, has eliminated habitat and continues to threaten the remaining nesting areas. Without treatment (hand pulling, disking, bulldozing, or herbicide application) European beachgrass quickly recolonizes open sand. In addition to losing essential nesting habitat, the constriction of the nesting areas forces birds to concentrate efforts within smaller areas, which increases competition, obscures predators, and increases the likelihood of predation. Natural disturbance, such as inclement weather, have also affected the quality and quantity of snowy plover habitat (USFWS 1993, p. 12872). Poor reproductive success resulting from disturbance by humans and domestic animals and predation are described in detail below.

Pedestrians

Human disturbance, especially recreation in and near snowy plover habitat, has been an ongoing factor affecting snowy plover populations in Oregon and across the range. At South Beach in Newport, for example, the number of snowy plovers declined from 25 in 1969 to five in 1979 to none in 1981 (ODFW 1994, p. 21). During this time South Beach State Park was opened and that habitat became more accessible to people and vehicles (Hoffman 1972, as cited in ODFW

1994, p. 21). Pedestrians can cause both direct and indirect mortality and harassment of snowy plovers.

Snowy plovers respond to pedestrians that approach too closely by flattening their profile and remaining motionless, increasing vigilance behavior, calling, performing distraction displays, flushing, or changing other normal breeding, feeding, and sheltering activities (Page *et al.* 1985, 2009). Snowy plovers that flush may or may not return to the original site or may take several minutes to return depending on age (Montgomerie and Weatherhead 1988), breeding status (Lafferty 2001b, Yasué and Dearden 2006), the activity engaged in (Weston and Elgar 2007), food and habitat availability (Yasué 2006), body condition (Beale and Monaghan 2004, p.1067), and previous disturbance exposure (Page *et al.* 1977, Burger *et al.* 2004) at the time of disturbance. Snowy plovers nesting on beaches that experience low levels of pedestrian traffic may be highly sensitive to human intrusion. Snowy plovers may also flush off nests and stay off nests for much longer periods than snowy plovers nesting on beaches with higher levels of pedestrian traffic. Suspended feeding and the expenditure of energy during a flushing event (*i.e.*, disturbance) may affect both reproduction and survival (Brown *et al.* 2000; Lafferty 2001a).

Snowy plovers have been observed leaving nests in response to pedestrians at distances greater than 200 m (Page *et al.* 1977, Robinson 2008, Muir and Colwell 2010), and incubating birds are often flushed off of nests before they are discovered (Castelein *et al.* 2012). Incubating snowy plovers have been observed leaving their nest up to 84 percent of the time when approached at distances less than 50 m of the nest, and remaining off the nest for up to five minutes following disturbance by pedestrians (Page *et al.* 1977, Lord *et al.* 2001, Colwell *et al.* 2007, Trulio *et al.* 2011, Trulio *et al.* 2012). Return times are significantly greater for humans that remain stationary nearby an active nest, and were more than 60 minutes for similar plover species (Weston *et al.* 2011).

Displacing nesting snowy plovers during incubation for even short periods of time has the potential to expose clutches to lethal levels of thermal stress when the ambient temperature is extreme (Amat and Masero 2004, Yasué and Dearden 2006), or result in nest burial by sand drift during extremely windy weather (Farrar *et al.* 2012). Nests that are not continuously incubated may also take longer to hatch, making the nest and incubating adults vulnerable to predation for a longer period of time.

Human disturbance can also prevent tending parents from brooding chicks, force chicks into suboptimal habitat or adjacent territories, cause chicks to become separated and abandoned from the rest of their brood or tending parent, reduce foraging time, and increase vigilance and predator avoidance behaviors of chicks (Warriner *et al.* 1986, Flemming *et al.* 1988, Loegering and Fraser 1995). Human disturbance, therefore, has the potential to increase the thermoregulatory needs of chicks, particularly during periods of inclement weather, as well as their vulnerability predation (Schekkermann and Visser 2001, Colwell *et al.* 2007). In Nova Scotia, piping plover chicks, a closely related species with similar biological and behavioral traits to snowy plovers, foraged less and were brooded less often when humans were within 160 m (525 feet), and significantly fewer chicks survived in areas with heightened levels of disturbance (Flemming *et al.* 1988). In one California study, three times as many chicks were

lost on weekends and holidays as on weekdays, suggesting that increased recreational activity is linked to increased chick loss (Ruhlen *et al.* 2003).

Snowy plover eggs and young chicks (less than 10 days old, Colwell *et al.* 2007) are small, difficult to detect, and at risk of being inadvertently stepped on by pedestrians, which could result in injury or death (Page *et al.* 1977). Pedestrians have been known to inadvertently step on eggs and chicks, deliberately take eggs from nests, and remove chicks from beaches, erroneously thinking they have been abandoned (USFWS 2007).

Camping and Beach Fires

The effects of camping on the beach are similar to those described for pedestrian traffic and picnicking; however, effects may be increased if people remain in or near breeding areas for extended periods. Beach fires and camping may disrupt incubation and brooding for long periods, potentially causing temporary nest abandonment and increasing the exposure of nearby chicks and eggs to hypothermia. Garbage left behind by campers and abandoned beach fires may attract scavengers such as gulls (*Larus* spp.) and predators such as coyotes, crows, and ravens. Also, human presence near nests may increase predator detection of nests or chicks.

Nighttime collection of wood or other human movement increases the risk of direct mortality or injury from stepping on nests and chicks, which are difficult to see even during daylight hours. Beach fires and camping may be harmful to nesting snowy plovers when valuable driftwood is removed or burned. Occasionally fires escape into nearby driftwood, and the resulting fire suppression activities may disturb and threaten snowy plover nests and chicks.

Prolonged camping and beach fire activities near these areas can potentially impact nests, especially those that are close to the edge of protected areas (compared to those further from camping and beach fire activities). Since broods rarely stay in their nesting area until fledging and may travel along the beach as far as 9.7 km (6 miles) from their natal area (Castelein *et al.* 2001), camping and beach fires could also cause the harassment of feeding or resting snowy plovers, or potentially crush adults and/or their broods.

Climate Change

Our analyses include consideration of ongoing and projected changes in climate. In revising our final rule on critical habitat for the snowy plover (USFWS 2012), we evaluated numerous climate change models of varying scope and scale, and selected those which reflected conditions across the range of the snowy plover. Sea level rise and hydrological changes associated with climate change are having and will continue to have significant effects on the snowy plover and its habitat over the next several decades. Projected loss of snowy plover habitat could range between 20 and 70 percent of the existing habitat (Galbraith *et al.* 2002, pp. 173–183). Areas with steep topography (Northern California to Washington State) with limited beach habitat are expected to have severe losses (Galbraith *et al.* 2002, pp. 173–183). Additionally sea-level rise would cause: (1) Inundation of low-lying areas by high tides; (2) flooding of coastal areas during major storm events, especially near river mouths; (3) acceleration of erosion of coastal bluffs; and (4) a shift in beach profiles, move the position of the mean high water line landward (Huppert *et al.* 2009, p. 285). These potential impacts may

affect the environmental baseline for the western snowy plover and a general overview of these potential effects is provided in Appendix D.

Dog Exercising

Dogs have a disproportionate effect on snowy plovers compared to other sources of recreational disturbance; snowy plovers react sooner, at greater distances, and for longer periods of time (Page *et al.* 1977, Yalden and Yalden 1990, Fahy and Woodhouse 1995, Lafferty 2001a and 2001b, Lord *et al.* 2001, Burger *et al.* 2004, Baudains and Lloyd 2007, Weston and Elgar 2007, Faillace 2010). Unleashed dogs may deliberately chase and kill snowy plovers, or inadvertently trample and destroy nests. Even when not chasing birds, unleashed dogs may traverse a large area of the beach, and have a tendency to move up and down the beach in an exploratory manner making rapid or erratic movements similar in behavior to other natural predators (*e.g.*, coyotes and foxes). Snowy plovers, in kind, respond to dogs as predators and use avoidance behaviors (*e.g.*, flushing) and distraction displays to avoid predation and conceal the location of nests and broods.

Prolonged absences of tending adults related to dog encounters may increase the exposure or access of eggs and chicks to other predators, lethal levels of thermal stress, nest burial by wind-blown sand, permanent separation of chicks from the rest of their brood or tending adult, or result in other adverse effects that ultimately reduce reproductive success. Several studies have reported higher nest failure rates and mortality rates of chicks on beaches where dogs were relatively prevalent compared to beaches with few dogs (Flemming *et al.* 1988, Dowling and Weston 1999, Ruhlen *et al.* 2003, Burger *et al.* 2004, Baudains and Lloyd 2007). Lafferty's (2001b) management model predicted that intense disturbances to snowy plovers could be dramatically reduced by removing dogs.

Driving

Motorized and non-motorized vehicles (including ATVs and off-highway vehicles) on beaches may adversely affect snowy plovers and their habitat. Use of motor vehicles on coastal dunes may be destructive to dune vegetation, especially sensitive native dune plants. Vehicles may affect remote stretches of beach where human disturbance would otherwise be slight if access were limited to pedestrians. The magnitude of this threat varies, depending on level of use and type of terrain covered.

Vehicles can displace and sometimes kill foraging, roosting, brooding, or incubating adult snowy plovers (USFWS unpublished data). Snowy plover adults, chicks and eggs are small, cryptically colored and extremely difficult to detect. Adults and chicks also roost and spend time in sand depressions including tire tracks. Snowy plover adults and older chicks generally respond to approaching sources of danger by moving or flushing away from the source of danger, though young chicks tend to crouch and remain motionless, and nests are placed on the ground. These characteristics create the potential for motorized vehicles to collide with snowy plover adults and chicks, and to crush snowy plover chicks and eggs. Driving vehicles in breeding habitat may cause destruction of eggs, chicks, and adults, abandonment of nests, and considerable stress and harassment to snowy plover family groups (Warriner *et al.* 1986, Stern *et al.* 1990, USFWS 2007). At wintering sites, disturbance from motorized vehicles may harass

snowy plovers and disrupt their foraging and roosting activities, thereby decreasing energy reserves needed for migration and reproduction (USFWS 2007).

Hoopes (1992) found off-road vehicles caused piping plovers to flush or move at an average distance of 40 m (131 feet). Off-road vehicles within 50 m (164 feet) of the birds caused piping plovers to stop feeding 77 percent of the time (Hoopes 1992). Piping plover chicks also respond to some disturbances either by freezing in place or moving very short distances and then freezing until the disturbance passes (Hoopes 1993). Because their behavior patterns and habitat use are similar, we anticipate that snowy plovers would exhibit similar responses to vehicles. Newly emerging, non-motorized recreation vehicles, such as kite buggies, land sailing, and others, are expected to have similar impacts on snowy plovers as motorized vehicles.

Beachcombing and Driftwood Collection/Removal

Driftwood can be an important component of snowy plover breeding and wintering habitat. Driftwood contributes to dune-building and adds organic matter to the sand as it decays (WDFW 1995, USFWS 2007). Additionally, driftwood provides snowy plovers with year-round protection from wind and blowing sand. Often, snowy plovers build nests beside driftwood, so its removal may reduce the number of suitable nesting sites. Driftwood is also used to escape detection by predators. However, too much driftwood can change the open nature of the habitat and large driftwood provides perches for avian predators.

Driftwood removed for firewood or decorative items can result in destruction of nests and newly-hatched chicks that frequently crouch by driftwood to hide from predators and people. Chainsaw noise may disrupt nesting, and vehicles used to haul wood may crush nests and chicks. Removal of driftwood has been documented as a source of nest destruction at Vandenberg Air Force Base where two nests were crushed beneath driftwood dragged to beach fire sites (Persons 1994). Also, driftwood beach structures built by visitors are used by avian predators of snowy plover chicks such as northern harriers and American kestrels, and predators of adults such as merlins and peregrine falcons.

Kite Flying

In a study on snowy plovers, the reaction of snowy plovers to kites “ranged from increased vigilance while continuing roosting in close proximity to the kite flying, to walking or running approximately 10 to 25 m (32.8 to 82.0 feet) away and resting again while remaining alert” (Hatch 1997). Hoopes (1993) found that piping plovers are intolerant of kites. Compared to other human disturbances (*i.e.*, pedestrian, off-road vehicle, and dogs), kites caused piping plovers to flush or move at a greater distance from the disturbance, to move the longest distance away from the disturbance, and to move for the longest duration. Piping plovers responded to kites at an average distance of 85 m (279 feet); moved an average distance of over 100 m (328 feet); and the average duration of the response was 70 seconds.

Biologists believe snowy plovers perceive kites as potential avian predators (Hoopes 1993, Hatch 1997). Kites may disturb snowy plovers when flown near nesting, feeding, or resting areas. Kites can cause adults to flush from nests, leaving eggs exposed extreme temperatures.

Furthermore, the movement of flushed adults may draw the attention of predators to adults or their nest. Kites also may cause adults and broods to spend less time foraging and result in increased energy expenditure, which could result in reduced fitness and delayed ability to fledge.

It is expected that stunt-kites would cause a greater response from snowy plovers than traditional, more stationary kites. Stunt kites include soaring-type, two-string kites with noisy, fluttering tails, which often exhibit rapid, erratic movements, similar to the behavior of falcons or other avian predators. As with kites, it is expected that model airplanes may also have a detrimental impact to snowy plovers because they may perceive them as potential predators (Hatch 1997).

Horseback Riding

Horses can affect nesting and wintering snowy plovers in ways similar to pedestrians. Additionally, horses may trample nests. Snowy plover monitors have documented at least four snowy plover clutches on Morro Spit, California that were destroyed by horses trampling the nests during the 2000 and 2001 breeding periods (Ellison 2001, Persons and Ellison 2001).

Lafferty (2001b) observed snowy plovers' response to people, pet dogs, equestrians, crows and other birds. Observations were made at Devereux Slough in Santa Barbara County, Santa Rosa Island, San Nicolas Island, and Naval Base Ventura County (Point Mugu). This study found that snowy plovers are most frequently disturbed when approached closely (within 30 m (98 feet)) by people and animals. The most intense disturbance (causing the snowy plover to fly away) was in response to crows, followed by horses, dogs, humans, and other birds.

Other Recreational Activities (Picnicking, Near Shore Activities/Surf Sports)

Beach-related recreational activities that are concentrated in one location (*e.g.*, sunbathing, picnicking, sandcastle building, birding, and photography) can negatively affect incubating adult snowy plovers when these activities occur too close to their nests. Recreational activities that occur in the wet sand area (sand sailing) can adversely affect snowy plovers when they disturb snowy plover adults or broods, which feed at the edge of the surf along the wrack line.

Recreational activities that occur in or over deep water (such as the beach- and water-oriented activities of surfing, kayaking, wind surfing, jet skiing, and boating, and the coastal-related recreational activity of hang gliding) may not directly affect snowy plovers; however, they can potentially be detrimental to snowy plovers when recreationists use the beach to take a break from these activities, or as access, exit, or landing points.

Predation

Predation, by a variety of native and nonnative species, has been identified as a major factor limiting snowy plover reproductive success at many Pacific coast sites. Known mammalian and avian predators of snowy plover eggs, chicks, or adults are listed in Table 252. A more detailed description of the range-wide threats to snowy plovers is available in the recovery plan for the species (USFWS 2007).

Table 252. Native and non-native predators known to prey on snowy plover eggs, chicks, and adults (USFWS 2007, Fancher *et al.* 2002, Powell *et al.* 2002).

Native Species	Non-native Species
Gray fox (<i>Urocyon cinereoargenteus</i>)	Eastern red fox (<i>Vulpes vulpes regalis</i>)
Santa Rosa Island fox (<i>Urocyon littoralis santarosae</i>)	Norway rat (<i>Rattus norvegicus</i>)
Coyote (<i>Canis latrans</i>)	Virginia opossum (<i>Didelphis marsupialis</i>)
Striped skunk (<i>Mephitis mephitis</i>)	Domestic and feral dog (<i>Canis familiaris</i>)
Spotted skunk (<i>Spilogale putorius</i>)	Cat (<i>Felis domesticus</i>)
Raccoon (<i>Procyon lotor</i>)	Fire ant (<i>Solenopsis geminate</i>)
California ground squirrel (<i>Citellus beecheyi</i>)	Argentine ant (<i>Linepithema humile</i>)
Long-tailed weasel (<i>Mustela frenata</i>)	
American crow (<i>Corvus brachyrhynchos</i>)	
Common raven (<i>Corvus corax</i>)	
Ring-billed gull (<i>Larus delawarensis</i>)	
California gull (<i>Larus californicus</i>)	
Western gull (<i>Larus occidentalis</i>)	
Glaucous-winged gull (<i>Larus glaucescens</i>)	
Gull-billed tern (<i>Gelochelidon nilotica</i>)	
American kestrel (<i>Falco sparverius</i>)	
Peregrine falcon (<i>Falco peregrinus</i>)	
Northern harrier (<i>Circus cyaneus</i>)	
Loggerhead shrike (<i>Lanius ludovicianus</i>)	
Merlin (<i>Falco columbarius</i>)	
Great horned owl (<i>Bubo virginianus</i>)	
Burrowing owl (<i>Speotyto cunicularia</i>)	
Great blue heron (<i>Ardea herodias</i>)	

ENVIRONMENTAL BASELINE – WESTERN SNOWY PLOVER

Regulations implementing section 7 of the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have undergone section 7 consultations and the impacts of State and private actions which are contemporaneous with the consultation in progress.

The action area is defined within 50 CFR 402 to mean all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. For

the purposes of this consultation, we consider the action area as the areas occupied by snowy plovers and those areas that may provide potential snowy plover habitat on the Oregon coast.

Breeding Habitat (Distribution, Amount and Quality)

Coos Bay North Spit

Since the early 1990s, the Coos Bay North Spit (CBNS) has been a documented, active breeding site. The action area consists of snowy plover areas on South Beach and Habitat Restoration Areas (HRAs) on CBNS and the project area consists of the BLM-administered portion of the spit. Habitat restoration and maintenance activities on CBNS began in 1994, and eventually led to the creation of five adjacent HRAs east of the ocean foredune. One is solely on BLM-administered land (the 1998 HRA West); two are solely on U.S. Army Corps of Engineers (USACE) administered land (South Spoil and the 1994 HRA); and two encompass both USACE and BLM (the 1995 HRA and the 1998 HRA East). Approximately 170 acres have been restored on CBNS, including 72 acres on BLM land and are maintained in a relatively grass-free condition to promote nesting by snowy plovers.

The area referred to as South Beach is approximately 2.5 miles long and is located on the ocean shoreline between the Coos Bay North Jetty and the Federal Aviation Administration (FAA) tower on CBNS. During the nesting season (March 15-September 15) beach restrictions are in effect. Snowy plovers nest in the narrow band of dry sand between the high tide line and the foredune. Management of this beach is shared among three agencies: USACE, BLM and OPRD. The USACE has jurisdiction over approximately one mile of dry sand beach beginning at the North Jetty northward, BLM manages the remaining 1.5 miles of dry sand beach, and Oregon Parks and Recreation Department (OPRD) has a recreational easement along the entire shoreline between extreme low tide and the statutory vegetation line (ORS 390). Because of the overlapping BLM and OPRD jurisdictions, both agencies share some responsibility for recreation impacts on the shoreline. The impacts considered in this opinion are those that are under the discretion of BLM, including maintenance of recreational access from BLM lands and recreation and snowy plover management on BLM lands.

New River ACEC

The action area consists of snowy plover areas located on the New River Spit within the New River ACEC. Management of the New River Spit is shared among two agencies: BLM and OPRD. BLM manages 9.5 miles of dry sand beach within the ACEC, and OPRD has a recreational easement along the entire shoreline between extreme low tide and the median high water line adjacent to Federal lands. As such, both agencies share some responsibility for recreation impacts on the shoreline. During the nesting season (15 March to 15 September), beach restrictions are in effect. These restrictions consist of: beach-driving prohibitions, dry sand closures for pedestrians within the vicinity of nest areas, and prohibitions on entering nesting areas.

New River Spit is a narrow, linear beach, located between the New River and the Pacific Ocean. Throughout their life cycle, snowy plovers will utilize the beach areas on the New River Spit for nesting, foraging or resting. Snowy plovers nest in the narrow band of dry sand between the

high tide line and the river foredune and in breach areas. Snowy plovers have been documented nesting on BLM land west of Storm Ranch since 1981 (Wickham 1981). Habitat restoration and maintenance activities by BLM on the New River Spit began in the winter of 1998. At the time, snowy plovers nested in overwashes across from the Storm Ranch boat ramp north to the mouth of New River. Over time, habitat restoration activities moved southward, lowering the elevation of the spit. The distribution of snowy plover nesting habitat within the New River ACEC varies across years, depending on episodic events that maintain the habitat by storm wave overwash, migration of the river's mouth and periodic (natural or manmade) breaching of the spit. A 50-foot wide vegetative buffer was maintained on the river side of the spit to prevent sediment from washing into New River. By 2005, 120 acres (2.75 miles) were restored on the New River Spit and maintained in a relatively grass-free condition to promote nesting by snowy plovers (Lauten *et al.* 2006, p. 21). Habitat restoration and maintenance ceased in 2006 and began again in 2009. Since 2009, 100 acres have been restored, and are maintained bi-annually to keep them suitable for snowy plovers (BLM 2015).

In 2002, the BLM initiated a long-term breaching project (BLM 2002) to control flooding on adjacent ranch lands and improve river conditions. When a breach is open, it provides a channel through which water and sediment are flushed out of the river channel and into the ocean. Between 2002 and 2006, New River was temporarily breached across the foredune at strategic sites chosen to best improve river function, such as a deeper channel. Three breach sites (Hammond, New Lake, and Croft Lake) are located within the existing snowy plover HRA and a fourth site (Clay Island) is located south of the HRA. Breach sites normally close during the spring, and are generally well armored with a sand berm prior to winter storm events. While the breaches have been effective for flood control on adjacent ranchlands and restoring the river channel, they also contribute to open, sand habitat and feeding areas for the snowy plover along the shoreline bordering the breach itself. Breaching has reduced the area needing treatment by heavy equipment within the HRA. Nesting and brood rearing activities commonly occur on the breach sites (Lauten *et al.* 2015, pp. 14 and 50).

Breeding Population (Numbers, Distribution, and Reproduction)

Coos Bay North Spit

In 2015, 146 individual adult snowy plovers were recorded at CBNS of which 107 nested (Lauten *et al.* 2015, p. 22). Numbers of nests and fledglings continue to increase annually and in 2015, reached their highest levels since listing (Lauten *et al.* 2015, p. 35). Out of the eight core breeding sites in Oregon, CBNS had the highest number of nests (127; average=63) and fledglings (102; average =42) in 2015 (Lauten *et al.* 2015, pp. 26-27).

The success at CBNS is attributed to its relatively remote location on the Oregon coast, and snowy plover management that began in 1990, including: predator exclosures (began in 1990), recreation restrictions for snowy plovers (began in 1993), habitat restoration and maintenance (began in 1994), and predator management (began in 2002). The number of fledglings produced on CBNS account for over 30 percent of the total number of fledglings produced at all snowy plover sites in Oregon between 2011 and 2015 (Lauten *et al.* 2011, p. 33; 2012, p. 33; 2013, p. 31; 2014, p. 24 2015, p. 27).

New River ACEC

In 2015, 53 individual adult snowy plovers were recorded within the New River ACEC, of which 23 nested (Lauten *et al.* 2015, p. 22). Past management on the New River Spit includes: predator exclosures (began in 1990), recreation restrictions for snowy plovers (began in 1993), habitat restoration and maintenance (1999-2005 and 2009-2015), and integrated predator management (began in 2002). The highest number of fledglings on New River Spit was 31 in 2007 (Lauten *et al.* 2007, p. 41), but has declined to an annual average of approximately 8 fledglings over the past five years (Lauten *et al.* 2015, p. 37). Despite this decline in the number of fledglings produced, the productivity goal of one fledged chick per male has been achieved in three of the past five years (Lauten *et al.* 2015, p. 37).

Wintering Habitat and Population

Since 1985, winter window surveys coordinated by Oregon Department of Fish and Wildlife and later by the Service have documented snowy plovers using the New River ACEC. Winter window surveys are a one-time pass of a single surveyor or team of surveyors through potential snowy plover wintering habitat during a one week period in January (USFWS 2007).

Coos Bay North Spit

Flocks of more than 20 birds have been observed at CBNS during each of the past four winter window surveys (USFWS unpublished data), which is consistent with recent and more intensive monitoring efforts that also observed flocks with more than 20 WSPs in the South Spoil and 1994 HRA (Lauten *et al.* 2009). During some winter window surveys these flocks were observed in the HRAs and not on South Beach, and other years the opposite was true. Lauten *et al.* 2009 observed WSPs on the South Spoil and 1994 HRA during 86 percent of the surveys conducted between 10 January and 10 March 2009, and concluded that these locations provided important winter roosting habitat, while South Beach provided important winter foraging habitat.

New River ACEC

The number of WSPs documented between the mouth of New River and the Floras Lake breach during the winter window survey increased to 60 birds in 2015, and incidental observations of flocks with up to 80 birds have also been reported along this stretch of beach (USFWS unpublished data). As breeding adult snowy plover numbers have increased, the number of wintering WSPs observed at New River has also increased, and this site has become one of the most important wintering locations along the Oregon coast.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range Within the Action Area

The following are factors that affect WSPs within the action area. Detailed information can be found within the recovery plan (USFWS 2007). Some of these actions will occur as a result of the proposed action and are further discussed in “Effects of the Proposed Action on the WSP.”

Shoreline Stabilization and Development

WSPs prefer wide, flat, sparsely-vegetated beaches, dependent on natural forces for replenishment and renewal. Within the action area, these habitats are highly susceptible to degradation by construction of breakwaters, jetties, homes, hotels, parking lots, access roads, trails, bike paths, day-use parks, recreational facilities, and support services that may cause direct and indirect losses of breeding and wintering habitat for the western WSP.

In Oregon, as in much of the range, habitat loss and degradation has been the major factor affecting distribution of the species. Habitat loss in Oregon has occurred primarily as a result of development and non-native plant species invasions (USFWS 2007, pp. 38-41). At South Beach in Newport, Oregon, for example, the number of western WSPs declined from 25 in 1969 to 0 in 1981 when a new park was constructed next to the beach and the adjacent habitat became more accessible to vehicles and people (Hoffman 1972, as cited in ODFW 1994).

Past actions, particularly the use of European beachgrass to stabilize dunes, continue to affect WSPs within the action area. European beachgrass was introduced to the west coast around 1898 to stabilize dunes (Wiedemann 1987). Since then, it has spread up and down the coast and now is found from British Columbia to Ventura County in southern California. In areas with European beachgrass, it has caused the development of a vegetated foredune that effectively blocks movement of sand inland and the open features that characterize snowy plover breeding habitat are destroyed.

WSP habitat has been maintained mechanically since 1994 or earlier. This manipulation must continue every year or two to provide suitable nesting sites. Without treatment (hand pulling, discing, bulldozing, or herbicide application) beach grass quickly recolonizes open sand (Wiedemann 1987). The areas surrounding occupied snowy plover sites and within the vicinity of the action area are relatively undeveloped and is primarily managed for recreation.

Resource Extraction

Dredging can be detrimental to snowy plovers when it eliminates habitat or alters natural patterns of beach erosion and deposition that maintain habitat. Infrastructure and activities associated with dredging operations may disturb nesting or wintering snowy plovers. In some cases, however, dredged materials may provide important nesting material for snowy plovers. Oyster shells placed in HRAs significantly improving nesting success by providing camouflage for nesting WSPs (Castelein *et al.* 1998, 2000).

Driftwood removed for firewood or decorative items can result in destruction of snowy plover nests and newly hatched chicks that frequently crouch by driftwood to hide from predators and people. Removal of driftwood has been documented as a source of snowy plover nest destruction at Vandenberg AFB where two snowy plover nests were crushed beneath driftwood dragged to beach fire sites (Persons 1994). In addition, driftwood beach structures built by visitors are used by avian predators of snowy plover chicks such as loggerhead shrikes (*Lanius ludovicianus*) and American kestrels (*Falco sparverius*), and predators of adult snowy plovers such as merlins (*Falco columbarius*) and peregrine falcons (*Falco peregrinus*) (USFWS 2007). Driftwood collection may occasionally occur in the action area outside the nesting season when

the area is open to vehicle traffic, but the use is likely low and is likely insignificant since other more accessible sites are available for this activity. During the nesting season, the area is closed to motor vehicles, making driftwood collection unlikely due to the distance from the action area to beach access points.

Overutilization for commercial, recreational, scientific, or education purposes

As discussed above, human activity near snowy plover habitat may disturb snowy plovers depending on their proximity to nesting and resting areas, frequency of occurrence, and type of use. The most common activities observed within the action area are stationary relaxing, walking, fishing, exercising dogs, kite-boarding, motor vehicle use, beach combing, and surfing. Overall, these activities can cause both direct mortality and harassment of snowy plovers, and degrade otherwise suitable habitat. Although there has been intensive monitoring within the action area for many years, human caused nest failures have been rarely documented. The likelihood that human disturbance would be observed and documented is very low given that any injured or crushed snowy plovers or eggs would be quickly removed by scavengers that frequent the ocean shore.

Indirect impacts by humans and domestic animals can be minimized within the action area by closing nesting areas to human use, educating beach visitors, and establishing rules for visitor conduct in adjacent areas, such as prohibiting activities that are prone to disturbing snowy plovers. Despite years of extensive signs, roping, and the regular presence of on-site interpreters, visitor compliance is still a difficult management challenge for BLM.

Biologists monitor snowy plovers to assess population status and evaluate management techniques. Additionally, nest searches at some sites allow for placement of predator exclosures that aid in hatching success. Measures to minimize disturbance from these activities include: time limits for surveys, exclosure construction and sign/rope maintenance; conducting walking surveys where feasible; and limited entries.

Qualified individuals may obtain permits to conduct scientific research and population census activities on snowy plovers under section 10(a)(1)(A) of the ESA. Specific activities that may be authorized include: population censuses and presence/absence surveys; monitoring of nesting activity; capturing, handling, weighing, measuring, banding, and color-marking of young and adults on breeding and wintering grounds; radio-telemetry studies; translocation studies; genetic studies; contaminant studies; behavioral, ecological, and life history studies; and placing predator exclosures around active nests. Short-term impacts of these activities may include harassment and possible accidental injury or death of a limited number of individual snowy plovers. The long-term impacts will be to contribute to recovery of the species by facilitating development of more precise scientific information on status, life history, and ecology (USFWS 2007).

Predation

Approximately 57 percent of all snowy plover nests fail each year on the Oregon coast, and predation accounts for approximately 50 percent of those nest failures (Lauten *et al.* 2005, 2006a, 2006b, 2007, 2008, 2009, 2010, 2011, 2012, 2014). More than half of all snowy plover

nest depredations (53 percent annually) cannot be linked with a particular individual or species (Lauten *et al.* 2005, 2006a, 2006b, 2007, 2008, 2009, 2010, 2011, 2012, 2014a, 2014b, and 2015). Ravens and crows, however, cause the bulk (60 percent annually) of snowy plover nest depredations where predator identity is confirmed (Lauten *et al.* 2005, 2006a, 2006b, 2007, 2008, 2009, 2010, 2011, 2012, 2014a, 2014b, and 2015).

The inadequacy of existing regulatory mechanisms

In addition to their Federal threatened status, snowy plovers in Oregon are protected by the Federal Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) and by State law as a nongame species and threatened species. Their breeding habitat, however, receives limited protection from these laws (*e.g.*, the Migratory Bird Treaty Act prohibition against taking "nests"). State regulations, policies, and goals include mandates both for protection of beach and dune habitat and for public recreational uses of coastal areas; consequently they may conflict with protection of snowy plovers in some cases. To effectively recover the snowy plover, it is necessary to develop participation plans among cooperating agencies, landowners, and conservation organizations to assure protection and appropriate management of breeding, wintering, and migration areas. The development of the Oregon Parks and Recreation Department Habitat Conservation Plan for snowy plovers (OPRD 2010) is an example of one such effort collaborative effort to provide protection for snowy plovers.

Other natural or manmade factors affecting their continued existence

Because most snowy plover nesting areas occur on unstable sandy substrates, nest losses caused by weather-related natural phenomena commonly occur. High tides and strong winds cause many nest losses (Lauten *et al.* 2005, 2006a, 2006b, 2007, 2008, 2009, 2010, 2011, 2012, 2014). Events such as extreme high tides (Wilson-Jacobs and Meslow 1984, Stenzel *et al.* 1981), river flooding (Stenzel *et al.* 1981), and heavy rain (Wilson-Jacobs and Meslow 1984, Warriner *et al.* 1986) have been reported to destroy or wash away nests.

Stormy winters can adversely affect the snowy plover. It is suspected that the severe storms occurring during the El Niño atmospheric and oceanic phenomenon of the winter of 1997/1998 caused a 10 to 30 percent decline in the 1998 snowy plover breeding population, depending on the coastal region. Additionally, a very wet spring resulted in a later than normal breeding initiation and fewer nesting attempts (USFWS 2007). Alternatively, severe storms can overwash beachside foredunes, killing invasive beach grass and maintaining open, sandy dunes.

Role of the Action Area in the Recovery of the Western Snowy Plover

Under the recovery objectives set forth in the recovery plan (USFWS 2007), the role of the action area in snowy plover conservation is to provide for long-term protection and maintenance of breeding and wintering snowy plovers and their habitat and to increase the number and productivity of breeding adult birds. Increasing snowy plover numbers and productivity (*i.e.*, fledglings per male) within the action area, increases the ability to withstand catastrophic events, and can increase its distribution and overall population within the recovery unit and rangewide.

Based on the recovery plan (USFWS 2007, p. B-8), the action area is found within breeding and wintering recovery units OR-13 and OR-15. Jurisdiction of these recovery units is under both Federal and non-federal control. In 2015, 49 percent of all Oregon coast snowy plovers nested in recovery units OR-13 and OR-15 (Lauten *et al.* 2015, p. 22), which represents a significant portion (8.5 percent) of all snowy plovers that were observed during the breeding season along the Pacific coast (USFWS unpublished data). Similarly, 43 percent of all snowy plover fledglings produced on the Oregon coast in 2015 came from nests located in OR-13 and OR-15 (Lauten *et al.* 2015, p. 27), which represent the most important breeding areas north of Monterey Bay, CA (USFWS unpublished data).

The role of Federal agencies in achieving recovery of the snowy plover is described in the recovery plan. Lands managed by Federal agencies are extremely important to the conservation of the snowy plover. The conservation of the snowy plover on these lands will require active monitoring and management for the full purposes of recovery or its population size will continue to decline. This action fulfills the monitoring and some aspects of management for the snowy plover in Oregon on Federal and State lands.

The recovery plan identifies several goals for these lands: (1) protect and intensively manage all breeding and wintering locations on Federal lands; (2) develop and implement site-specific management plans; and (3) encourage and assist local governments and private landowners to develop and implement management plans for snowy plovers and their habitat.

EFFECTS OF THE ACTION – WESTERN SNOWY PLOVER

Although numerous resource programs under the PRMP have the potential to adversely affect the snowy plover, the BLM (2016a, p. 196) has included specific management direction under two resource programs to protect this species. This management direction will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the snowy plover under those programs except where necessary for the conservation of the species. These two resource programs and this management direction are as follows:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61), which includes the following management direction:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.*
- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation*

agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*

Wildlife – Pacific Coast Distinct Population Segment of the Western Snowy Plover

- *Do not authorize or construct additional discretionary roads and trails within designated critical habitat or within western snowy plover habitat.*
- *Restore snowy plover nesting habitat.*
- *Restrict the timing and location of beach access or activities to avoid disruption of normal snowy plover nesting and nesting behaviors.*

2. The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33), which includes the following management direction:

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*

The New River and North Spit ACECs will be designated with the snowy plover as one of the relevant and important values (BLM 2016b, pp. 1269-70). Absent the above constraints, several resource programs under the PRMP would have the potential to adversely affect snowy plovers in areas occupied by this species. For example, Recreation and Visitor Services includes off-highway vehicle (OHV) use which has the potential to crush nests, eggs and fledglings, and kill adults by striking them. Beach visitors have the potential to flush adults from their nests leaving their young vulnerable to predation. However, under the PRMP's management direction, BLM would manage this resource program to avoid these adverse effects to the snowy plover unless it was necessary for the conservation of the species. Implementation of the management direction described above will insure that no actions (*e.g.*, OHV use, beach combers with dogs) which would adversely affect the snowy plover would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. Thus, with the above conservation measures, none of these potential adverse effects would be expected to occur under the PRMP because of the constraints on activities noted in the management direction above.

The ACEC resource program requires the implementation of the management direction described above which has the potential to maintain, enhance, and restore snowy plover populations on BLM lands within the action area. In addition to the restriction on approving, funding or implementing actions with adverse effects for the species unless necessary for conservation, the PRMP designates the New River and North Spit ACECs which will benefit the snowy plover.

Some conservation actions may have short-term adverse effects. For example, impacts of predators are a significant threat to this species, and alleviating the impact of predators is a key part of the snowy plover recovery plan (USFWS 2007, pp. 47-55) and necessary for the conservation of the species. Predator control during the nesting season can cause disruption of nesting snowy plovers because trappers need to work in proximity to active nests.

The snowy plover recovery plan (USFWS 2007) identifies other recovery actions to intensively monitor snowy plover abundance, distribution, survival and productivity, restore nesting habitat including the control of invasive beach grass which are necessary for the conservation of the species, but some aspects of these measures have the potential to cause adverse effects to the snowy plover. For example, some surveying techniques require the trapping, handling and banding of individuals, which can cause stress or injury to individual snowy plovers. Habitat restoration and enhancement projects have the potential to disturb snowy plovers and cause short-term degradation of habitat. The removal of beach grass involves digging, pulling and hauling of materials by humans, which has the potential to disrupt snowy plovers and attract predators. These activities provide or maintain nesting habitat for the snowy plover, but may involve short-term degradation of habitat or disturbance of individual snowy plovers.

Therefore, since the PRMP would require BLM to avoid any adverse effects to the snowy plover except where necessary for the conservation of the species, and all actions will be consistent with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, the only potential adverse effects to the plover under implementation of the PRMP are those that result from actions that are consistent with the conservation and recovery needs of the species. Implementation of such actions under the PRMP have the potential to improve the habitat and population condition of the snowy plover in the action area over the long-term and to move the species' condition closer to recovery. These actions will positively affect the plover's numbers, reproduction and distribution because they should protect nesting plovers and increase the population such that colonization of other potential nesting areas may occur.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be "caused by or will result from" the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon.

Beach areas in Oregon that are occupied by snowy plovers are all managed in a similar fashion such that that beach access and activity restrictions are implemented cooperatively across jurisdictional boundaries of adjacent land management agencies. Cooperative management provides protection for snowy plover breeding, feeding, and sheltering activities that span jurisdictional boundaries of adjacent land management agencies. The BLM regulates administrative and public use and access on its lands down to the mean high water mark, while the Oregon Parks Department regulates administrative and public use and access below that point to the mean low water elevation. Since adjacent land management in areas occupied by

nesting snowy plovers is coordinated to provide uninterrupted protection for the plover, the Service does not anticipate PRMP management will result in any effects on non-federal lands within the action area that will have adverse effects to snowy plovers that are not consistent with the recovery needs of the species.

CONCLUSION

After reviewing the current status of the snowy plover, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service's biological opinion that the PRMP is not likely to jeopardize the continued existence of the snowy plover.

The key basis for this conclusion is the BLM's explicit management direction under the PRMP to not approve, fund, or implement actions that would adversely affect the snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. Although there is a potential under this management direction for BLM conservation actions that may have short-term adverse impacts to the snowy plover, the long-term effects would be beneficial and support the species' recovery. Effects on non-federal lands within the action area are not expected to negatively impact the numbers, reproduction or distribution of the plover.

STATUS OF THE SPECIES – WESTERN SNOWY PLOVER CRITICAL HABITAT

Previous Federal actions regarding the snowy plover can be found in the December 7, 1999 final rule to designate critical habitat for the snowy plover (USFWS 1999). Following designation in 1999, legal challenge, and revisions (USFWS 2005), we published the final rule designating revised critical habitat for the snowy plover on June 19, 2012 (USFWS 2012). In the 2012 final rule, a total of 24,527 acres (9,926 ha) of revised critical habitat were designated within the snowy plover's historical range, across 60 units in Washington, Oregon, and California. The acreage breakdown by State is as follows: Washington, 6,077 acres (2,460 ha); Oregon, 2,112 acres (856 ha); and California, 16,337 acres (6,612 ha).

The revised final designation constituted an increase of approximately 12,377 acres (5,009 ha) from the 2005 designation of critical habitat for the snowy plover (USFWS 2012, p. 36728). We designated specific areas outside the geographical area occupied by the species at the time of listing because such areas are essential for the conservation of the species, are within the snowy plover's historical range. One objective of the revised final rule was to identify and protect those habitats that we determined would provide resiliency for snowy plovers in the face of the effects of climate change on habitat. We selected some areas within occupied units that, once restored would be able to support the snowy plover. These areas generally are upland habitats adjacent to beach and other areas used by the species containing introduced vegetation, such as European beachgrass, that currently limits use of the area by the species. These areas would provide habitat to off-set the anticipated loss and degradation of habitat due to sea-level rise expected from the effects of climate change or due to development. These areas previously contained and would still contain the PBFs essential to the conservation of the species once removal of the beachgrass and restoration of the area has occurred.

The PBFs essential for the conservation of the snowy plover are derived from studies of this species' habitat, ecology, and life history. Based on the best available information (as described in the final rule, USFWS 2012), the PBFs essential to the conservation of the snowy plover are the following: Sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with:

1. Areas that are below heavily vegetated areas or developed areas and above the daily high tides;
2. Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low- water flow and annual high tide or high- water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, that are essential food sources;
3. Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PBF 2 for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults; and,
4. Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

Climate Change- Critical Habitat

One objective of our final rule revising critical habitat for the snowy plover (USFWS 2012) was to identify and protect those habitats that we determined would provide resiliency for the species in the face of the effects of climate change on habitat. We selected some areas within occupied critical habitat units that, once restored, would be able to support snowy plovers. These areas are generally upland habitats adjacent to beach and other areas used by the species containing introduced vegetation, such as European beach grass (*Ammophila arenaria*), that currently limits use of the area by snowy plovers. These areas could be restored with special management, thereby providing suitable habitat to offset habitat loss from anticipated sea level rise resulting from climate change. These areas previously contained and would still contain the PBFs essential to the conservation of the species once removal of the beachgrass and restoration of the area has occurred. The PRMP provides the management direction necessary to restore upland habitats adjacent to the beach to conditions that would provide suitable habitat for the snowy plover and mitigate projected habitat loss associated with climate change. For example, the Wildlife Resource Program requires management of habitat for ESA-listed species, consistent with recovery plans, conservation agreements, and designated critical habitat. The PRMP will, therefore, result in no change or a net increase in the total area of habitat for the snowy plover. These measures, described in detail elsewhere in this BO, will increase the ability of the snowy plover to persist and recover in the face of climate change effects by providing additional areas of habitat.

Nine CHUs are designated within Recovery Unit 1 (Table 253), located between the Necanicum River Spit, Clatsop County and Euchre Creek, Curry County in Oregon. These units total approximately 2,112 acres. All CHUs provide crucial nesting habitat for snowy plovers except CHUs OR-2, OR-4, OR-6, OR-8A and OR-13. CHU OR-2 has the potential to provide habitat for breeding snowy plovers and connectivity between occupied areas in Washington and Oregon's south coast. CHUs, OR4, OR-6, and OR-13 historically supported nesting snowy plovers and may again support snowy plovers with intensive management to restore habitat and manage predators and recreation. CHU OR-8A was designated to protect wintering snowy plovers that use the area. The action area encompasses the entirety of these CHUs.

Table 253. Snowy Plover designated CHUs, Oregon (USFWS 2012).

CHU	Subunit	Unit Name	Acres (ha)
OR 2		Necanicum River Spit	11 (4)
OR 4		Bayocean Spit	201 (82)
OR 6		Sand Lake South	5 (2)
OR 7		Baker/Sutton Beaches	276 (112)
OR 8	A	Siltcoos Breach	15 (6)
	B	Siltcoos River Spit	116 (47)
	C	Dunes Overlook/Tahkenitch Creek Spit	383 (155)
	D	North Umpqua River Spit	59 (24)
OR 9		Tenmile Creek Spit	223 (90)
OR 10		Coos Bay North Spit	273 (111)
OR 11		Bandon to New River	541 (219)
OR 13		Euchre Creek	9 (4)
Subtotal			2,112 (855)

ENVIRONMENTAL BASELINE – WESTERN SNOWY PLOVER CRITICAL HABITAT

Approximately 2,112 acres (854 hectares) of critical habitat are designated in Oregon and distributed among nine units located in Clatsop, Tillamook, Lane, Douglas, Coos and Curry Counties (Table 253). The action area is located within CHUs OR-10 and OR-11 on the western coast of Coos and Curry Counties, Oregon. These units represent a significant portion (35 percent) of the critical habitat designated along the Oregon coast, and about three percent of the critical habitat designated along the Pacific coast.

CHU OR-10, Coos Bay North Spit

This CHU is on the western coast of Coos County, about 3 mi (5 km) west of the City of Coos Bay. It is bounded by the Oregon Dunes National Recreation Area 3 mi (4.8 km) to the north, Coos Bay North Jetty to the south, Coos Bay to the east, and Habitat Conservation Plan covered lands to the west.

Coos Bay North Spit was occupied at the time of listing and is currently occupied. Documented snowy plovers for this unit include 107 breeding snowy plovers in 2015 (Lauten *et al.* 2015, p. 22). The unit consists of 273 ac (111 ha) of Federal land primarily managed by the BLM and USACE.

The unit is characteristic of a dune-backed beach in close proximity to tidally influenced estuarine mud flats and containing interior interdune flats created through dredge material disposal or through habitat restoration. This unit includes the following PBFs essential to the conservation of the species: Expansive sparsely vegetated interdune flats; open, sandy areas that are relatively undisturbed by humans; areas of sandy beach above the mean high water line with occasional surf-cast wrack supporting small invertebrates; and close proximity to tidally influenced estuarine mud flats.

Primary threats to essential PBFs that may require special management in this unit are degradation of sand dune system due to the encroachment of European beachgrass; disturbance from humans, pets, and horses in important foraging and nesting areas; vehicle trespass into closed areas; and predators.

CHU OR-11, Bandon to New River

CHU OR-11 is on the southwestern coast of Coos County, Oregon, about 3 mi (5 km) south of the City of Bandon. The unit consists of multiple land ownerships bounded by the southern boundary of Bandon State Natural Area to the north, the New River to the east, north of the Floras Creek outlet to the south, and Habitat Conservation Plan covered lands to the west. The unit encompasses all of the New River Spit and extends behind a relatively low foredune north of Floras Creek. Sea-level rise and overwashing of these areas during the winter months is anticipated to result in vegetation removal and the creation of additional snowy plover breeding habitat.

New River was occupied at the time of listing and is currently occupied. Documented snowy plovers for this unit include 23 breeding snowy plovers in 2015 (Lauten *et al.* 2015, p. 22). The BLM is the unit's primary land manager. Unit OR 11 consists of 459 ac (186 ha) of Federal land with 82 ac (33 ha) of private land.

The unit is characteristic of a dune-backed beach and barrier spit, and contains interdune flats created through habitat restoration. It includes the following PBFs essential to the conservation of the species: Wide sand spits or overwashes and sparsely vegetated areas, low-lying areas of sandy dune; open, sandy areas that are relatively undisturbed by humans; areas of sandy beach above the mean high water line with occasional surf-cast wrack supporting small invertebrates; and close proximity to tidally influenced freshwater areas.

Primary threats that may require special management in this unit are degradation of the sand dune system due to encroachment of European beachgrass; disturbance from humans and pets in important foraging and nesting areas; vehicle trespass into closed areas; and predators.

EFFECTS OF THE ACTION - SNOWY PLOVER CRITICAL HABITAT

Although numerous resource programs under the PRMP have the potential to adversely affect snowy plover critical habitat, the BLM (2016a, p. 196) has included specific management direction under two resource programs to protect this species and its critical habitat. This management direction applies to all PRMP resource programs and avoids the potential for adverse effects to occur to the snowy plover critical habitat under those programs except where necessary for the conservation of the species. These two resource programs and the management direction are as follows:

1. *The Wildlife Resource Program (BLM 2016a, p. A54-A61), which includes the following management direction:*

- *Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.*
- *Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the snowy plover, conduct surveys to determine species presence.*
- *Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.*
- *Wildlife – Pacific Coast Distinct Population Segment of the Western Snowy Plover*
 - *Do not authorize or construct additional discretionary roads and trails within designated critical habitat or within western snowy plover habitat.*
 - *Restore snowy plover nesting habitat.*
 - *Restrict the timing and location of beach access or activities to avoid disruption of normal snowy plover nesting and nesting behaviors.*

2. *The Area of Critical Environmental Concern Resource Program (BLM 2016a, p. A33), which includes the following management direction:*

- *Implement activities as necessary to maintain, enhance, or restore relevant and important values.*

The functionality of snowy plover critical habitat is contingent upon isolation from human disturbance. Human presence, pets, vehicles and human-attracted predators reduce the quality of PBFs that provide for the snowy plover's life-history processes (USFWS 2012, pp. 36745-

36748). Absent the above constraints, several resource programs under the PRMP would have the potential to adversely affect snowy plover critical habitat within the action area. For example, the Recreation and Visitor Services resource program includes OHV use which has the potential to disturb nesting adult and fledgling plovers (PBF 4). Beach visitors have the potential to flush adult plovers from their nests leaving their young vulnerable to predation (PBF 4). These visitors also can attract predators that are known to prey on adult and juvenile plovers and their eggs (PBF 4). However, under the PRMP's management direction, BLM would manage this resource program to avoid these adverse effects to snowy plover critical habitat unless these actions were necessary for the conservation of the species.

Implementation of the management direction described above has the potential to maintain, enhance, and restore snowy plover critical habitat PBFs on BLM lands within the action area. Such an outcome underlies the basis for which the New River and North Spit ACECs will be designated under the PRMP because the PBFs of snowy plover critical habitat match the habitat needs of the species, which is one of the relevant and important values for which these two ACECs will be designated (BLM 2016c, pp. 1269-1270). Implementation of the management direction described above will insure that no actions (*e.g.*, OHV use, beach combers with dogs) which would adversely affect the snowy plover would be approved, funded, or implemented, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

The ACEC resource program requires the implementation of “activities as necessary to maintain, enhance, or restore relevant and important values;” such activities can include predator control during the nesting season (PBF 4). Predator control involves human presence within areas where plovers are nesting. Such human presence can itself contribute to predation of nesting snowy plovers because human presence can attract some predators. However, impacts of predators are a significant threat to this species (PBF 4), and alleviating the impact of predators is a key part of the snowy plover recovery plan (USFWS 2007, pp. 47-55) and necessary for the conservation of the species. Habitat restoration and maintenance activities occur primarily within Habitat Restorations Areas at the Coos Bay North Spit and New River ACECs, and are focused on reduction of predator cover, reduction of European beachgrass cover, re-establishment of plant species native to the dune-grass community, and enhancement of nesting substrate in ways that reduce detection of nests, chicks and incubating adults by predators. Some aspects of these measures have the potential to cause adverse effects to the snowy plover critical habitat, but they are considered necessary for the conservation of the species. For example, habitat restoration and enhancement projects have the potential to cause short-term degradation of critical habitat. The removal of European beach grass involves digging, pulling and hauling of materials by humans, which has the potential to attract predators. These activities provide or maintain nesting habitat for the snowy plover over the long-term, but may involve short-term degradation of habitat or the potential to increase the presence of snowy plover predators.

These actions are included in the snowy plover recovery plan and are necessary for the conservation of the species. The role of a recovery plan is to provide a roadmap of recommended actions the Service believes necessary to conserve and recover the listed species. The snowy plover recovery plan (USFWS 2007) identifies recovery actions to support predator

management during the breeding season, restore nesting habitat including the control of invasive beach grass, and restrict recreational use at breeding locations. Some aspects of these measures have the potential to cause adverse effects to the snowy plover critical habitat, but they are considered necessary for the conservation of the species. Considering this information and based on the management direction in the PRMP, the Service concludes that all actions to be implemented by the BLM under the PRMP that may have the potential to adversely affect the snowy plover will be consistent with the recovery plan and will be “necessary for the conservation of the species.”

Therefore, implementation of PRMP resource programs with the potential to adversely affect snowy plover critical habitat will be consistent with the conservation and recovery needs of the species and are expected to improve or enhance the value of the critical habitat for the conservation of the species. Implementation of such actions will have the potential to improve the condition of critical habitat in the action area over the long-term for the conservation of the species.

Non-Federal Lands

Where access to non-federal lands is only available via BLM lands to be managed under the PRMP, the effects of actions on those non-federal lands are considered to be “caused by or will result from” the PRMP through the use of those BLM roads which meets the regulatory definition of indirect effects of the action (50 CFR §402.02). Therefore the action area extends to those adjacent, non-federal lands accessed by BLM roads. This is most likely to occur in the checkerboard ownership pattern that is characteristic of the O&C lands of southwest Oregon and on lands adjacent to BLM lands.

There are private lands within ½ mile of the New River ACEC that are designated critical habitat for the snowy plover (USFWS 2012, p. 36759, 36817). There are also State lands within ½ mile of the New River ACEC, but these were excluded from the designation because the State entered into a Habitat Conservation Plan to manage for the recovery of the species (USFWS 2012, pp. 36780-36787). The Service has no information on the coordinated management of private lands within the action area that are designated as snowy plover critical habitat, and we have no information to indicate that changes in the management of snowy plover critical habitat from the current practices which have produced the existing PBFs and critical habitat conditions non-federal lands within the action area are reasonably certain to occur. Therefore, we anticipate that existing PBFs on non-federal land within the action area are likely to remain at about current levels.

CONCLUSION

After reviewing the current status of snowy plover critical habitat, the environmental baseline for the action area, the effects of the action, and cumulative effects, it is the Service’s biological opinion that the PRMP is not likely to destroy or adversely modify snowy plover critical habitat.

The key basis for this conclusion is the BLM’s explicit management direction under the PRMP to not approve, fund, or implement actions that would adversely affect snowy plover critical habitat, except when done in accordance with an approved recovery plan, conservation

agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species. Although there is a potential under this management direction for BLM actions that may have short-term adverse impacts to snowy plover critical habitat, the long-term effects would be beneficial and improve the conservation value of the critical habitat for the species.

OVERALL CONCLUSION

The PRMP will provide direction for the management of approximately 2.5 million acres of BLM-administered lands for the purposes of producing a sustained yield of timber, contributing to the recovery of threatened and endangered species, providing clean water, restoring fire adapted ecosystems, and providing for recreation opportunities. The direction provided in this plan will be used to develop and implement specific projects and actions during the life of the plan (50 years), which will generally require additional and subsequent evaluation for compliance with NEPA, the ESA, and other appropriate federal statutes and policies.

The overall goal of this section 7 consultation process was to evaluate the BLM PRMP for its consistency with the conservation of listed species. This BO uses a programmatic approach to evaluate the PRMP and describes in detail the effects of the proposed action on 17 listed species and nine critical habitat designations. The analysis in this BO allows for a broad-scale examination of the PRMP's potential impacts on listed species and their designated critical habitats, and examines how the parameters of the BLM PRMP align with the survival and recovery needs of listed species occurring in the action area.

This BO concludes there is the potential for adverse effects to some of the listed species and critical habitats to occur as projects under this plan are implemented, but we also conclude that these potential impacts are not likely to jeopardize any of these species or adversely modify any designated critical habitat. We further conclude that the PRMP will generally result in an overall incremental improvement in the long term conservation outlook for these listed species and critical habitats on BLM lands when compared to the land management plans currently in place (*i.e.*, the NWFP). This conclusion is based on an expected net increase in forest reserve areas and an improvement in many practices affecting these species that will be applied across all BLM land designations.

INCIDENTAL TAKE STATEMENT

The proposed action addressed in this biological opinion conforms to a "mixed programmatic action" as that term is defined at 50 CFR 402.02 of the implementing regulations for section 7 (80 FR 26844). On that basis, only take that is anticipated to be caused by activities that are authorized under the program and not subject to further section 7 consultation (except under circumstances where reinitiation is required per 50 CFR 402.16) are addressed herein.

Incidental take resulting from any action subsequently authorized, funded, or carried out under the proposed RMP program will be addressed in subsequent section 7 consultation, as appropriate, on that action(s).

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by

significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Incidental take” is defined by regulation as take that results from, but is not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this incidental take statement.

FORM AND AMOUNT OR EXTENT OF ANTICIPATED TAKE

Based on the analyses presented in the “Effects of the Action” section and Appendix C (pp. 560-694) of this biological opinion, the Service anticipates that incidental take in the form of harm and harass of the bull trout, Lost River sucker, and the shortnose sucker is reasonably certain to occur with implementation of the PRMP. Take of the bull trout is likely to be caused by non-commercial road use authorized by the PRMP. Take of the Lost River sucker and the shortnose sucker is likely to be caused by non-commercial road use and recreational activities authorized by the PRMP.

The causal mechanisms for take of these listed fish species as a result of road use are associated with sediment and stormwater contaminants entering streams occupied by the bull trout, Lost River sucker and/or the shortnose sucker. The causal mechanism for take of the suckers as a result of recreational activities is human disturbance caused by wading, swimming, and boating within waters occupied by these species (see Table 254).

The very limited number of bull trout likely to be present in suitable habitat adjacent to BLM recreational facilities along the McKenzie River makes it extremely unlikely that these fish will be adversely affected by wading, swimming, and boating activities. The small reach/amount of the McKenzie River under BLM ownership also limits the magnitude of any potential adverse effects to the bull trout as any individual bull trout that might be affected can easily flee to areas outside of the recreational influence. Therefore, the Service finds that take of the bull trout from recreational activities authorized by the PRMP is not reasonably certain to occur.

Sediment-based take

Wind and runoff transport of unconsolidated sediment created by human use of trails and roads into stream systems is likely to adversely affect the more sensitive young life stages of fish including juveniles, eggs, embryos, and emerging fry. Exposure of rearing and adult fish and their habitat to sediments can cause gill abrasion, modification of their foraging behavior, and reductions in their prey populations, foraging opportunities, and oxygen transfer within redds. Increases in sediment in streams can also alter the embeddedness of the substrate.

Based on the analyses presented in the “Effects of the Action” section and Appendix C (pp. 560-694) of this biological opinion, the Service finds that the bull trout, Lost River sucker, and the shortnose sucker are likely to be exposed to adverse effects that biologically conform to take in the form of harm caused by increased sediment levels within their occupied habitat as a result of non-commercial road use.

Contaminant-based Take

As discussed in the Effects of the Action and Appendix C of this biological opinion, chemical contamination from stormwater runoff from the use of paved roads delivers heavy metals and petroleum distillates and other harmful chemicals into streams. Harm from chemical contamination carried by stormwater includes adverse effects to all life stages of fish that are in proximity to the source (Table 254). These pollutants may accumulate in the prey and tissues of exposed fish. Depending on the type of contaminant, exposure process, and level of exposure, these contaminants can cause a variety of lethal and sublethal effects to fish, including disrupted behavior, reduced olfactory function, reduced response to predators or danger, reduced directional perception, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities.

Based on the analyses presented in the “Effects of the Action” section and Appendix C (pp. 560-694) of this biological opinion, the Service finds that the bull trout, Lost River sucker, and the shortnose sucker are likely to be exposed to adverse effects that biologically conform to take in the form of harm caused by the runoff of contaminants into their occupied habitat as a result of non-commercial road use.

Recreational Activity-based Take

Wading, swimming, and boating cause disturbance of exposed fish that may significantly alter their behavior or result in the trampling of eggs, embryos, and emerging fry.

Based on the analyses presented in the “Effects of the Action” section and Appendix C (pp. 560-694) of this biological opinion, the Service finds that the Lost River sucker and the shortnose sucker are likely to be exposed to adverse effects that biologically conform to take in the form of harm caused by wading, swimming, and boating activities within their occupied habitat.

Table 254. Take pathways for listed fish species resulting from recreation, and trails and travel management programs authorized under the proposed action.

	Suspended Sediment	Substrate	Forage	Chemical Contaminants – Stormwater	Non-Habitat (harassment)
Bull trout	X	X	X	X	
Lost River sucker	X	X	X	X	X
Shortnose sucker	X	X	X	X	X

Use of a surrogate to express the Amount or Extent of Take

Accurately quantifying the number of fish taken by these actions is not possible. Fish population sizes fluctuate annually and seasonally within a watershed, basin and species, depending on many complex environmental variables. Fish distribution within a watershed also varies in response to many other environmental variables. In addition, the challenges of accurately estimating fish numbers and determining exposure levels at these scales is beyond the scientific capabilities of the Service. Even if such an effort were attempted, collecting or sampling fish populations at these scales would also add significant additional stress and risk of injury to affected fish. Additionally, take caused by habitat-related pathways cannot be accurately predicted as a number of fish because the relationship between habitat conditions and the distribution and abundance of those individuals in the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the non-commercial road use and recreational actions authorized under the PRMP.

For the above reasons, the distribution and abundance of listed fish within the action area for the PRMP cannot be attributed entirely to habitat conditions, nor can we precisely predict the number of listed fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by recreational activities and non-commercial road use authorized by the PRMP. Under such circumstances and in accordance with the section 7 regulations at 50 CFR 402.14(i)(1)(i), we can use a surrogate to express the amount or extent of take provided that we: 1) describe the causal link between the surrogate and take of the listed species; 2) explain why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and 3) we set a clear standard for determining when the level of anticipated take has been exceeded.

For purposes of this incidental take statement, we have identified three surrogate indicators to express the amount or extent of anticipated take: 1) the current number of identified recreational facilities within 216 feet of Lost River sucker or shortnose sucker-occupied habitat; 2) the current number of BLM paved road miles within 200 feet of a listed fish-occupied stream; and 3) the total current BLM road miles within 200 feet of a listed fish-occupied stream (Table 255). As explained in more detail below, the calculations of these metrics are designed to reflect existing sites and roads within occupied habitat of the bull trout, Lost River sucker, and the shortnose sucker.

In terms of satisfying the criteria for use of a surrogate: the surrogates described above represent the source of the take-related stressors, as further discussed below (criterion 1); the discussion above explains why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species (criterion 2); and a clear standard for determining when the level of anticipated take has been exceeded is established below in this incidental take statement (criterion 3).

Table 255. Extent of take indicators by listed species within the action area of the proposed RMP. “Recreational facilities” is a surrogate for take caused by recreational activities; the numbers presented in this column represent the number of BLM-identified facilities within 216 feet of Lost River and shortnose sucker-occupied habitat. “BLM paved roads” is a surrogate for take caused by contaminants associated with non-commercial road use; the numbers presented in this column represent the linear distance of BLM roads that lie within 200 feet of listed fish-occupied streams. “All BLM roads” is a surrogate for take caused by sediment associated with non-commercial road use; the numbers presented in this column represent the linear extent of all surface types (paved, unknown, native, and aggregate) located within 200 feet of a listed fish-occupied stream. N/A = not applicable.

Analysis Unit	Species	Recreation facilities	BLM paved roads	All BLM roads
McKenzie River Basin	Bull trout	N/A	42	345
Upper Klamath Recovery Unit	Lost River and shortnose suckers	15	22	277
Lost River Recovery Unit	Lost River and shortnose suckers	12	6	228

The road-related surrogates are related to the take pathways because the number of road miles proximate to streams occupied by listed fish is proportionally related to the amount of sediment (all BLM roads) and stormwater contaminants (paved roads) that enter waterways and expose fish to detrimental environmental conditions. The number of recreational facilities within 216 feet correlates to the numbers of recreational users congregating near waterways occupied by the listed sucker species which is in turn proportionally related to the likelihood of recreational water use causing take of these species. We used 216 feet because that is the best available information to characterize and enumerate the number of recreational facilities in close proximity to listed fish-occupied habitat. The analysis in this BO identifies road segments within 200 feet of a stream occupied by listed fish species as the most likely delivery zones for sediment and contaminant-laden stormwater that cause take. Stormwater from paved roads is likely the greatest contributor of contaminant-laden stormwater run-off due to the higher traffic volume and efficacy of the surface to transmit water to the ditchlines and waterways. We consider paved road miles that occur within 200 feet of a waterway occupied by listed fish species as a reasonable indicator of incidental take caused to each of these ESA-listed species by introducing stormwater contaminants to the water body (Table 255). Sediment exposed by public and administrative use of roads and trails and transported to streams by wind and runoff is best represented by all of the road surface types; therefore, we consider the total BLM road miles within 200 feet of listed fish-occupied streams to be a reasonable indicator of sediment-caused take (Table 255).

The number of recreational facilities occurring within 216 feet of a waterbody occupied by Lost River and/or shortnose suckers reflect the most likely sources that attract and congregate users to a specific site where associated water use and take incidental to that use is likely to occur.

The Service finds that BLM can routinely quantify these surrogates within the action area for each species as presented in Table 255. Each of these values is dependent on the spatial database of their origin; therefore, our surrogates are dependent on the accuracy and continued use of that database by the BLM. Because such databases may contain errors, the road miles represented in Table 255 are considered representative of the known data as of the date of this biological opinion. Considering errors could occur within the database, the Service is reluctant to rely solely on these specific numbers without some margin of error for a reinitiation trigger. We consider a 5 percent margin of error to be sufficiently small enough that future database reports resulting in equal to or less than a 5 percent increase over the values presented in Table 255 to be within the margin of error, and to reflect the magnitude of effects that were not analyzed in this BO, and would not trigger reinitiation of formal consultation.

Under the proposed action and the terms and conditions (below) of this incidental take statement, within one year of the effective date of the ROD, and every three years thereafter, the BLM shall report the following information to the Service:

1. The number of recreational facilities within 216 feet of occupied habitat for the Lost River and shortnose suckers.
2. The number of miles of BLM paved roads occurring within 200 feet of listed fish-occupied streams for each of the three analysis units.
3. The number of miles of BLM roads (all surface types) within 200 feet of listed fish-occupied streams for each of the three analysis units.

Any road miles or recreational sites addressed in project-specific consultations subsequent to the issuance of the ROD or for which BLM makes a no-effect determination subsequent to the issuance of the ROD should be deducted from the totals because the incidental take exempted in this Opinion relates to use of existing roads and sites. New roads and sites are addressed at a framework programmatic level in this BO: specific actions will be subject to future ESA consultation obligations and any associated incidental take that is reasonably certain to occur will be exempted in those consultations; or, in the unique factual situations where BLM makes a no-effect determination, BLM will have made a determination that there is no take. If the resultant totals are greater than 5 percent more than the values in Table 255 for any one species, then the extent of take is exceeded, which will trigger reinitiation of consultation.

EFFECT OF THE TAKE

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the impacts of the anticipated taking on the listed species:

1. The BLM shall implement measures through Management Direction and anticipated travel management plans to minimize take of listed species due to sediment and stormwater contaminants derived from the use of roads.
2. The BLM shall implement measures to minimize take of Lost River and shortnose suckers due to use of recreational facilities by implementing an educational program.
3. The BLM shall monitor and report the measures implemented to minimize take of listed species specified under RPMs #1 and #2 above.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the BLM must comply with the following terms and conditions, which implement the RPMs, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Term and Condition 1

- a) The BLM shall maintain a spatial database containing the following minimum information on their road system:
 - i. Road segments identified by surface type.
 - ii. Road classification (Collector, Local, and Resource), or some equivalent classification representing relative type, purpose, and traffic volume.
 - iii. A complimentary stream and watershed boundary spatial layer to facilitate water related analysis.
- b) The BLM shall initiate travel management plans in areas with listed fish or designated critical habitat covered by this BO within five years of the effective date of the ROD.
 - i. Travel management plans shall fully implement Management Direction related to identifying resource conflicts and consider opportunities to reduce roads most likely to introduce sediment and stormwater to streams inhabited by ESA-listed species.
 - ii. The BLM shall use travel management plans and additional planning opportunities to identify and prioritize erosion and stormwater reduction measures associated with road use.
 - iii. The BLM shall incorporate into watershed restoration strategies the identification and prioritization of opportunities, measures, and methods to reduce road-derived sediment and stormwater contaminants.
- c) The BLM shall complete all travel management plans in areas with listed fish or designated critical habitat covered by this BO within ten years of the effective date of the ROD.
- d) The BLM shall provide to the Service within three years of the effective date of the ROD a report on progress of completion of travel management plans and a schedule

- for completion of travel management plans. The BLM shall provide the Service with additional reports on the progress and schedule for completion of travel management plans every three years until all travel management plans in areas with listed fish or designated critical habitat covered by this BO are completed.
- e) The BLM shall coordinate with the Service on the data and roads assessment needs required for access and travel management plans to facilitate the effort to satisfy term and condition 1.b.

Term and Condition 2

- a) The BLM shall develop and expand existing public educational programs directed at minimizing take of Lost River and shortnose suckers at recreational facilities.
- i. The BLM shall develop and acquire educational signs educating the public on the importance of not disturbing Lost River and shortnose suckers.
 - ii. The BLM shall prioritize the distribution of these signs to recreational facilities within 216 feet of waterbodies designated as critical habitat or inhabited by Lost River and shortnose suckers. BLM shall distribute these signs to other recreational facilities where they deem to have a high value opportunity for educating the public on the importance of not taking Lost River and shortnose suckers.
 - iii. The BLM shall assess recreational user educational information (e.g., recreational boating, camping, and hiking pamphlets) to determine the current level of information related to protecting Lost River and shortnose suckers. When these products are revised, BLM shall incorporate educational information regarding the take of lost river and shortnose suckers.
 - iv. The BLM shall follow management objectives and direction to mitigate (reduce) recreational impacts on natural resources, such as the ESA-listed species considered herein. This includes using management direction that requires the use of recreational management tools where resource damage, including take of the ESA-listed fish species considered herein, is occurring.
- b) The BLM shall partner with the Service regarding these educational opportunities.

Term and Condition 3

- a) The BLM shall notify the Service of the spatial data layers developed for the access and travel management planning process in support of term and condition 1.b.
- b) The BLM shall monitor the road system and track spatially where:
- i. The BLM removes a road segment within 200 feet of a stream.
 - ii. The BLM implements a road-related sediment reduction action.
 - iii. The BLM implements a stormwater reduction action.
 - iv. The BLM builds a new road within 200 feet of a stream.
- c) The BLM, by March 31st every three years following the signature of the ROD for the PRMP, shall provide a report to the Service containing the following information:
- i. Progress towards collecting information to support the travel and access management plans.

- ii. A list of accomplishments fulfilling the requirement under term and conditions 1 and 2.
- iii. Travel and access management plan completion timelines, including ESA consultation timelines.
- d) The BLM shall send the reports to the:

U.S. Fish and Wildlife Service
Attention: TAILS 01EOW00-2015-F-0279
Oregon Fish and Wildlife Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. Continue stream surveys within the McKenzie River and Gate Creek to establish the current presence and to estimate the actual population size of bull trout within the portion of McKenzie River that is within the action area.
2. Work with other landowners to promote improved habitat conditions for listed fish species and their habitat.
 - a. Work with education programs within watershed councils.
 - b. Ongoing one-on-one discussions with contractors, operators, and neighboring property owners.
 - c. Work with other landowners to manage the road system in the action area to reduce road-related effects to listed fish species and their habitat.

The Service believes the following conservation recommendation will reduce the impact of the proposed action on nesting spotted owls within the action area:

1. Delay activities that may disturb spotted owls as late as possible into the nesting season. This will provide the maximum opportunity for juveniles to successfully fledge prior to any habitat manipulation or noise disturbance.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification regarding the implementation of any conservation recommendation.

The Service does not anticipate that adoption of the PRMP will result in the incidental take of any spotted owls without subsequent consultation and site-specific project planning and analysis. Therefore, no incidental take of spotted owls is exempted as part of this consultation.

SPOTTED OWL REINITIATION TRIGGERS

These reinitiation triggers are included in the spotted owl section and restated here. In addition to the regulatory triggers for reinitiation of consultation (50 CFR §402.16), the analysis of effects of this potential barred owl management program rely on the following specific assumptions regarding a potential barred owl management program, harvest rate on BLM lands, and the biological results for the spotted owl. Monitoring results will be measured against these assumptions to determine the effectiveness of a barred owl management program. Failure to meet these assumptions will trigger reinitiation of consultation.

1. Implementation of a barred owl management strategy and associated monitoring program that the Service concludes are adequate to achieve and measure the results described in paragraph 3, below, will begin on BLM lands in the action area by year 8 of PRMP implementation.
2. Rates of spotted owl territorial site abandonment resulting from timber harvest in the Harvest Land Base will not exceed 10 percent in the first decade of implementation, 15 percent in the second decade, and 20 percent in each subsequent decade.
3. The following benchmarks for the rate of spotted owl population change on BLM lands within the action area will be met or exceeded (Tables 232 and 256). These rates of population change were used in estimating the number of occupied owl sites discussed above and meeting them would be expected to achieve similar results. Determination of whether these benchmarks have been met can be achieved in a number of ways. For the barred owl management scenario we have described in this BO, spotted owl demographic rates from the NWFP Effectiveness Monitoring Program demographic study areas (see Dugger et al. 2016 for details) can be used to assess the effectiveness of barred owl management. There are 4 northern spotted owl demographic study areas (Oregon Coast Ranges, Tyee, Klamath, Union/Myrtle) (Dugger et al. 2016) that overlap the 5 potential barred owl management areas we described above. Demographic study areas overlap the OCR-N, OCR-S, KLV-N and KLE potential barred owl management areas (Figure 28) and comprise approximately 40% (324,398 acres) of these areas. While the KLV-S and WCS barred owl management areas do not include demographic study areas, we believe that changes in population growth rate obtained from portions of the demographic study areas that do overlap potential barred owl management areas are sufficient to assess the effectiveness of a barred owl management program on BLM lands because the demographic study areas are representative of forest types within the barred owl management areas and provide robust data for estimating rates of population change. Rates of population change should be assessed using estimates of population change for the portions of these demographic study areas that overlap the barred owl management areas. These population parameters have been estimated every five years since the mid-1990s. Anticipated future analyses would occur in 2019, 2024, 2029, 2034, 2039, 2044, 2049, 2054, 2059 and 2064.

Table 256. Annual rate of population change (λ) for spotted owls in demographic study areas (DSAs) within barred owl management areas on the six potential barred owl management areas if barred owl management is successfully implemented.

	Years after implementation of the PRMP				
	2034	2039	2044	2054	2059
Annual rate of population change (λ) for spotted owls within demographic study areas on the barred owl management areas	-0.05%	0 (stable)	+1%	+2%	+2.75%

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in your Biological Assessment. As provided in (50 CFR § 402.16), reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action.

LITERATURE CITED

The literature cited section is organized by species for the citations that are in the Status of the Species, Environmental Baseline for the Species and Effects of the Action on the species, and Status of the Critical Habitat, Environmental Baseline for the Critical Habitat, and Effects of the Action on the Critical Habitat, where applicable. There are some citations that are applicable to nearly all the sections of the BO, including the introduction. Those are included in the first section of the literature cited, Common Citations; in addition, citations from that portion of the BO prior to the sections stated above are included here as well. Where citations are included in text excerpted or quoted from other documents, such as one of the BAs, please refer to those documents for those records.

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Betsy Glenn pers comm June 7, 2016 (GIS query)

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Glenn, B. 2016a. Betsy Glenn, wildlife biologist, USFWS, Portland, OR, personal communication June 7, 2016 (email RE: Table for Query)

Glenn, B. 2016b. Betsy Glenn, wildlife biologist, USFWS, Portland, OR, personal communication June 1-14, 2016 (email Fwd: FW: Data request for non-fed lands in the action area)

Glenn, B. 2016c Betsy Glenn, wildlife biologist, USFWS, Portland, OR, personal communication June 10-13, 2016 (email RE: more GIS info needed :())

Hardt, R. 2016. Richard Hardt, Interdisciplinary Team Leader, RMPs for Western Oregon, Bureau of Land Management, personal communication June 14, 2016 (email Re: lets talk)

McGraw, R. 2016a. Rex McGraw, District Wildlife Biologist, Roseburg District BLM, Oregon, personal communication, May 17, 2016a (email Re: Request for CH info broken out by Conservation zones)

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McGraw, R. 2016c Rex McGraw, District Wildlife Biologist, Roseburg District BLM, Oregon, personal communication, May 30, 2016 (email Re: NSO habitat in ACECs)

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APPENDIX A – LETTERS OF CONCURRENCE

COLUMBIAN WHITE-TAILED DEER

The Columbian White-Tailed Deer (CWTD) is listed as endangered and is closely associated with riparian (riverside) habitats in the Lower Columbia River drainage. The deer found on islands in the Columbia River use "tidal spruce" habitats characterized by densely forested swamps covered with tall shrubs and scattered spruce, alder, cottonwood and willows. Optimum CWTD foraging habitat contains a variety of food types that are abundant at different times of year and is located within 820 feet of forest cover near riparian areas (Brookshier 2004, p.3). The CWTD is the western-most subspecies of white-tailed deer which occurs throughout North America.

The lands in the action area within the potential range of the CWTD are not close to the deer's preferred habitat along the Columbia River, are not currently suitable for CWTD and are not currently occupied by the CWTD. In fact, the range of the CWTD does not currently extend to the action area parcels nearest any CWTD populations. While it is possible the deer could potentially occupy these parcels if the population increased significantly and expanded its range upslope across state highway 30 from the Columbia River, there are several factors working against this from occurring. While early-successional habitat may contain high-quality forage, the proposed RMP does not specify what variety of plant species will likely constitute early-successional forest within their action area, nor does it state the distribution and connectivity of the newly created areas across the action area. Therefore, it is uncertain if these areas will even provide suitable CWTD habitat.

Not only are the nearest parcels away from existing CWTD populations and away from the CWTD's preferred habitat of "tidal spruce" habitats, but any habitat created in the action area would also serve as habitat for the black-tailed deer (*Odocoileus hemionus columbianus*), a similar species that competes with CWTD for resources. Black-tailed deer already inhabit the forests in and around these action area parcels which would make the expansion of the CWTD into these areas even less likely given their need to compete for any forage resources.

For the stated reasons above the Service finds the expansion of the CWTD to the currently unoccupied parcels of the action area to be an extremely unlikely scenario. The Service finds the likelihood of CWTD occupying the action area to be discountable, and therefore we concur with the BLM's determination that the proposed action *may affect, but is not likely to adversely affect* the CWTD.

GRAY WOLF

The BA (BLM 2016a, pp. 177-78) identifies general human disturbance and three resource program areas that the BLM determined *may affect, but would not be likely to adversely affect* gray wolves (*Canis lupus*). Our analysis of the effects of these activity categories is provided below.

1. Disturbance

Under the proposed RMP, the BLM proposes to address potential human disturbance (*i.e.*, human use not associated with vegetation- or ground-disturbing activities) on gray wolves by implementing the following management direction (BLM 2016a, pp. A56 to A57):

- Restrict activities that create noise or visual disturbance(s) above ambient conditions within one mile of known active gray wolf dens from April 1 to July 15.

We expect this management direction will benefit wolves by minimizing human disturbance near den sites during the period of time when wolves are using those sites. Wolves in the southern Cascades have demonstrated successful denning in close proximity to forest roads with normal use patterns (Stephenson 2016, pers. comm.). Efforts to avoid particularly disruptive activities or loud noises (*e.g.*, blasting, heavy machinery) within one mile of a den site, where warranted, are expected to result in conditions fully compatible with successful denning. Therefore, the potential effects to the wolf from disturbance are insignificant, and the Service concurs with BLM that the PRMP *may affect, but would not be likely to adversely affect* gray wolves through disturbance.

2. Livestock Grazing (BLM Medford District and Klamath Falls Field Office only)

Under the proposed RMP, the BLM proposes to address the potential effects to gray wolves from livestock grazing on BLM allotments by implementing the following management direction (BLM 2016a, pp. A56 to A57):

- In accordance with 43 CFR 4110, modify grazing leases, as appropriate, to include the following measures when the Service: (1) determines gray wolf occupancy of a BLM grazing allotment; and (2) recommends the implementation of these measures as part of its wolf conservation strategy:
 - Remove, bury, or otherwise dispose of livestock carcasses found on areas of the allotment where they would attract wolves to a potential conflict situation with other livestock (such as a salting ground, water source, or holding corral) such that the carcass will not attract wolves.
 - Move sick or injured livestock from the allotment so they are not targeted by wolves.
 - Limit allotment management activities by humans near active wolf den sites during the denning period (April 1 to July 15) to avoid human disturbance of the site. Determine the distance on a site-specific basis, depending primarily on topography around the den site.
 - Do not place salt or other livestock attractants near known wolf dens or rendezvous sites to minimize livestock use of these sites. If a new den or rendezvous site is discovered, relocate any previously established salt or attractant location as necessary to minimize livestock use of these sites.

The Service expects this management direction will effectively reduce the potential for attracting wolves into close proximity with livestock, primarily by eliminating attractants (*i.e.*, dead, injured, or sick livestock) that are known to draw in wolves. When such attractants are removed, wolves are less likely to be in close proximity to grazing livestock, which reduces the risk of them targeting livestock as potential prey. Avoiding livestock attacks is important because wolf recovery is predicated on wolves subsisting on wild sources of food, and livestock

losses can cause significant economic impacts to the affected producers. Such impacts also increase negative attitudes towards wolves in local communities.

Because the proposed actions are expected to be effective at preventing or minimizing wolf attacks on livestock and keeping them from developing into chronic depredation situations, the Service concurs with BLM that the proposed Livestock Grazing Program *may affect, but would not be likely to adversely affect* gray wolves.

3. Wild Horses

Under the proposed RMP, BLM proposes to address the potential effects of the Pokegama Wild Horse herd management activities on gray wolves by implementing the following management direction (BLM 2016a, pp. A56 to A57):

- Restrict activities that create noise or visual disturbance(s) above ambient conditions within one mile of known active gray wolf dens from April 1 to July 15.

We do not expect that wild horse activity in the vicinity of wolves will have any effect on gray wolves. Wolves are bold, apex predators and their behavior will not be influenced by the presence of wild horses. In general, we expect there to be very little interaction between them, although wolves may opportunistically prey on sick or badly injured horses.

The potential for any effect to wolves from BLM's herd management activity is also very low, and is not expected to be adverse to them. The proposed management direction to minimize disturbance near active den sites provides further assurance that there will be no adverse effects from wild horse management activities. The BLM determined that proposed management direction for the free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office *may affect, but would not be likely to adversely affect*, gray wolves, and for the reasons stated the Service concurs with BLM's determination.

4. Land Use Allocations and Other Resource Programs

Under the proposed RMP, the BLM determined that proposed management direction for Land Use Allocations and Other Resource Programs *may affect, but would not be likely to adversely affect*, gray wolves, because the amount and distribution of gray wolf habitat in the action area would not change, given the plasticity of gray wolves in using the landscape and their resilience to different land-use management regimes, rendering the effects *insignificant* or *discountable*. Because wolves are habitat generalists and largely insensitive to most land use activities occurring on public lands, and because of the conservation measures included in the proposed action as noted above, the Service concurs with this determination.

WESTERN LILY

Although numerous resource programs under the PRMP have the potential to adversely affect the western lily (*Lilium occidentale*), the BLM (2016a, pp. 157-158) has included specific measures to protect this species. These measures will apply to all PRMP resource programs and avoid the potential for adverse effects to occur to the western lily under those programs except

where necessary for the conservation of the species. This program and the specific measures are:

4. *The Rare Plants and Fungi Resource Program (BLM 2016a, p. A-47-A-48), which includes the following management direction:*
 - *Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of the species.*
 - *Manage ESA candidate and Bureau Sensitive species consistent with any conservation agreements or strategies including the protection and restoration of habitat, alteration of the type, timing, and intensity of actions, and other strategies designed to conserve populations of the species.*
 - *Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.*
 - *Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.*
 - *Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.*
 - *When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.*
 - *Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.*
 - *Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives.*

Absent the above constraints, some resource programs under the PRMP may have the potential to adversely affect western lily depending on how the BLM implements the particular program in areas occupied by this species. For example, managing encroaching shrubs could damage individual lilies by dragging or yarding harvested shrubs over lilies.

However, based on our consideration of the above program and management direction that will apply to all PRMP resource programs and land-use allocations, the Service concludes that these measures will constrain potential adverse effects of PRMP-associated resource programs on the western lily to an extent that: a) is compatible with the conservation of this species; and b) will not result in adverse effects. This is because the measures described above would require pre-project surveys for the western lily and preclude implementation of future activities under the PRMP that may affect western lilies that:

- Are not consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measures developed with the Service;
- Would not maintain populations of ESA-listed plant species; and
- Would not maintain or restore natural processes, native species composition, and vegetation structure in natural communities.

The management direction described above has a high potential to protect existing western lily individuals and populations and prevent any adverse effects. The Service believes this is true because the key threat is encroachment of habitat which can be and has been managed in a manner that avoids adverse effects and individual lilies are readily identifiable and visible, and can therefore be easily avoided and protected during management actions.

While the only population within the action area is in the New River ACEC, this plant is not identified as a relevant and important value of the ACEC (BLM 2016c, p. 1269).

The Service has published a recovery plan for the western lily (USFWS 1998). The recovery plan provides a roadmap of recommended actions that the Service believes will result in the conservation and recovery of this species. The development of site-specific future actions under the PRMP-associated resource programs are required to consider and be consistent with recommendations of the plan. Provisions of the recovery plan include (USFWS 1998, pp. 32-33) reducing encroachment by trees and shrubs through individual removal of young trees, which is anticipated to alleviate the main threat facing this population. Individual removal is recommended to avoid using heavy machinery which has the potential to compact soils in the area. Because of the management direction under the Rare Plants and Fungi resource program, the BLM's implementation of tree and shrub removal will be consistent with this recommendation from the recovery plan.

There are no known populations of the western lily on non-federal lands within the action area.

Because the recovery plan provides for recommendations that alleviate the threats facing this population in a manner that does not have adverse effects to the western lily, the Service

concur with BLM's assessment that implementation of the PRMP *may affect, but is not likely to adversely affect* the western lily.

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APPENDIX B – BLM EFFECTS DETERMINATIONS COMMON TO ALL SPECIES AND CRITICAL HABITATS IN THE TERRESTRIAL BA

The PRMP covers a wide variety of potential actions under 20 separate resource programs. To assist the Service in understanding and analyzing the various aspects of the mixed programmatic action, the BLM prepared the two BAs covering the proposed action (BLM 2016a, BLM 2016b) to include effect determinations for terrestrial and aquatic listed species and designated and proposed critical habitats for each resource program. For 10 of the 20 resource programs where the BLM determined their effects to all listed species and their critical habitats in the terrestrial BA were either minor or not subject to consultation (2016a, pp. 147-152), the BLM included a section addressing effect determinations common to all listed and proposed species and critical habitats. For all these resource programs the BLM determined the resource program was either a *no effect* or *may affect, not likely to adversely affect* determination, or else the resource program was not considered to be subject to this consultation, as noted below. The Service relied upon those “common” effect determinations in the following way to define, in part, the scope of our analysis:

- Where the BLM determined that *no affirmative agency action* is enacted by the PRMP for a particular resource program or program area, that action was not considered subject to this consultation for the species in the BA (BLM 2016a, entire).
- For resource programs for which the BLM made a *no effect* determination, that program or program area was not considered subject to this consultation for the species in the BA (BLM 2016a, entire).
- For resource programs for which the BLM made a *not reasonably certain to occur* determination, the Service considered that finding and the reasoning supporting it in our analysis.
- Likewise, for resource programs or program areas for which the BLM made a *not likely to adversely affect* determination, the Service considered that finding and the reasoning supporting it in our analysis.

Overlap exists in some places between activities that are part of resource programs and also part of land use allocations. Where the BA (BLM 2016a, entire) identified effects to listed species that result from activities listed in this appendix, even if they are identified as part of a management direction that is not subject to this consultation, the Service included them in our analysis of effects out of an abundance of caution.

Resource Program:

1. Congressionally Reserved and National Landscape Conservation System

The designation of these lands is beyond the discretion of the BLM and, therefore, is *not an affirmative agency action* subject to ESA section 7. (This determination does not pertain to Lands with Wilderness Characteristics, which the BLM includes in its system of District-Designated Reserves.)

2. Air Quality

The implementation of proposed management direction for Air Quality (p. A-33) would have *no effect* on the species or designated or proposed critical habitats addressed by this assessment (BLM 2016a).

3. Cultural Resources

The implementation of proposed management direction for Cultural Resources (pp. A-33 to A-34) would have *no effect* on the species or designated or proposed critical habitats addressed by this assessment (BLM 2016a).

4. Lands, Realty, and Roads

a. Right-of-Ways

As noted in the BA (BLM 2016a, pp. 148-150) and as modified by BLM for clarity:

As stated in Section II G 2 of this assessment, under the Proposed RMP, right-of-way avoidance areas would increase from 243,928 acres to 326,510 acres, and right-of-way exclusion areas would increase from 43,590 acres to 93,274 acres. These changes are *not likely to adversely affect* the species and the designated and proposed critical habitats addressed by this assessment because the potential for adverse effects caused by increasing right-of-way avoidance and exclusion areas under the Proposed RMP would be *discountable* (i.e., extremely unlikely to occur).

As stated in Section II G 2 of this assessment, other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, the PRMP does not contain any *affirmative agency actions* subject to the ESA regarding rights-of-way. The BLM would grant future rights-of-way only in compliance with regulatory requirements and subject to consultation in accordance with ESA section 7(a)(2) as appropriate.

Section II G 2 of the BA (BLM 2016a, p. 40) further explains this aspect of the proposed action as follows:

Under the Proposed RMP, right-of-way avoidance areas would increase from 243,928 acres to 326,510 acres, and right-of-way exclusion areas would increase from 43,590 acres to 93,274 acres. Other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, the Proposed RMP does not contain any *affirmative agency actions* subject to the ESA regarding rights-of-way. The Proposed RMP does not make any designations or allocations regarding rights-of-way other than the right-of-way avoidance areas and right-of-way exclusion areas. Other than the designation of right-of-way avoidance areas and right-of-way exclusion areas, the Proposed RMP makes no decision in principle about future rights-of-way and does not establish criteria for granting or denying future rights-of-way. Other than the designation of right-of-way avoidance areas and right-of-way exclusion

areas, all components of the PRMP regarding rights-of-way state the BLM's existing authorities and responsibilities or are beyond the discretion of the BLM.

Based on the BLM's description, the only affirmative actions under consultation on this point are BLM's designation of areas where future rights-of-way will be avoided or excluded; any new rights-of-way will be subject to section 7 compliance. This point was confirmed by BLM on January 27, 2016, in a meeting with BLM and the Service (Hardt 2016a, pers. comm.). The practical result of BLM's decisions in the PRMP is to reduce areas open to rights-of-way permits, which means that effects commonly associated with rights-of-way, such as habitat manipulation, road building and noise disturbance, among other potential effects, will be reduced. Therefore, the Service concurs that this aspect of the proposed action is *not likely to adversely affect* any of the species addressed in this consultation. Where the BLM's BA (BLM 2016a) included the issuance of ROWs in their effects to specific species or as part of a land use allocation or resource program management direction the Service has assessed these effects to listed species and their critical habitats in the species-specific analyses in this BO.

b. Land Disposal and Acquisitions

The following proposed management direction for Lands, Realty, and Roads (pp. A-36 to A-37) is beyond the discretion of the BLM and, thus, does not constitute an *affirmative agency action* subject to the ESA:

- The BLM may dispose of lands designated in Zones 2 and 3 that provide habitat for ESA-listed species, including critical habitat, only following consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service and upon a determination that such action is consistent with relevant law and maximizes public resource values.
- As required by the Oregon Public Lands Transfer and Protection Act (Public Law 105-321), do not reduce through disposal, exchange, or sale the acres of O&C lands of all classifications, and the acres of O&C and public domain lands that are available for harvesting.
- Make available for disposal the public domain lands in Zones 2 and 3 that have been classified under Section 7 of the Taylor Grazing Act.
- Recognize existing rights-of-way, permits, leases, and easements as valid uses.
- Process formal land withdrawals being relinquished by the BLM or other Federal agency according to the procedures stated under 43 CFR 2372. If the lands are found suitable for return to the public domain, the revocation order will recommend the management prescriptions developed in the environmental review. Manage the lands according to management prescriptions for those lands having the same or similar resource values in the same general area of the land withdrawal.
- Where the BLM has administrative responsibility on lands managed by other agencies, the BLM will administer those lands in accordance with interagency agreements.

The following proposed management direction (pp. A-36 to A-37) is not an *affirmative agency action* subject to the ESA because, with these statements, the BLM only states its existing authorities and responsibilities before taking action.

- Make lands in Land Tenure Zone 2 available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict. Zone 2 lands consist of all lands not listed in the descriptions of either Zone 1 lands or Zone 3 lands.
- Make lands in Land Tenure Zone 3 available for disposal using appropriate disposal mechanisms. These lands include:
 - Lands that are either not practical to manage, or are uneconomical to manage (because of their intermingled location and non-suitability for management by another Federal agency)
 - Survey hiatuses
 - Unintentional encroachments
- Assign to Zone 3 patented lands with reversionary interests reserved by the United States that are relinquished back to federal ownership.
- Acquire or dispose of lands to facilitate resource management objectives as opportunities occur.
- Manage newly acquired lands for the purpose for which they were acquired or in a manner that is consistent with management objectives for adjacent BLM-administered lands or other BLM-administered lands having similar resource values.
- Issue temporary-use permits, as identified under the Federal Land Policy and Management Act (Section 302), for a variety of uses, such as, but not limited to, stockpile and storage sites and as tools to authorize unintentional trespass situations pending final resolution.
- Use land-use authorizations to resolve agricultural or occupancy trespasses, where appropriate.
- Grant rights-of-ways in utility corridors as the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline. Grant the rights-of-way as the minimum necessary to accommodate a specific request. Do not permit development or management activities that would conflict with construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor.
- Construct communication facilities on existing developed communication sites where they do not conflict with other management objectives. Require a site plan for applications for communication facilities on undeveloped communication sites.
- Expand existing communication sites and the development of new sites. Prioritize the use of existing sites and facilities for accommodating the need for additional capacity.

c. Land Tenure Zone Designations

The effects of the following proposed management direction (p. A-36) are *not reasonably certain to occur* and, thus, are not addressed by this assessment, because: (1) the BLM knows of no current situation to which such direction is applicable; and (2) based on the rarity of past applicable actions the BLM cannot reasonably determine the effects of this direction. The BLM would initiate ESA section 7 consultation with the U.S. Fish and Wildlife Service on individual projects, as appropriate:

- Assign to Zone 3 survey hiatuses and unintentional encroachments discovered in the future.
- Assign to Zone 3 land boundary adjustments due to river movement discovered in the future.

Because the BLM has determined the aforementioned management direction are *not reasonably certain to occur* and are not addressed by the BLM's assessment (BLM 2016a, p. 149), the Service does not evaluate them further in this BO.

Implementation of the following proposed management direction (pp. A-36 to A-38) *may affect, but would not be likely to adversely affect*, the species, and the designated and proposed critical habitats, addressed by this assessment because it would reduce the likelihood of species and their habitats being negatively affected by disposal or the construction in future rights-of-way, rendering the effects of implementing such direction *entirely beneficial*.

- Retain lands in Land Tenure Zone 1 under BLM administration. Lands in Zone 1 include existing and future:
 - Designated, eligible, and suitable Wild and Scenic River corridors
 - Wilderness Areas
 - Wilderness Study Areas
 - National Trail management corridors
 - District-Designated Reserves - Lands Managed for their Wilderness Characteristics
 - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)
 - Congressionally designated Outstanding Natural Areas
 - Lands acquired with Land and Water Conservation Funds
- Designate Right-Of-Way Exclusion Areas in:
 - Lands designated as Wilderness
 - District-Designated Reserves – Lands managed for their Wilderness Characteristics
 - Wilderness Study Areas
 - Designated and suitable Wild and Scenic Rivers classified as wild rivers
 - Visual Resource Management Class I areas
 - In Right-Of-Way Exclusion Areas, do not grant rights-of-way, except when mandated by law.
- Designate Right-Of-Way Avoidance Areas in:
 - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)
 - Recreation Management Areas (Special and Extensive)
 - Designated and suitable Wild and Scenic Rivers classified as scenic and recreational rivers
 - Visual Resource Management Class II areas not included in Right-Of-Way Exclusion Areas,

In Right-Of-Way Avoidance Areas, grant rights-of-way if the BLM determines that the right-of-way proposals are compatible with the protection of the values for which the land use was designated, or when no feasible alternative route or designated right-of-way corridor is available as applicable with BLM laws and policy.

To the extent that these aforementioned portions of the proposed action are both discretionary and are affirmative agency actions, the Service concurs the retention of current and future

protected areas in BLM ownership (Land Tenure Zone 1 [BLM 2015a, p. 364]) as protected is beneficial to listed species and designated critical habitats because doing so will prevent the modification of habitat and critical habitat PBFs that these species rely on and of which these critical habitats are comprised. These protected lands, whether designated by Congress or by the BLM through the PRMP, confer restrictions on actions that could otherwise cause adverse effects to the species and critical habitats. However, the issuance of ROWs has the potential to affect listed species. Where these effects have been identified as part of a land use allocation or resource program management direction for individual species we have included them in our effects analysis for those species in the BO.

d. Leases and Withdrawals

Implementation of the following proposed management direction (p. A-36) would have *no effect* on the species and critical habitats addressed by this assessment because potentially affected areas are *not reasonably certain* to overlay listed-species' habitats:

- Do not issue leases or permits for landfills or other waste disposal facilities.
- Limit withdrawals to the area needed and restrict only those activities needed to accomplish the purposes of the withdrawal.

Determinations for effects for additional proposed management direction for Lands, Realty, and Roads are included by species in the effects section of this BO.

5. Minerals

As noted in the BA (BLM 2016a, pp. 150-151):

The implementation of proposed management direction for Minerals (pp. A-45 to A-47) *may affect, but would not be likely to adversely affect*, the species and designated and proposed critical habitats addressed by this assessment. Prior to beginning any suction dredging activity within lands or waters that contain listed species or their proposed or designated critical habitat, an operator would be required to contact the BLM for the BLM to determine if the proposed use is classified as casual use, or requires a notice or a plan of operations. It would be the operator's burden to determine the location of their activity relative to the location of lands or waters that contain listed species or their proposed or designated critical habitat. Suction dredging activity proposed within lands or waters that contain listed species or their proposed or designated critical habitat, regardless of the level of surface disturbance, would not begin until the BLM had completed ESA section 7 consultation, as appropriate. For notice-level mining proposals that are located within lands or waters known to contain listed species or their proposed or designated critical habitat, the notice would be complete only after the BLM had reviewed the notice and completed ESA section 7 consultation. Plans of operation located within lands or waters known to contain listed species or their proposed or designated critical habitat would continue to be governed by the standards in 43 CFR 3809 et seq. The effects of implementing this proposed management direction on the species and proposed and designated critical habitats addressed by this assessment would be *entirely beneficial* because it would help to ensure

that potential impacts to these species and habitats are fully evaluated before any BLM authorization.

The Service considered the potential effects of suction dredging in the effects of the action sections of this BO.

Leasable Minerals: Oil, Gas or Coalbed Natural Gas Resources

- Proposed management direction to maintain all lands open to leasable mineral entry except those closed by legislation (p. A-46) is beyond the discretion of the BLM and, thus, is not an *affirmative agency action* subject to the ESA. The implementation of the remaining proposed management direction for Leasable Minerals (p. A-46), requiring the BLM to apply site-specific stipulations as needed to protect federally-listed threatened and endangered species and their critical habitats, *may affect, but would not be likely to adversely affect*, the species and designated and proposed critical habitat addressed by this assessment because the effects of implementation on these species and habitats would be *entirely beneficial*.

The portion of the Leasable Minerals: Oil, Gas or Coalbed Natural Gas Resources action that is not an *affirmative agency action* is not part of the scope of this consultation. The portion of this action that is discretionary and involves an agency action includes (BLM 2016a, pp. A-46) the following:

- Apply site-specific stipulations, such as no surface occupancy or conditional surface uses, based on resource protection needs in—
 - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
 - National Trail management corridors;
 - District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
 - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas where not already closed by legislation); and
 - Recreation Management Areas (Special Recreation Management Area/Extensive Recreation Management Area).
- Apply site-specific stipulations as needed to protect ESA-listed species and their critical habitats.

Because this part of the proposed action requires the specific protection of listed species and their critical habitats, the Service concurs that this part of the action is *not likely to adversely affect* listed species and their critical habitats.

Salable Minerals

As stated in Section II G 2 of this assessment, under the Proposed RMP the BLM would close 249,241 acres to salable mineral entry. The implementation of proposed management direction to close these acres to salable mineral entry (pp. A-46 to A-47) *may affect, but would not be likely to adversely affect*, the species, and designated and proposed critical

habitats, addressed by this assessment because it would reduce the risks that species' habitats would be modified by salable mineral entry, rendering the effects on species and their habitats *entirely beneficial*. The implementation of proposed management direction to retain all areas not closed to salable mineral entry, through legislation, as open for such entry (pp. A-46 to A-47) is beyond the discretion of the BLM and, therefore, is not an *affirmative agency action* subject to the ESA.

The portion of the salable minerals action that is not an *affirmative agency action* is not part of the scope of this consultation. Closing particular areas to salable mineral entry (BLM 2016a, pp. A-46 - A-47) would involve the following:

- Close to salable mineral material disposal—
 - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
 - National Trail management corridors; and
 - District-Designated Reserve – Lands Managed for their Wilderness Characteristics.
- Close Special Recreation Management Areas and Extensive Recreation Management Areas to salable mineral material disposal when not compatible with meeting recreation objectives or maintaining recreation setting characteristics.
- Close Areas of Critical Environmental Concern with identified special management needs to salable mineral material disposal.

Salable mineral entry can result in habitat disturbance, deterioration and removal through extraction activities that can include the harvest of trees, the digging of soil, the erosion of soil, the introduction of sediments into waterways, the building of graded and spur roads, among other activities. Because this part of the action only involves closing areas to these potential activities due to salable mineral entry, thereby avoiding these effects, the Service concurs that the discretionary portion of this action is *not likely to adversely affect* listed species in the terrestrial BA (BLM 2016a, entire).

Locatable Minerals

As stated in Section II G 2 of this assessment, under the Proposed RMP the BLM would recommend for withdrawal from locatable mineral entry 307,312 acres. The implementation of proposed management direction for Locatable Minerals (p. A-46) to petition to withdraw these acres from locatable mineral entry *may affect, but would not be likely to adversely affect*, the species, and designated and proposed critical habitats, addressed by this assessment (BLM 2016a, entire) because Congressional or Secretarial approval of the withdrawals would reduce the risks that species' habitats would be modified by locatable mineral entry, rendering the effects on species and their habitats *entirely beneficial*. The implementation of proposed management direction to retain all areas not congressionally or secretarially withdrawn from locatable mineral entry as open for such entry is beyond the discretion of the BLM and, therefore, is not an *affirmative agency action* subject to the ESA.

The portion of the locatable minerals action that is not an *affirmative agency action* is not part of the scope of this consultation. The petitioning to withdraw particular areas from locatable mineral entry (BLM 2016a, pp. A-46) would involve the following:

- Recommend for withdrawal from locatable mineral entry—
 - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
 - National Trail management corridors; and
 - District-Designated Reserve – Lands Managed for their Wilderness Characteristics.
- Recommend for withdrawal from locatable mineral entry Special Recreation Management Areas and Extensive Recreation Management Areas when mineral entry is not compatible with meeting recreation objectives or maintaining recreation setting characteristics.
- Recommend for withdrawal from locatable mineral entry Areas of Critical Environmental Concern with identified special management needs associated with locatable mineral entry.

Locatable mineral entry can result in habitat disturbance, deterioration and removal through extraction activities that can include the harvest of trees, the digging of soil, the erosion of soil, the introduction of sediments into waterways, the building of graded and spur roads, among other activities. Because this part of the action only involves recommending areas for withdrawal from locatable mineral entry, thereby avoiding these effects, the Service concurs that the discretionary portion of this action is *not likely to adversely affect* listed species in the terrestrial BA (BLM 2016a).

Overall, because the portions of the management direction for Minerals that are discretionary agency actions subject to consultation (BLM 2016a, pp. A-45 – A-47) either increase the areas where mineral extraction may not occur or include the protection of listed species and their critical habitats, the Service concurs with the BLM's determination that this part of the proposed action is *not likely to adversely affect* the listed species and their critical habitats in the terrestrial BA (BLM 2016a).

6. Paleontological Resources

The implementation of proposed management direction for Paleontological Resources (p. A-47) would have *no effect* on the species and their critical habitats, addressed by the terrestrial BA (BLM 2016a).

7. Soil Resources

As noted in the BA (BLM 2016a, pp. 151-152):

The implementation of proposed management direction for Soil Resources (p. A-50) *may affect, but would not be likely to adversely affect*, the species, and designated and proposed critical habitats, addressed by this assessment because it would cause the BLM to maintain or enhance the inherent soil functions of managed ecosystems so that the overall soil properties do not decline beyond acceptable levels that would impede said functions across the planning area, and provide landscapes that stay within natural soil stability failure rates

during and after management activities. Thus, the effects of restoring and maintaining hydrologic function would be *discountable* during the short term and *entirely beneficial* during the long term to each of these species and critical habitats.

The management direction related to Soil Resources includes protections to maintain certain levels of soil function for future landscape maintenance and development, including during and after management actions. While impacts to soil may arise from management of forests, the impacts of that forest management itself is not at issue in this resource program, but is, instead, addressed in the species-specific discussions in this BO for those species or critical habitats that may be affected by forest management (or any other resource program where the BLM needs to manage the soil to meet the following management direction). Management direction for Soil Resources includes (BLM 2016a, p.A-50):

- Apply BMPs (**Appendix J** of the Proposed RMP) as needed to maintain or restore soil functions and soil quality, and limit detrimental soil disturbance.
- Limit detrimental soil disturbance from forest management operations to a total of < 20 percent of the harvest unit area. Where the combined detrimental soil disturbance from implementation of current forest management operations and detrimental soil disturbance from past management operations exceeds 20 percent of the unit area, apply mitigation or amelioration to reduce the total detrimental soil disturbance to < 20 percent of the harvest unit area. Detrimental soil disturbance can occur from erosion, loss of organic matter, severe heating to seeds or microbes, soil displacement, or compaction.
- Avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would likely damage infrastructure (*e.g.*, BLM or privately owned roads, State highways, or residences) or threaten public safety.
- Do not till soils where tillage will cause soils to become unstable due to increasing the soil moisture content.

Because this management direction contains only productive and protective measures that improve soil conditions and productivity while limiting the potentially impactful effects to soil from other programs (that are addressed separately in other parts of this effects analysis), the Service concurs with the BLM's determination that the Soil Resources resource program is *not likely to adversely affect* listed species or their critical habitats in the terrestrial BA (BLM 2016a). The effects of this program will be the retention and improvement of productive soil qualities such that robust growth of native vegetation should be maintained and improved. This should have neutral or beneficial effects to species and critical habitats included in the terrestrial BA (BLM 2016a).

8. Sustainable Energy

As noted in the BA (BLM 2016a, p. 152):

The implementation of proposed management direction for Sustainable Energy (pp. A-50 to A-52), to exclude from sustainable energy development areas that are part of the National Landscape Conservation System, Areas of Critical Environmental Concern, and District-

Designated Reserves, *may affect, but would not be likely to adversely affect*, the species, and the designated and proposed critical habitats, addressed by this assessment because it would reduce the risks that species' habitats would be modified, rendering the effects *entirely beneficial*. The implementation of proposed management direction to develop sustainable energy sites and transmission corridors using best management practices to reduce or avoid impacts to other resource uses, including the species and habitats addressed by this assessment, *may affect, but would not be likely to adversely affect*, those species and critical habitats because it would reduce the risks that species' habitats would be modified, rendering the effects *entirely beneficial*. The implementation of proposed management direction that directs the BLM to offer timber harvest slash (biomass energy conversion feedstock) for sale as an alternative to being burned on-site or left in place for soil stabilization, *may affect, but would not be likely to adversely affect*, the species and the designated and proposed critical habitats addressed by this assessment (BLM 2016a) because, even though slash removal could indirectly affect forest stand regrowth, the rarity of past requests for biomass feedstock, and the BLM analysis that shows no biomass processing infrastructure in the planning area, renders the effects to species and critical habitats *discountable*.

There are several distinct aspects to the “Sustainable Energy” resource program. Here are the Management Direction (BLM 2016a, pp. A-50 – A-52):

Sustainable Energy

Management Direction

- Exclude from sustainable energy development areas that are part of the National Landscape Conservation System (*e.g.*, Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers, and National Historic and Scenic Trails), Areas of Critical Environmental Concern, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics.
- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
 - Control outdoor lighting with motion or heat sensors to the maximum extent practicable.
 - Use hooded outdoor lighting directed downward to minimize horizontal and skyward illumination to the maximum extent practicable.
 - Minimize the use of high-intensity lighting.
 - Establish non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern.
 - Control any pets of operations staff kept on-site to avoid harassment and disturbance of wildlife.
 - Use existing roads and utility corridors to the maximum extent feasible; minimize the number and length/size of new roads, lay-down areas, and borrow areas.
 - Minimize traffic volumes to the maximum extent practicable; maintain roads adequately to minimize associated impacts.

- Install and maintain permanent fencing around electrical substations, emergency generators, and other areas potentially hazardous to human health.
- Consolidate necessary infrastructure requirements wherever possible, including electric power transmission lines, pipelines and market access corridors, and support utility infrastructure.
- Keep energy conversion sites clean of debris, garbage, fugitive trash or waste, and graffiti; minimize the accumulation of scrap heaps, dumps, and storage yards.
- Design facilities used for sustainable energy harvesting, conversion, and transmission to discourage the perching or nesting by birds.
- Integrate facilities used for sustainable energy harvesting, conversion and transmission with the surrounding landscape including minimizing the profile of ancillary structures, burial of cables, prohibition of commercial symbols, and lighting.
- Provide secondary containment for all on-site hazardous materials and waste storage, including fuel.

Sustainable Energy – Biomass Energy Development

Management Direction

- Offer slash in excess of soil stabilization needs as biomass energy feedstock.

As noted in the BLM's write-up, the rarity of past requests for biomass feedstock and the lack of biomass processing infrastructure in the planning area, the Service believes this action is extremely unlikely to occur which renders the effects to species and critical habitats *discountable*, which is *not likely to adversely affect* the species included in this consultation (BLM 2016a). The Service concurs that the history of this practice and the operational capacity for it to occur are telling for its future likelihood, and so we concur with the BLM's determination.

Sustainable Energy – Wind Energy Development

Management Direction

- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
 - Lock turbine tower access doors to limit public access.
 - Locate turbines away from landscape features known to attract raptors.
 - Locate turbines away from colonies where bats hibernate, breed, and raise their young; locate turbines outside of bat migration corridors or flight paths between colonies and feeding areas
 - Encompass specific design elements for turbine arrays and turbine design including visual uniformity, use of tubular towers, proportion and color of turbines, non-reflective paints, and prohibition of commercial messages on turbines.

- Repair, replace, or remove inoperative turbines in a timely manner.
- Exclude designated areas that are part of the National Landscape Conservation System (*e.g.*, Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers, and National Historic and Scenic Trails) and Areas of Critical Environmental Concern from wind energy site monitoring and testing and development.
- Incorporate wildlife-compatible design standards when fencing is necessary.
- Avoid the use of guy wires on communication towers and meteorological towers at wind energy project sites.
- Keep the installation of meteorological towers on a project site to a minimum; do not locate these towers in sensitive habitats or in areas where ecological resources known to be sensitive to human are present.
- Light only a portion of the turbines within a wind project; fix all pilot warning lights to fire synchronously.
- Do not add any wildlife habitat enhancements or improvements (*e.g.*, ponds, guzzlers, rock piles, brush piles, bird nest boxes, nesting platforms, wildlife food plots) that would attract small mammals to wind energy facilities.
- Use only shielded, separated, or insulated electrical conductors that minimize electrocution risk to avian wildlife.

Sustainable Energy – Geothermal Energy Development

Management Direction

- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
 - Minimize impacts to livestock operations from geothermal energy drilling and development.
 - Incorporate certified weed-free mulch into the reclamation of the land disturbed during the development of geothermal resources.
 - Raise above-ground piping on-site for sufficient wildlife passage.
 - Isolate any liquid that is at elevated temperatures or contains contaminants that are toxic or harmful to fur or feathers from wildlife access with fencing, netting or complete enclosure.

Sustainable Energy – Sustainable Energy Transmission Corridors

Management Direction

- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
 - Site overhead lines away from areas where bird crossings are frequent.
 - Mark overhead lines in accordance with Avian Power Line Interaction Committee collision guidelines.

- Install overhead lines such that the conductors parallel tree lines, employ bird flight diverters, or are otherwise screened so that bat and bird collision risk is reduced.
- Where pipeline right-of-way clearings can be incorporated into a strategic system of fire breaks, make clearings sufficiently wide to be effective as fire breaks.
- Raise pipelines constructed above ground sufficiently high enough to allow wildlife passage where needed and avoid potential alterations to predator/prey dynamics.

With respect to Wind Energy Development, Geothermal Energy Development and Sustainable Energy Transmission Corridors the management direction above was developed by the BLM to be consistent with existing national NEPA decisions and consultations that are currently in place. Because BLM complied with ESA section 7 consultation on these actions prior to signing the records of decision and is not taking any affirmative action regarding them in the PRMP, the BLM is not requesting further ESA consultation on these projects (Hardt 2016b, pers. comm.). These decisions are (BLM 2016a, p. 23):

- *Record of Decision for Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments (USDI BLM 2005b)*
- *Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States (USDA FS and USDI BLM 2008)*
- *Approved Resource Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-administered lands in the 11 Western States (USDI BLM 2009)*

Any future implementation and development of these programs will also be consistent with those existing consultations which are considered part of the environmental baseline for this consultation.

9. Visual Resource Management

As noted in the BA (BLM 2016a, p. 152):

The implementation of proposed management direction for Visual Resource Management (pp. A-53 to A-54) *may affect, but would not be likely to adversely affect*, the species, and designated and proposed critical habitats, addressed by this assessment because it would help prevent negative impacts to these species and habitats from new construction and habitat modification, making the effects *entirely beneficial*.

The Management Direction for Visual Resource Management (BLM 2016a, pp. A53-A54) include the following:

- Only allow activities that are found to meet visual management objectives using the Visual Resource Contrast Rating system.
- Visual Resource Management Class I includes—
 - Wilderness Areas;

- o Wilderness Study Areas; and
- o Designated and suitable Wild and Scenic Rivers that are classified as Wild.

Manage Visual Resource Management Class I areas in accordance with natural ecological changes. Prohibit activities that would lower the Visual Resources Inventory class of Visual Resource Management Class I areas. The level of change to the characteristic landscape will be very low and will not attract attention. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

- Visual Resource Management Class II includes—
 - o Designated and suitable Wild and Scenic Rivers that are classified as Scenic;
 - o Eligible Wild and Scenic Rivers that are classified as Scenic outside of the Harvest Land Base;
 - o National Trail management corridors;
 - o District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
 - o Special Recreation Management Areas that fall within the Primitive and Backcountry category of the Recreation Opportunity Spectrum; and
 - o Areas of Critical Environmental Concern in Visual Resource Inventory Class II outside of the Harvest Land Base.

Manage Visual Resource Management Class II areas for low levels of change to the characteristic landscape. Management activities will be seen but will not attract the attention of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

- Visual Resource Management Class III includes—
 - o Designated, suitable, and eligible Wild and Scenic Rivers that are classified as Recreational;
 - o Eligible Wild and Scenic Rivers that are classified as Scenic within the Harvest Land Base;
 - o Special Recreation Management Areas and Extensive Recreation Management Areas that fall within the Middle country category of the Recreation Opportunity Spectrum; and
 - o Areas of Critical Environmental Concern in Visual Resource Inventory Class III, and in Visual Resource Inventory Class II inside the Harvest Land Base.

Manage Visual Resource Management Class III areas for moderate levels of change to the characteristic landscape. Management activities will attract attention but will not dominate the view of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.

- Visual Resource Management Class IV includes all lands that are not designated as Visual Resource Management Class I, II, or III. Manage Visual Resource Management Class IV areas for high levels of change to the characteristic landscape. Management activities may dominate the view and will be the major focus of viewer attention.

The application of Visual Resource Management is an overlay that restricts on a portion of the landscape the types of activities that occur in a certain spot. The Visual Resource Management program, however, does not implement any actions that affect the landscape, but as an overlay allows other programs to operate at differing levels on the landscape. The effects of actions on those acres where Visual Resource Management permits activities that may affect listed species will be covered by the resource programs that actually implement those activities.

10. Wild Horses

As noted in the BA (BLM 2016a, p. 152):

The implementation of proposed management direction for the free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office (p. A-61) would have *no effect* on any of the plant species and their designated critical habitats addressed by this assessment because none of these species or their critical habitats occur in this area. The Pokegama Herd Management Area is coincident with areas of known gray wolf activity in the planning area (Keno pair) and with modeled habitat for the fisher (although no known fisher observations within the herd management area). The implementation of proposed management direction for the free-roaming horses in the Pokegama Herd Management Area *may affect, but would not be likely to adversely affect*, the wolf and fisher because it would direct the BLM to maintain current herd levels and infrastructure, which would be expected to maintain current habitat conditions for both species, and herd harvest actions would not be expected to disrupt the normal behaviors of wolves or fisher in the area because of their abilities to use a variety of habitats and move away from disturbances. For the remaining wildlife species, and their designated and proposed critical habitats, addressed by this BA (BLM 2016a, entire), the implementation of proposed management direction for the free-roaming horses in the Pokegama Herd Management Area would have *no effect* because none of these species or their critical habitats occur in this area.

Although Wild Horse management is included within the Determinations Common to all Species and Critical Habitats, the BLM (2016a, p. 147) has two different determinations, as stated above. While the Service does not comment on the *no effect* determination for the plants, we will address the *not likely to adversely affect* determination for the gray wolf. The effects to this species from BLM's wild horse management program are included in the species-specific discussions in this consultation.

Conclusion

The BLM determined that the resource programs included in "Determinations Common to all Species and Critical Habitats" in the terrestrial BA (BLM 2016a, pp. 147-152) were either not subject to this consultation, had *no effect* on the listed species and their critical habitats in the terrestrial BA, or were not likely to adversely affect listed species and their critical habitats in the terrestrial BA because the effects were either negligible (insignificant), discountable (extremely unlikely to occur) or entirely beneficial. Where the Service did not concur with these determinations we addressed the effects of these resource programs in our individual species effects analyses in the BO.

LITERATURE CITED

BLM. 2016a. Terrestrial biological assessment of the proposed resource management plan for western Oregon. Oregon/Washington State Office, Bureau of Land Management. Portland, Or. 376 pp.

Hardt, R. 2016a. Personal communication. Richard Hardt, BLM, Interdisciplinary team lead, BLM RMP Revisions for Western Oregon. January 27, 2016.

Hardt, R. 2016b. Personal communication. Richard Hardt, BLM, Interdisciplinary team lead, BLM RMP Revisions for Western Oregon. April 26, 2016.

APPENDIX C – AQUATIC ANALYTICAL PROCESS

As noted in the BA (BLM 2016b, p.279) the Service analyzed the effects of the PRMP on listed fish and their critical habitats using a process based on a modified version of an analytical tool called the Matrix of Pathways and Indicators (MPI) (USFWS 1998). The MPI was originally designed to facilitate and standardize determinations of effect for section 7 conferences, consultations and permits focusing on bull trout. Since that time the use of the MPI has been expanded to analyze effects to various other fish species because of its utility. Similarly, the MPI was the basis for development of the Analytical Process (AP) (USFWS and NMFS 2004) which is commonly used to analyze effects of timber projects on listed fish. In this consultation the effects to listed fish were analyzed by assessing the effects of the action on seven aquatic habitat indicators which were developed by combining various aspects of the indicators described within both the MPI and AP. The decision to use these indicators was reached jointly between the BLM, NMFS and the Service during the early consultation process because their overall importance to key riparian and aquatic processes. This joint approach presents a detailed analysis of effects based on diagnostic pathways, the effects to which are analyzed through effects of the actions on various indicators to determine both function of habitat and relevant impacts to the species.

The indicators and their descriptions, as jointly agreed to follow are discussed below.

Habitat Indicators Used for the Effects Analysis

The effects analysis utilizes the following indicators. These indicators were chosen based on their overall importance to key riparian and aquatic processes. A list of some of the key process interactions is provided below each indicator. Narrative descriptions of these key process interactions, with references, are provided below. Effects to fish habitat and to fish from impacts to the indicator are also described. Narrative excerpts are largely from the programmatic biological assessment for fish habitat restoration activities, known as ARBA II (USFS *et al.* 2013), unless otherwise cited.

Large and small wood

On the forest floor adjacent to streams:

- Traps fine sediment and contributes key nutrients to riparian soils

In the stream channel, physical effects include:

- Pool formation (number and depth)
- Creation of off-channel habitat
- Connectivity of stream channels with floodplains
- Cover for fish and other organisms
- Creates space for additional territories for juvenile fish
- Channel form (dissipates stream energy and limits downcutting/bank erosion)
- Substrate sorting and accumulation from bedload, thereby influencing hyporheic flow
- Larger wood pieces often trap and retain smaller wood pieces, and other organic materials

Biological effects include:

- Provides cover for fish and other organisms through a range of flow conditions
- Creates space for additional territories for juvenile fish
- Serves as substrate for aquatic algae and macroinvertebrates
- Contributes to nutrient cycling as it decomposes in stream channels
- Contributes to nutrient cycling by increasing a stream's ability to retain salmon carcasses and smaller organic detritus, important sources of stream nutrients.

“Large wood in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978; Bisson *et al.* 1987). Common sources of large wood include falling of dead trees, wind-throw and breakage, and landslides (Johnston *et al.* 2011). Latterell and Naiman (2007) observed that the primary source of in-stream wood on the Queets River in Washington was from channel meandering and bank erosion through riparian areas. Large wood influences channel gradient by creating step pools and dissipating energy (Heede 1985), lengthens streams by increasing sinuosity (Swanson 1991), and serves as an important agent in pool formation (Montgomery *et al.* 1995; Reeves *et al.* 2011). In low order streams, in particular, LW collects sediment and larger substrates during high flow events (Keller *et al.* 1985) and can account for 50 percent of the sediment/substrate storage sites (Megahan 1982). Further, LW is instrumental in nutrient retention by capturing and storing salmon carcasses (Cederholm and Peterson 1985; Strobel *et al.* 2009) and allochthonous materials, a primary energy source for smaller rivers and streams (Gregory *et al.* 1991). The resulting effect of LW on fish habitat is significant. Crispin *et al.* (1993) noted increased salmon spawning activity in an area where gravels accumulated behind LW. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of LW, and Fausch and Northcote (1992) documented that Coho salmon and cutthroat trout production was greater in LW-dominated streams, where pools, sinuosity, and overhead cover were greatest. The role of LW decreases as streams become larger, because greater currents will carry LW out of the active channel and onto the banks (Murphy and Meehan 1991).” (Quoted from USFS *et al.* 2013, P.218)

Sediment/Turbidity/Substrate

- Stream channels develop with natural sediment loads and adjust in width and depth to changed sediment loads
- Aquatic organisms evolved to utilize substrates and suspended sediment within certain ranges at specific seasons of the year
- Excess fine sediments fill in interstitial spaces between coarse substrate particles, limiting physical living space for aquatic macroinvertebrates, amphibians, and small (and juvenile life stages) of fish
- Loss of cover as a result of reduced interstitial spaces may result in increased predation
- Fine sediments deposited on gravel can negatively affect the quality of spawning substrate
- Suspended sediments added to existing loads, and unseasonal suspended sediment, stress aquatic organisms, including fish
- Pools can be filled by sediment and degraded or lost.

“Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival and developing alevins (Everest *et al.* 1987; Hicks *et al.* 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961; Loyd *et al.* 1987) due to reductions in photosynthesis within murky waters. Social (Berg and Northcoate 1985) and feeding behavior (Noggle 1978) can be disrupted by increased levels of suspended sediment. Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Kelsey *et al.* 1981; Megahan 1982). Robichaud *et al.* (2010) documented that sediment influxes into streams, which create turbidity, were lower in natural (undisturbed) forests relative to disturbed sites created by land management activities. Reeves *et al.* (1995) describe that sediment influxes and resulting turbidity occurs through naturally occurring landslides in western Oregon.” (Quoted from USFS *et al.* 2013, p. 209)

“The NMFS (1996) notes that rearing capacity of salmon habitat decreases as cobble embeddedness levels increase, resulting from increased sedimentation. Furthermore, over wintering rearing habitat within substrate may be a limiting factor to fish production and survival, and the loss of this over wintering habitat may result in increased levels of mortality during rearing life stages. Likewise, when the percent of fine sediments in the substrate was relatively high, rearing ESA-listed fish were also less abundant.”(Quoted from USFS *et al.* 2013, pp. 217-218)

Water temperature

- Aquatic organisms are adapted to specific temperature ranges.
- Water temperatures above tolerances result in avoidance behavior, negatively impact metabolism and reduce growth, reduce disease resistance and can result in mortality.
- Increase in water temperature can lead to increased distribution of non-native fish, as well as native fish, that are both competitors and predators to listed salmonids.

“Water temperatures affect the survival and production of fish throughout all life stages. For instance, a study of Chinook salmon survival from fertilization to hatching demonstrated that those eggs incubated at 15.0°C had a 23 percent survival rate while those incubated at 9.9 and 11.4°C had a 49 and 50 percent survival rate, respectively (Garling and Masterson 1985). In Chum salmon, embryo survival was demonstrated to be highest at 11°C (Murry and McPhail 1988), hatching success of rainbow trout reaches its maximum at 10-12°C (McCullough 1999), and preferred temperatures for bull trout ranges are 2-4°C (McPhail and Murray 1979). Next, changing water temperatures affect juvenile fish. Cairns *et al.* (2005) documented that increased temperatures in an Oregon stream resulted in higher neascus-type trematode infestations of juvenile salmonids. Further, juvenile (fry, fingerling, parr) Chinook demonstrate optimum growth between 10.0-15.6°C (Armour 1990), while growth drastically declines or ceases at 19.1°C (Armour 1990) and is accompanied by decreased feeding, increased stress, and warm water diseases. Juvenile bull trout are usually found in water temperatures below 12°C (Goetz 1994). Finally, at a certain point, temperatures become lethal for all fish. McCullough (1999), citing numerous studies, stated that temperatures above 21°C equal or exceed incipient lethal temperatures for Columbia River Chinook stocks and steelhead stocks migrating during

the summer season. The best bull trout habitat in Oregon streams seldom exceeded 15°C (Buckman *et al.* 1992; Ratliff 1992; Ziller 1992).” (Quoted from USFS *et al.* 2013, pp.209-10)

Peak/base flows

- Channel form, bank stability, instream wood distribution and substrates are affected by peak flow magnitude and frequency, to different degrees dependent upon the type of stream channel, confinement and bed.
- Increases in peak flows resulting from natural events or anthropogenic activities (such as forest fires, removing forest cover via timber harvest, or increasing concentration of flows due to road/stream intersections) can impact these processes.
- Base flows can also be impacted by such activities, with both increases and decreases to base flows being possible. Lower base flows could result in reduced physical living space and warmer stream temperatures. Increased base flows would have the opposite effect.

Grant *et al.* (2008) reviewed existing studies on peak flow effects from forest harvest activities. Peak flow increases in small catchments (<10 km²) had the greatest number of studies. Response curves constructed using existing study data determined that in the rain zone, the maximum response line reaches the 10-percent detection limit at approximately 29 percent harvested. This suggests that if less than 29 percent of the watershed is harvested, there are no data supporting a resultant increase in peak flow. The first detectable reported value occurs at 40 percent. However, study data could not be disentangled from the amount of roads within each harvested watershed.

For the rain on snow zone, a maximum response line for studies with less than 2 percent roads was constructed. The line reaches the detection limit at approximately 15 percent harvested. The mean response line, which includes a few basins with roads, crosses the detection limit at a slightly higher value of 19 percent harvested.

Grant *et al.* (2008) stated that the data suggest that peak flow effects on channels, if any, should be confined to channel gradients less than approximately 0.02. These are primarily gravel-bed rivers and streams in forested landscapes in western Oregon and Washington. Peak flow effects on channel morphology can be confidently excluded in high-gradient (slopes >0.10) and bedrock reaches, and are likely to be minor in most step-pool systems. On the other hand, if channels have beds of fine gravel or sand, a much closer hydrologic and geomorphic analysis seems warranted.

The 2008 RMP/EIS provided a summary of the potential effects of stream flow and peak flows on fish habitat. That discussion is incorporated here by reference (BLM 2008, pp. 390, 800-801) and summarized below:

“Scour from peak flows is an annual natural process. However, changes in the frequency or magnitude of peak flows can result in stream instability and increased scour. Scour and entrainment of eggs in gravel has frequently been documented (Schuett-Hames *et al.* 1996, McNeil 1966 in Schuett-Hames *et al.* 1996, Duncan and Ward 1985, Tripp and Poulin 1986, Lisle 1989, Nawa *et al.* 1993, Kondolf *et al.* 1991, and Schuett-Hames *et al.* 2000). Loss of eggs

due to gravel movement occurred frequently in southeast Alaska pink and chum salmon spawning streams. Mortality often exceeded 50 percent and ranged as high as 90 percent (McNeil 1966). In the Queen Charlotte Islands of British Columbia, estimated mortality of chum and coho salmon eggs from scour was 80-90 percent (Tripp and Poulin 1986). Disturbance of more than 75 percent of the chinook redds was estimated in a southwest Oregon stream due to scour (Nawa *et al.* 1993)."

"Based upon the conclusion by Grant *et al.* (2008) above regarding channel types and gradients likely to be affected by peak flow scour, streambed scour that would result in egg mortality would generally occur in lower gradient stream channels with gravel and sand-bed substrates, and would not typically occur within cascade and step-pool stream types.

A literature review by Moore and Wondzell (2005) suggests that logging can result in increases in summer base flows in rain-dominated small watersheds following logging: "The majority of rain dominated catchments had less extreme low flows for at least the first few years after harvest, based on studies in northern California, the Oregon Cascades and Coast Range, and Vancouver Island..." The review was based on studies of catchments smaller than 100 hectares and with stream channels less than 2 – 3 m wide. The authors characterized the duration of the increases as "at least the first few years after harvest." In one of the reviewed studies (Hicks *et al.*, 1991), a clearcut watershed in the H.J. Andrews forest in Oregon had higher flows in August for 8 years after logging, and a 25 percent partial cut watershed nearby had increased August water yield for 16 years post-logging. However, base flows in some instances were lower than pre-harvest after the initial few years of being greater than pre-harvest. It was hypothesized that the reduction in base flow increases over time was attributable to increased evapotranspiration from deciduous and young conifer trees. "

Riparian Reserve function and vegetation diversity

The species composition, root strength, duff layer and structural diversity of plant communities in riparian areas serve to:

- Buffer water temperature fluctuations by providing shade and cool micro-climates
- Moderate the routing of nutrients from upland disturbance
- Filter sediments eroded from uplands and reduce surface erosion, influencing the quality of pools, channel width to depth ratios, water quality (suspended sediments), streambed substrate, and spawning gravel
- Moderate bank erosion and builds streambanks, influencing floodplain connectivity
- Regulate channel migration
- Provide woody material to stream channels of various sizes (see large and small woody material discussion, above)
- Provide leaf/needle drop for nutrient cycling in streams, affecting the food web
- Provide habitat for terrestrial insects that serve as a food source for fish
- Moderate impacts of fire (patchy distribution of burnt areas due to humidity and damp soils)

The following discussion was adapted from FEMAT (1993). “Riparian areas are those portions of watersheds that are directly coupled to streams and rivers, the portions of watersheds required for maintaining hydrologic, geomorphic, and ecological processes that directly affect streams, stream processes, and fish habitats. The network of Riparian Reserves—comprised of all stream orders both intermittent and perennial—allow for connectivity of the aquatic ecosystem within a watershed. Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflows, deposition by floods and debris flows. The near-stream riparian areas—floodplains—may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides allochthonous (organic debris) to stream channels and associated aquatic invertebrate communities. Further, riparian vegetation moderates light levels and stream temperature, helps armor stream banks with extensive root systems, and contributes large wood into the stream channel.”

Chemical contamination/nutrients

Human-caused introduction of chemicals or nutrients (petroleum products, phosphorous/nitrogen fertilizers) at certain concentrations in streams can negatively influence the aquatic ecosystem. Likewise, changes to forest structure and tree species diversity (via forest fires or timber harvest) may also result in changes to nutrient availability and cycling in the aquatic system. These changes may result in:

- Unanticipated increases or decreases in stream productivity
- Sub-lethal reactions of macroinvertebrates and fish, including avoidance behavior and respiratory stress
- Developmental abnormalities in developing embryos for fish
- Bioaccumulation in tissues
- Mortality

“Aquatic ecosystem perturbations related to chemical contamination include thermal pollution, toxicity due to organic compounds and heavy metals, organic wastes and resulting changes in dissolved oxygen, acidification, and increased eutrophication.”(Quoted from USFS *et al.* 2013, p.209).

Roads within Riparian Reserves

There is no natural analogue for a road. As a result, roads can impact riparian processes when located in riparian areas (potentially impacting many of the functions described in the Riparian Reserve discussion, item 5 above).

- Existing roads that cross fish-bearing streams may have culverts that fully or partially block fish passage to important habitats upstream

- Roads connected to the stream network via drainage ditches (whether located in or out of Riparian Reserves) and stream crossing culverts also directly influence fine sediment delivery to stream channels, and peak/base flows
- Culvert crossings tend to pile wood rather than allow the wood to move and function downstream

“Wemple *et al.* (1996) documented that 57 percent of a road system within a watershed, located in the western Cascades of Oregon, was hydrologically connected to the stream network by roadside ditches draining directly into streams and roadside ditches draining into relief culverts with gullies below their outlets. Thus, an increase in road densities led to an associated increase in drainage density by up to 50 percent. High-density road systems have been linked to changes in the hydrograph or magnitude and timing of flow events. For instance, in an Oregon Coast Range watershed, Harr *et al.* (1975) showed that peak flows increased significantly after road building converted at least 12 percent of the area to road prisms. The causal effects were attributed to increased surface compaction, which reduces water infiltration, resulting in excess water being carried down the road, drainage ditches, and relief culverts into the stream network. Jones and Grant (1996) documented that peak flows increased by 50 percent in a watershed within a five year period following road construction and logging. The longevity of the hydrologic changes are as permanent as the roads, and until a road is removed and natural drainage patterns are restored, the road will continue to affect the routing of water through a watershed.”(Quoted from USFS *et.al.* 2013, p. 223)

“Human constructed physical barriers within the stream channel, such as culverts, headcuts, irrigation weirs, and dams can impair sediment and debris transport, migration routes, life history patterns, and population viability. First and second order streams, which generally include permanently flowing non-fish bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest (Benda *et al.* 1992). These streams are the sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms (Swanson *et al.* 1982; Benda and Zhanag 1990). Decoupling the stream network (through physical barriers) can result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat. Further, physical barriers prevent the movement of fish in their fulfillment of life history functions. Culverts, for instance, prevent juvenile fish from reaching rearing habitats (Furniss *et al.* 1991) and have blocked significant amounts of historical anadromous salmonid habitat (Roni *et al.* 2002; Sheer and Steel 2006). Even more, barriers restrict the expression of various life history forms within a species. Migratory movements of fluvial or adfluvial forms of bull trout, for example, can be restricted or prevented, and such a loss of life history forms restricts the full potential of fish production. Finally, strong populations rely on unimpeded access between watershed reserves, those areas of high quality habitat occupied by viable subpopulations, for dispersion and genetic interchange (Noss *et al.* 1997).”(Quoted from USFS *et.al.* 2013, p. 216)

Bull Trout Population Indicators Used for the Effects Analysis

The USFWS (1998) includes a set of four indicators used to describe the effects of an action to characteristics of bull trout populations. They are:

1. Subpopulation Size

2. Growth and Survival
3. Life History Diversity and Isolation
4. Persistence and Genetic Integrity

An effect to a population indicator is based upon the totality of effects to habitat indicators and whether or not injury, death or disturbance to the species may occur. For these reasons, the effects of the entire action to the four population indicators are done at the end of the indicator and direct effects to the species section and not by individual program.

Organization of the Effects Analysis for ESA-listed Fish

This analysis is organized in the following manner:

First, the program of work is discussed and analyzed against the indicators. A preliminary general determination based on the most impactful effect on indicators for each program (or group of programs) for all listed fish is made from this analysis.

In the sections for specific species which follow these preliminary effects discussions, the Service's uses the PBFs from each species critical habitat to analyze effects to both the species and critical habitat, where applicable. These PBFs were developed to provide a concise guide to describe the needs for survival and recovery of these fish and therefore, provide a good tool to analyze specific effects to these species. Thus a more specific analysis is done for bull trout and bull trout critical habitat based on likely effects to salmonids using the PBFs of bull trout critical habitat. This is followed by an analysis for Lost River and shortnose suckers, and shortnose sucker critical habitat (there is no Lost River Sucker critical habitat within the action area) using the PBFs from their critical habitat.

Proposed Programs of work:

1. Cultural and Paleontological Resources

Archaeological data in western Oregon shows that past human activity most often took place on flat ground and near freshwater sources. This suggests that cultural resource program activities (inventories, site-testing/excavation, and appropriate rehabilitation or stabilization techniques) are likely to occur in or near Riparian Reserves (BLM 2016b, p.286).

Cultural resource surveys are walking surveys, where the surface duff layer is removed to mineral soil. The disturbed areas are typically 1 x 1 meter in size and occur every 20-30 meters. Because it is not desirable to let the public know the location of cultural resources, the surveyor will restore each disturbed area to the extent practicable so that it looks like the surrounding ground surface. This serves to minimize erosion potential at the site. Little to no vegetation is removed. Excavation at a site with known cultural resources is performed to determine the boundaries and depth of the site. In recent memory, the largest excavation for this purpose in the decision area was 3 x 3 meters in size and to a depth of approximately 2 meters. The hole was filled and the surface restored to look like the surrounding area (BLM 2016b, p. 286).

The provisions in 43 CFR 8365.1-5 describe the reasonable amounts of paleontological specimens that can be collected. Specimens are small samples that are easily carried and transportable by hand. Specimens can only be collected from the surface or with the use of non-powered hand-tools. Casual collecting activities may not cause disturbance to the surface that would have impacts on other natural or cultural resources. The collection of common fossils for personal use is opportunistic in nature. For example, people may notice a fossil in a bare soil area, such as a road cutbank or a streambank, and collect it (BLM 2016b, p. 286).

Effects to Environmental Baseline Indicators from Cultural and Paleontological resources programs:

Large and Small Wood

A subset of cultural and paleontological activities under the PRMP would occur within Riparian Reserves. The potential to affect large and small wood recruitment to stream channels is extremely limited. Site excavations typically have a small footprint and rarely impact vegetation. Vegetation that may be affected would primarily be low growing vegetation such as grasses, shrubs and forbs, and would not typically include trees that would provide large or small wood to the system. Effects to small and large wood recruitment would be extremely unlikely to occur. Therefore, there would be a discountable effect to the indicator.

Sediment/Turbidity/Substrate

Site excavation is the only mechanism with potential effects to the indicator. The potential to affect fine sediment delivery to stream channels, with consequent increases in fines within spawning gravel or interstitial spaces between cobbles used for rearing habitat is extremely limited. As described above, site excavations typically have a small footprint. Those done for cultural resources and for paleontological resources under permit, would have site rehabilitation that would minimize or eliminate any off-site movement of disturbed soil. The amount of fine sediment reaching stream channels occupied by ESA-listed fish is not likely to result in measurable effects to the indicator. Consequently, there will be an insignificant effect to the indicator because site excavations are typically very small in area and the amount of fine sediment reaching stream channels occupied by ESA-listed fish could not be meaningfully measured.

Water Temperature

Site excavation is the only mechanism with potential effects to the indicator. The potential to affect water temperature is extremely limited. Site excavations typically have a small footprint, and little to no vegetation that provides shade to stream channels would be removed. At most, there would not be meaningfully measurable effects to water temperature. Consequently, there will be an insignificant effect to the indicator because site excavations are typically very small in area and little to no shade vegetation would be removed along any streams occupied by ESA-listed fish. These effects could not be meaningfully measured.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. Cultural and Paleontological program actions do not include road construction or other flow-concentrating mechanisms. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected. This results in a discountable effect to the indicator because site excavations are typically small in area and do not impact much vegetation, and therefore it is extremely unlikely that peak/base flows would be affected.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. The effects to the Large and Small wood indicator, the Sediment/Turbidity/Substrate indicator, and the Water Temperature indicator have been determined to be discountable negative, or insignificant. There is no mechanism to affect the Chemical Contamination and Nutrients indicator or the Roads within Riparian Reserves indicator, as described below.

Because sediment delivery to stream channels would be extremely limited, there is no mechanism to affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of low-growing riparian vegetation may be reduced in the short-term, but the effects would be insignificant.

There will be a mix of insignificant and discountable effects to several functions of Riparian Reserves. Consequently, there will be an overall insignificant effect to the indicator.

Chemical Contamination and Nutrients

There is no mechanism to affect the indicator. Neither program utilizes chemicals or adds nutrients. There will be no effect to the indicator.

Roads within Riparian Reserves

There is no mechanism to affect the indicator. Neither program affects the quantity or quality of roads. There will be no effect to the indicator.

Direct Effects to the Species from the Cultural and Paleontological Resources Programs

There is no mechanism of the Cultural and Paleontological programs that would result in direct effects to ESA-listed fish. No activities occur within streams, and any collection activity that would occur near a streambank occupied by ESA-listed fish would not result in disturbance.

Summary

The indicator analysis results are summarized in Table C1.

Table C1. Summary of indicator analysis results for the Cultural and Paleontological resources programs (BLM 2016b, p. 289)

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Insignificant
Water temperature	Insignificant
Peak/base flows	Discountable
Riparian Reserve function and vegetation diversity	Insignificant
Chemical contamination / nutrients	No effect
Roads within Riparian Reserves	No effect

Based on the analysis of the effects on the indicators, the most impactful effects were considered to be insignificant to ESA-listed fish.

2. Fire and Fuels

The potential causal mechanisms for effects to ESA-listed fish species by wildfire suppression and non-timber harvest fuels treatments have common elements, and the effects for both types of actions are addressed in this section.

Effects to Environmental Baseline Indicators from Fire and Fuels programs

Large and Small Wood

A subset of wildfire suppression and fuels treatment activities under the PRMP would affect potential large and small wood recruitment to stream channels. Specifically, those within a site-potential tree distance of stream channels. Should back burns used for fire suppression enter into Riparian Reserves, there would be a short-term increase in primarily small woody debris recruitment from the dead trees that may result. Some of these may be directionally felled towards the stream channel if there is site preparation for tree planting at a later date.

There may be a similar, but lesser, effect to wood recruitment from controlled burn fuel reduction projects within Riparian Reserves. Controlled burn activities typically take place when fuels are relatively moist (such as spring time). Studies of the effects of controlled burns to riparian areas are limited. The USFWS ARBO II (p. 251) documents that the Joint Fire Science Program (2009) concluded that a prescribed fire in the spring on the Payette National Forest in Idaho resulted in riparian forest burn severity and extent that was lower than after wildfire. In addition, a study conducted in the Sierra Nevada Mountains of California, Bêche *et al.* (2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area had minimal effects on a small stream and its riparian zone during the first year post-fire. Mortality of trees in the riparian zone was low, at 4.4 percent.

Mechanical mastication and other forms of fuel reduction that physically remove small diameter trees would reduce potential for wood debris delivery to streams. However, this is mitigated by management direction that does not allow ground-based equipment for fuels reduction projects within 50 feet of streams unless it is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.

PRMP management direction (see BLM 2016b, Appendix C, pp.719-722) would limit the magnitude of adverse effects to the small and large wood indicator, because trees may not be removed near streams for thinning fuel treatments and larger trees may not be cut. For example, within the inner zone of (0-120 feet) of fish-bearing and perennial streams of the Riparian Reserve (west of Highway 97) – Dry, management direction prohibits thinning fuel treatments within 60 feet of such streams, and does not allow cutting trees >12 DBH. This is for Class I and Class II sub-watersheds. The same requirements apply to the 0-50 feet inner zone of non-fish-bearing intermittent streams (While 50 feet is the entire Riparian Reserve width for Class III sub-watersheds).

For the Riparian Reserve west of Highway 97 – (Dry), there are several examples of management direction that would limit the magnitude of adverse effects to the small and large wood indicator because a minimum number of trees must be retained or thinning is prohibited entirely. In the outer zone (between 120 feet from the stream to one-site potential tree height) management direction requires retaining at least 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. For intermittent, non-fish bearing streams in Class I and II sub-watersheds, management direction for the middle zone (only in Class I; 50-120 feet from the stream) and outer zones (120 feet to one site potential tree height (Class I) or 50 feet to one site potential tree height (Class II)) requires retaining at least 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. For intermittent, non-fish bearing streams in Class III sub-watersheds, no thinning is allowed in the 50 foot wide Riparian Reserve.

Best Management Practices for Fire and Fuels management that would minimize the magnitude of impacts to existing or potential future small and large wood in stream channels are presented below and in BLM (2016b, Appendix C). For some BMPs, only that part of the text of the BMP that applies is displayed. These BMPs limit the numbers of trees killed by burns for fuel treatments, limit consumption by controlled burns of existing LWD, reduce the removal of trees by fire line construction, prevent cutting of down wood that extends into stream channels, increase the numbers of LWD/SWD by directional falling of snags during fire suppression, and avoids killing or suppressing trees by prohibiting the placement of fire incident activity centers within 200 feet of any waterbody. Implementation of BMPs alone will not necessarily change adverse effects to listed fish, but may reduce the magnitude of those effects,

- F1. Keep broadcast burns and jackpot burns out of Riparian Reserve inner zone, unless prescribed for restoration purposes (*e.g.*, sudden oak death sanitation, improve species composition, invigorate deciduous trees). Locate ignition lines above large open meadows associated with stream channels, unless prescribed for restoration.
- F3. Avoid direct ignition or ignition by a backing-in fire of large woody material that is touching the high water mark of a water body or that may be affected by high flows.

- F5. Limit fire lines inside Riparian Reserve. Construct fire lines by hand on all slopes greater than 35 percent and inside the Riparian Reserve inner zone.
- F10. Prevent mechanical fuel reduction equipment within the Riparian Reserve inner zone, unless prescribed for restoration.
- F13. Limit firelines inside Riparian Reserves.
- F14. Prevent cutting of logs or woody material if any portion of that material extends into the stream channel, unless for restoration. Fall snags in the Riparian Reserve towards the stream channel when felling is necessary for safety or fire suppression activities.
- F15. Avoid locating incident bases, camps, helibases, staging areas, constructed helispots, and other centers for incident activities in Riparian Reserve or within 200 feet of any waterbody, floodplain, or wetland.

In the long-term, fuel reduction projects within Riparian Reserves would reduce the risk of catastrophic wildfire, encourage growth of remaining trees as a result of reduced competition, and maintain late-seral (old-growth trees) which serve as sources of LWD to streams. The NMFS ARBO II (NMFS 2013) and the USFWS ARBO II (USFWS 2013) both state that the category of Riparian Vegetation Treatment (controlled burns) would result in minor reductions in LWD recruitment, but in some cases LWD levels will increase due to prescribed fire (Chan 1998).

Summary of effects to large and small wood

For a subset of fire suppression and fuels management projects, primarily those within Riparian Reserves proximal to ESA-listed fish, there would be insignificant negative and long-term positive effects to large and small wood recruitment to stream channels. Fire suppression and controlled burn fuels reduction projects in Riparian Reserves may result in dead, small diameter trees, potentially increasing short-term recruitment of SWD. Longer-term recruitment of SWD would be reduced, however. Fuel treatments within Riparian Reserves would retain live larger diameter trees and reduce competition from younger trees, maintaining and enhancing future LWD recruitment. Because these outcomes cannot be meaningfully measured, effects to this indicator are considered *insignificant*.

Sediment/Turbidity/Substrate

Potential sources of fine sediment to stream channels from the Fire and Fuels programs include fire lines and bare soil as a result of under burns, back burns or burning of piles. All fire lines, whether constructed by hand or by heavy equipment, are water-barred after the fire is out. The patchy distribution of bare soils within Riparian Reserves resulting from under-burns, back-burns and pile-burning treatments for fuels reduction, maintains duff and vegetation to capture fine sediment. This reduces the potential for fine sediment delivery to stream channels.

In addition, use of mechanical equipment for fuel mastication and machine piling within Riparian Reserves may result in areas of disturbed soils. However, management direction does not allow ground-based equipment for fuels reduction projects within 50 feet of streams unless it is on improved roads, designated stream crossings, or where equipment entry into the 50-foot

zone would not increase the potential for sediment delivery into the stream. There is also a prohibition of use of ground-based machinery for fuels reduction projects on slopes >35 percent, which would reduce erosion potential. Mechanical harvesting equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet).

A subset of wildfire and fuels treatment activities would occur within Riparian Reserves of streams proximal to the distribution of ESA-listed fish species. Use of BMPs, Program Direction, and PDC from ARBO II (USFWS 2013) would minimize fine sediment delivery to stream channels and the water column. Management direction cited above that excludes fuels thinning treatments within 60 feet of fish-bearing and perennial streams (Class I and Class II) in the Riparian Reserve (west of Highway 97) – Dry, would reduce soil disturbance immediately adjacent to stream channels, thereby limiting sediment delivery. Several of the BMPs cited above in the section evaluating effects to small and large wood recruitment also would reduce the amount of sediment reaching stream channels. Specifically, BMPs F1, F3, F5, F10, F13, and F15 (BLM 2016b, Appendix C, pp. 719-722) would limit the amount of bare soil in riparian areas that may be delivered to streams. Additional BMPs (and parts of BMPs) that would limit creation of bare soil areas that may erode sediment into streams (or reduce creation of hydrophobic soils that would increase overland flow contributing to erosion and turbid run-off in the case of BMP F6) include:

- *F5: Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space the waterbars as shown in Table I-5. Avoid placement of any fire line where water would be directed into water bodies, floodplains, wetlands, headwalls, or areas of instability.*
- *F6. In broadcast burning, consume only the upper horizon organic materials and allow no more than 15% of the burned area mineral soil surface to change to a reddish color.*
- *F7. Avoid burning piles within 35 feet of a stream channel.*
- *F8. Avoid creating piles greater than 16 feet in height or diameter. Pile smaller diameter materials and leave larger >12 inch pieces within the unit. Reduce burn time and smoldering of piles by extinguishment with water and tool use.*
- *F10. Limit mechanical fuel reduction equipment to slopes less than 35%. Restrict non-track mechanized equipment (e.g., feller bunchers, horizontal bar masticators) to slopes less than 20%.*
- *F11. Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including public motorized travel). Follow Temporary Stream Crossing practices under Roads section.*
- *F12. Place residual slash on severely burned areas, where there is potential for sediment delivery into water bodies, floodplains and wetlands.*
- *F13. Limit firelines inside Riparian Reserve. Where hand constructed firelines are necessary in Riparian Reserve, angle the approach, where feasible, rather than have it perpendicular to the Riparian Reserve.*
 - *Limit heavy equipment to slopes less than 35%.*

- *Locate fire lines to minimize directing water into water bodies, wetlands, headwalls, or areas of instability.*
 - *Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space waterbars as shown in Table I-5. Block dozer lines and roads or landing intersections with an approved barricade or scattered slash to preclude public motorized travel use.*
- *F18. Implement emergency fire stabilization or rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to:*
 - *Seeding or planting native vegetation for short-term cover development and long-term recovery, unless not available in quantities necessary for the emergency response.*
 - *Mulching with straw, wood chips, or other suitable material. To avoid introducing noxious weeds when mulching, use certified weed-free straw mulch or rice straw where available.*
 - *Placing straw wattles on the contour at adequate spacing between each row to capture eroded material without overflowing. Embed to the surface of the soil in slight trench to prevent undermining.*
 - *Placing and anchoring log erosion barriers similarly to straw wattles.*
 - *Spreading available cut vegetation or slash on bare soils.*
 - *Placing channel sediment retention or stabilization structures.*
 - *Placing trash racks for debris above road drainage structures.*
 - *Installing drainage structures, such as:*
 - *waterbars or drainage dips, on fire lines, fire roads, and other cleared areas according to guidelines in Table I-5 (Waterbar spacing by gradient and erosion class).*
 - *Repairing damaged road drainage facilities, such as flattened or ripped culvert ends, or burned out plastic pipes, or cleaning ditch lines of materials that impede natural flow.*
 - *Blocking or decommissioning roads and trails.*
- *F19. (Post Fire Road Repair). Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season.*
 - *Soil and water conservation practices may include, but are not restricted to:*
 - *Reducing road system hydrologic conductivity through proper grading, culvert spacing, and installing drivable dips.*
 - *Replacing culverts to increase peak flow capacity of stream crossing culverts to accommodate the 100-year design flood.*
 - *Preventing culvert plugging.*
 - *Correcting stream diversions.*

However, even with the implementation of the above Management Direction and BMPs, it is anticipated that some fine sediment would enter stream channels as a result of these activities and affect habitat for ESA-listed fish. In the case of sediment from wildfire suppression activities, the magnitude of it would likely be masked by the sediment eroded and delivered to the stream channel as a result of the fire itself. In addition, there would be a long-term risk of

mass erosion from areas where the fire burned through unstable areas, further masking erosion from wildfire suppression actions.

Short-term increases in fine sediment within interstitial spaces of larger bed particles (including spawning gravel and cobbles), and increased turbidity would occur. Overland flow from rainfall or snow-melt events occurring later in time after the fuel treatment projects are completed would be the delivery mechanism to stream channels and the water column. Effects to coarse substrate such as cobble may last for weeks to months dependent upon shear stress of future flow events to mobilize fine bed particles. Turbidity increases may be undetectable due to background levels in the water column. Armoring of the soil surface, regrowth of vegetation, and needle/leaf/fine branch drop to the soil surface would ameliorate erosion over time.

The ARBA II (USFS *et al.* 2013) describes that turbidity increases as a result of controlled burns would deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish to move downstream, and alter fish behavior patterns for a short time. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and spawning gravels are not expected. Pump chances occur in ESA-listed fish habitat. Use of pump chances for water withdrawals may result in stirring up of existing streambed sediments for moments when the hose/pipe is placed and removed in the stream. There will be a very slight increase in turbidity for a relatively short time (usually under an hour).

Summary of effects to sediment/turbidity/substrate

Fine sediment would enter stream channels as a result of a sub-set of fire suppression and fuels treatment activities occurring within Riparian Reserves proximal to ESA-listed fish habitat. There would be measurable negative effects to turbidity and streambed substrate composition from fine sediments. Effects are anticipated to be short-term, with fine sediments on and between streambed substrate particles dispersed within weeks to months. Episodes of increased turbidity may last hours to days dependent upon extent of overland flow and ability of duff, down wood and live vegetation to capture fine sediment. Because of the adverse impacts to ESA-listed fish over the short-term the effects are considered to be adverse.

Water Temperature

A subset of wildfire suppression and fuels treatment activities under the PRMP may impact vegetation that provides shade to stream channels, and potentially affect water temperatures, in areas proximal to ESA-listed fish habitat. This would result from back burns used for fire suppression, and low to moderate intensity prescribed fire, as well as hand and mechanical treatments that remove vegetation. Use of BMPs, Program Direction, and PDC from ARBA II (USFS 2013) would minimize loss of riparian shade canopy from wildfire suppression and fuels treatments.

The Program Direction described above in the effects to the Small and Large Wood Indicator section that prohibits thinning fuels treatments within 60 feet of fish-bearing and perennial streams within the Riparian Reserve (Dry), and the management direction within the inner zone (0-120 feet) of fish-bearing and perennial streams for Class I and Class II sub-watersheds in the Riparian Reserve (Dry) that requires retaining at least 50 percent canopy cover would limit the loss of near stream shade within Riparian Reserves to negligible levels.

Many of the BMPs that would reduce the loss of potential small and large wood recruitment cited above would also limit shade loss near streams. Specifically, BMPs: F1, F3, F5, F10, F13 and F15 (BLM 2016b, PP. 719-722). They do so by limiting the location or amount of fuels reduction or fire suppression actions that may kill or damage trees that provide shade within Riparian Reserves.

ARBO II (USFWS 2013, p. 251) states that there would be minor reductions in stream shade as a result of low to moderate intensity prescribed fire. A study conducted in the Sierra Nevada Mountains of California (Bêche *et al.* 2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area did not result in a measurable decrease in riparian canopy cover. Mortality of trees in the riparian zone was low, at 4.4 percent. Because it is anticipated that there would be at most, minor decreases in riparian shade from losses of streamside vegetation due to fire suppression and fuels treatments activities, it is extremely unlikely that there would be measurable increases in water temperature. Also, in the case of wildfire, the effects to water temperature from any shade loss from back-burns would likely be masked by the effects to water temperature from shade loss along streams from the fire itself. The ARBA II concluded that controlled burning would result in reduced shade on a limited basis and in such a manner as to have discountable impacts to water temperature; these impacts will be ameliorated through growth of desired riparian vegetation.

In the long-term, fuel reduction projects within Riparian Reserves would reduce the risk of catastrophic wildfire that may nearly completely remove shade canopy.

The effects of water withdrawals at pump chances are addressed in the Western Oregon Programmatic BA (USFS *et al.* 2010). Project Design Criteria (PDC) “e” for use of pump chances directs: “Pump only from streams that have continuous surface flow where the pumping will not adversely affect water quantity or quality in stream reaches inhabited by ESA-listed species.” This is a standard practice that the BLM follows. The Western Oregon Programmatic BO (NMFS 2011a) identified minor, localized increases in water temperature from the Pump Chance/Helipond Maintenance and Non-Emergency Use category. The descriptions of the activities, effects analyses and effects conclusions are herein incorporated by reference.

Summary of effects to water temperature

Minor reductions in riparian shade canopy from wildfire suppression and fuels treatment activities are anticipated to not have a measurable effect on water temperatures. Fuel reduction projects would reduce the risk of catastrophic wildfire and the loss of significant shade canopy in riparian areas. Use of pump chances will result in minor, localized increases in water temperature that are considered to be insignificant.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment (watershed or Basin) where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of a HUC12 sub-watershed or larger. Controlled burns and back burns by design do not remove all of the vegetation. There is management direction for the Riparian Reserve (Dry) that limits how much of a HUC 12 sub-watershed would be subject to moderate severity prescribed burns:

“In all sub-watershed classes:

- Apply low or moderate-severity prescribed burns where needed to invigorate native deciduous tree species. Moderate severity prescribed burns will be limited to no more than 20 percent of area of Riparian Reserve sub-watershed (HUC 12) each year.
- Apply non-commercial tree thinning to adjust fuel loads as necessary to achieve desired fire effects prior to prescribed burning.”

BMP F13, described above, has multiple measures to limit firelines within Riparian Reserves, locate them so as to minimize directing flow into water bodies, and till, water-bar or place debris on them to minimize concentration of flows and delivery to water bodies. BMPs F18 and F19 described above also have measures such as placing drainage structures on roads that would reduce road system hydrologic connectivity post-fire. In combination, these BMPs effectively eliminate the risk of increasing the stream network that may contribute to increased peak flows. Also, in the case of wildfire, the loss of vegetation from the fire itself would have more impact to peak and base flows than back-burns. The only measurable effect to base flows would result from the use of pump chances for water sources. This effect to base flows would be short-term, and the impacts are likely to be minimized by BMPs and the PDC of ARBA II (in the case of controlled burns).

BMP R61 (BLM 2016b, p. 709) addresses the amount of water that may be removed at pump chances:

“Avoid water withdrawals from fish bearing streams whenever possible. Limit water withdrawals in listed fish habitat and within 1,500 feet of listed fish habitat to 10 percent of stream flow or less at the point of withdrawal, and in non-listed fish habitat to 50 percent or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish.”

The short-term measurable effect to base flows from water withdrawals at pump chances would be minimized by PDC “f” in the Western Oregon Programmatic BA (USFS *et al.* 2010), which the BLM will continue to implement: “When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10 percent.” However, a 10 percent reduction in base flows would result in a meaningfully measurable (negative) effect to the indicator.

Summary of effects to peak and base flows

It is extremely unlikely that wildfire suppression or fuels treatment activities would impact vegetation such that peak or base flows would be measurably increased. A short-term measurable effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC “f” in the Western Oregon Programmatic BA (USFS *et al.* 2010), which the BLM will continue to implement: “When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10 percent.” A 10 percent reduction in base flows would result in a meaningfully measurable negative to the indicator.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by wildfire suppression activity and fuels treatments that occur within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. As described earlier in this section, there may be increases in small wood delivery in the short-term, with long-term benefits to large wood delivery, minimal amounts of riparian shade will be lost in the short-term with no projected impairment of water temperature, and sediment will be delivered to stream channels and the water column as a result of short-term impairment of the filtering ability of the riparian forest floor. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator as a result of phosphorous and nitrogen transport through the riparian area to the stream channel. That transport is facilitated by partial loss of duff and vegetation on the forest floor in the short-term by controlled burns.

It is not anticipated that the magnitude and duration of sediment delivery to stream channels as a result of this program would measurably affect the quality of pools, cause changes to width-depth ratios, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of riparian vegetation may be reduced in the short-term, but a long-term increase in diversity is expected to result.

The analysis below for effects to the Roads within Riparian Reserves indicator determined that there may be situations where firelines constructed by heavy equipment may be placed within Riparian Reserves. They would largely be constructed so as not to increase connectivity with stream channels, and would have erosion control measures as soon as possible. However, in the short-term riparian vegetation and the functions it provides would be measurably negatively impacted.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of short and long-term insignificant and discountable effects to several functions of Riparian Reserves. However, there are two short-term effects that are neither insignificant nor discountable. One is impairment of the filtering capability of the riparian forest floor for fine sediments and nutrients from program activities within Riparian Reserves as a result of loss of duff and vegetation from the forest floor. The other is impairment of functions provided by riparian vegetation removed by mechanized construction of firelines for fire suppression. Consequently, there will be an overall negative effect to the indicator.

Chemical Contamination and Nutrients

Petroleum products are used as fuel and lubricants for chainsaws, mechanical machination machines and dozers that create firelines. Also, drip torches use petroleum products. There is a discountable risk of chemical contamination to streams as a result of fuel spills with employment of Management Direction (BLM 2016b, Appendix A), BMPs (BLM 2016b, Appendix B, Table J-273) and the ACM/PDC of ARBA II:

- i. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (*e.g.*, generators, canes, etc.), and gas-powered equipment with tanks larger than five gallons.
- ii. Store and fuel equipment in staging areas after daily use.
- iii. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.
- iv. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.

Similarly, the risk of chemical contamination from chemical retardant, foam or other chemicals used for fire suppression is discountable as a result of BMP F4 that states: “Avoid delivery of chemical retardant foam or additives to water bodies, and wetlands. Store and dispose of ignition devices/materials (*e.g.*, flares, plastic spheres, etc.) outside Riparian Reserves or a minimum of 100 feet from water bodies, floodplains and wetlands. Maintain and refuel equipment (*e.g.*, drip torches, chainsaws) a minimum of 100 feet from water bodies, floodplains and wetlands. Portable pumps can be refueled on-site within a spill containment system.”

Controlled burns, back burns and burning of piles will generate nutrients such as phosphorous and nitrogen. While minimized by use of BMPs and Management Direction cited above, some bare soil areas as a result of those burns are anticipated. Such bare soil areas may facilitate the delivery of those nutrients to stream channels from overland flow. There are many variables that would affect the delivery of those nutrients to stream channels, including slope, amount of bare soil (fuel reduction burns typically result in patches of bare areas interspersed with patches with duff and intact vegetation), and distance between burned areas and the stream channel. Also, in the case of wildfire, there would be high severity fire impacts to soils from the wildfire itself that would mask the lower intensity effects of back-burns and fuel treatments. The effects to productivity, eutrophication and dissolved oxygen levels in the water column would vary, with a primary variable being the volume of flow and baseline impairment of the stream. Conservatively, we consider the overall effect to the indicator to be *adverse*.

Summary of effects to chemical contamination and nutrients

There would be discountable effects to the indicator from the use of petroleum products and chemical retardants, foam, and other chemicals used to suppress fires. This results from employment of Program Direction, BMPs and the ACM/PDC of ARBA II. However, due to a number of uncertainties, a conservative determination of *adverse effect* to the indicator results

from the potential for delivery of nutrients such as phosphorous and nitrogen to stream channels as a result of fire suppression and fuels treatments.

Roads within Riparian Reserves

There may be situations where firelines constructed by heavy equipment may be placed within Riparian Reserves. The amount of firelines constructed within Riparian Reserves is limited by BMP F5 and F13, described above. While not serving the purpose of a road for transportation, the effects of firelines on the landscape are similar to that of roads. Firelines created by bulldozers or other heavy equipment would largely be constructed so as not to increase connectivity with stream channels, and would have erosion control measures as soon as possible (see description above regarding BMPs F13, F18 and F19). Program direction and BMPs would help reduce the risk of effects to sediment delivery and peak/base flows to a discountable probability (see analysis above for the sediment/turbidity/substrate indicator and the peak/base flows indicator). This program has no mechanism to affect migration barriers.

Summary of effects to roads within riparian reserves

Effects on the landscape from fire lines constructed by heavy equipment may be similar to roads. Such fire lines would be designed to not increase connectivity with stream channels, resulting in a discountable probability of affecting peak/base flows and sediment delivery to stream channels. There is no mechanism to affect migration barriers. The overall effect to the indicator is *discountable*.

Direct Effects to the Species from the Wildfire Suppression and Fuels Treatment Program

Use of pump chances is the only activity that would occur instream with the potential for direct effects to ESA-listed fish. There would be temporary displacement of fish from their territories due to disturbance when water is withdrawn at pump chances in habitat occupied by ESA-listed fish. This would last for the duration of time it takes to fill the pumper truck. There is a potential that small fish can be impinged against pump screens when water is withdrawn. Pumps will have screens that meet NMFS standards when used at all sites with ESA-listed fish. Some administrative units require that water pumps be placed in caged structures to off-set the potential for fish entrapment in the pump.

The NMFS programmatic BO (NMFS 2011a, consultation no. 2010/02700 (BLM)) that addressed the category of *Pump Chance/Helipond Maintenance and Non-Emergency Use* concluded:

“While discharge to listed fish habitat (LFH) will likely be reduced (<10 percent change) for short periods of time (<1 hr), the magnitude of flow reductions is not likely to affect the species or the quality of their critical habitat because the periods of withdrawal will be short and will not affect inflow from tributary streams and hyporheic flow downstream of the point of withdrawal.”

Because there will be disturbance associated with displacement of ESA-listed fish from territories, and potential injury or death resulting from impingement on screens, there will be an **adverse effect** to the species.

Summary of effects from the Fire and Fuels program

The indicator analysis results are summarized in Table C2. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities.

Table C2. Summary of indicator analysis results for the Fire and Fuels program (BLM 2016B, P. 300).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Insignificant
Sediment/turbidity/substrate	Adverse (short-term due to fine sediment entering channels and water column)
Water temperature	Adverse (short-term due to water withdrawal at pump chances)
Peak/base flows	Adverse (short-term to the base flow component)
Riparian Reserve function and vegetation diversity	Adverse (short-term due to impacts to filtering capability for fine sediments and nutrients)
Chemical contamination / nutrients	Adverse (short-term due to nutrients entering water column)
Roads within Riparian Reserves	Discountable
Bull trout subpopulation size	Insignificant
Bull trout growth and survival	Insignificant
Bull trout life history and isolation	No effect
Bull trout persistence and genetic integrity	No effect

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in disturbance (temporary displacement of fish from territories as a result of use of pump chances) and potential injury or death (possible impingement of small fish on pump screens). Therefore, the proposed fire and fuels program would have negative effects to ESA-listed fish.

3. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities in the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect ESA-listed fish and their habitat are habitat restoration actions. The

ARBA II (USFS *et al.* 2013) and both ARBO II (NMFS 2013, USFWS 2013) documents address the effects of 20 aquatic restoration activities. The descriptions of the activities, effects analyses and effects conclusions are herein incorporated by reference. The effects analysis done within these three documents is considered robust and detailed and describes those effects expected from the proposed Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs fully. The first 19 activities are on-the-ground actions. The 20th category addresses direct effects to the species caused by surveys. The list of restoration activities is displayed below.

1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation & Screen Installation/Replacement.)
2. Large Wood, Boulder, and Gravel Placement (Large Wood and Boulder Projects; Engineered Logjams; Porous Boulder Weirs and Veins; Gravel Augmentation; Tree Removal for Large Wood Projects)
3. Dam, Tidegate, and Legacy Structure Removal
4. Channel Reconstruction/Relocation
5. Off- and Side-Channel Habitat Restoration
6. Streambank Restoration
7. Set-back or Removal of Existing Berms, Dikes, and Levees
8. Reduction/Relocation of Recreation Impacts
9. Livestock Fencing, Stream Crossings, and Off-Channel Livestock Watering
10. Piling and other Structure Removal
11. In-channel Nutrient Enhancement
12. Road and Trail Erosion Control and Decommissioning
13. Non-native Invasive Plant Control
14. Juniper Removal
15. Riparian Vegetation Treatment (controlled burning)
16. Riparian Vegetative Planting
17. Bull Trout Protection
18. Beaver Habitat Restoration
19. Sudden Oak Death Treatments
20. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration

De-compaction of skid trails to improve soil function is not explicitly listed as an ARBA II/ARBO II restoration category. However, it has effects analogous to “tilling compacted surfaces to reestablish native vegetation” in the description of category 12 (Road and Trail Erosion Control and Decommissioning).

Table C3. Effects to indicators for restoration activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs as interpreted from ARBA II analysis (as summarized in BLM 2016b, p. 302).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Long-term beneficial.
Sediment/turbidity/substrate	Short-term negative (adverse) for all categories except In-channel Nutrient Enhancement and Surveys. Long-term beneficial for reduction of fine sediments from a variety of sources, including roads put to bed during decommissioning. Also beneficial effect from bedload recruitment against placed large wood in the stream channel, which may increase hyporheic flow and reduce water temperature.
Water temperature	Discountable, except for category of Sudden Oak Death Treatments where the effect is measurable negative (adverse). Long-term beneficial.
Peak/base flows	Long-term beneficial
Riparian Reserve function and vegetation diversity	Short-term negative (adverse). Long-term beneficial.
Chemical contamination / nutrients	Insignificant, except for category of Non-native Invasive Plant Control where the effect is short-term, measurable negative (adverse). Long-term beneficial.
Roads within Riparian Reserves	Long-term beneficial due to road decommissioning.

Direct Effects to the Species from the Fisheries, Hydrology and Soils Program

Some restoration activities will result in disturbance and/or injury or death of ESA-listed fish, and will result in an adverse effect to the species. The ARBA II describes the mechanisms that cause the adverse effect. Turbidity plumes from instream heavy equipment use will cause fish to move downstream and alter behavior patterns for a short time. Fish may be incidentally injured or killed by heavy equipment that operates in or along the stream channel. Several activity types involve fish salvage that may include isolation, capture, handling, transport, and relocation. Fish handling has the potential to result in fish injury or death. Death may be immediate or delayed. Fish handling increases stress levels and can cause reduced disease resistance, osmoregulatory problems, decreased growth, decreased reproductive capacity, and increased mortality. There is a potential for a small number (up to five percent) of juvenile fish that are present in the dewatered section to avoid being captured and relocated, and thus die because they remain undetected in stream margins under vegetation, rocks, or gravels.

Projects implemented under the In-channel Nutrient Enhancement category will likely harass fish through carcass placement, such as by helicopter. Further, redd and habitat surveys in support of restoration activities, can result in disturbance of fish during spawning and other times. Finally, work conducted under the Bull Trout Protection category may incidentally

injure or kill ESA-listed fish during removal (isolation, transfer and capture techniques) of non-native fish to help secure bull trout populations, mainly in headwater streams.

Summary

The indicator analysis presented above in Table C3 determined that there would be short-term negative (adverse) effects with beneficial long-term effects to the following indicators:

- Sediment/turbidity/substrate
- Riparian Reserve function and vegetation diversity
- Chemical contamination/nutrients

Beneficial effects would occur to the following indicators:

- Large and small wood
- Peak/base flows
- Roads within Riparian Reserves

In summary, there would be long-term beneficial effects to several indicators at the cost of short-term adverse effects. It was also determined that there would be direct effects to the species, resulting in disturbance (temporary displacement of fish from territories as a result of surveys, nutrient enhancement carcass placement, and turbidity plumes) and potential injury or death from heavy equipment operating in streams and fish handling during fish salvage to remove them from instream project sites). Therefore, the analysis above would suggest that these programs will have negative effects to ESA-listed fish species.

4. Forest Management Program

Effects to Environmental Baseline Indicators from the Forest Management Program

The effects of timber harvest and forest roads on salmonids and their habitat have been documented in Meehan (1991), Spence *et al.* (1996), NMFS (1997a), and NMFS (1997b). Timber harvest has the potential to reduce streamside canopy levels that may result in increased stream temperatures and reduce the supply of large woody debris; alter stream flow regime; and accelerate surface erosion, causing increased sediment delivery and turbidity in streams.

However, these potential impacts will largely be mitigated by application of PRMP management direction, use of BMPs, and the Riparian Reserve land use allocation (LUA)(see BLM 2016b, Appendices A-C). Many of the studies referenced in the literature are based upon regeneration cuts on 50 to 90 percent or greater of the land area in watersheds, in short time frames, with relatively narrow riparian buffers. These circumstances are extremely unlikely to be replicated in projects implemented under the PRMP.

To facilitate the analysis for effects to the habitat indicators at the scale of a site-specific timber management project, the component parts of the Forest Management program are identified as project elements (PE). The project elements are: Roads and Landings, Falling and Yarding, Timber Haul, Fuels Treatment, and Post-harvest Silvicultural Treatment.

Roads and Landings

New road construction, renovation/maintenance, decommissioning and landing construction are included in the project element. Road renovation/maintenance actions include surface maintenance (blading), surface replacement, drainage maintenance and repair, vegetation management (brushing, limbing, seeding and mulching along roadways), and maintenance, replacement and repair of structures such as culverts. Access roads may be decommissioned upon completion of the timber sale. Pump chances used to draw water for road use purposes are included in the PE.

Road and Landing BMPs would reduce or eliminate impacts within Riparian Reserves. There are 100 road and landing-related BMPs (R 1 to R 100) in the PRMP (Appendix J) (see BLM 2016b, Appendix C, pp. 700-714). An abbreviated list of BMPs relevant to new road construction is presented below. Others address permanent stream crossings, temporary stream crossings, surface drainage, cross drains, timing of in-water work, low water fords, water quality for noxious weed treatment of road equipment, water source development and use, erosion control, use of fertilizers, dust abatement, road maintenance, road storm-proofing, and road closure and decommissioning,

- R2. Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.
- R3. Locate roads and landings away from wetlands, Riparian Reserves, floodplains and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.
- R6. Confine pioneer roads to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserves, floodplains and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.
- R8. End-haul material excavated during construction, renovation, and/or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.
- R11. Locate waste disposal areas outside wetlands, Riparian Reserves, floodplains and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.
- R12. Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserves, floodplains, and waters of the State.
- R13. Use temporary sediment control measures (*e.g.*, check dams, silt fencing, bark bags, filter strips and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul are complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.

The following management direction from the Hydrology and Soil Resources sections of BLM 2016b, Appendix A, (pp. 643, 658) would reduce the impacts of forest roads over time.

- Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts shall be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.
- Implement road improvement, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.
- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.
- Decommission roads that are no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.
- Avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would likely damage infrastructure (*e.g.*, BLM or privately owned roads, State highways, or residences) or threaten public safety.

Falling and Yarding

Felled trees are bucked into logs. Logs are then brought to landings by various means. The three main yarding types are ground-based, cable and helicopter. Horse yarding is an option that is infrequently used. Ground-based yarding involves heavy equipment such as tractors. Skyline yarding occurs on terrain with sufficient slope to allow one end of the log to be suspended in the air. As a result, this method is often used adjacent to streams. Helicopter yarding is done where road access is limited.

Yarding BMPs TH 1 to TH 27 (BLM 2016b, pp. 714-717) are employed when applicable to protect soil properties, riparian vegetation, stream banks and channels, water quality from fine sediment delivery, and to minimize soil erosion and concentration of run-off. Please see Appendix C of the BA for specific wording of each BMP.

The following management direction from the Riparian Reserve LUA (BLM 2016b, Appendix A, pp. 613, 631) for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (*e.g.*, excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access

benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).

The following management direction from the Riparian Reserve LUA (BLM 2016b, Appendix A, p. 613) for the Riparian Reserve in the Eastside Management Area would reduce the impacts of ground-based yarding.

Fish-bearing streams and perennial streams

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Non-fish bearing intermittent streams

- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes > 35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Lakes, natural ponds and wetlands

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

Note that this project element also includes Tree-Tipping.

Timber Haul

Timber haul is the transportation of logs from the logging site to lumber mills or other storage yards. The following management direction from the Hydrology section (BLM 2016b, Appendix A, p. 643) would reduce the impacts of timber haul to aquatic and riparian resources.

- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.

Fuels Treatment

This section evaluates treatment of fuels created by Forest Management (timber harvest) projects. On-site treatment of fuels generated by timber harvest can be accomplished through various means. Treatment options include under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. There would be no broadcast burns under the PRMP to treat Forest Management project generated fuels.

Fuel management BMPs F 1 to F 12 (BLM 2016b, Appendix C, pp. 719-721) would reduce impacts to aquatic and riparian resources. Fuel management BMPs F 1 to F 6 are employed when applicable for under burns and jackpot burns to protect Riparian Reserve characteristics, soils, large woody material that is touching the high water mark, and to avoid delivery of chemical retardant foam or additives to water bodies and wetlands.

Fuel management BMPs F 7 to F 9 are employed when applicable for pile and burn fuel treatments to protect and minimize erosion to stream channels, and to protect soil organic materials. Fuel management BMPs F 10 to F 12 are employed when applicable for mechanical and manual fuel treatments to protect Riparian Reserve characteristics, stream channels, and to minimize potential sediment delivery to water bodies, floodplains and wetlands.

Post-harvest Silvicultural Treatment

This project element includes tree planting, pre-commercial thinning, manual removal of competing vegetation and use of fertilizer. Regarding the use of fertilizers, there are no acres projected for use of fertilizer for silvicultural purposes under the PRMP. However, it is an option that may be used. It is anticipated that fertilizer may be applied to individual trees or small areas in stands, rather than widespread application that could be measured in acres. It would only occur within the Harvest Land Base LUA. Management direction for the Harvest Land Base LUA only allows for manual application of supplemental nutrients and prohibits aerial application.

Large and Small Wood

Background

Woody debris is an important channel-forming component in forested streams in the Pacific Northwest. Wood traps and stores gravel, generates scour that creates pool habitat, provides overhead cover, and protects banks by reducing stream energy. In headwater streams, small wood can retain fine sediment and prevent downstream transport to fish-bearing reaches. Conifer species persist the longest in stream channels. However, hardwood trees, such as red alder and big leaf maple, provide wood as well as leaf litter that serves as a nutrient base for macroinvertebrates, which in turn provide food for anadromous fish.

Trees closer to the stream have a higher probability of falling into the stream. Wood is delivered to stream channels generally from distances less than one site-potential tree height⁶² in width from edge of the active channel. Beyond a distance of one site-potential tree height from the stream, contribution of wood in the form of whole trees is rare and results from episodic natural debris flows and slope failures. These slope failures result from oversaturation of soils or unstable underlying geology, where large wood along with small wood, boulders, and other substrates can be delivered over longer distances. The 2008 RMP/EIS analyzed land management alternatives using a wood model that accounted for the delivery of wood in the form of whole trees from a variety of sources (BLM 2008, pp. 779-799). That analysis identified three primary sources of instream large wood: riparian tree fall, channel migration, and debris flows (BLM 2008, pp. 376-384, 781-797) and is the best available information on this topic within the action area.

Headwater streams that are prone to debris flow delivery can contribute a large proportion of instream wood downstream in fish-bearing stream reaches (Benda *et al.* 2003). Riparian tree mortality and subsequent recruitment to streams can represent the primary contribution of large wood in low-gradient meandering streams, while upslope and debris flow contributions can be greatest in higher gradient streams (Bigelow 2007, Reeves *et al.* 2003).

During the last century, many streams were “cleaned” of large wood to make the downstream transport of harvested logs more efficient. Without large wood to retain gravel and other woody material, many streams were scoured to bedrock and have correspondingly poor habitat for fish. Active restoration to offset the loss of habitat has involved the placement of logs and whole trees in addition to boulders into these bedrock channels. These restorative efforts persist for several decades as riparian stands develop that are capable of supplying long-term sources of wood to streams.

Past timber harvest of riparian stands has resulted in the replacement of structurally-complex stands with large diameter trees to young stands with small diameter trees. These young riparian stands have a preponderance of smaller diameter trees and a lack of understory vegetation. This results from high tree densities and competition, limiting the ability of these riparian stands to provide functional wood to streams. These young riparian stands are developing at higher densities than the stand conditions under which the existing structurally-complex stands developed (Poage and Tappeiner 2002, Tappeiner *et al.* 1997). Additional support for the “artificial” nature of these stands was provided by Pollock *et al.* (2005) who found that “Riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest.” The 2008 RMP/EIS described the effects of past harvest on forest stands across the landscape and riparian forest stands specifically (BLM 2008, pp. 202-212, 375-376), and those discussions are incorporated here by reference.

Analysis at the 100-year time frame

⁶² Site-potential tree-heights generally range from 140 feet to 210 feet across the decision area, depending on site productivity.

The BLM evaluated the effect of the PRMP on the potential contribution of large and small functional wood to fish-bearing and non-fish-bearing streams over a 100-year time frame. The complete details of that analysis are available in BLM 2016b (pp. 309-323). The 2008 RMP/EIS utilized a spatially explicit GIS model to estimate large and small wood delivery to BLM-administered and non-BLM-administered streams for all HUC-10 watersheds within the planning area. The 2008 RMP/EIS analyzed potential large wood and small functional wood contribution to streams considering the effects of forest management and stand growth over time in portions of the landscape capable of delivering wood to streams. That analysis is incorporated here by reference (BLM 2008, pp. 779-797). The analysis reported the effects at the scale of the planning area.

The effects of the four PE's of the Timber Harvest program: Falling and Yarding, Timber Haul, Fuels Treatment and Post-harvest Silvicultural Treatment to large and small wood were analyzed using a model to predict potential recruitment of functional wood to streams from within one site potential tree height distance from streams at the end of implementing the PRMP for a 100-year period. Characteristics of the stands that were evaluated included: changes in tree stand structural stage classes; total trees per acre; trees greater >20" DBH per acre; and, percent canopy cover in hardwoods. Results indicate that the effects over the 100-year period to the environmental baseline condition under the PRMP would be an increased potential for areas within Riparian Reserves to provide functional large and small wood to stream channels. This is a beneficial effect to potential recruitment of functional wood to stream channels over the 100-year time-frame at the spatial scale of the entire planning area, including streams inhabited by ESA-listed fish.

Analysis at the scale of a site-specific timber management project

Thinning (west of Highway 97)

Roads and Landings. While anticipated to be a rare occurrence, new road construction for the purposes of Forest Management activities is allowed within the Riparian Reserve where there is no practicable alternative to accomplish resource management objectives. For sediment modeling purposes at the scale of the decision area (see analysis that follows), the BLM estimates approximately 66 miles of new road construction in the first decade within a 200 foot sediment delivery distance to streams. To put the 66 miles in perspective, it would be a subset of the 439 miles of new road construction under the PRMP in the first decade, and add to the existing 14,330 miles of BLM-controlled roads in the planning area.

The sediment delivery distance of 200 feet is a reasonable surrogate for the maximum distance that a tree may grow from a stream that, when the tree falls, may reach a stream channel and serve as functional wood. The 66 miles of new road construction within the first decade within that 200 foot distance is useful to describe the magnitude of the potential loss of live and dead trees when they are removed during road construction that may have become functional wood in stream channels if they had not been removed. The 66 miles of road construction within 200 feet of streams would occur over a ten year period and be spread out at the scale of the entire planning area. Specific locations are not known at this time, therefore the proximity to ESA-listed fish habitat or designated critical habitat is also not known.

New road construction has the potential to negatively affect sources of large and small wood to stream channels occupied by ESA-listed fish species, by removing trees from the road prism. The extent of the effect is dependent upon the distance of the road from the stream channel, and the length of the road within the Riparian Reserve. The duration of the effect is dependent upon whether the road is a permanent road, or will be decommissioned.

Removal of hazard trees as part of road maintenance may occasionally remove a tree that might have become functional wood in a stream channel. This would be a rare occurrence, however, as Management direction for the Riparian Reserve west of Highway 97 directs retention of hazard trees and blow down trees for fish habitat restoration, unless removal of a portion of the logs is necessary for fuels reduction, or to actually accomplish opening of a road to access roads and facilities (*i.e.*, a very large blowdown event or other disturbance).

New landing construction is expected to be very limited and generally outside of the Riparian Reserve for commercial thinning projects. It is common practice to use existing landings, which are a result of the original logging of the stand subject to thinning. Landings are usually part of a road, often at the end of a spur road.

Falling and yarding. Some stands overstocked with small diameter trees within Riparian Reserves would be thinned under the PRMP. This would affect current and future sources of large and small wood. Due to the small diameter of trees in stands being thinned (no trees >20" dbh, therefore not meeting the definition of large wood), this would only affect small wood. Furthermore, because there will be no thinning within 120 feet of a stream channel for any fish-bearing or perennial stream in all three classes of Riparian Reserves, small wood sources for any habitat occupied by ESA-listed fish species would not be affected. Trees that would meet the definition for small wood (<20" dbh) would not be 120 feet or greater in length and would not be affected by thinning in the outer zone of the Riparian Reserves for fish-bearing and perennial streams.

It is acknowledged that some of the trees that would be removed by thinning in the outer zone beyond 120 feet, if left to grow, may ultimately exceed 120 feet in height. However, the probability of such a tree falling in an arc that would intersect the stream becomes increasingly lower as the distance of the tree from the stream increases. Should such a tree hit the stream, it may not remain intact on impact, and that portion of the top of the tree that is in the channel may not be of a diameter to be functional wood (depending upon the width of the channel). Given these considerations, the number of trees that may be removed by thinning in the outer zone of fish-bearing or perennial streams that, if left to grow, would have resulted in functional wood pieces in stream channels is very low.

Thinning between 50-120 feet from the stream channel for non-fish-bearing intermittent streams in Class I (Moist – non-commercial only; Dry – commercial allowed for fuels reduction) and Class II (Moist and Dry – commercial allowed) sub-watersheds would reduce the potential for small wood recruitment to the channel, but this would occur in stream channels not utilized by ESA-listed fish as habitat. The potential for movement of pieces of functional small wood from these locations to stream channels utilized by ESA-listed fish as a result of high stream flows is extremely unlikely, as intermittent streams do not have the stream power to move these pieces. These pieces would only be mobilized during very infrequent flood flows, or debris flows.

The Class III Riparian Reserve distance for a non-fish bearing intermittent stream is 50 feet. Beyond that distance a variety of silvicultural treatments are allowed under the PRMP, including thinning and regeneration. Thinning beyond the 50 feet would negatively affect small wood recruitment in the short-term. However, recent studies on density management thinning treatments on second growth stands have indicated that 80 percent of instream large and small wood originates from within 50 feet of the streams (USFS PNW 2015). Regeneration cuts would eliminate current and future large and small wood sources beyond the 50 feet buffer. However, these areas are not occupied by ESA-listed fish, nor are channels downstream that are within the Class III 6th field sub-watershed. The likelihood that any trees, if left to grow outside the 50 foot buffer, would contribute to potential small or large wood where there is habitat occupied by ESA-listed fish beyond the 6th field sub-watershed boundaries is extremely low.

Debris torrents and landslides are a source of wood to streams, and the initiation points for them may occur at distances greater than 50-120 feet from a stream channel. However, this would be a relatively rare occurrence within a thinning project area. Thinning projects are typically located in plantations that are a result of regeneration (clear-cut) logging. If the site is predisposed to debris torrents or landslides that could deliver to stream channels occupied by ESA-listed fish species, it is likely that it would have occurred in the years following the initial logging. Furthermore, during interdisciplinary project planning for proposed harvest areas, areas identified as unsuitable for sustained yield timber production, such as unstable landforms, would be avoided (BLM 1986). The BLM periodically adds such areas to the unsuitable classification through updates to the timber production capability classification system.

The PRMP also includes tree tipping management direction (as described above in the analysis of effects at the scale of the decision area) for the purposes of aquatic or riparian restoration. When trees are felled/tipped into a stream channel, or subsequently placed in stream channels, it would result in an increase in functional large and small wood.

In the long term, remaining trees in thinned stands within the Riparian Reserve would have accelerated growth and reach the 20-inch dbh class faster than would occur if the stand were left to natural processes.

Ground-based yarding may occur within some areas of riparian thinning. It would have negative effects to large and small wood recruitment to streams by killing or injuring trees within the skid trails that would otherwise be potential sources of future large and small wood. The following management direction from the Riparian Reserve LUA section of BLM 2016b, (Appendix A, pp. 626, 631) for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding to existing live trees in the stand. It does so by excluding some areas from ground-based machinery.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (*e.g.*, excavators, loaders, forwarders, and harvesters) may be used on short

pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).

The following BMPs (BLM 2016b, Appendix C, p. 715) would further reduce the potential impact of ground-based skidding on large and small wood recruitment by limiting the total area in designated skid trails and using existing skid trails and landings. This would limit the killing or injuring of trees within the skid trails that would otherwise be potential sources of future large and small wood.

- BMP TH 08. Limit designated skid trails for thinning or regeneration harvesting to ≤ 15 percent of the harvest unit area to reduce displacement or compaction to acceptable limits.
- BMP TH 12. Incorporate existing skid trails and landings as a priority over creating new trails where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor, and the yarding itself would damage or kill some small trees within the corridor. This would negatively affect potential sources of current and future small wood, and future large wood to stream channels. However, BMP TH 2 requires trees felled for yarding corridors in the Riparian Reserve within a tree height distance of a stream channel to be directed toward the stream and left on site.

There is currently no estimate of how many yarding corridors may be constructed on streams occupied by ESA-listed fish in the planning area. However, impacts to large and small wood recruitment is expected to be small because of the limited amount of Riparian Reserve thinning that is estimated to occur, the fact that not all of that thinning would be adjacent to stream reaches occupied by ESA-listed fish, limited use of yarding corridors for Forest Management timber sale units located outside of the Riparian Reserve, and the immediate recruitment of large and small wood as a result of BMP TH 2 (BLM 2016b, Appendix C, p. 715).

Helicopter yarding results in extremely limited ground disturbance, and therefore would not have meaningfully measurable effects to residual trees that may become large and small wood in stream channels.

Overall, while there are long-term and short-term benefits to potential recruitment of large and small wood to streams occupied by ESA-listed fish species by thinning activities and tree-tipping, the overall effect of the PE is negative and measurable, predominately from skid roads and yarding corridors.

Table C4. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the McKenzie River basin bull trout evaluation area (BLM 2016b, pp. 63-64)

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	42	0	0	2,167	4,750	6,959
2033	0	0	0	5,640	2,227	7,867
2043	42	0	0	1,549	4,459	6,051
2053	0	0	0	1,489	2,650	4,139
2063	0	0	0	2,730	2,107	4,837
Total BLM acres in McKenzie Basin = 51,805						

Table C5. Acres of PRMP Riparian Reserve thinning by decade within the McKenzie River basin bull trout evaluation area (BLM 2016b, p.68).

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	17,559	17,559	17,559	17,559	17,559
Not Eligible	3,661	3,661	3,661	3,661	3,661
Eligible	13,898	13,898	13,898	13,898	13,898
Not Thinned	13,181	13,669	13,587	13,614	13,740
Thinned	717	228	311	283	158
% of total R. Reserve Thinned	4.1%	1.3%	1.8%	1.6%	0.9%

Fuels treatment. Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. However, it is fuels treatment that occurs within the Riparian Reserve that has the potential to affect the wood indicator. Landing pile and burn would not affect the wood indicator as landings are typically well outside of the Riparian Reserve. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve is hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the wood indicator. Any burning of slash has the potential to kill an existing tree and affect the wood indicator. However, a slash pile created by the hand pile and burn treatment type typically has a small footprint (BLM 2016b, Appendix C, p.720), BMP F 8 limits piles to 16 feet in height or diameter) and the piles are placed in openings that would not have many existing live trees that could be killed by the burning pile. It is also common practice to plan and implement fuels treatments when fuel moisture and weather conditions minimize the risk of a hot burn and escape of fire that may kill or damage residual trees, or damage soil. The effect of fuels treatment to Forest Management generated slash within the Riparian Reserve is expected to have an insignificant effect to the wood indicator.

Post-harvest silvicultural treatment. Within the Riparian Reserve, there would be extremely limited post-harvest silvicultural treatment. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. This would have a very small beneficial effect to potential future wood recruitment. Pre-commercial thinning is associated with regeneration types of harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation. Spot-fertilizer use may have a beneficial effect on growth of trees, but its use is so limited and distant from stream channels that its effect on potential large and small wood recruitment would be insignificant. Overall, the PE would have an insignificant effect to the indicator.

Thinning and Other Silvicultural Activities (east of Highway 97)

The following analysis applies to forested lands east of Highway 97 in the Eastside Management Area LUA. Riparian Reserves in this area are 150 feet on each side of fish-bearing and perennial streams and 100 feet on each side of non-fish bearing intermittent streams and lakes. Lost River sucker and shortnose sucker utilize some streams and reservoirs/lakes in this area for habitat. With respect to effects to the wood indicator, the analysis focuses on activities within the Riparian Reserve.

Roads and Landings. The analysis for effects of roads and landings to the wood indicator for the Riparian Reserve West of Highway 97, above, also applies to the Riparian Reserve East of Highway 97.

Falling and yarding. Management direction for various types of water features direct silvicultural treatments within the Eastside Management Area Riparian Reserve to achieve ecological goals (BLM 2016b, Appendix B. pp. 612-614).

Management direction that applies to all water features states: “Remove conifer encroachment” in the Riparian Reserve “where conifers are interfering with the natural vegetation community type, or where excessive erosion may occur.”

Management direction that applies to fish-bearing perennial streams states: “Conduct thinning and other vegetation treatments to accelerate the development of potential natural forest stand conditions including late-successional stand characteristics and native riparian shrub communities.”

Management direction that applies to non-fish bearing intermittent streams states: “Conduct thinning and other vegetation treatments to speed the development of large trees to provide an eventual source of large woody debris to stream channels.”

Management direction that applies to reservoirs/lakes states “Conduct thinning and other vegetation treatments within the Riparian Reserve to speed the development of potential natural vegetation communities.”

Inner and outer zones are not designated for the Eastside Management Area Riparian Reserve. Consequently, thinning and other silvicultural treatments that cut trees could occur at any distance from the bank or shoreline. This would reduce the potential for short-term recruitment of small wood (presuming that no trees qualifying as large wood would be affected by the thinning or other silvicultural treatments). Developing late-successional stand characteristics, speeding the development of large trees, and speeding the development of potential natural vegetation communities would have beneficial, long-term effects to the large and small wood indicator.

However, while there is management direction to apply thinning within the Riparian Reserve, the BLM projects almost no Riparian Reserve thinning under the PRMP. There is no Riparian Reserve thinning scheduled under the PRMP within the Lost Recovery Unit whatsoever (Table C6). The only Riparian Reserve acreage projected for thinning in the Upper Klamath Lake Recovery Unit is 3 acres for the decade beginning in 2043 and 2 acres for the decade beginning in 2053 (Table C7). The other harvest methods with projected acres in either Recovery Unit would take place outside of the Riparian Reserve.

Table C6. Acres of PRMP Riparian Reserve thinning by decade within the Lost Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 70).

Riparian Reserve Category	2023	2033	2043	2053	2063
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Total Riparian Reserve	11,641	11,641	11,641	11,641	11,641
Not Eligible	11,627	11,627	11,627	11,627	11,627
Eligible	14	14	14	14	14
Not Thinned	14	14	14	14	14
Thinned	0	0	0	0	0
% of total R. Reserve Thinned	0%	0%	0%	0%	0%

Table C7 Acres of PRMP Riparian Reserve thinning by decade within the Upper Klamath Lake Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 70).

Riparian Reserve Category	2023	2033	2043	2053	2063
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Total Riparian Reserve	4,147	4,147	4,147	4,147	4,147
Not Eligible	3,310	3,310	3,310	3,310	3,310
Eligible	837	837	837	837	837
Not Thinned	837	837	834	835	837
Thinned	0	0	3	2	0
% of total R. Reserve Thinned	0%	0%	0.07%	0.05%	0%

Table C8. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Lost Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 65).

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	0	0	22	0	0	22
2033	0	0	309	0	0	309
2043	0	0	422	0	0	422
2053	0	0	531	0	0	531
2063	0	0	105	0	0	105
Total BLM acres in Recovery Unit = 158,534						

Table C9. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Upper Klamath Lake Recovery Unit for Lost River and shortnose suckers (BLM 2016b, p. 65).

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	0	0	7,149	24	653	7,826
2033	0	0	8,058	18	582	8,659
2043	0	0	8,162	78	775	9,347
2053	0	0	7,720	379	856	8,955
2063	0	0	6,637	131	559	7,328
Total BLM acres in Recovery Unit = 71,291						

The need for ground-based yarding within the Riparian Reserve is almost nil due to the low amount of thinning projected to occur under the PRMP. Should it be used, the following management direction specific to the Eastside Management Area Riparian Reserve for fish-bearing streams and perennial streams would reduce the impacts of ground-based yarding to existing live trees in the stand. The second bullet statement also applies to non-fish-bearing intermittent streams.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Management direction for the Riparian Reserve of lakes, natural ponds and wetlands would reduce the impacts of ground-based yarding to existing live trees in the stand.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

The following BMPs would reduce the potential impact of ground-based skidding on large and small wood recruitment:

- BMP TH 8. Limit designated skid trails for thinning or regeneration harvesting to ≤ 15 percent of the harvest unit area to reduce displacement or compaction to acceptable limits.
- BMP TH 12. Incorporate existing skid trails and landings as a priority over creating new trails where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor, and the yarding itself would damage or kill some small trees within the corridor. This would negatively affect potential sources of current and future small wood, and future large wood to stream channels. However, BMP TH 2 requires trees felled for yarding corridors in the Riparian Reserve within a tree height distance of a stream channel to be directed toward the stream and left on site.

There is currently no estimate of how many yarding corridors may be constructed on streams occupied by ESA-listed fish in the Eastside Management Area. However, impacts to large and small wood recruitment is expected to be small because of the extremely limited amount of Riparian Reserve thinning that is estimated to occur (as described above), the fact that not all of that thinning would be adjacent to stream reaches occupied by ESA-listed fish, limited use of yarding corridors for Forest Management timber sale units located outside of the Riparian Reserve, and the immediate recruitment of large and small wood as a result of BMP TH 2.

While there are long-term benefits to potential recruitment of large and small wood to streams occupied by ESA-listed fish species by thinning activities (which will be a rare occurrence within the Eastside Management Area Riparian Reserve), the overall effect of the PE is negative and measurable, predominately from actions to reduce conifer encroachment within the Riparian Reserve, and the effects of yarding corridors. These activities would occur infrequently.

Fuels treatment and post-harvest silvicultural treatment. The analysis for effects of timber harvest related fuels treatments and post-harvest silvicultural treatment to the wood indicator for the Riparian Reserve West of Highway 97, above, also applies to the Riparian Reserve East of Highway 97. Note that because there is an extremely low amount of thinning scheduled within the Riparian Reserve, there would be a correspondingly extremely limited amount of timber harvest related fuels treatments.

In the short-term, and at the project-scale, some Forest Management activities that occur within the Riparian Reserve would reduce potential for small wood recruitment to stream channels occupied by ESA-listed fish. Within the Riparian Reserve west of Highway 97, this would occur primarily from ground-based yarding, yarding corridors (mitigated by management direction and BMP requirements to leave downed trees within the Riparian Reserve and directionally felled toward the stream as described in BLM 2016b, Appendix A-C), and the rare new road construction associated with thinning. Effects to small wood recruitment from thinning in Riparian Reserves of fish-bearing and perennial streams west of Highway 97 would be nearly non-existent due to the 120-foot no-thin buffer. In addition, tree-tipping would directly increase large and small wood numbers in stream channels.

Within Riparian Reserves east of Highway 97, the mechanisms to negatively affect current and future small and future large wood potential for delivery to streams and lakes are: thinning (PRMP thinning is nearly non-existent but may occur) and reducing conifer encroachment; skid trails, yarding corridors (see mitigating BMPs, above), and new road construction. Because of increased growth of remaining trees within thinned stands, there would be a beneficial effect to future recruitment of large wood.

Based on the analyses discussed above, considering the most impacting effects, the overall effect to the large and small wood indicator from implementing the PRMP is **adverse**. There are short and long-term beneficial effects to the indicator would result from some components of the PEs, notably faster growth of residual trees in thinned areas that lead to a shorter time-frame to attain a dbh that would result in functional wood in stream channels, from the tree-tipping requirement, and the requirement to fell trees in skyline corridors towards the stream channel and leave them on site.

Sediment/Turbidity/Substrate Background

Sediment occurs naturally in stream systems and is an important component of a stream's channel substrate. In large quantities, fine sediment can affect fish directly by increasing turbidity and inhibiting foraging and breathing functions, or smothering developing fish embryos and fry within redds, or indirectly by embedding in stream substrates thereby reducing macroinvertebrate productivity. Fine sediment in streams can affect fish habitat by filling interstitial spaces in gravel substrate, reducing oxygen flow to incubating eggs, and by physically preventing newly-hatched fish from emerging. In suspension, fine sediment reduces visibility, reduces foraging ability, and impairs oxygen uptake in gill membranes (Waters 1995).

Thresholds for lethal and sub-lethal effects on fish from increases in sediment delivery have not been well established at the scale of watersheds or greater. Cederholm (1981) concluded that there was a two percent decrease of egg to emergence survival of salmonids for each one percent increase in fine sediment over natural levels at the watershed scale. Suttle *et al.* (2004) suggest there is no threshold below which fine sediment is harmless to fish, and the deposition of fine sediment in the stream channel (even at low concentrations) can decrease the growth of salmonids, resulting in sub-lethal effects.

The 2008 RMP/EIS summarized the effects of sediment on fish and aquatic habitat and that summary is incorporated here by reference (BLM 2008, pp. 385-388, 799-800). Based upon the

analysis in the 2008 RMP/EIS, the BLM assumed that every one percent increase in fine sediment from management activities would result in a 3.4 percent decrease in fish survival at the scale of the planning area. The BLM also assumed that increases in fine sediment less than 1 percent would not result in measurable or meaningful effects on fish survival at the large scale because increases of less than 1 percent would be difficult to discern from background fluctuations.

Analysis at the scale of the decision area

The BLM analysis (BLM 2016b, pp. 325-338) calculated potential fine sediment delivery (tons/year) from the projected miles of new temporary and permanent roads through 2023. It also modelled the potential for landslide activity that would contribute sediment to the system.

Sediment production from existing BLM-controlled road system and from new construction

Soil erosion is a natural occurrence in a forested landscape, aided by water, climate, gravity, soil properties, and lack of vegetative cover. Forest roads are unnatural, compacted surfaces and offer opportunities for accelerated erosion and potential sediment delivery to stream channels. This may occur from a variety of sources, including small slumps and slides into the roadway from the cut bank, water channeling from the road or ditches if not properly directed and controlled, and blocked culverts and road fill washouts during floods. Sediment sources from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (BLM 2008, pp. 343-346).

Roads can deliver up to 90 percent of the total sediment production from forestry activities. This especially occurs on older roads where mid-hillslope construction and side casting of excess soil material was common. Newer roads built in the last 30 to 40 years typically use ridge top locations, full bench construction practices across steep slopes removing excess soil material to offsite waste areas, and manage drainage more effectively. In general, modern road construction practices produce less sediment delivered to streams from forest roads than older road construction practices (Copstead 1998).

The distance that sediment travels along roadways depends upon a number of factors, including underlying geology, age of road since construction, road gradient, road drainage, and ground cover. The average sediment travel distance from seven studies in different geologies, including highly relevant studies in western Oregon, is 40 feet, with a range of zero to 639 feet. Sediment travel distances from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (BLM 2008, p. 345). The BLM conservatively used a 200 feet sediment delivery distance for its modeling of sediment yield from roads.

The modeled sediment delivery distance (200 feet) takes into account existing roads paralleling streams and existing roads with inside ditches that carry concentrated flow from a further distance to a stream due to lack of ditch relief culverts. This modeled distance is of little relevance to thinning activities and necessary new road construction in the Riparian Reserve, because these roads are further than mean sediment travel distance to a stream, are separated by the unthinned portions of the Riparian Reserve, and therefore cannot be conduits for runoff to a stream.

Because a large proportion of sediment delivery to streams is from roads associated with timber management activities, and the proximity and magnitude of potential non-road timber management projects within Riparian Reserves with respect to designated critical habitat and to ESA-listed fish species is unknown at this time, the focus of the sediment production potential for timber management activities under the PRMP will be on the road system and potential effects to landslide rates.

Sediment delivery from roads can result from surface erosion, gullying, and mass wasting. However, due to limitations of model capability and geospatial processing across the large planning area, the analysis is restricted to surface erosion from roads. The empirical basis for the analysis is the Washington Road Surface Erosion Model (WARSEM) Manual (Dube *et al.* 2004). The BLM used the WARSEM methodology combined with BLM spatial GIS data layers to derive estimates of annual long-term sediment production.

Factors affecting surface erosion include geologic parent material, surface type, age of the road, road drainage, degree of vegetative cover on cut and fill slopes, and traffic factors including winter haul. In this analysis, the BLM evaluated watersheds (approximately 60 to 300 mi²) (USGS hydrologic unit code 10, which had previously been termed “fifth-field” watersheds).

The miles the BLM used in their analysis are based upon projected timber volume and road ratios by harvest type. Although the Planning Criteria displayed calculations over a longer period, the analysis is restricted to a ten-year time span because estimations of road construction beyond ten years become speculative. After ten years of implementation, the road system would be fully developed for the most part. That is, the BLM would have built most of the road network necessary to provide access to the actively managed forest stands and the rate of road construction would decline over time. In addition, new road construction and logging technology, and changing harvest types would continue to reduce the road construction necessary to provide access to the actively managed forest stands. Therefore, potential fine sediment delivery from new roads in future decades would be lower than the sediment delivery calculated for the first decade.

Approximately 36 percent of all existing BLM-controlled roads on BLM-administered lands are within a 200-foot delivery distance (5,096 miles of 14,330 total miles). The average potential fine sediment delivery yield to streams from existing BLM-controlled roads within the 200-foot sediment delivery distance is 2.26 tons/mi²/year as shown in C10 (BLM 2008, p. 347, Table 3-59). The highest potential fine sediment yield is from natural surface roads, while the lowest potential fine sediment yield is from paved roads.

Table C10. Potential fine sediment delivery from existing roads (BLM 2016b, p. 326).

Existing Roads ^a	Roads Within Fine Sediment Delivery Distance (Miles) ¹		Potential Fine Sediment Delivery (Tons/Year) ²		Watershed Potential Fine Sediment Delivery (Tons/Mile ² /Year) ³	
	BLM	Other	BLM	Other	BLM	Other
Natural	1,738	15,874	23,050	233,054	0.86	8.75
Aggregate	2,590	22,938	28,938	30,765	1.09	1.15
Paved	767	2,436	8,277	33,807	0.31	1.27
Totals	5,096	21,249	60,265	297,626	2.26	11.17

¹ Includes BLM-controlled roads and private roads within the decision area from BLM GIS GTRN (roads) coverage.

² Includes road segments within 200 feet of a stream channel, where ditch flow carrying fine sediment could enter streams.

³ Planning criteria estimate in which calculations are based on surface type for each HUC 10 watershed and summed for the planning area.

Model results indicate that the 5,096 miles of existing BLM-controlled roads within the 200-foot fine sediment delivery distance produce 60,265 tons/year of potential fine sediment delivery. This is approximately 17 percent of all sediment delivered to stream channels from roads of all ownerships within the planning area.

Implementation of best management practices (BMPs) is a primary reason that BLM-controlled roads currently result in a minor portion of the total sediment delivery to streams from roads.

The BLM would decommission 372 miles of permanent road by 2023 under the PRMP, bringing the total road in long-term storage to 1,272 miles (8 percent of the entire road system). Decommissioning includes a variety of practices, ranging from simply blocking access to the road to “full decommissioning,” which may include re-establishing drainage by removing culverts and re-contouring, and planting the roadbed.

The BLM estimates that approximately one-quarter of the roads decommissioned would be “fully decommissioned,” which would typically reduce potential fine sediment delivery by 11 to 13 tons/mile/year. For all decommissioned roads, potential fine sediment delivery would decline over time, but the amount of improvement would be difficult to estimate. The reduction in potential fine sediment delivery following decommissioning would depend on site-specific and road-specific factors and the level of decommissioning, which cannot be predicted and evaluated at this scale of analysis. The BLM may reopen these decommissioned roads in the future if needed to provide access for management, such as when timber stands in the Harvest Land Base reach harvestable age. Unneeded roads would remain decommissioned. Which roads would be decommissioned and whether they would remain decommissioned would depend on site-specific and road-specific conditions related to whether the road would be needed to provide access for future management actions.

The BLM assumes that an increase of one percent or less fine sediment delivery to streams at the scale of the planning area would not result in measurable or meaningful effects on fish survival as this small increase would be difficult to discern from natural fluctuations. Model

projections are for an increase of about 0.4 percent. Therefore, the BLM concludes that there will not be measurable or meaningful effects on fish survival at the scale of the planning area by implementing the PRMP.

Potential effects to the risk of landslides that would deliver to stream channels under the PRMP

Not all landslides result in effects on streams: from 30 to 70 percent of landslides deliver sediment and other material to streams (Miller and Burnett 2007a). A channelized debris flow (also called debris torrent or sluice-out) is a rapidly moving slurry of soil, rock, vegetation debris and water that can travel long distances from an initiation site through steeply confined mountain channels. Travel distance of stream debris flows depends upon slope gradient, valley width, and high angle tributary junctions encountered. As debris flows move downhill, they entrain additional sediment and organic debris that can expand the original volume by 1,000 percent or more, being more destructive with distance traveled (Benda and Cundy 1990). Debris flows lose energy and terminate at high angle stream tributary junctions and low gradient valley floors.

Shallow, rapidly moving landslide⁶³ initiation normally requires some combination of steep and convergent slopes, shallow soils overlying semi-impervious bedrock, and heavy or prolonged precipitation. Removing forest cover can elevate susceptibility to landsliding. Because of the multiple factors affecting landslide occurrence, including stochastic factors, it is not possible for the BLM predict landslide occurrence. Instead, this analysis presents a depiction of risk and the effect of timber harvest under the PRMP on that risk.

The BLM evaluated the risk of landslides by measuring relative landslide density using the geographic information system mass wasting hazard model within NetMap (Miller 2003, Miller and Benda 2005, and Miller and Burnett 2007a). The NetMap model produces a naturally occurring landslide susceptibility from geologic and landform factors, but independent of vegetation factors. The modeling is based on landslide inventories from the Coast Range, Western Cascades, and Klamath Provinces. The model produces a spatially distributed estimate of landslide density by mathematically matching observed landslide locations with topographic attributes including slope, convergence (bowl-shaped landforms), and watershed area, using a digital elevation model. BLM used the channelized mass wasting delivery model in NetMap to determine susceptible areas from the hill slope relative landslide density that could deliver to any stream channel.

The BLM calibrated this modeling for heavy precipitation represented by the 1996 storms (70- to 100-year return period event). Extreme storms are highly correlated with increased rates of landsliding on susceptible sites. For the 1996 storms, observed landslide densities and size in the Coast Range were the highest for forest stands less than 10 years old, lower for mature

63 A shallow, rapidly moving landslide is a mass of soil, rock or debris that rapidly moves down a slope or stream channel at a velocity that is difficult for people to outrun or escape.

forests, and lowest for forested areas between 10 to 100 years (Miller and Burnett 2007a, Robison *et al.* 1999).

The BLM evaluated the effects of timber harvest on relative landslide density over 50 years. This long period is appropriate, given the importance of stochastic events with long return-intervals (*i.e.*, heavy precipitation) to the underlying landslide risk.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (BLM 2014, pp. 80-82).

Model results indicate that relative landslide density in the Harvest Land Base would rise from the baseline rate of 0.118 per square mile at year 2013 to 0.131 at 2023, then range from 0.128 to 0.131 through 2053, before declining slightly to 0.126 in 2063. Model results for the PRMP are less than for the No Action alternative initially and at each 10-year increment through the 50-year model period (FEIS Figure 3-100). This is a result of differences in the naturally occurring relative landslide density that is included in the Harvest Land Base between the No Action alternative and the PRMP, combined with the amount and specific locations of regeneration harvest under the No Action alternative and the PRMP.

The size and placement of the Harvest Land Base is as important as the intensity of regeneration harvest. The PRMP would have lower average landslide density with regeneration harvest than the naturally occurring landslide density of the No Action alternative, indicating the importance of included or excluded lands in the Harvest Land Base and where suitable stands are available for regeneration harvest.

Portions of the Harvest Land Base would be susceptible to deliver sediment to a channel by shallow landsliding, whether managed or not, under the PRMP or any of the other alternatives evaluated in the FEIS. In the context of extreme storms, the percentage of regeneration harvest areas under the PRMP that would have some measure of susceptibility to deliver to a channel over the 40-year period from 2023 to 2063 ranges from 6.0 to 7.0 percent (Table C11). By way of comparison, the No Action alternative would have 7.8 percent to 11.1 percent of regeneration harvest areas susceptible to deliver to a channel in the same time frame. The remaining regeneration harvest areas would have essentially no susceptibility at all.

Table C11. Percentage of PRMP regeneration harvest areas prone to debris flows from 2023 to 2063 (BLM 2016b, p. 333).

Year	2023	2033	2043	2053	2063
Percentage	6.0	6.3	6.1	6.3	7.0

Shallow landsliding may contribute sediment, rocks, and forest debris to stream channels from susceptible portions of regeneration harvest areas during extreme storms, and from other unmanaged areas of the Harvest Land Base. There is increased risk for landsliding where the combination of steep slopes and geomorphic factors lower hill slope stability. Removal of vegetation by regeneration harvest would lower the strength of live roots binding the soil. If an

extreme storm would occur during the early-successional period, the susceptibility of landsliding would be increased compared to forests where basal area would be maintained. Under the PRMP over the next 50 years, the area of increased landsliding susceptibility with potential to deliver to streams would range between 6.0 to 7.0 percent of the regeneration harvest area and less than one percent (0.57 percent) of the Harvest Land Base.

It is not possible at this scale of analysis to reasonably quantify the amount of sediment that would be delivered from landslides or debris flows to streams. There will be some sediment delivery to streams from landslides or debris torrents that occur in areas within the Harvest Land Base, post-timber harvest. The risk of landslides or debris flows will be minimized by use of BMPs, management direction and the removal of landslide and debris flow susceptible areas from the Harvest Land Base over time.

The lower relative landslide risk in lands in the Harvest Land Base under the PRMP, and lower percentage of regeneration harvest areas prone to deliver debris flows to streams, in contrast to the No Action alternative, has a beneficial effect to the risk of introducing sediment to stream channels.

There may be short-term negative impacts to water quality from increased turbidity. However, at the time when fine sediment from Forest Management activities enters the water column, it may not be distinguishable from background turbidity in stream flows. At that time, fine sediment is being mobilized from the rest of the landscape and some of it is delivered to streams. As sediments are flushed from road surfaces, there could be some short-term increases in instream turbidity that would be dispersed within about 500 feet downstream from the source.

Effects by Project Element

Roads and Landings. The BLM analysis of sediment delivery to streams from new roads at the scale of the planning area used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to streams. The analysis concluded that there would be sediment reaching stream channels from these new road segments. At the individual project scale, it is unknown what proportion of new road construction, if any, would deliver fine sediment to stream segments occupied by ESA-listed fish. There are many variables such as road surface type, road slope, cross-drain spacing, ditch vegetation, and out-sloping. However, the BLM acknowledges that there may be some sediment delivery to stream channels from new road construction at a subset of Forest Management projects.

As stated above in the description of this PE, there are 100 road and landing BMPs (see BLM 2016b, Appendix C) and multiple Hydrology and Soils program direction (see BLM 2016b, Appendix A) that serve to minimize erosion and sediment delivery to water bodies from BLM road and landing activities.

Culvert replacements at stream crossings with flow at the time of the culvert would be a significant source of short-term turbidity. All culvert replacements would follow management direction and employ BMPs to reduce turbidity and introduction of fines directly to the stream channel. Culvert replacements for streams occupied by ESA-listed fish will follow the aquatic

conservation measures (ACM) and project design criteria (PDC) for fish habitat restoration activities, also known as ARBA II (USFS *et al.* 2013). Similarly, road decommissioning and a variety of road erosion control activities done for Forest Management projects also will follow ACM and PDC of ARBA II (USFS *et al.* 2013). In addition, road maintenance actions would utilize PDC of the biological assessment known as the Western Oregon Programmatic (USFS *et al.* 2010). Both road decommissioning and road maintenance actions may result in fine sediment delivery to stream channels. These PDCs and ACMs have been designed with the goal of minimizing the effects to listed fish by limiting sediment delivery to LFH.

Activities such as road decommissioning, road maintenance and upsizing culverts during replacement would reduce erosion and the potential for catastrophic erosion events to deliver fine and coarse sediment to stream channels (*e.g.*, a blow-out of a plugged culvert during a high flow event). This would have a beneficial effect to the sediment/turbidity and substrate indicator.

Overall, the Service anticipates that there would be an adverse effect to the indicator from a subset of BLM road and landing activities. Effects would be short-term and localized. Falling and yarding. Falling results in minimal ground disturbance. Yarding creates bare soil areas that may erode and result in sediment transport. Yarding activities that occur upslope from the Riparian Reserve are not anticipated to result in sediment delivery to stream channels because of vegetation and duff within the Riparian Reserve that will effectively capture that sediment. The following analysis describes potential effects from yarding activities occurring within the Riparian Reserve to the Sediment/Turbidity/Substrate indicator. Yarding activities are associated only with thinning in the outer zone of the Riparian Reserve.

There is much more bare soil created by ground-based skidding than by cable yarding. Ground-based yarding may occur within some areas of riparian thinning, and may have negative effects to the indicator. The following management direction from the Riparian Reserve LUA section of BLM 2016b, Appendix A for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding to erosion and potential sediment delivery to stream channels.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (*e.g.*, excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).

BMPs TH 1 to TH 24 (BLM 2016b, Appendix C, pp. 714-717) would reduce the potential impact of ground-based skidding to erosion and potential sediment delivery to stream channels. They address Riparian Reserve inner zone exclusions, avoidance of hydric soils, use during low soil moisture periods, limiting designated skid trails to no more than 15 percent of the harvest unit area, location of skid trails to channel water away from water bodies, erosion control measures, waterbar construction, subsoiling to minimize surface runoff, and other measures.

The need for ground-based yarding is almost non-existent in the Eastside Management Area Riparian Reserve due to the low amount of thinning projected to occur under the PRMP. Should it be used, the following management direction (BLM 216b, Appendix A, p. 612) specific to the Eastside Management Area Riparian Reserve for fish-bearing streams and perennial streams would reduce the potential for sediment delivery to stream channels as a result of ground-based yarding because the distances are far enough from streams that the vegetation closer to the streams would capture the sediments. The second bullet statement also applies to non-fish-bearing intermittent streams.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Management direction (BLM 2016b, Appendix A, p. 613) for the Eastside Management Area Riparian Reserve of lakes, natural ponds and wetlands would reduce the potential for sediment delivery to stream channels as a result of ground-based yarding because the distances are far enough from streams that the vegetation closer to the streams would capture the sediments.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

The same BMPs listed above for the Riparian Reserve west of Highway 97 would serve to reduce the potential impact of ground-based skidding to erosion and potential sediment delivery to stream channels in the Eastside Management Area Riparian Reserve.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor. There would be no yarding of trees from within the corridor as BMP TH 2 (BLM 2016b, Appendix C, p. 714) requires all wood felled for corridor construction be kept in the Riparian Reserve. Therefore, there would be no soil disturbance or erosion yarding from within the corridor, except for yarding within the timber harvest unit boundary upslope.

Use of cable yarding (*e.g.*, skyline systems) for thinning within the Riparian Reserve would have less erosion potential than ground-based systems. Erosion potential is greatest adjacent to the landing, as this is where the logs delivered from throughout the logging unit converge and contact the ground. Landings are typically located distant from streams. Erosion potential is limited within the logging unit to areas where logs initially drag on the ground for short distances before they are fully suspended. Because these are not heavy, large diameter logs the distance of drag and the width of the drag marks are small.

Helicopter yarding results in extremely limited ground disturbance, and therefore would not have meaningfully measurable effects to the Sediment/Turbidity/Substrate indicator.

Tree-tipping may result in some trees/logs being yarded to take them to other locations for purposes of aquatic restoration. The effects to the indicator are as described above for the different yarding methods. The majority of trees directionally felled towards streams or tipped over would not have direct meaningfully measurable effects to the Sediment/Turbidity/Substrate indicator. There may be indirect effects that occur later in time, as the trees in the stream channel would store or sort bedload sediment, or direct flow into streambanks that would result in increased short-term turbidity and sediment that would settle in the streambed at distances downstream.

A sub-set of tipped trees with intact root wads would have direct meaningfully measurable effects. Specifically, they are trees with roots integrated into the streambank. When the tree is tipped, sediment in and around the roots may enter the stream channel. Flows may be directed into the streambank by the rootwad that would cause further erosion, increased short-term turbidity and sediment that would settle in the streambed at distances downstream.

Vegetation and duff within the inner zones of the Riparian Reserve areas west of Highway 97, and undisturbed areas of the forest floor within Riparian Reserves east of Highway 97, would effectively capture much or all of the fine sediment from yarding activities. Regeneration cuts will not occur within Riparian Reserves, and no-cut buffers will act as effective filtering areas to prevent sediment delivery to stream channels from Forest Management activities within the Riparian Reserve. Rashin *et al.* (2006) evaluated the effectiveness of stream buffers to prevent sediment delivery to streams for two years post-harvest during a study of forest harvest BMPs in the state of Washington. Study sites were primarily logged second-growth stands. Harvest types included clear-cuts for even-aged management and partial-cuts for uneven-aged management. Yarding systems included ground-based and cable. Not all buffers in the study were no-cut; some tree harvesting did occur at a lower intensity within the buffer than upslope from the buffer.

Twenty-two sediment routing surveys were conducted. Average width of one-sided stream buffers ranged from 7 to 66 meters (23 to 217 feet). The average width of buffers in the sample was 25 meters (82 feet), and more than 75 percent of the buffers were between 10 and 35 meters (33 to 115 feet) wide. Average near stream hill-slope gradients ranged from 4 to 75 percent, with half of the study sites having average slopes of 36 percent or greater.

Rashin *et al.* (2006) concluded that the proximity of ground disturbance to streams is an important factor controlling sediment delivery. A buffer width of 10 meters (33 feet) appeared to be effective at preventing sediment delivery to streams. “Of 212 erosion features identified within 10 m of streams, 69 percent were found to deliver sediment during the first and/or second year following harvest. Conversely, when erosion features are farther than 10 m from streams, delivery is unlikely unless sediment is routed via concentrated drainage. Of 193 erosion features located greater than 10 m from streams, 95 percent did not deliver sediment.”

However, the Service believes that for a subset of timber management projects under the PRMP, there may be a short-term increase in fine sediment delivery to stream channels proximal to ESA-listed fish and to designated critical habitat as a result of yarding activities. Therefore the Service finds that the effects will result in a net **adverse** determination to this indicator.

The planning-area scale analysis presented in BLM 2016b, pp. 328-333 about the risk of landslide occurrence concluded that less than 1 percent of the Harvest Land Base would be susceptible to landslides with the potential to deliver sediment to streams over time under the PRMP. Without site-specific locations for any specific timber harvest proposal, it is not possible to quantify the risk of a landslide delivering sediment to a stream that would negatively affect ESA-listed fish species or designated critical habitat.

Debris torrents and landslides are a source of sediment to streams, and the initiation points for them may occur at distances greater than 50-120 feet from a stream channel. However, this would be a relatively rare occurrence within a thinning project area. Thinning projects are typically located in plantations that are a result of regeneration (clear-cut) logging. If the site is predisposed to debris torrents or landslides that could deliver to stream channels occupied by ESA-listed fish species, it is likely that it would have occurred in the years following the initial logging. Furthermore, during interdisciplinary project planning for proposed harvest areas, areas identified as unsuitable for sustained yield timber production, such as unstable landforms, would be avoided (BLM 1986). The BLM periodically adds such areas to the unsuitable classification through updates to the timber production capability classification system.

There would be a negative effect to the indicator if a landslide occurs as a result of a Forest Management project, and it delivers sediment to a stream channel that would affect ESA-listed fish or designated critical habitat.

Timber haul. Timber haul may result in measurable fine sediment delivery to streams occupied by ESA-listed fish. This may result in increased localized short-term turbidity in the water column and short-term increases in fine sediment in streambed substrate. Effects vary depending upon the duration of the haul, road surface, proximity of haul road locations to streams, connectivity to streams, road surface types and the length of the haul route. Effects are more likely to occur during wet weather haul. The following management direction from the Hydrology section of BLM 2016b, Appendix A, p. 643 would reduce the impacts of timber haul to the Sediment/Turbidity/Substrate indicator.

- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.

In addition, BMPs R 94 to R 100 (BLM 2016b, Appendix C, p. 714) are designed to minimize sediment delivery as a result of wet season road use. BMPs address durable rock surfacing and rock depth, pre-haul road structural treatments, snow removal, adding gravel approaches before entrance onto surfaced roads to minimize sediment tracking, and installing temporary culverts and washed rock on top of low water fords. See Appendix C for a verbatim description of each BMP.

Because this PE will result in meaningfully measurable increases in sediment the Service finds that actions contained within this PE will result in adverse effects to the indicator.

Fuels treatment. Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. However, because of the width of the Riparian Reserve and the effectiveness of vegetation and duff within the Riparian Reserve to capture fine

sediment from activities outside of the Riparian Reserve, it is fuels treatment that occurs within the Riparian Reserve that has the potential to affect the sediment/turbidity/substrate indicator.

The landing pile and burn technique would not affect the indicator as landings are typically well outside of the Riparian Reserve. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve is hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the sediment/turbidity/substrate indicator. Slash piles created by the hand pile and burn treatment type typically have a small footprint (BLM 2016b, Appendix C, p. 720, BMP F 8 limits piles to 16 feet in height or diameter) and the piles would be located outside of the inner zone of the Riparian Reserve west of Highway 97.

While there are no thinning zones in the Eastside Management Area Riparian Reserve, there is nearly no thinning planned under the PRMP. There is none planned in the Lost River RU. For the Upper Klamath RU there is 3 acres for the decade beginning in 2043 and 2 acres for the decade beginning in 2053. The need for slash treatment would be almost non-existent.

Overall, the effect of fuels treatment to Forest Management generated slash is expected to not result in meaningfully measured effects to the sediment/turbidity/substrate indicator, therefore the Service believes that the effects from this PE are insignificant to the indicator.

Post-harvest silvicultural treatment. Because of the effectiveness of vegetation and duff within the Riparian Reserve to capture fine sediment from post-harvest silvicultural treatments occurring upslope from the Riparian Reserve, the analysis here focuses on actions within the Riparian Reserve. There would be extremely limited post-harvest silvicultural treatment within the Riparian Reserve. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. Tree planting disturbs very little surface area of soil, and it is unlikely to be transported to stream channels because of other erosion control measures such as seeding and mulching. Pre-commercial thinning is associated with regeneration types of harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation (that may result in some soil disturbance). Overall, the PE would have an insignificant effect to the indicator.

Summary of effects to sediment/turbidity/substrate

The potential sediment delivery to stream channels from the existing BLM road network and new road construction for the first 10 years under the PRMP was evaluated by the BLM with a model for the entire planning area. The incremental increase in potential fine sediment delivery from new road construction over the first 10 years within the 200-foot sediment delivery distance at the scale of the planning area is projected at 165 tons/year, an increase of 0.4 percent over the baseline. While this is a small incremental increase, the effect to ESA-listed fish species and designated critical habitat at the scale of the entire planning area is not anticipated to be measurable or meaningful. The model results are likely to be an overestimate, as this model did not account for reductions in sediment delivery to stream channels as a result of road decommissioning under the PRMP. In addition, the model did not account for sediment

reductions achieved through other road restoration and storm proofing activities, which are likely to be a substantial focus of future aquatic restoration efforts in the planning area.

The BLM evaluated the risk of landslides as a result of implementing the PRMP by measuring relative landslide density in the geographic information system mass wasting hazard model over a 50-year period within NetMap (Miller 2003, Miller and Benda 2005, and Miller and Burnett 2007a). The BLM added forecasts of future timber harvest to the NetMap model outputs, and assumed that regeneration harvest would increase the relative landslide density while commercial thinning would not affect landslide risk. The BLM evaluated relative landslide density only within the Harvest Land Base because the BLM would implement regeneration harvest only within the Harvest Land Base. The model did not include effects to landslide risk from new roads, because most new roads under all alternatives would be built on stable areas such as ridge top locations, and would mostly be short spurs to the existing collector roads. Model results indicate that the relative landslide density in the Harvest Land Base compared to intrinsic potential for the PRMP would be less initially and at each 10 year interval evaluated throughout the 50 year time frame than for the No Action alternative. This would indicate a reduced potential for landslides as a result of timber management activities over the 50-year time period and at the scale of the planning area. In addition, less than one percent of the Harvest Land Base would be susceptible to landslides with the potential to deliver sediment to streams over time under the PRMP.

For a subset of Forest Management actions at the scale of an individual project, the analysis of effects to the indicator by PEs determined that there may be a localized increase in fine sediment delivery to streams proximal to ESA-listed fish. The Service concludes that meaningfully measurable amounts of fine sediment may be delivered from several sources, including new construction for road segments within 200 feet of stream channels, roads used for wet season haul, and from ground-disturbing activities occurring within Riparian Reserves, such as road decommissioning and road maintenance (including culvert replacements) and in some instances, yarding. There is also an unquantifiable risk of a landslide or shallow debris torrent reaching a stream channel as a result of timber management activities. Sediment entering stream channels may negatively impact the fish habitat value of streambed substrate, including cobbles used for cover and spawning gravels, in the short-term until higher flows scour and disperse the fines downstream. It would also result in short-term increases in turbidity. Utilizing BMPs and management direction would minimize sediment delivery to stream channels.

The overall conclusion is that a subset of Forest Management actions would result in measurable negative (adverse) effects to the Sediment/Turbidity/Substrate indicator.

Water Temperature

The BLM analyzed water temperature within the Hydrology section of the BLM FEIS, and described this analysis further in BLM 2016b (pp. 341-345), these are incorporated by reference.

Background

Stream temperature variation depends upon a number of natural and management factors, including topography, forest vegetation, channel characteristics, streamflow, and climate (Caissie 2006). Water volume and stream width are important as mechanisms by which stream temperatures can fluctuate (Kibler 2007). As stream discharge increases, a fixed amount of solar energy is diluted and the resultant temperature change is decreased. As streams widen, the wetted surface area increases, which results in a higher absorption per unit volume of stream with a corresponding temperature rise.

The interactions controlling stream temperature in mountainous-forested landscapes are complex because simultaneous daily fluxes are occurring over a varying topography with steadily declining streamflow into summer. The temporal area of interest for this analysis is July to August, when clear sky days and solar radiation approach maximum levels. Direct solar radiation is the most important source of the energy budget affecting stream temperature gain at the water and streambed surfaces (Brown 1969, Beschta 1997, Moore and Wondzell 2005, Caissie 2006). During July to August, the sun is high in the sky, as only the portion of forest canopy to the south in line with the sun's daily path is involved. Sun blocking by stream banks or hill slopes in the path of the sun as well as understory brush and forest trees with varying canopy layers and densities produce shade for most daylight hours. There may be a few gaps where sunlight can reach the stream during the morning or afternoon hours, depending on the specific stand characteristics. However, at mid-day when the sun is near its zenith, solar radiation may reach the stream through overhead canopy gaps in the forest or overtop the highest trees shade angle, depending on tree height, setback distance, angular canopy density, and stream width. Small streams are well-shaded because the tree-to-tree spacing is close and canopies spread over the channel. As watershed area increases and streams widen to rivers with floodplains, larger linear gaps appear over the stream channel.

There are important interactions simultaneously occurring among stream direction (azimuth), topography, tree height, and density in blocking solar radiation. The natural environment poses an array of possibilities in assessing the transmission of solar radiation to the stream. Shade-blocking forest vegetation involves duration and quality. The duration of shade depends upon shade-producing vegetation in the path of the sun at any given time during the day as the sun's path and altitude changes. The quality of shade depends upon solar radiation transmission through forest canopies, where solar radiation decreases as leaf area index and forest density increases.

The BLM 2008 RMP/EIS provides additional detailed background information on the effects of riparian forests on stream shading and is incorporated here by reference (BLM 2008, pp. 336-34; Appendix I- Water, pp. 250-252).

At the reach scale, a loss in stream shade that would result in stream heating could induce non-lethal heat stress on juvenile or adult ESA-listed fish where stream temperatures already exceed ODEQ standards for fish use. This could include lowered disease resistance and reduced growth rates. Effects from canopy removal would be most noticeable in smaller headwater perennial streams that have a continuous canopy over the channel. Shade reductions on intermittent

streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

Larger order channels (>5th order) would have a sufficient buffer to temperature increases from the large volume of water that the overall effect on salmonids would be negligible (Poole and Berman 2001). Additionally, larger streams have more open canopy over the center of the channel and a small reduction in shade would represent a relatively small change in the overall amount of sunlight reaching the stream.

The BLM used two different methodologies to evaluate stream shade. Method A determines the width of Riparian Reserves by empirical relationships necessary to provide 80 percent effective shade and relies upon previous work in the 2008 RMP/EIS (BLM 2008). Effective shade is the percentage of sun blocking by topography, forest trees, and vegetation during a solar day. Effective shade reaches an upper limit in the 80 to 90 percent range for normally-stocked young to mature forest stands (USFS and BLM 2012). During daylight hours in the summer months when stream heating is a concern, the sun's altitude (vertical zenith angle) and horizontal position (azimuth) change constantly directing solar radiation down to the earth's surface. Solar radiation intensity at the water surface varies with the sun's altitude, azimuth, and cloud cover, diminishing with blocking by topography and reflection or adsorption by forest tree crowns (Brazier and Brown 1972, Boyd 1996). The sun's path length through vegetation decreases transmissivity (the degree which radiation passes through), particularly where leaf area is high (DeWalle 2010). Where the solar angle exceeds the forest shade angle from the tallest trees, solar radiation will reach the water body (Boyd 1996). When varying angular canopy density is summed for the primary daytime hours and weighted for the proportion of incoming solar radiation blocked for each time period, an estimate of effective shade is obtained. Angular canopy density is the sun-blocking vegetation in the path of the sun from 10 a.m. to 2 p.m. (Brazier and Brown 1972). For normally stocked young to mature forest stands, forest shade tends to reach a maximum near 80 percent effective shade, where increasing the width of the Riparian Reserve further only marginally improves effective shade. Gaps in forest vegetation as well as the quality of shade from needles, leaves, tree-branches and boles, even in mature forest stands, prevent much higher measures of effective shade. There is always some solar radiation transmissivity to the water surface through needles and leaves and over the tallest trees, especially near solar noon.

Method B, proposed by the Environmental Protection Agency, presents a mechanistic modeling approach that uses the ODEQ shade model to develop shade loss tables for the Riparian Reserve design. The rationale uses a before-after-control-impact design, where observed changes in stream temperature are due to the difference between pre-harvest and post-harvest monitoring (Groom *et al.* 2011). The EPA methodology considers whether various widths and canopy cover densities in inner and outer zones of the Riparian Reserve would result in shade loss associated with management that would increase stream temperature. Although Groom *et al.* (2011) determined that levels less than six percent shade loss would have no statistical effect on raising stream temperature.

Both Methods A and B assume for analytical purposes that regeneration harvest has removed canopy cover outside of all Riparian Reserves. Although this assumption is not realistic, because the majority of the decision area would be in reserves and planned regeneration harvest

within the Harvest Land Base would be spread out temporally and spatially across the Harvest Land Base under all alternatives. However, this assumption is unlikely to affect the analytical conclusions under Methods A or B; studies and modeling suggest that direct solar radiation from outside of riparian buffers of the widths allocated in the alternatives does not increase shade loss at the stream, because solar radiation has already been reflected, adsorbed or otherwise extinguished by forest vegetation inside the riparian buffer.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (BLM 2014, pp. 65-75).

Results

There are 6,970 miles of fish-bearing or perennial streams on BLM lands within the PRMP boundary where forest management within the outer zone of the Riparian Reserve would potentially affect stream temperature. The PRMP Riparian Reserve design for Class I, II and III would maintain an unthinned 120-foot width inner zone on fish-bearing or perennial streams, which would overlay the primary shade zone and the secondary shade zone. The inner zone alone would be sufficient to avoid reduction in stream shading under Method A. Nevertheless, the PRMP also includes an outer zone to one site-potential tree height in which any thinning would maintain at least 30 percent canopy cover and 60 trees per acre. The outer zone would provide a high protection to the inner zone for blow-down at the edge of the Riparian Reserve.

Utilizing Method B, under the PRMP there would be 5.9 to 38.1 miles by decade of fish-bearing or perennial streams that would be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves over a 50-year time frame (Table C12). The highest number by decade (38.1) is approximately 0.5 percent of the 6,970 total miles of fish-bearing or perennial streams.

Table C12. Predicted miles of perennial or fish-bearing streams susceptible to water temperature increases by thinning in Riparian Reserves by decade in the entire PRMP planning area using Method B (BLM 2016b, p. 346).

Decade	2013	2023	2033	2043	2053	2063
Miles	33.8	38.1	7.0	7.1	5.9	7.1

The predicted miles by ESA-listed sucker RU and within the McKenzie River basin bull trout analysis area are shown in Table C13.

Table C13. Predicted miles of perennial or fish-bearing streams susceptible to water temperature increases by thinning in Riparian Reserves by decade using Method B by fish species geographic area (BLM 2016b, p. 346).

ESU/DPS/RU	Miles of Perennial or Fish-bearing Streams Susceptible to Water Temperature Increases by Thinning by Decade					
	2013	2023	2033	2043	2053	2063
¹ UWR Chinook	1.2	0.9	0.8	0.8	0.8	1.2
¹ UWR steelhead	1.4	1.1	1.0	1.0	1.0	1.4
McKenzie River Basin bull trout	0	0	0	0	0	0
Lost River RU suckers	0	0	0	0	0	0
Upper Klamath RU suckers	2.0	2.0	0	0	0	0
¹ Included because they form an important prey source for McKenzie River bull trout						

Using Method B, the shade loss thresholds are exceeded most frequently where the forest canopy density is < 60 percent in the 120-foot no harvest inner zone for fish-bearing or perennial streams. Even if the outer zone adjacent to an inner zone with low canopy cover were to be thinned, not all of the susceptible reaches would be treated in a given year and as some reaches are treated other reaches would recover, reducing the overall effect of canopy removal. The unharvested condition of the inner zone, regardless of initial canopy cover, would reduce the miles of susceptible streams in future time periods, until a relatively constant canopy cover would be attained, commensurate with mature or structurally complex riparian forests. This is why stream mileage susceptible to shade reductions would decline within the first 20 years under the PRMP, and then would remain relatively constant in future decades.

Method B identifies 5.9 to 38.1 miles of fish-bearing and perennial stream miles under the PRMP across the action area that would be susceptible to shade loss that may result in measurable increases in water temperature if the outer zone of the Riparian Reserve were to be thinned. However, without site-specific information for any specific riparian thinning project that includes the proximity to ESA-listed fish species and designated critical habitat, as well as the magnitude of the project (the linear distance of the Riparian Reserve outer zone treated), and whether or not any of the miles projected to be thinned would include any of the miles predicted to be susceptible to water temperature increases by thinning, the effects at the scale of the planning area cannot be precisely predicted.

Analysis at the scale of a site-specific timber management project

There is no causal mechanism for the Timber Haul PE to affect shade canopy and water temperature, and it will not be analyzed further. The Service makes an assumption that any Forest Management actions outside of a Riparian Reserve would not impact shade canopy to a stream and therefore would not affect water temperature. This is because any trees removed outside of the Riparian Reserves would not contribute to stream shade. The analysis that follows concentrates on activities occurring within the Riparian Reserve.

Roads and Landings. The above analysis of sediment delivery to streams from new roads at the scale of the planning area, used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to fish-bearing or perennial streams. The 200-foot distance is approximately equivalent to a site potential tree height; the width of a Riparian Reserve with the exception of the Riparian Reserve for non-fish bearing intermittent streams in Class III sub-watersheds. The 66 miles will be used as an approximation of how many miles of road may potentially remove shade canopy within a Riparian Reserve.

As described in the analysis of effects to water temperature at the scale of the planning area (BLM 2016b, p. 341), shade reductions on intermittent streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

At the individual project scale, it is unknown what proportion of the projected 66 miles of new road construction within the 200-foot distance to perennial or fish-bearing streams, if any, may reduce shade canopy to stream segments occupied by ESA-listed fish. There are many variables such as the orientation of the road to the sun's path (is the road between the sun and the stream), the distance within the Riparian Reserve between the road and the stream, and the length of the road within the Riparian Reserve. It is unlikely that any new road or landing construction would occur within the inner zone of a Riparian Reserve.

The likelihood that any new road/landing construction for an individual timber sale may occur within the outer zone of a PRMP Riparian Reserve that may coincide with any of the perennial or fish-bearing stream segments with riparian areas susceptible to shade loss that may result in a water temperature increase is very low. At the planning area scale, only 0.5 percent (38.3 miles of a total of 6,970 miles) of all perennial or fish-bearing streams were determined to be susceptible to a water temperature increase by outer zone thinning by Method B and none by Method A. The Service assumes that the same percentage would apply to stream segments susceptible to a water temperature increase by new road construction in the outer zone. The 0.5 percent is an overestimation of the effects to ESA-listed fish, as some of the 38.3 miles may not occur where it may measurably increase water temperature in stream reaches occupied by ESA-listed fish or contain designated critical habitat. Based on this discussion the Service believes there is a **discountable** probability that this PE will affect listed fish.

Falling and yarding. Given the information presented in Table C13 above, at the scale of ESA-listed fish geographic areas, there would be no risk of a water temperature increase from thinning in the outer zone of the Riparian Reserve for fish-bearing or perennial streams in the Lost River RU for Lost River sucker and shortnose sucker, or for the McKenzie River basin bull trout analysis area. Shade would be protected in the Eastside Management Area LUA. Management direction (BLM 2016b, Appendix A, p. 613) for fish-bearing and perennial streams there requires the BLM to "Retain and promote long-term site-potential shade conditions." Given the very low miles of fish-bearing or perennial streams susceptible to water temperature increases, and the low acres of projected Riparian Reserve thinning within the first decade under the PRMP, there is an extremely low probability that thinning would take place that may result in a measurable increase in water temperature in the following ESUs, and RUs: UWR Chinook salmon; UWR steelhead or in the Upper Klamath for suckers.

Should thinning take place in a susceptible stream reach, a loss in stream shade that would result in stream heating could induce sub-lethal heat stress on ESA-listed fish species in areas where stream temperatures already exceed ODEQ standards for fish use. Sub-lethal effects may manifest as lowered disease resistance, reduced growth rates and migrating to areas with cooler water temperatures (potentially resulting in competition for space with other individuals).

Effects from canopy removal would be most noticeable in smaller headwater perennial streams that have a continuous canopy over the channel. Shade reductions on intermittent streams that are dry during the hotter summer months would not result in an increase in stream temperatures or affect fish because they would primarily be exposed to increased solar radiation only during the season when they are running little or no water.

Larger order channels (>5th order) would have a sufficient buffer to temperature increases from the large volume of water that the overall effect on salmonids would be negligible (Poole and Berman 2001). Additionally, larger streams have more open canopy over the center of the channel and a small reduction in shade would represent a relatively small change in the overall amount of sunlight reaching the stream.

Based on the discussion above and the location of ESA-listed fish under the jurisdiction of the Service the effects of this PE as considered discountable.

Fuels treatment. Fuels treatment that occurs within the Riparian Reserve has the potential to affect the water temperature indicator. The mechanism would be loss of shade to stream channels as a result of fuel treatments. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve are hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the water temperature indicator.

Burning of slash has the potential to kill an existing tree and affect shade. However, a slash pile created by the hand pile and burn treatment type typically has a small footprint (BLM 2016b, Appendix C, p. 720 BMP F 8 limits piles to 16 feet in height or diameter), would be located in the outer zone of the Riparian Reserve, and the piles are placed in openings that would not have many existing live trees that could be killed by the burning pile. The likelihood that any burn piles would kill trees or other vegetation that provides shade to a perennial or fish-bearing stream channel is very low. The likelihood that this would occur in a stream reach susceptible to a water temperature increase is also very low (0.5 percent of all miles of perennial or fish-bearing streams in the planning area by method B; none by method A). Considering the compounding effect of low likelihood of killing shade vegetation on a very small footprint, and a very low likelihood of occurring within a susceptible stream reach, the overall effect to the indicator by the PE is discountable.

Post-harvest silvicultural treatment. Within the Riparian Reserve, there would be extremely limited post-harvest silvicultural treatment, and none that would affect shade canopy over streams. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. However, because these activities would be outside of the inner zone, effects to the water temperature indicator would be **discountable**. Pre-commercial thinning is associated with regeneration types of

harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation. Spot-fertilizer use may have a beneficial effect on growth of trees, but its use is so limited and distant from stream channels that its effect on potential shade is discountable. Overall, the PE would have a discountable effect to the indicator.

Summary of effects to water temperature

The BLM analyzed stream shading using two models. By Method A, PRMP Riparian Reserve thinning in the outer zone would avoid any measurable increases in stream temperature. Results from Method B identified approximately 0.5 percent of fish-bearing and perennial streams in the planning area where forest management (thinning) in the Riparian Reserve outer zone of fish-bearing or perennial streams under the PRMP would potentially affect stream temperature.

Without site-specific information on the proximity and magnitude of any future riparian thinning project and associated road construction to ESA-listed fish species and designated critical habitat, it is speculative to determine if there would be a measurable effect to shade and water temperature at either the planning area scale or at the site-specific scale. The probability of thinning or new road construction within a susceptible stream reach is very low, based upon the low (or in two cases, no) miles of such streams within each ESU, DPS, RU or in the McKenzie River bull trout analysis area, the low acres of thinning projected within the Riparian Reserve, and the small number of miles of Riparian Reserve thinning used for modeling purposes at the scale of the planning area.

It should be noted that monitoring over the last 20 years of NWFP implementation has detected statistically significant improving trends in watershed yearly seven-day average water temperatures (USFS and BLM AREMP 2015), suggesting that Forest Management activities on Federal lands, including riparian thinning actions, have not resulted in water temperature increases in this timeframe. This is important to note, because past riparian thinning treatments were much closer to perennial streams, and consisted of heavier thinning actions than what is currently proposed in the PRMP. Based upon the results of NWFP monitoring, the results of the water temperature modeling efforts presented in BLM 2016b (pp. 340-347) at the planning area scale, and the PE analysis, the BLM concluded that the risk of future PRMP Forest Management actions resulting in measurable increases to water temperatures where it may affect ESA-listed fish species or designated critical habitat is virtually non-existent, and the conclusion is a discountable/negligible effect to the water temperature indicator.

Peak and Base Flows

Background

Increased frequency and severity of flood flows during winter can affect over-wintering juvenile fish and eggs incubating in the streambed. Eggs of fall and winter spawning fish, including Chinook salmon and bull trout, may suffer higher levels of mortality when exposed to increased flood flows (Jager *et al.* 1997). Scouring of the streambed can dislodge the eggs (Schuett-Hames *et al.* 2000) and elevated sediment transport caused by high flow can increase sediment

deposition in redds, suffocating eggs (Peterson and Quinn 1996). Spring spawning fish, such as steelhead and cutthroat trout, also may suffer increased egg mortality due to dewatering of redds caused by earlier snow melt runoff (Jager *et al.* 1997). Shifts in the timing and magnitude of natural runoff will likely introduce new selection pressures that may cause changes in the most productive timing or areas for spawning.

Ongoing low intensity storms are common in the planning area, but occasional intense storms will produce a storm depth of more than six inches of precipitation in 24 hours (NOAA 1973). These storms generate peak flows that may overflow banks and cause channel changes, with a return frequency of 2 to 100 years.

Experimental sub-watershed studies in hydrology demonstrate elevated peak flows during flood-producing storms when a high proportion of timber basal area has been removed by forest harvest (Figure C1), particularly within rain-on-snow watersheds (Grant *et al.* 2008, p. 40). As the proportion of forest stand harvest increases within a watershed, evapotranspiration, direct interception, and potential for fog drip declines, while the potential for snow accumulation and melt increases. Snow accumulates faster in openings, but is also susceptible to elevated snowmelt rates compared to a forest (Harr 1981, Harr and Coffin 1992). Storm flow causes runoff along road surfaces into drainage ditches or upon fills, while subsurface routes may be day-lighted in road cuts or flow paths cut off or modified under the road surface. This can result in quicker runoff into stream channels during storms where ditch lines connect, compared to slower subsurface flow routes (Harr 1976, Harr *et al.* 1979, Megahan *et al.* 1992, Wemple *et al.* 1996). As storm intensity increases, runoff would more fully synchronize, contributing to peakflows (Megahan and Kidd 1972, LaMarche and Lettenmaier 2001, Luce 2002, Wemple and Jones 2003).

Likelihood of peak flow increase			Potential considerations
High		Low	
High	Moderate	Low	Road density
All or most	Some	Few or none	Road connectivity
Fast	Moderate	Slow	Drainage efficiency
Large	Small	Thinned	Patch size
Absent	Narrow	Wide	Riparian buffers

Figure C1. Site conditions and treatments for risk of peak flow increase. Source: Grant *et al.* 2008 PNW-GTR-760 p. 40. (Y axis represents the intensity of timber harvest).

There has been a long debate regarding the magnitude of peak flows resulting from timber harvesting and road building. The 2008 RMP/EIS contained a review of the research and debate over peak flows (BLM 2008, pp. 357-359), which is incorporated here by reference.

There are 1,203 sub-watersheds within the planning area. When separated by hydroregion, 679 sub-watersheds are predominately rain-dominated, 96 sub-watersheds are predominately rain-on-snow-dominated, 163 sub-watersheds are predominately snow-dominated and 265 sub-watersheds have proportions of each hydroregion. Figure C2 shows the proportion of sub-watersheds by hydroregions in the planning area.

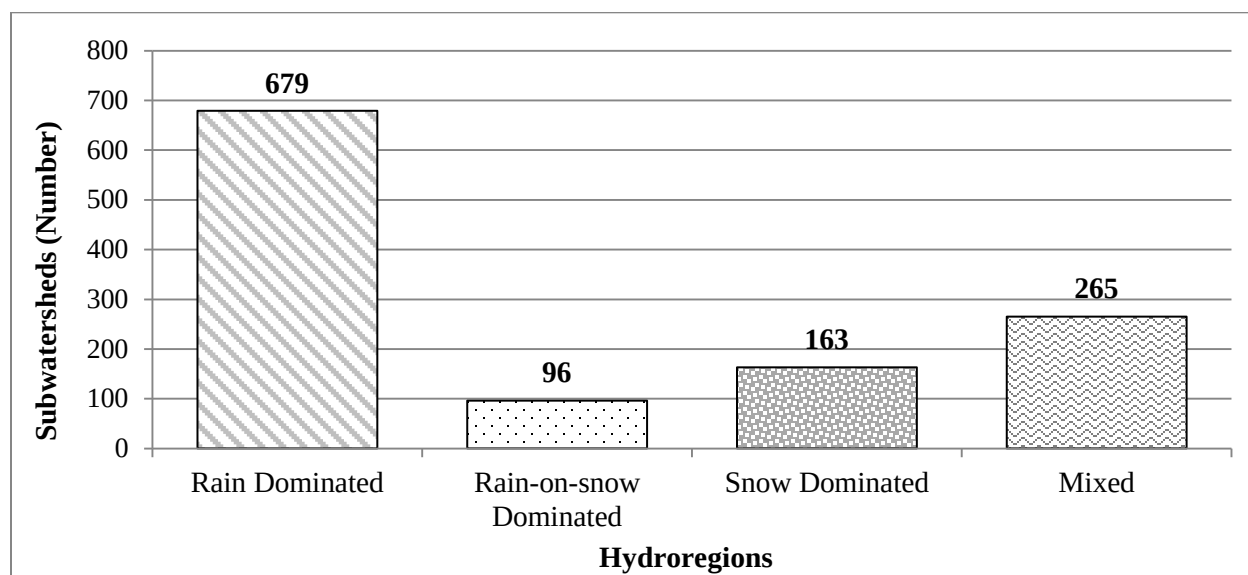


Figure C2. Number of sub-watersheds by hydroregions in the planning area (BLM 2016b, p. 352).

Of the 96 sub-watersheds (3 percent) in the decision area that are rain-on-snow dominated, 38 sub-watersheds include BLM-administered lands, for 197,709 BLM-administered acres. These intermediate elevations in rain-on-snow sub-watersheds are analyzed with the methodologies presented in the Planning Criteria, and they range in area from 3,300 to 27,400 acres, with a mean size of 15,500 acres and an area of 591,626 acres.

Figure C2 shows the potential sediment transport and channel scour by channel gradient and stream type for 1-6 year recurrence interval peak flows from forest management and roads. Gravel bed channel types with a 1 to 2 percent gradient are most likely to be affected for any detected peak flow increase from forest management and roads. Generally, these gravel bed stream types are a small proportion of total stream miles (less than 10 percent) in any sub-watershed in the decision area. Most streams in the decision area are cascade or step-pool channel types. The predominance of cascade or step-pool channel types and the general absence of sand-bed channel types in the decision area reduces the likelihood that any peak flow increases would result in changes to channel structure in the decision area.

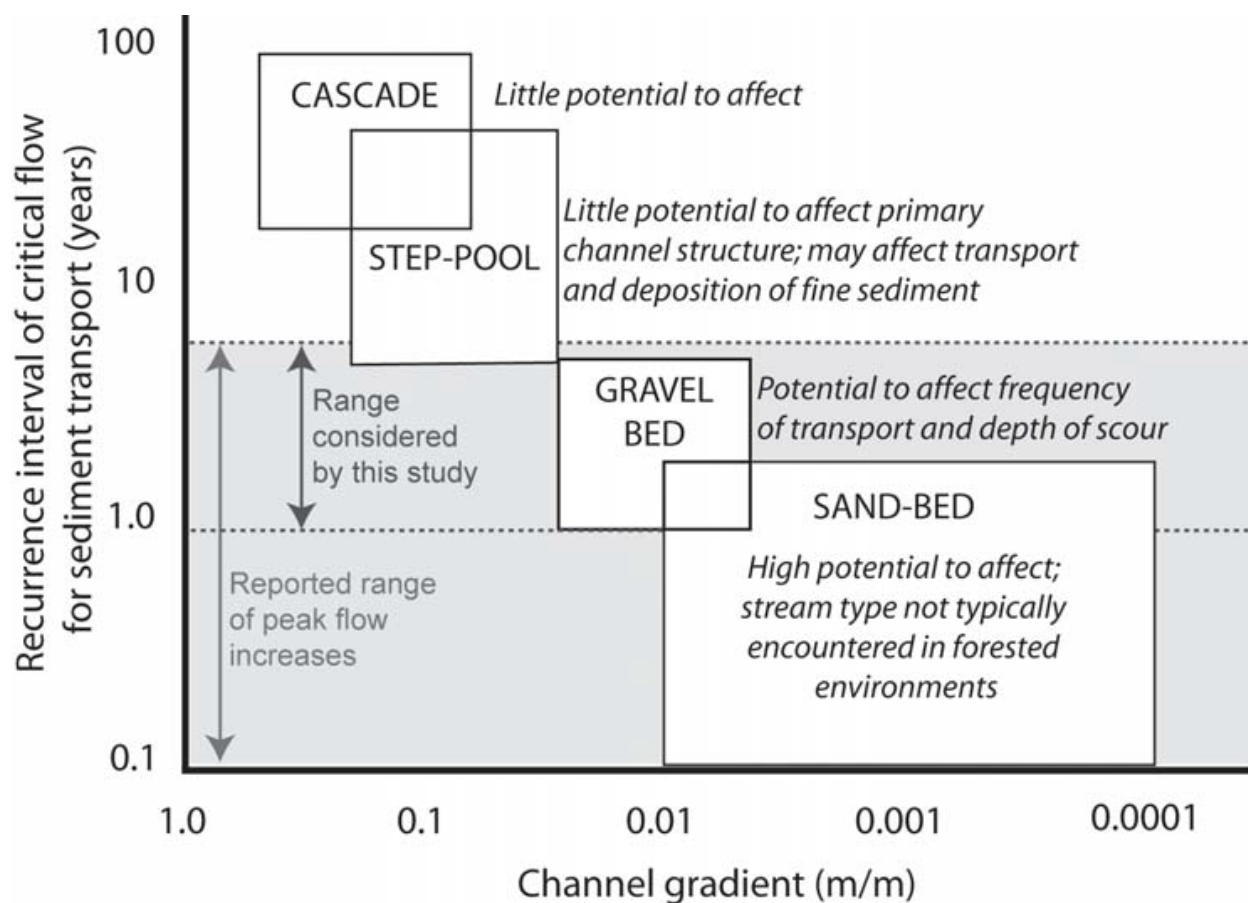


Figure C3. Sediment transport by return period and stream type (Source: Grant *et al.* 2008 PNW-GTR-760 p. 43).

Analysis at the scale of the decision area

The BLM analyzed the potential for changes in peak and base flows in the Hydrology section of the FEIS, and in BLM 2016b, (pp. 353-356) which are incorporated by reference.

Results

Table C14 displays the only susceptible rain-on-snow sub-watershed with BLM-administered lands that falls within the range of ESA-listed fish administered by the Service, by decade with more than 19 percent of the sub-watershed that are, or would be, in an open condition with regeneration harvest units and roads under the PRMP. According to Grant *et al.* (2008), this sub-watershed would be susceptible to a detectable change in peak flow response under the PRMP.

Table C14. Rain-on-snow sub-watersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Upper Klamath Lake Recovery Unit for Lost River sucker and shortnose sucker (BLM 2016B, P. 359).

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Fall Creek-Klamath River ¹ 180102060502	X	X	X	X	X	X
There are 30 sub-watersheds with BLM land ownership in the Upper Klamath RU.						

¹ Fall Creek-Klamath River does not have Lost River sucker or shortnose sucker distribution within the Planning Area. The sub-watershed is split by the Oregon-California border, which is also the Planning Area boundary. There is no designated critical habitat for either species in the entire sub-watershed. However, the Klamath River is known to be occupied by both species on the California side of the sub-watershed. This is located a minimum of 2.5 miles from the Planning Area boundary. There are 2,304 acres of the BLM Eastside Management Area LUA on the Oregon side of the sub-watershed, within the Planning Area boundary.

There are no sub-watersheds that are, or would be, susceptible to a detectable change in peak flow response in the McKenzie River Basin bull trout analysis area, or in the Lost Recovery Unit for shortnose and Lost River suckers.

It is important to note that the Fall Creek-Klamath River sub-watershed does not have Lost River sucker or shortnose sucker distribution at this time.

Analysis at the scale of a site-specific forest management project

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows may also be affected by concentration of flows associated with increases in road connectivity to stream channels.

The timber haul PE has no mechanism to affect peak or base flows, and will not be evaluated further.

Roads and Landings. Roads connected to streams have the potential to concentrate stream flows and affect peak flows. The analysis discussed above of sediment delivery to streams from new roads at the scale of the planning area, used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to fish-bearing or perennial streams. The 200-foot distance and 66 miles are used as criteria for the maximum amount of new roads from which flows from road surfaces and ditch lines may enter perennial or fish-bearing stream channels. The BMPs listed below for road surface drainage and cross-drains will reduce that mileage by directing flows from roads onto the forest floor. It is not known how many miles of the projected 439 miles of PRMP new road construction would deliver water directly to intermittent, non-fish bearing channels.

A number of BMPs reduce the potential for concentration of flows from roads that may increase peak flows. They are summarized here, but a complete verbatim description of each BMP is presented in BLM 2016b, Appendix C. BMPs R 2, R 3 and R 4 (BLM 2016b, Appendix C, p. 700) minimize the number of stream crossings and total road transportation system mileage, direct locations of roads and landings away from water bodies unless there is no practicable alternative, and avoid locating landings that contribute runoff to channels.

BMP R 26 (BLM 2016b, Appendix C, p. 703) directs disconnecting road runoff to stream channels at permanent road crossings by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.

BMPs R 30 to R 38 (BLM 2016b, Appendix C, pp. 704-705) address surface drainage of roads, including use of crowning, insloping, outsloping, rolling dips, water bars and other methods. BMP R 38 directs the design of landings to disperse surface water to vegetated stable areas. BMPs R 39 to R 47 (BLM 2016b, Appendix C, pp. 705-706) address the location, spacing and other characteristics of cross-drains, including the diameter and type of cross-drain culverts according to predicted ditch flow.

The likelihood that any new road/landing construction for an individual timber sale may occur within a sub-watershed that is susceptible to a peak flow increase is very low, as detailed above in the peak flow analysis at the scale of the planning area.

The only component of this PE that may have a measurable effect to base flow is the use of pump chances to obtain water for road purposes. BMP R 60 addresses the amount of water that may be removed:

“Avoid water withdrawals from fish bearing streams whenever possible. Limit water withdrawals in listed fish habitat and within 1,500 feet of listed fish habitat to 10 percent of stream flow or less at the point of withdrawal, and in non-listed fish habitat to 50 percent or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish.”

A short-term measurable effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC “f” in the Western Oregon Programmatic BA (USFS *et al.* 2010): “When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10 percent.” A 10 percent reduction in base flows would result in a meaningfully measurable effect to the peak and base flow indicator. The use of pump chances in proximity to ESA-listed fish habitat or designated critical habitat is generally expected to be a relatively rare occurrence considering the BMP and alternative pump chance locations. However, there are four locations along the McKenzie River on Eugene BLM where pump chances may occur. All of these are located within bull trout critical habitat. All of these locations are on the mainstem of the river and it is unlikely that even if all four were

operated simultaneously that the flow would be reduced by 10 percent. Short-term measurable negative effects would occur from reductions in flow from pump chances.

Falling and yarding. The likelihood that the removal of trees from a specific BLM timber management activity would exacerbate the risk of a detectable peak flow increase sufficient to erode channel beds, impact channel form, and thereby negatively impact instream and riparian habitat conditions for ESA-listed fish species and designated critical habitat at the sub-watershed scale or larger is very low. There will be only 6-10 sub-watersheds at any given time in the rain-on-snow hydro-region across the range of the planning area in a 50-year time frame that are susceptible to a detectable peak flow increase (see planning-area scale analysis above). Some of these watersheds will not be proximal to the distribution of ESA-listed fish species or designated critical habitat as described below.

There are no sub-watersheds susceptible to peak flow increases in the Lost River RU for Lost River sucker or shortnose sucker, or the McKenzie River basin for bull trout. The Upper Klamath RU for Lost River sucker and shortnose sucker has one sub-watershed that is susceptible to a detectable peak flow response. Fall Creek-Klamath River does not have Lost River sucker or shortnose sucker distribution within the Planning Area. The sub-watershed is split by the Oregon-California border, which is also the Planning Area boundary. There is no designated critical habitat for either species in the entire sub-watershed. However, the Klamath River is known to be occupied by both species on the California side of the sub-watershed. This is located a minimum of 2.5 miles from the Planning Area boundary. There are 2,304 acres of the BLM Eastside Management Area LUA on the Oregon side of the sub-watershed, within the Planning Area boundary.

Based on the discussion above and the location of ESA-listed fish under the jurisdiction of the Service the effects of this PE as considered insignificant.

Fuels treatment. Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. The main mechanism for effects to peak and base flows is large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. Peak flows are also influenced by roads that are hydrologically connected to stream channels, but the fuels treatment PE does not affect that mechanism. PRMP timber harvest activities (falling) of the Forest Management program will have removed the vast majority of vegetation that may affect flows in a catchment. Any incidental loss of remaining live vegetation from the treatment of timber harvest fuels would be miniscule in the water budget of a catchment in comparison to the trees removed during timber harvest. Considering this minute effect to the water budget of a catchment from Forest Management project generated fuels treatment, and the very low risk of any particular harvest unit being in a sub-watershed susceptible to a peak flow increase, the overall effect of the fuels treatment PE to the peak flow aspect of the indicator is discountable. Similarly, there is a very low probability that fuels treatment would contribute to a base flow increase in small catchments. The overall effect of fuels treatment to the Peak and Base flows indicator is discountable.

Post-harvest silvicultural treatment. Tree planting would increase evapotranspiration and would reduce the risk of an increase in peak or base flows over time. Pre-commercial thinning is associated with regeneration types of harvest. Thinning may result in a slight reduction in short-term evapotranspiration that would quickly return to original or higher levels over time with accelerated tree growth of remaining trees in the stand. This would not likely have a measurable effect to the risk of detectable peak or base flows. Spot-fertilizer use may have a beneficial effect on growth of trees and may therefore contribute to an increase in evapotranspiration, but because its use is so limited, it would not likely have a measurable effect to the risk of detectable peak or base flows., but its use is so limited and distant from stream channels that its effect on potential shade is discountable. Overall, the PE would have a negligible effect to the Peak and Base Flows indicator.

Summary of effects to peak/base flows

The BLM analyzed sub-watersheds in the BLM planning area that met the following criteria, to determine if any would be susceptible to detectable change in peak flow response using criteria from Grant *et al.* (2008): BLM administers > 1 percent of the sub-watershed, there is >100 acres of BLM land ownership in the rain-on-snow hydro-region, and >60 percent of the sub-watershed is in the rain-on-snow hydro-region. Modeling over a 50 year time at 10 year intervals indicates that there would be 6-10 watersheds that would be susceptible to detectable peak flow increases at any given 10 year period. At this large scale (6-10 of a population of 1,203 sub-watersheds in the planning area), the potential for BLM to impact peak flows in rain-on-snow watersheds is very low. Bull trout and suckers are not present in some of the sub-watersheds determined to be susceptible to a peak flow increase.

There is no site-specific information at this time to determine whether or not there would be Forest Management actions in any of the susceptible watersheds, the proximity of any future actions to ESA-listed fish species or to designated critical habitat, and whether or not the project design would affect the risk of a detectable peak flow increase. Therefore, it is highly speculative to state that there would be negative impacts from the Forest Management program to habitat utilized by ESA-listed fish species or to designated critical habitat as a result of detectable increases in peak flows. The risk of it occurring is very low considering that there would only be 6-10 sub-watersheds at any 10 year interval in the entire planning area that are susceptible to a peak flow increase.

The analysis indicates there would be either no sub-watersheds susceptible to detectable peak flow increases, or the susceptible sub-watersheds have no ESA-listed fish presence or designated critical habitat, for the Lost RU for Lost River and shortnose sucker, and the McKenzie River Basin bull trout analysis area. Please see above for a detailed description of the one sub-watershed in the Upper Klamath RU.

Regarding base flows, a sub-set of BLM logging projects under the PRMP may result in increased summer base flow for a period of years in small catchments. It is uncertain if this would be detectable downstream where habitat is occupied by ESA-listed fish. If it does manifest downstream, the increase in flow would increase available habitat at a time when it is limiting for juvenile salmonid rearing. This would result in a short-term beneficial effect to the indicator.

A short-term measurable negative effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC “f” in the Western Oregon Programmatic BA (USFS *et al.* 2010): “When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10 percent.” BMP R 60 has similar language. A 10 percent reduction in base flows would result in a meaningfully measurable (adverse) effect to the indicator. The use of pump chances in proximity to ESA-listed fish habitat or designated CH is expected to be a relatively rare occurrence considering the BMP and alternative pump chance locations.

Among the PEs and their subcomponents, the only measurable negative effect to the Peak and Base Flows indicator is from the rare water withdrawal at pump chances where the stream is occupied by ESA-listed fish or where there is designated critical habitat. The overall effect to the Peak/Base flow indicator is therefore negative. This reduction in flow would reduce water quality, reduce habitat availability and could reduce refugia for ESA-listed fish.

Riparian Reserve Function and Vegetation Diversity

Analysis at the scale of the decision area and a site-specific forest management project

Some Riparian Reserve functions will be affected by Forest Management projects that occur within, or may affect conditions within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis and the results of the analyses are reiterated here. Because there are multiple components of this indicator, the effects to each component are evaluated collectively by PEs of the Forest Management program.

Providing large and small wood. As described earlier in the effects to the Large and Small Wood indicator, model results indicate that there would be a potential improvement to the recruitment of functional wood to streams. An analysis of potential recruitment of functional wood to streams from within one site potential tree height distance from streams at the end of implementing the PRMP for a 100-year period was performed utilizing a model. Characteristics of the stands that were evaluated included: changes in tree stand structural stage classes; total trees per acre; trees >20” DBH per acre; and, percent canopy cover in hardwoods. Results indicate that the effects over the 100-year period to the environmental baseline condition under the PRMP would be an increased potential for areas within Riparian Reserves to provide functional large and small wood to stream channels. This is a beneficial effect to potential recruitment of functional wood to stream channels over the 100-year time-frame at the spatial scale of the entire planning area, including streams inhabited by ESA-listed fish.

In the short-term, and at the project-scale, some Forest Management activities that occur within the Riparian Reserve would reduce potential for small wood recruitment to stream channels occupied by ESA-listed fish. Within the Riparian Reserve west of Highway 97, this would occur primarily from the ground-based yarding and yarding corridors (mitigated by BMP requirements to leave downed trees within the Riparian Reserve and directionally felled toward the stream) components of the Falling and Yarding PE, and the rare new road construction associated with thinning (Roads and Landings PE). Effects to small wood recruitment from thinning in Riparian Reserves of fish-bearing and perennial streams west of Highway 97 would

be nearly non-existent due to the 120-foot no-thin buffer. In addition, tree-tipping would directly increase large and small wood numbers in stream channels (Falling and Yarding PE).

Within Riparian Reserves east of Highway 97, the mechanisms to negatively affect current and future small and future large wood potential for delivery to streams and lakes are: thinning (PRMP thinning is nearly non-existent but may occur) and reducing conifer encroachment; skid trails, yarding corridors (but see mitigating BMPs, above) (all components of the Falling and Yarding PE), and new road construction (Roads and Landings PE). Because of increased growth of remaining trees within thinned stands, there would be a beneficial effect to future recruitment of large wood in both westside and eastside Riparian Reserves.

Given the analysis above, considering the most impacting effects, the overall effect to the Providing Large and Small Wood component of the Riparian Reserve Function and Vegetation Diversity indicator from implementing the PRMP is adverse. There are short and long-term **beneficial** effects to the indicator from some components of the PEs.

Filtering sediment, nutrients, and chemical contaminants. There will be a generally short-term negative effect to the sediment filtering function. For a subset of Forest Management projects, there may be a localized increase in fine sediment delivery to streams proximal to ESA-listed fish. Fine sediment would be delivered from several sources, including road segments within 200 feet of stream channels used for log haul (primarily wet weather haul), and from ground-disturbing activities occurring within Riparian Reserves, such as road construction and decommissioning, road maintenance (including culvert replacements) (all components of the Roads and Landing PE), and yarding corridors and skid trails (Falling and Yarding PE). Effects from fuels treatments are expected to be insignificant (Fuels Treatment PE). There is also an unquantifiable risk of a landslide or shallow debris torrent reaching a stream channel as a result of timber management activities (Falling and Yarding PE). This would negatively affect the Riparian Reserve function of serving as a filter for sediments. Forest management actions such as culvert replacement, road maintenance and road decommissioning would have short-term negative effects and a long-term beneficial effect (Roads and Landings PE). Increases in stream sedimentation would reduce spawning opportunities, reduce foraging opportunities and reduce overall water quality. Culvert replacement would improve fish passage, while road maintenance and decommissioning would help to reduce sediment sources and benefit water quality over time.

There will be an insignificant negative effect to the nutrient filtering function. Increased nutrients from upslope sources, such as slash burning (Fuels Treatment PE), would move downslope but largely be effectively captured by duff, down wood, live herbaceous vegetation and soil in undisturbed parts of the forest floor within the Riparian Reserve. Similarly, chemical contaminants such as fertilizers would be effectively filtered (Post-harvest Silvicultural Treatment PE). Non-target effects of their application are minimized by use of management direction that prohibits aerial application. There is also no scheduled use of fertilizer. It is expected to be used rarely and localized.

Given the analysis above, considering the most impacting effects, the overall effect to the Filtering Sediment, Nutrients, and Chemical Contaminants component of the Riparian Reserve Function and Vegetation Diversity indicator from implementing the PRMP is adverse.

Shade to streams function. Use of an EPA model identified approximately 0.5 percent of fish-bearing or perennial stream miles in the planning area where thinning in the Riparian Reserve outer zone under the PRMP would potentially affect stream temperature (Falling and Yarding PE). It is not known if any future thinning activities would take place along any of those vulnerable stream miles, or the magnitude (distance along stream) of the impact to shade. There may be some minor losses of stream shade that would have insignificant effects, such as where there is a cable-yarding corridor. However, without site-specific information on the proximity and magnitude of any future riparian thinning project where ESA-listed fish species and/or designated critical habitat are present, it cannot be determined if there will be an adverse effect to the shade to streams function. However, site-specific consultations done at the time these projects are proposed will address these concerns.

The conclusion of effect to the water temperature indicator was a discountable effect, due to the low probability of a susceptible stream reach being thinned and a low probability of any road construction within the outer zone of a Riparian Reserve that may remove shade within a stream reach susceptible to water temperature increases by shade removal.

Channel geometry and habitat-forming processes. It is not anticipated that large and small wood delivery, the magnitude and duration of sediment delivery to stream channels, effects to peak or summer base flows, or physical effects from yarding or road construction as a result of the Forest Management program, alone or combined, would measurably affect the number or quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. Effects would be insignificant because of management direction and the extensive list of BMPs described within BLM 2016b (Appendices A and B).

Riparian vegetation diversity. Thinning and other silvicultural activities within the Riparian Reserves largely occur within plantations (Falling and Yarding PE). These unnaturally overstocked stands are often conifer monocultures with low diversity. Forest management activities within Riparian Reserves are guided by management direction (BLM 2016b, Appendix A, pp. 613, 637) such as:

- Conduct thinning and other silvicultural treatments to accelerate the development of potential natural forest stand conditions including late-successional stand characteristics and native riparian shrub communities. (Applicable to the Eastside Management Area).
- Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. (Applicable to the outer zone of Class II and III watershed Riparian Reserve for fish-bearing perennial streams, and the outer zone of Class III intermittent, non-fish-bearing streams).

Thinning and other silvicultural treatments within Riparian Reserves should increase riparian vegetation diversity, and would have a long-term beneficial effect to the indicator.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of short and long-term insignificant and discountable effects to several functions of Riparian Reserves. The effect to the shade function is uncertain, as it is unknown if future thinning may occur in the outer Riparian Reserve of the approximately 0.5 percent of fish-bearing and perennial streams in the planning area determined to be vulnerable to shade loss that may result in a water temperature increase. However, there is a low probability of thinning any susceptible stream reach (1 in 200). If such thinning did occur the effects would be extremely localized. There would be a long-term beneficial effect to vegetation diversity. There is also a low probability of any new road construction that may reduce stream, shade occurring in the outer zone of the Riparian Reserve of a stream segment that may be susceptible to a water temperature increase from a loss of shade.

There are two negative effects to the Riparian Reserve and Vegetation Diversity indicator that are neither insignificant nor discountable. One is the result of a measurable negative impact to the large and small wood indicator, with a long-term beneficial effect (Falling and Yarding PE). This would affect the function of being a source of wood to stream channels. Another is impairment of the sediment filtering function. Fine sediments may enter stream channels from road segments used for log haul within 200 feet of stream channels (primarily from wet weather haul), and from ground-disturbing activities occurring within Riparian Reserves, such as road construction and decommissioning, road maintenance (including culvert replacements) (all associated with the Roads and Landings PE), and yarding corridors and skid trails (both associated with the Falling and Yarding PE). Consequently, there will be an overall adverse effect to the indicator. The measurable negative effects are generally short-term and include.

Chemical Contamination and Nutrients

Use of fertilizers has the potential for chemical contamination of streams. Fuel spills of petroleum products from machinery and equipment used in timber harvest, timber haul and road construction/maintenance and decommissioning activities also have the potential for chemical contamination of streams. The PRMP does not include use of herbicides for treatment of competing vegetation in conifer plantations.

The effects of the use of fertilizers for Forest Management are discussed in Meehan (1991) and Spence *et al.* (1996). Use of fertilizers has the potential for chemical contamination of streams. Burning of slash will generate nutrients such as phosphorous and nitrogen. The potential to deliver fertilizers and nutrients to stream channels is mitigated by project design under the PRMP, including use of BMPs, management direction and no-treatment buffers. PRMP management direction for the Harvest Land Base LUA regarding the use and application of fertilizers states: “Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.” However, the PRMP does not project any acres of fertilizer application. Use of fertilizers is expected to be rare and localized.

In addition to primary productivity, there are other sources of nutrient input and food web stimulus into small fish-bearing streams. Opening the riparian overstory and increasing the available light that reaches the stream can increase primary productivity (Hill *et al.* 1995), hasten breakdown of litter and leaf material (Lagrué *et al.* 2011) and translate to increases in macroinvertebrate and fish biomass (Kiffney *et al.* 2014, Wootton 2012). However, Danehy *et*

al. (2007) found little effect on instream flora, fauna, or macroinvertebrate assemblages due to thinning (Danehy *et al.* 2007). Additionally, periphyton biomass was larger in thinned stands than in mature stands, and macroinvertebrate assemblages, biotic metrics, functional feeding group composition, and biomass measures were the same in both mature and thinned riparian stands (Danehy *et al.* 2007). This occurs because changes in abiotic and biotic features of these systems are less dramatic with the retention of trees near the channel (Danehy *et al.* 2007). Fish-bearing stream reaches can receive nutrient influxes from headwater reaches. Both invertebrates and detritus can be exported downstream from non-fish-bearing, headwater reaches year-round and, in turn, support large numbers of juvenile fish (Wifpli and Gregovich 2002).

Analysis at the scale of a site-specific forest management project

Roads and Landings, Falling and Yarding, and Timber Haul. These PEs have a common mechanism for possible chemical contamination. It is the potential for contamination from fuel spills, lubricants and hydraulic fluid. Potential sources are from use of heavy equipment and chain saws.

Contract requirements specify spill containment measures for all machinery and equipment used in timber harvest activities. Heavy equipment is fueled on landings. Spills associated with loading equipment may occur but are also likely to be very small and would occur within the road prism. A fuel spill kit is required of operators in case of accidental spill to minimize adverse aquatic effects. Chainsaws use minimal amounts of gas and any spills would likely be very small and would not likely reach a stream. The no harvest inner zones of Riparian Reserves are sufficient to minimize potential transport of spilled fuels and fluids to stream channels during timber falling and ground-based harvest.

Equipment using fuel and hydraulic fluids are used in road construction, renovation, decommissioning and rock quarry development activities. Based upon experience with past projects, there is a very low probability of spilling significant amounts of fuel or oil near enough to channels to be transported and present a risk to aquatic organisms. Project contract requirements and mitigation measures are effective to contain potential fuel and fluid transmission into waterways, reducing the possibility of aquatic habitat contamination to a discountable risk.

The greatest risk for introducing petroleum products into stream channels is during culvert replacement projects, particularly those that would occur in fish-bearing streams. The ARBA II (USFS *et al.* 2013) has aquatic conservation measures for heavy equipment use to minimize or prevent chemical contamination in streams:

- v. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (*e.g.*, generators, canes, etc.), and gas-powered equipment with tanks larger than five gallons.
- vi. Store and fuel equipment in staging areas after daily use.
- vii. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.

- viii. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.

The Service's ARBO II (p.225) states that the use of heavy equipment creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants are likely to occur. Effects are acutely toxic at high levels and sub-lethal adverse at lower concentrations. The Service's ARBO II (p.225) displays that a negative effect with a significant magnitude would occur for the chemical contamination/nutrients indicator for construction activities (which would include culvert replacements).

The timber haul component has contract requirements for spill abatement. Experience with past timber haul without incident (communication between trucks is excellent and accidents are rare) reduces the possibility of aquatic habitat contamination to a discountable risk.

Overall, the effect of the three PEs to the Chemical Contamination and Nutrients indicator is measurable negative. This is a result of road construction or renovation work that may introduce chemicals into streams during culvert replacements in streams. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to fish and other aquatic organisms at high levels of exposure and can cause sublethal adverse effects to aquatic organisms at lower concentrations (USFWS 2013, p. 225).

Falling and yarding. Thinning riparian stands, especially near streams, could potentially increase the primary productivity in streams by increasing sunlight to streams and altering the litter fall composition. The PRMP would limit near-stream thinning to the area in the outer zone of Riparian Reserves west of Highway 97 (beyond 120 feet on either side of fish bearing or perennial streams; beyond 50 feet on either side of non-fish-bearing intermittent streams) to maintain stream shading. Management direction for fish-bearing and perennial streams in the Eastside Management Area LUA requires the BLM to "Retain and promote long-term site-potential shade conditions."

Thinning in the outer zone of Riparian Reserves west of Highway 97, or within the Riparian Reserves of the Eastside Management Area LUA, would not result in a measurable increase in primary productivity and subsequent growth rates of juvenile resident/anadromous or adult resident ESA-listed fish as a result of an increase in biomass of the macroinvertebrate forage base. For these reasons the Service believes that this PE would have an insignificant effect to this indicator.

Fuels treatment. Nutrients from slash burns would be effectively filtered by the intact forest floor in the distance between thinning activities and stream channels. This would be a minimum of either 50 or 120 feet depending upon whether the stream is in the Riparian Reserve stream category of non-fish-bearing intermittent, fish-bearing, or perennial. There would be at most an **insignificant** effect to the indicator.

Post-harvest silvicultural treatment. Use of fertilizers has the potential for chemical contamination of streams. This is mitigated by project design under the PRMP, including use of

BMPs, management direction and inner zone Riparian Reserve buffers. Applicable BMPs (BLM 2016b, Appendix C, pp. 719, 726) include:

- S 3. For streams and water bodies that support domestic use, apply fertilizer further than 100 feet from the edge of the active channel or shoreline.
- S 4. Locate storage, transfer, and loading sites outside Riparian Reserve and separated from hydrological connections (*e.g.*, road ditches that are linked to stream channels).
- SW8. Avoid loading, or storing chemical, fuel, or fertilizer in DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.

Management direction does not allow aerial application of fertilizers. It would be spread by hand for spot treatments. The probability of fertilizer entering stream channels with designated critical habitat or ESA-listed fish presence when applied manually at localized spots within plantations is extremely unlikely. It would be at minimum, a distance of 120 feet from fish-bearing or perennial stream channels. Once applied, the probability of any of it moving to a fish-bearing or perennial stream channel during a precipitation event is also extremely unlikely, as much of would be absorbed by the target and other vegetation before the precipitation event, and what remains would be captured in the duff layer of the forest floor between the application area and the stream. There would be discountable effects to ESA-listed fish or designated CH from BLM use of fertilizers.

Summary of effects to chemical contamination/nutrients

Use of fertilizers has the potential for chemical contamination of streams. The probability of an effect to ESA-listed fish or designated critical habitat is extremely low. It is mitigated by use of management direction that precludes aerial application of fertilizer, BMPs and the inner zone distance of 120 feet for Riparian Reserves on fish-bearing or perennial streams. For these reasons the effect to the indicator from use of fertilizers in plantations is discountable.

Chemical contamination from petroleum products associated with heavy equipment use during culvert replacements on fish-bearing streams with ESA-listed fish present, or where there is designated critical habitat, may occur. Effects would be minimized by management direction, BMPs and the Aquatic Conservation Measures of the ARBA II. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to fish and other aquatic organisms at high levels of exposure and can cause sublethal adverse effects to aquatic organisms at lower concentrations.

Nutrients from slash burns would be effectively filtered by the intact forest floor in the distance between thinning activities and stream channels. There would be at most an insignificant effect to the indicator.

Thinning in the outer zone of Riparian Reserves under the PRMP is unlikely to result in a beneficial effect to rearing ESA-listed fish species and to corresponding PBFs of designated critical habitat from increased primary productivity and subsequent effects to the food chain.

Overall, a conservative judgment of the effect to the indicator is a short-term negative effect based solely upon the potential contamination of streams by petroleum products during replacements of culverts on fish-bearing streams.

Roads within Riparian Reserves

Analysis at the scale of a site-specific forest management project

The only Forest Management program PE that may affect the Roads within Riparian reserves indicator is Roads and Landings.

Roads and Landings. While anticipated to be a rare occurrence, new road construction for the purposes of Forest Management activities is allowed within Riparian Reserves where there is no practicable alternative (BLM 2016b, Appendix C, p. 700: BMP R 3). The sediment modeling analysis (BLM 2016b, p. 370) stated that a total of 437 miles of new road construction is projected under the PRMP at the scale of the planning area. For sediment modeling purposes, an estimate of 66 miles was used for new road construction within the 200-foot sediment delivery distance in the first decade. However, the impetus for entering Riparian Reserves for Forest Management activities is for thinning projects, located largely within plantations. The mainstem road network already exists to the plantations (exceptions being those that have been decommissioned). So, the need for road construction within Riparian Reserves will be limited.

Construction of the likely short spur roads in the Riparian Reserve to facilitate Forest Management activities will follow management direction and employ BMPs. Most will likely be at the outer (uphill) edge of the Riparian Reserve and not be hydrologically connected to stream channels. This will minimize the potential for concentration of flows during precipitation events, and the downslope parts of the Riparian Reserve would effectively maintain a sediment filtration area between the road and stream channels. Some of these new road segments would be decommissioned post-project.

The sediment modeling analysis (BLM 2016b, p. 371) stated that a total of 372 miles of permanent road would be obliterated by 2023 under the BMP. It is not known what proportion of these roads would be within the Riparian Reserve, so it is not possible to determine whether or not there would be a net reduction of roads within the Riparian Reserve over time, although it's likely some of these roads would be located within Riparian Reserves.

There will be some culverts replaced that currently are partial barriers to migration of ESA-listed fish species. This would have a beneficial effect to the indicator as it would improve fish passage, and allow more natural passage of stream materials (wood, cobble, gravel, etc.).

Considering the above analysis, based on the collective effects expected from the PRMP there would be an overall insignificant effect to the indicator.

Summary of effects to roads within riparian reserves

There would be a beneficial effect from improvement of fish passage at culvert replacement projects. Installation of properly sized culverts will allow increased passage of natural stream

materials. The overall effect to the indicator, however, is an insignificant negative effect. Roads are likely to be constructed within Riparian Reserves, but effects to peak/base flows and sediment delivery would be minimized because it is probable that most roads will not be hydrologically connected to stream channels given updated road construction techniques. Because they will not be hydrologically connected to the streams the amount of sediment, nutrient and chemical inputs to the stream will be extremely low, as the only avenue to the streams would be through filtering vegetation.

Direct Effects to the Species from the Forest Management Program

Temporary displacement of ESA-listed fish from their territories may occur due to disturbance when yarding corridors are constructed and are in operation. ESA-listed fish will be captured at some culvert replacement sites, held and then released back to the stream. This activity will follow the ACMs and PDC of the ARBA II. Because there will be disturbance associated with displacement of ESA-listed fish from territories, and potential injury or death resulting from capturing and handling fish, there will be an **adverse effect** to the species.

Summary

The indicator analysis results are summarized in Table C15. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities. Note that these effects will occur for a sub-set of Forest Management actions.

Table C15. Summary of indicator analysis results for the Forest Management program (BLM 2016b, pp. 371-372).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Adverse (loss of wood from ground-based yarding skid roads and road construction within Riparian Reserves)
Sediment/turbidity/substrate	Adverse (short-term due to fine sediment entering channels and water column). Primary sources include road construction, decommissioning and maintenance, wet season haul and culvert replacements.
Water temperature	Discountable (very low probability of thinning a stream reach on a fish-bearing or perennial stream that is susceptible to water temperature increases due to only 0.5 percent of all stream reaches in the planning area being susceptible). Not all susceptible stream reaches would be in reaches occupied by ESA-listed fish or designated as critical habitat. AREMP water temperature monitoring has detected an improving trend for water temperatures on Federal land in the NWFP area over the past 20 years. There would be a wider no-thin buffer under the PRMP than has been employed for thinning under the NWFP.

Indicator	Effects to the Indicator (most impacting)
Peak/base flows	Adverse. It is solely from use of pump changes in streams. There is a low probability of timber harvest or new road construction resulting in a peak flow increase that would affect ESA-listed fish or designated critical habitat. There is also a potential short-term beneficial effect to base flows in small catchments (<100 hectares) for a small sub-set of timber harvest actions.
Riparian Reserve function and vegetation diversity	Adverse (short-term due to impacts to large and small wood delivery function, and filtering capability for fine sediments and nutrients)
Chemical contamination / nutrients	Adverse (short-term effect may result from petroleum products used by heavy equipment entering stream channels during culvert replacements in fish-bearing streams)
Roads within Riparian Reserves	Insignificant

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in disturbance (temporary displacement of fish from territories as a result of construction and use of cable yarding corridors) and potential injury or death (handling of fish to remove them from culvert replacement sites). However, these impacts are outweighed by the benefit of providing upstream access, and potential expansion of populations through increased numbers and increasing in available habitat.

Based on the analysis above the Forest Management program will have negative effects to ESA-listed fish.

5. Lands and Realty

The following analysis is based upon a road constructed under a discretionary right-of-way grant across BLM land, where the right-of-way will result in road construction within a Riparian Reserve adjacent to a stream occupied by ESA-listed fish or containing designated critical habitat. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in the past 10 years (BLM 2016b. p. 373).

Based upon the past history of limited acres of land exchanged since 1995, the PRMP management direction quoted above that requires the maximizing of public resource values, and fish biologist involvement in the NEPA process, it is extremely unlikely that BLM-administered land occupied by or designated as critical habitat for ESA-listed fish species would be exchanged.

Effects to Environmental Baseline Indicators from the Lands and Realty Program

Large and Small Wood

Road construction for a right-of-way would affect large and/or small wood recruitment, dependent upon its location within the Riparian Reserve. If very near the stream, both large and small wood would be affected, as trees in either size class would be removed from the road prism. The magnitude of the effect to the indicator would be dependent upon the length of the road segment that is within the Riparian Reserve. It would have a measurable negative effect to the indicator.

Summary of effects to large and small wood

Road construction within a Riparian Reserve would result in a measurable negative effect to the indicator because trees would be removed from the road prism.

Sediment/Turbidity/Substrate

Road construction for a right-of-way within Riparian Reserves of streams proximal to the distribution of ESA-listed fish species would be a mechanism for fine sediment to enter stream channels. Use of BMPs and management direction for road construction would minimize fine sediment delivery to stream channels and the water column.

There are 100 road and landing-related BMPs in BLM 2016b (Appendix C). An abbreviated list of BMPs relevant to new road construction is presented below. Others address permanent stream crossings, temporary stream crossings, surface drainage, cross drains, timing of in-water work, low water fords, water quality for noxious weed treatment of road equipment, water source development and use, erosion control, dust abatement, road maintenance, road storm-proofing, and road closure and decommissioning.

- R2. Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.
- R3. Locate roads and landings away from wetlands, Riparian Reserves, floodplains and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.
- R6. Confine pioneer roads to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserves, floodplains and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.
- R8. End-haul material excavated during construction, renovation, and/or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.
- R11. Locate waste disposal areas outside wetlands, Riparian Reserves, floodplains and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.

- R12. Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserves, floodplains, and waters of the State.
- R13. Use temporary sediment control measures (*e.g.*, check dams, silt fencing, bark bags, filter strips and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul are complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.
- R27. Disconnect road runoff to the stream channel by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.
- R30. Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips) and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion proofed.
- R31. Outslope temporary and permanent low volume roads to provide surface drainage on road gradients up to 6 percent unless there is a traffic hazard from the road shape.
- R34. Construct variable road grades and alignments (*e.g.*, roll the grade, grade breaks) which limit water concentration, velocity, flow distance and associated stream power.
- R36. Design roads crossing low-lying areas so that water does not pond on the upslope side of the road. Provide cross drains at short intervals to ensure free drainage.
- R39. Locate cross drains to prevent or minimize runoff and sediment conveyance to waters of the State. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences, and check dams to prevent or minimize sediment conveyance. Locate cross drains to route ditch flow onto vegetated and undisturbed slopes.
- R40. Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion. At a minimum, space cross drains at intervals referred to in the BLM Road Design Handbook 9113-1 (BLM 2011), Illustration 11 -"Spacing for Drainage Lateral." Increase cross drain frequency through erodible soils, steep grades, and unstable areas.
- R42. Locate surface water drainage measures (*e.g.*, cross drain culverts, rolling dips, water bars) where water flow will be released on convex slopes or other stable and non-erosive areas that will absorb road drainage and prevent sediment flows from reaching wetlands, floodplains and waters of the State. Where possible locate surface water drainage structures above road segments with steeper downhill grade. Locate cross drains at least 50 feet from the nearest stream crossing and allow for a sufficient non-compacted soil and vegetative filter.

- R44. Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures and/or energy dissipaters at cross drain outlets or drivable dips where alternatives to discharging water onto loose material, erodible soils, fills, or steep slopes are not available.

Depending upon the road's connectivity with the stream network via side drains, and the distance between the forest floor and the stream that would serve as a sediment-filtering zone, some to all of the fine sediment would be captured before it entered the stream channel. If the road construction created a stream crossing (culvert or bridge) there would be a segment of the road that would drain to the stream directly, although management direction and BMPs would minimize the amount of sediment delivered to the stream. The amount of sediment delivered would also depend upon the road surface. The gradation from higher to lower is from native surface to gravel surface to pavement.

Fine sediment may lead to short-term increases in fine sediment within interstitial spaces of larger bed particles (including spawning gravel and cobbles), and increased turbidity would occur. Overland flow from rainfall or snow-melt events occurring later in time after the road construction is completed would be the delivery mechanism to stream channels for roads not directly connected to stream channels via adjacent road ditchlines, culverts or bridges. Effects to spawning gravel and coarse substrate such as cobble may last for weeks to months dependent upon shear stress of future flow events to mobilize fine bed particles, and could include impacts to the survivability of those eggs (need to, at some point, carry this effect forward to what it means for recovery, etc.). Sediment entering stream channels later in time during run-off events may lead to turbidity increases that may be undetectable due to background levels in the water column. The effect to the indicator in the worst case would be a measurable negative.

Summary of effects to sediment/turbidity/substrate

Fine sediment as a result of right-of-way road construction may enter stream channels within Riparian Reserves proximal to ESA-listed fish habitat. While there are a number of variables that would condition how much fine sediment is delivered, it is anticipated that there would be measurable negative effects to turbidity and streambed substrate composition from fine sediments for a sub-set of road right-of-way construction projects. Effects are anticipated to be short-term, with fine sediments on and between streambed substrate particles dispersed within weeks to months due to subsequent high flow events. Episodes of increased turbidity may last hours to days dependent upon several factors: connectivity of the road with the stream network; extent of overland flow; and, ability of duff, down wood and live vegetation to capture fine sediment draining from the road surface to the forest floor. Effects are neither discountable nor insignificant, and therefore adverse. Increased turbidity can affect the ability of fish to spawn, cause gill abrasion. Fine sediments deposited on top of redds can cause fish eggs and embryos to smother, or reduce available oxygen and slow development.

Water Temperature

A road right-of-way construction project may remove vegetation that provides shade to stream channels, and potentially affect water temperatures, in areas proximal to ESA-listed fish habitat. The magnitude of the shade loss would be dependent upon the length of the road that is within a

distance that the height of the vegetation is providing shade to the stream channel. Because the BLM would condition the location of the road segment, the amount of shade-producing vegetation removed for a road right-of-way construction project is unlikely to lead to a measurable increase in water temperature. This results in an *insignificant* effect to the indicator.

Summary of effects to water temperature

There will be an insignificant effect to the indicator because the amount of shade-producing vegetation removed for a road right-of-way construction project is unlikely to lead to a measurable increase in water temperature. ESA-listed fish are not expected to have any noticeable response to immeasurable increases in water temperature. Therefore, the Service does not expect this activity/aspect to cause effects to their numbers, reproduction or distribution.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

The location and design standards for roads constructed under a BLM right-of-way agreement would result in very little road connectivity with stream channels. It is unlikely that a road constructed under a BLM road right-of-way agreement would lead to changes in peak or base flows that would be measurable at the scale of 6th field HUC sub-watersheds or larger. There would be an insignificant effect to the indicator which would not be anticipated to affect bull trout or listed suckers.

Summary of effects to peak and base flows

There would be an insignificant effect to the indicator because roads constructed under a discretionary BLM right-of-way agreement would have little connectivity with stream channels. See BMPs R27, R30, R31, R34, R36, R39, R40, R42, and R44 in the list above.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by road right-of-way construction that occurs within a Riparian Reserve. Other indicators used for this effects analysis address many functions of Riparian Reserves. As described earlier in this section, there may be decreases in small and/or large wood delivery because trees would be removed from within the road prism, leading to a measurable negative effect to the Large and Small Wood indicator. In the worst case, there would be a short-term, measurable negative effect to the Sediment/Turbidity/Substrate indicator due to fine sediment delivery to stream channels. An insignificant effect to the water temperature indicator would occur because the BLM would condition the road location, minimizing shade loss to stream channels. The filtering capability of the forest floor to prevent fine sediment from reaching channels may be negatively affected

by road construction. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator.

It is not anticipated that the short-term nature, and the small magnitude and duration of sediment delivery to stream channels as a result of this program would measurably affect the quality of pools, cause changes to width-depth ratio or affect streambank stability. A road right-of-way within a portion of a Riparian Reserve may be within a floodplain. Dependent upon the specific right-of-way location, it may negatively affect the connectivity of a stream with its floodplain for a short distance. Because of the BMPs and management direction, this is expected to be a rare occurrence. If this did occur the effects would be extremely localized, and thus limited to the area immediately adjacent to the action. The overall diversity of riparian vegetation would not be reduced.

The analysis below for effects to the Roads within Riparian Reserves indicator determined that there would be a measurable negative effect to the indicator. Overall, there would be a measurable negative effect to the Riparian Reserve Function and Vegetation Diversity indicator.

Summary of effects to riparian reserve function and vegetation diversity

There are measurable negative effects to the Large and Small Wood, Sediment/Turbidity/Substrate and Roads within Riparian Reserves indicators from right of way road construction. In addition, there would be impairment of the filtering capability of the riparian forest floor for fine sediments, and potential loss of connectivity of a stream with its floodplain (dependent upon the specific location of the right-of-way). Consequently, there will be an overall measurable negative effect to the Riparian Reserve Function and Vegetation Diversity indicator.

Chemical Contamination and Nutrients

Heavy equipment and chainsaws used during the construction of roads use petroleum products as fuel. The potential for chemical contamination from a fuel spill reaching a stream channel is limited. BMP SP 2 (BLM 2016b, Appendix C, p. 734) states:

“Take immediate action to stop and contain leaks or spills of chemicals and other petroleum products. Notify the Oregon Emergency Response System, through the District Hazard Materials specialist, of any spill that enters the waters of the State.

Inspect and clean heavy equipment as necessary prior to moving on to the project site, in order to remove oil and grease, noxious weeds, and excessive soil.

Inspect hydraulic fluid and fuel lines on heavy-mechanized equipment for proper working condition.

Where possible, maintain and refuel equipment a minimum of 150 feet away from streams and other water bodies, except small equipment (*e.g.*, chainsaws or water pumps). Refuel small equipment from no more than 5-gallon containers. Use absorbent material or a containment

system to prevent spills when re-fueling small equipment within the stream margins or near the edge of water bodies.”

Consequently, the overall effect to the indicator is insignificant.

Summary of effects to chemical contamination and nutrients

There would be insignificant effects to the indicator from the possibility of a fuel spill. Use of BMP SP2 would minimize the risk of causing meaningfully measurable chemical contamination of waters occupied by ESA-listed fish species.

Roads within Riparian Reserves

In the worst case, an approved right-of-way agreement would result in a road segment being constructed within a Riparian Reserve. It would be constructed to minimize connectivity with stream channels and, if a stream crossing is created, would not be a barrier to fish migration. However, it could result in fine sediment being delivered to stream channels as well as removal of some riparian vegetation. Consequently, there would be a measurable negative effect to the indicator.

Summary of effects to roads within riparian reserves

A road constructed within a Riparian Reserve would adversely affect several functions of the Riparian Reserve. Consequently, there would be a measurable negative effect to the indicator. These effects could include: Increased turbidity and sediment to streams which could limit water quality to ESA-listed fish. Fish could suffer gill abrasion, reduced spawning opportunities, and a reduction in foraging opportunities due to increases in turbidity and sediment deposition on substrate. Decreased delivery of small and large wood, which could decrease stream habitat quality through reduced gravel retention, reduced habitat complexity and reductions in the size and frequency of pools within adjacent streams.

Direct Effects to the Species from the Lands and Realty Program

The main mechanism for a direct effect to an individual ESA-listed fish would be if a new road crossing is required on a stream occupied by the species. This would be a very rare event for a discretionary road right-of-way. Fish salvage may occur, and there is the potential for disturbance, injury, or death during such activities. At any time there is heavy equipment operating in the stream channel, there is the potential for a fish to be injured or killed. The majority of these direct effects would be the removal of listed fish prior to heavy machinery entering the stream. This can cause stress, mechanical injury and even mortality. It's possible that not all fish will be removed and may experience injury or death from heavy machinery, or from stranding if the stream section is dewatered. The service anticipates that this will be a limited number, and a very rare occurrence based on past experience.

Summary

The indicator analysis results are summarized in Table C16. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant or discountable effects from different components of the program activities.

Table C16. Summary of indicator analysis results for the Lands and Realty program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Measurable negative (adverse)
Sediment/turbidity/substrate	Measurable negative (adverse)
Water temperature	Insignificant
Peak/base flows	Insignificant
Riparian Reserve function and vegetation diversity	Measurable negative (adverse)
Chemical contamination / nutrients	Insignificant
Roads within Riparian Reserves	Measurable negative (adverse)

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species resulting in disturbance, injury or death if road construction involves fish salvage during construction of a stream crossing.

6. Livestock Grazing

In past BLM evaluations and ESA consultations, livestock grazing actions distant from the distribution of ESA-listed fish species and designated critical habitat, or where livestock access to stream reaches containing ESA listed fish is precluded or limited by fencing, terrain, down wood or dense woody vegetation, have been determined to be No Effect or the effects would be insignificant or discountable to ESA-listed fish species and respective designated critical habitat. Adverse effects may occur for livestock grazing actions where livestock have access to streams occupied by ESA-listed fish. There is no permitted livestock grazing on BLM ownership within the McKenzie River bull trout area, therefore the PRMP grazing program will have no effect on bull trout.

The following analysis is based upon an allotment where livestock have access to a stream or standing body of water that is inhabited by ESA-listed fish. These circumstances occur in a subset of allotments administered by the BLM, notably in the Lost Recovery Unit for shortnose sucker.

The Klamath Falls Resource Area grazing allotments include tributaries to Gerber and Dry Prairie Reservoirs, and border Dry Prairie Reservoir itself. Several tributaries are used for spawning and rearing by shortnose sucker. Note that the Klamath River borders BLM grazing allotments managed by the Klamath Falls Field Office within the planning area. The Klamath River is occupied by shortnose sucker and Lost River sucker. However, because of steep terrain, it is extremely unlikely that cattle access it. The potential for effects to PBFs of designated

critical habitat in the Klamath River is discussed in detail in the effects to PBFs of designated critical habitat section for the two sucker species. The Service believes that effects to any of the habitat indicators by livestock grazing adjacent to the Klamath River would have a **discountable** probability of occurring because of limited access by cattle.

Table C17. Livestock grazing allotments that contain or are bordered by a water body that has designated critical habitat for shortnose sucker.

<i>District/Field Office</i>	<i>ESA-listed Fish Species</i>	<i>Number of Allotments</i>	<i>Miles of Designated critical habitat</i>	<i>Acres of Designated critical habitat</i>
<i>Klamath Falls</i>	<i>shortnose sucker</i>	4	7.5	147.1

Effects to Environmental Baseline Indicators from the Livestock Grazing Program

The potential effects of livestock grazing on ESA-listed fish and their habitat are discussed in Meehan (1991), Spence *et al.* (1996), Chaney *et al.* (1990), Clary and Webster (1989), and Johnson (1992). Livestock grazing can have both acute and chronic effects. Acute effects are those that contribute to the immediate loss of incubating embryos and/or fish, such as by trampling of redds, and loss of specific habitat features or localized reductions in habitat quality. Chronic effects are those that, over time, result in widespread reductions in habitat quantity and/or quality or loss of entire fish populations (for further discussion see Meehan (1991) and NMFS (1997b)). The primary potential impacts for BLM allotments would be from grazing near or on streambanks and removing and/or trampling associated vegetation. Livestock grazing can result in increases in water temperature by reducing streamside vegetation that provides shade and by altering the shape of stream channels that increases the surface area of a stream. Grazing can result in fine sediment delivery to stream channels.

Grazing effects on the sediment regime are primarily expressed in the interception of precipitation, infiltration of the soils, and surface runoff. Concentrated trampling of banks and intensive use can result in soil compaction, reduced vegetative cover and erosion. Grazing at any intensity influences infiltration and sediment production, and heavy grazing is statistically different from light and moderate grazing with respect to hydrologic effects (Johnson 1992). In a review of many studies, Johnson (1992) found that in most cases, moderate grazing affects infiltration and sediment production but is not statistically different from no grazing.

Range management techniques used by the BLM to reduce or eliminate the impact of livestock grazing to streambanks, instream habitat, water quality and riparian areas include:

- Following utilization standards
- Adjusting AUMs based upon monitoring
- Rest-rotation grazing with multiple pastures
- Early season use of riparian pastures

- “Flash” (high intensity, short duration) grazing where cattle are moved relatively quickly from pasture to pasture and several pastures are rested during the growing season each year
- Placement of mineral and salt supplement blocks a minimum of ¼ mile upslope from permanent waterbodies or Riparian Reserves
- Exclusion fences
- Herding
- Development of upland water sources

Livestock grazing BMPs (BLM 2016b, Appendix C, pp. 730-731) to reduce grazing impacts are displayed in Table C18.

Management direction for livestock grazing is presented in BLM 2016b (Appendix A).

The ARBA II (USFS *et al.* 2013) and both ARBO II documents (NMFS 2013, USFWS 2013) include an analysis of the effects of the Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering Facilities category. It is described in ARBA II, p. 47:

Projects will be implemented by constructing fences to exclude riparian grazing, providing controlled access for walkways that livestock use to transit across streams and through riparian areas, and reducing livestock use in riparian areas and stream channels by providing upslope water facilities. Such projects promote a balanced approach to livestock use in riparian areas, reducing livestock impacts to riparian soils and vegetation, streambanks, channel substrates, and water quality. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Table C18. Livestock grazing BMPs (BLM 2016b, pp. 380-381).

BMP Number	Best Management Practices
G 1	Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.
G 2	Do not locate salting areas within ¼ mile of permanent water sources or Riparian Reserves.
G 3	Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserves or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserves to meet water quality standards and regulations.

BMP Number	Best Management Practices
G 4	Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition. Use one or more of the following features: Inclusion of the water bodies, floodplains, and wetlands within a separate pasture. Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover. Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species. Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition. Limit grazing intensity to a level that will maintain desired species composition and vigor. Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.
G 5	Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.

Large and Small Wood

Low to moderate intensity livestock grazing generally has little effect to sources of large and small wood. An exception is when grazing occurs within hardwood stands such as aspen, alder, birch, and cottonwoods that could contribute larger pieces of wood to small streams. Livestock will graze young hardwoods, and rarely young conifers, but at levels that would not result in meaningfully measured effects to future large and small wood availability because these trees are not their primary forage source. There may also be incidental trampling of hardwood or conifer seedlings, but at very low levels. The effect to the indicator is immeasurable or insignificant.

Summary of effects to large and small wood

The effect to the indicator is insignificant, because there would not be meaningfully measured effects to large and small wood availability as a result of livestock grazing.

Sediment/Turbidity/Substrate

Livestock use can result in trampled and grazed riparian vegetation, and altered stream banks. Livestock use trails to access streams for water. Livestock may concentrate in certain areas, creating patches of relatively bare soil. Some of these areas may adjoin stream sections used by ESA-listed fish species for spawning, incubation, larval development and rearing. Erosion can result in fine sediment entering stream channels. Habitat impacts are likely to include areas of exposed streambank up to a few feet wide where livestock access streams to drink or cross, and areas of bank disturbance where livestock graze in riparian areas.

Erosion of soil from bare areas is likely to result in a slight increase in turbidity for a short distance downstream during rainstorms or runoff events. However, it is often difficult to distinguish turbidity resulting from grazing impacts and background turbidity. A slight increase in fine sediment deposition on substrate for a short distance downstream of exposed and disturbed areas is also likely to occur. There is the potential for fine sediment to slightly increase embeddedness within gravels suitable for spawning where it is located downstream from the exposed and disturbed streambank areas. These impacts are expected to be localized due to the scattered nature of the allotments and short-term, due to adaptive management that would be implemented to reduce these occurrences when they are discovered. However, the effect to this indicator by livestock use is measurable and significant. The ARBA II concluded that activities in the livestock fencing, stream crossings and off-channel livestock watering facilities category may increase short-term sediment loads into a stream channel during project implementation. This would result in short-term negative increases in turbidity. The following PRMP grazing management direction (BLM 2016b, Appendix A, p. 647) would minimize effects from range improvements:

- Implement range improvement projects in adherence with the following:
- Conduct inventories and surveys for cultural resources, ESA-listed species, and Bureau Special Status Species prior to authorization of any project construction. Implement appropriate mitigations to reduce or eliminate potential effects to these resources.
- Design projects to minimize surface disturbance at all project sites.
- Rehabilitate disturbed soil to blend into surrounding soil surface. Re-vegetate using seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable, to replace ground cover, reduce soil loss from wind and water erosion, and discourage the potential establishment of any invasive plant species.
- Use existing roads and trails to access areas for range improvement construction to the extent practicable. If needed, unimproved trails and tracks would be created to reach construction sites and provide access for future maintenance of the improvements. Locate unimproved trails or tracks outside riparian management areas where workable.

- Limit brushing and tree limb removal to only that necessary for surveying, placement, and construction of improvements.

Fine coats of sediment would be deposited on channel substrate downstream. The distance traveled would depend on the geomorphology of the stream (*i.e.*, whether it is a transport or depositional reach, how much wood is in the channel to trap sediment, and channel slope). It is anticipated that most project-related sediment would be flushed out during the first high flows after project completion. However, smaller amounts of sediment may pulse through the stream system with subsequent flow events. Site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and spawning gravels are not expected from the grazing-related restoration actions covered in ARBA II. Therefore, we expect a minor impact to the overall reproductive capacity of resident fish. Adverse effects would be reduced by use of ACMs and PDCs of ARBA II, as well as PRMP BMPs and management direction (BLM 2016b, Appendices A, C). Overall, the effect to the indicator from the grazing-related activities would be a measurable and significant effect.

Administration of livestock grazing by permittees involves use of vehicles on and off roads, as well as infrastructure maintenance. There is the potential for fine sediment to be transported to stream channels, primarily at road crossings, during rainstorms or runoff events. However, it would be indistinguishable from fines generated by other road users and background sources of fines. This should not result in meaningfully measurable amounts of turbidity, cobble embeddedness, or fines on spawning gravel. Range riding with horses will not cause any meaningfully measured increases in streambed sediment or turbidity. Maintenance activities are typically distant from occupied streams or designated critical habitat, disturb little to no soil, and are not hydrologically connected to stream channels. Overall, the effects to the indicator from use of vehicles, range-riding with horses, and grazing infrastructure maintenance is immeasurable insignificant.

Effects to the sediment/turbidity/substrate indicator would be minimized by use of PRMP grazing BMPs:

BMP G1. Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.

BMP G2. Do not locate salting areas within 0.25 mile of permanent water sources or Riparian Reserves.

BMP G3. Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserves or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserves to meet water quality standards and regulations.

BMP G4. Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition.

Use one or more of the following features:

- Inclusion of the water bodies, floodplains, and wetlands within a separate pasture.
- Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover.
- Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species.
- Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition.
- Limit grazing intensity to a level that will maintain desired species composition and vigor.
- Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.

BMP G5. Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.

Summary of effects to sediment/turbidity/substrate

Fine sediment would enter stream channels as a result of livestock access, construction of some livestock exclusion fences and cattle stream crossings, as well as from development of some off-channel livestock watering facilities. Sediment from these sources would result in measurable short-term increases in turbidity, as well as fine sediment deposition on streambed substrate, including spawning gravels. These effects are anticipated to be short-term (becoming immeasurable before the next grazing season). The effect to the indicator is measurable and negative.

Water Temperature

The preferred forage for cattle is grass or grass-like species. In meadow streams with narrow channels, they often are the plants that provide most of the stream shade. Livestock use will potentially reduce vegetation heights to 4 or 6 inches. This will considerably reduce stream shade in those circumstances compared to the ungrazed potential vegetation heights. There may also be some grazing on hardwood trees such as willows, which would reduce stream shade.

Livestock use is likely to result in measurable water temperature increases for certain stream reaches. These negative impacts are expected to be generally confined to narrow, low gradient stream channels where grass/grass-like vegetation, and small woody shrubs provide the majority of the stream shade. The effect to this indicator by livestock use is measurable and therefore significant.

Summary of effects to water temperature

Grazing of narrow streams with grass or grass-like species providing the shade is likely to reduce the shade to a point where a measurable stream temperature increase would result. This would be a measurable negative effect.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. Base flows can be negatively affected by livestock drinking directly from a stream channel.

The activity does not include road construction. BMPs would not allow grazing allotments to reduce vegetation levels to the point where there would be a measurable change to peak or base flows. However, there is the potential for a measurable effect to base flows by livestock drinking directly from small streams at summer low flows. In the case of sucker species, livestock drinking from a reservoir at minimum pool may measurably negatively affect base level water availability. In that specific circumstance when the water body supports ESA-listed fish or designated critical habitat, there would be a negative effect to the indicator.

Summary of effects to peak and base flows

The effect to the indicator is measurable negative in the circumstance when livestock drink from a small stream or reservoir at low flow/minimum pool, where the stream or reservoir provides habitat for ESA-listed fish and/or has designated critical habitat.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by livestock grazing that occurs within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. Grazing would reduce shade provided by grass or grass-like vegetation, and also from grazing of hardwood trees such as willows. The combined effects may result in measurable water temperature increases in specific situations where the stream has a narrow channel and grass or grass-like vegetation provides the stream shade. The filtering capability of near stream vegetation would be impaired, resulting in fine sediment entering stream channels. As described below, there would be a measurable negative effect to the Chemical Contamination and Nutrients indicator from phosphorous and nitrogen sources (urine and dung in riparian areas).

Streambanks may be altered, negatively affecting streambank stability. There may be localized changes in channel geometry, with an increased width-to-depth ratio (shallowing of the stream). The diversity of riparian vegetation may be reduced in the short-term. Overall, there would be a measurable negative effect.

Summary of effects to riparian reserve function and vegetation diversity

There will be localized short-term negative (adverse) effects to several functions of Riparian Reserves. They are effects to: shade and water temperature; filtering capability for fine sediment; bank stability; channel geometry; and, diversity of riparian vegetation. Consequently, there will be an overall negative effect to the indicator.

Chemical Contamination and Nutrients

Urine and dung from livestock use in riparian areas and directly deposited into streams or reservoirs results in nutrient loading of nitrogen and phosphorous. In small streams at low flow periods, and reservoirs at base pool levels, this can increase oxygen demand and algal growth, reducing habitat quality for ESA-listed fish species. At higher stream flow and larger reservoir pool situations, nutrient increases could result in increased primary productivity that may increase macroinvertebrate production. In the low flow/minimum pool situation, it would result in measurable negative effects to the indicator.

The risk of chemical contamination to streams by vehicle use during grazing administration by permittees is not expected to be meaningfully measured. Maintenance activities are typically distant from designated critical habitat, and at locations not hydrologically connected to stream channels. Therefore, it is extremely unlikely for petroleum products spilling from power tools to affect the indicator. Use of horses for range riding will have similar, but very reduced effects to the indicator from horse dung and urine, when compared to livestock grazing. The overall effect of grazing administration and maintenance activities to the indicator could not be meaningfully measured, and is therefore an insignificant effect.

Summary of effects to chemical contamination and nutrients

Livestock grazing will result in urine and dung in riparian areas, and potentially in the stream/reservoir itself. This will lead to increases in nutrients, such as nitrogen in the water column. During low flow periods in streams and minimum pool periods in reservoirs, this nutrient enrichment could lead to reduced dissolved oxygen levels and increased algal growth, reducing habitat quality for ESA-listed fish species. Therefore, the effects to the indicator are measurable negative.

Roads within Riparian Reserves

There is no road construction or maintenance associated with livestock grazing. Consequently, there is no mechanism to affect the indicator. There is no effect to the indicator.

Summary of effects to roads within riparian reserves

There is no effect to the indicator because there is no road construction or maintenance associated with livestock grazing.

Direct Effects to the Species from the Livestock Grazing Program

There is a potential for some life stages of ESA-listed fish species to be present in stream reaches when cattle have access to the stream. Cattle walking into the water would disturb

and/or displace individual fish. This may cause them to move away from cover, leave established territories, expose them to predation, and cause them to expend energy. The Management direction below would limit interactions between livestock and ESA-listed or Bureau Sensitive fish.

- Restrict livestock from streams with ESA-listed or Bureau Sensitive fish species during spawning, incubation, and until 30 days following the emergence of juveniles from spawning areas.

However, it is concluded that there may be disturbance, injury or death to individual fish as a result of livestock grazing where cattle have access to stream reaches where the species are present.

Summary

The indicator analysis results are summarized in Table C19. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities. The analysis above was based upon an allotment where livestock have access to a stream or standing body of water that is inhabited by ESA-listed fish. The site-specific circumstances of an allotment may result in different effects to the indicators, dependent upon the exposure of the habitat characteristics to the effects of livestock grazing, and the timing, duration and magnitude of that exposure.

The adverse effects summarized below would occur at scattered locations within and downstream from BLM land with designated critical habitat for the species. For shortnose suckers, it would occur within and downstream for short distances from the 7.5 miles of stream and 147.1 acres of designated critical habitat in or adjacent to livestock grazing allotments in the Lost River Recovery Unit. This is out of a total of 39 miles and 5,382 acres of designated critical habitat in the Lost River Recovery Unit within the planning area.

Table C19. Summary of indicator analysis results for the Livestock Grazing program (BLM 2016b, p. 388).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Insignificant
Sediment/turbidity/substrate	Adverse (short-term measurable negative effects due to fine sediment entering channels and water column)
Water temperature	Adverse (a measurable negative effect in specific stream reaches where grass or grass-like vegetation and willows provide shade to narrow stream channels)
Peak/base flows	Adverse (measurable negative in the circumstance where livestock drink from a small stream or reservoir at low flow/base pool).
Riparian Reserve function and vegetation diversity	Adverse (short-term due to measurable negative effects to: shade and water temperature; filtering capability for fine sediment; bank stability; channel geometry; chemical contamination from livestock urine/feces; and, diversity of riparian vegetation.)

Indicator	Effects to the Indicator (most impacting)
Chemical contamination / nutrients	Adverse (short-term measurable negative effects due to decreased dissolved oxygen and increased algal growth in streams with low flows or reservoirs at minimum pool).
Roads within Riparian Reserves	No effect

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in disturbance, injury or death as a result of livestock interactions with individual fish in stream channels.

Based on the preceding analysis the Livestock Grazing Program will have negative effects on ESA-listed fish. Over time, monitoring and adaptive management are expected to result in a lessening of potential impacts stemming from grazing activities. If effectiveness monitoring indicates that applied grazing scenarios are not resulting in progress toward meeting the standards for rangeland health, the BLM would adjust grazing levels and management practices to correct this situation.

7. Minerals

BMPs for salable mineral activity under the PRMP (BLM 2016b, Appendix C, p. 732) address measures to reduce the possibility of sediment delivery or chemical contamination to floodplains, wetlands, Riparian Reserves, and waters of the state (Table C20).

Table C20. BMPs for salable mineral activity under the PRMP (BLM 2016b, p. 389).

BMP Number	BMP Description
M 1	Locate stockpile sites on stable ground where the material would not move into water bodies, floodplains, and wetlands.
M 2	Locate, design, and construct salable mineral sites to control runoff and prevent or minimize sediment delivery to streams. Prevent overburden, solid wastes, drainage water or petroleum products from entering wetlands, Riparian Reserves, flood plains and waters of the State.
M 3	Locate, design, and maintain settling ponds to contain sediment discharges.
M 4	When a quarry or rock pit is depleted or vacated, stabilize cutbanks, headwalls, and other surfaces to prevent surface erosion and landslides. Close roads, excavations, and crusher pads in accordance with Roads and Landings section. Remove all potential pollutants to prevent their entry into wetlands, Riparian Reserves, floodplains, and waters of the State.
M 5	Use erosion-reduction practices, such as seeding, mulching, silt fences, and woody debris placement, to limit erosion and transport of sediment to streams from quarries. Provide drainage from stockpiles and mineral sites, dispersed over stable vegetated areas rather than directly into stream channels. Grade all material sites, where practicable to conform with the surrounding topography prior to closure. Utilized topsoil as a medium to for successful revegetation. Reseed and plant trees, where needed.

The operation of existing rock quarries has undergone ESA consultation for Pacific salmon species, resulting in the Western Oregon Programmatic Consultation BO (NMFS 2011a, consultation no. 2010/02700). Mandatory Project Design Criteria (PDC) identified for quarry operations covered under the Programmatic BO are shown in Table C21.

Table C21. Project design criteria (PDC) for rock quarry operations covered by the Western Oregon Programmatic Biological Opinion (NMFS 2011a).

PDC	PDC Description
A	For quarries within riparian areas, conduct activities with the potential to introduce sediment into streams only during the dry season (generally May 15 to October 15). If unusual circumstances (<i>e.g.</i> , emergency road repair) require such activities to occur outside of the dry season to prevent greater damage to water quality and fish habitat, prevent off-site sediment soil movement through use of filter materials (such as straw bales or silt fencing) and other mitigation measures.
B	For quarries within riparian areas, prepare and carry out an erosion and pollution control plan, commensurate with the scope of activity at the quarry, that includes the following information: (1) The name, phone number, and address of the responsible official; (2) best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion and sedimentation associated with the action; (3) best management practices to confine, remove, and dispose of hazardous materials generated, used, or stored at the work site; and (4) procedures to contain and control a spill of any hazardous material generated, used or stored at the work site, including notification of proper authorities.
C	Avoid ground-disturbing activities during wet periods that have the potential to generate and deliver sediment to streams.
D	Exposed soils that may deliver sediment to streams shall be treated prior to fall rains with grass seed, slash, water bars or other appropriate methods that will minimize or eliminate sediment delivery.

The following Conservation Measure from Appendix 9 of the WOPR BA (USFS *et al.* 2010) will be followed. We realize the best available data will change over time. The PRMP is expected to follow WOPR or the most up-to-date version of the routine actions and maintenance BO that is in existence.

a. Apply the minimum setback distances (or greater) from LFH for blasting, based on charge weight. Blasting closer to LFH than the setback distances identified in Appendix 9 would require an individual consultation under section 7 of the ESA.

b. Prohibit blasting during upstream migration of adults, adult holding, spawning, and egg incubation for ESA-listed fish within 3 miles of LFH. Blasting during these periods is LAA listed species, is beyond the scope of this opinion, and would require an individual consultation under section 7 of the ESA.”

All quarry operations will conform to the BMPs, PDCs and Terms and Conditions of the Western Oregon Programmatic consultation, state and federal laws and regulations.

The Programmatic BO (NMFS 2011a) describes the criteria for the ESA effect determination for rock quarry operations. It has two main components: the nature of the environmental disturbance that will be caused by the action, and the proximity of the environmental disturbance to Listed Fish Habitat (LFH). Activities that cause or sustain the following types of disturbance in the following locations shall be considered LAA listed species and their critical habitats, and subject to pre-activity notification and annual reporting; actions that do not cause or sustain these types of disturbance, or that occur outside of the following locations shall be considered NLAA. The appropriate PDCs for each activity shall apply.

1. Nature of the environmental disturbance. The following types of disturbance shall lead to a determination of LAA when they occur in proximity to LFH:
 - a. erosion or compaction of riparian soils, streambanks, or channel substrates
 - b. removal or suppression of native riparian vegetation
 - c. runoff containing sediment, nutrients, pesticide, salts, or other pollutants that are delivered to LFH through a system of culverts, ditches or channels
 - d. removal of water
2. Proximity of the environmental disturbance to LFH. An environmental disturbance shall be considered in proximity to LFH when it occurs in the following locations:
 - a. any area within 150 feet (slope distance) of LFH
 - b. any area within 150 feet (slope distance) of any stream that is up to 300 feet upstream of LFH
 - c. any area that is physically connected to LFH by a system of ditches, channels or culverts such that runoff or sediment delivered from that area into the drainage system will eventually be delivered to LFH without being intercepted and immobilized by a riparian or vegetation buffer
 - d. for removal of water only, any stream reach within LFH or within 1,500 feet of LFH

Effects to Environmental Baseline Indicators for the Minerals Program

The variety and magnitude of possible mineral activities on BLM land is diverse. The footprint can range from far less than one acre to many acres. Most Plans of Operation are less than 3 acres, and rock quarries typically range from .01 to 5 acres (BLM 2016b, p. 391. A sub-set of

mineral activities could be proximal to the distribution of ESA-listed fish and to designated critical habitat. Consequently, the effects to ESA-listed fish and their designated critical habitat could range from “No Effect” to “May Affect, Likely to Adversely Affect” (LAA). It would be speculative to analyze the effects of a worst-case scenario that may be extremely unlikely to occur for actions of any of the three categories of BLM mineral management (Salable, Locatable, Leasable). Currently, there are no proposals before the BLM for leasable minerals, including geothermal fluid minerals.

It is known that the ESA effect determination for effects of BLM rock quarry operations to ESA-listed Pacific salmon and designated critical habitat is either NLAA or LAA for specific conditions described in the Western Oregon Programmatic Consultation BO (NMFS 2011a). The Service expects that bull trout and ESA-listed suckers would experience similar effects. The adverse effects in that consultation for rock quarry operations correspond to the following indicators of this BO:

- Sediment/turbidity/substrate (fine sediment delivery to water column and streambed)
- Chemical contamination (from spills or leaks of fuel, lubricants, hydraulic fluid or coolants)

In addition, adverse effects from rock quarry operations could occur due to hydroacoustic impacts from blasting, and the reduction of forage organisms for juvenile ESA-listed Pacific salmon as a result of fine sediment reducing their living space on streambed substrate.

The ESA effect determination for the approval of Forest Service Notices of Intent for suction dredge gold mining in streams inhabited by ESA-listed fish and to designated critical habitat in watersheds of the Rogue-Siskiyou National Forest was determined to be “LAA” (USFS 2015). The effects analysis for the USFS (2015) BA is herein incorporated by reference. Similar effects could be expected for suction dredging occurring on BLM lands during the life of the RMP (notwithstanding the soon to be enacted moratorium by the state of Oregon). The adverse effects identified in the 2015 USFS BA (2015) correspond to the following indicators of this BA:

- Sediment/turbidity/substrate (fine sediment delivery to water column and streambed)
- Chemical contamination (from fuel spills and the remobilization of mercury and other trace metals from deep sediments)

Adverse effects from suction dredge gold mining were also attributed to effects to forage organisms for rearing ESA-listed fish species as a result of fine sediment reducing their living space on streambed substrate, and from bioaccumulation of methylmercury. Direct effects may occur due to the following:

- Entrainment in suction dredge or impingement on screens
- Trampling by wading by mineral operators
- Displacement by dredge tailings (reduction in living space)

- Disturbance during dredge operation
- Spawning on unstable dredge tailings
- Stranding

Consequently, the Minerals Program will have negative effects on ESA-listed fish. Effects would be minimized by regulations (CFRs), use of management direction, BMPs, PDCs and Terms and Conditions of the Western Oregon Programmatic BO (NMFS 2011a), and future ESA consultation.

8. Recreation and Visitors Services

The BLM's Recreation and Visitor Services Program provides a diverse array of recreation opportunities. The FEIS identifies the top 13 recreation experiences by number of participants in the planning area (shown from high to low below). The range of annual participants in 2012 was from about 2.6 million for wildlife viewing to 6,900 for snowmobile and other motorized winter activities:

- Wildlife Viewing, Interpretation, and Nature Study
- Driving for Pleasure (along designated BLM roadways)
- Camping and Picnicking
- Non-motorized Travel (hiking, biking, and horseback riding)
- Hunting (big game, upland game, and migratory game birds)
- Motorized Off-Highway Vehicle Travel
- Fishing
- Specialized Non-motorized Activities and Events
- Swimming and Other Water-Based Activities
- Motorized Boating
- Non-motorized Winter Activities
- Snowmobile and other Motorized Winter Activities

The FEIS projects increases in participants for each activity type from 2012 to 2060. The average annual rate of increase ranges from 0.4 percent (hunting) to 1.4 percent (non-motorized winter activities). The BLM provides campgrounds, day use areas, boat ramps, a public motorized travel system, trail system and hiking trails to facilitate several activity types. In addition, the BLM issues special use permits for commercial, competitive, educational and organized group recreational activities. Table C22 presents a count of BLM recreational sites within a site-potential tree distance (216 feet) of streams occupied by ESA-listed fish or with designated critical habitat in the planning area.

Table C22. Number of recreation facilities by type within a site-potential tree distance of occupied habitat or designated CH for ESA-listed fish species in the planning area.

ESA Listed Fish Species or Critical Habitat Unit	Recreation Facility Type	Number
Mckenzie bull trout	Water/River Use Area	4
	Boat Launch	2
	Day Use Area	2
	OHV Area	1
Lost River Sucker Recover Unit	Campground	7
	Water Access	2
	Day Use Area	1
	Trailhead	1
	Scenic overlook	1
Upper Klamath Sucker Recovery Unit	Campground	8
	Day Use Area	5
	Water/River Use Area	1
	Winter Sports Area	1

These aforementioned recreation activities (Table C22) are authorized under the PRMP, but will not undergo future consultation. Therefore they will be analyzed as an ongoing activity in the document.

The BMPs (BLM 2016b, Appendix C, pp. 727-731) that apply to recreation serve to reduce impacts to ESA-listed fish. The BMPs that apply to public motorized travel trails and the hiking trail system that would reduce effects to ESA-listed fish habitat and designated critical habitat are displayed in Table C27 in the Trails and Travel Management effects analysis section of this BA. The remaining Recreation BMPs are shown below in Table C23.

Table C23. BMPS for all recreation facilities, and those specific to developed recreation sites, water dependent facilities and dispersed recreation (BLM 2016b, p. 392).

BMP Number	BMP Description
All Recreation Facilities	
REC 1	Implement erosion control measures at recreation sites to stabilize exposed soils where water flows or sediment, may reach water bodies.
REC 2	Minimize development of recreation facilities that are not water-dependent (<i>e.g.</i> , boat ramps and docks) in the Riparian Reserve.
Developed Recreation Sites	
REC 3	Self-contained sanitary facilities would be used at all developed recreational facilities, unless a sewage system and drain field is approved by the Department of Environmental Quality.
REC 4	When conducting recreation site maintenance, do not cut portions of logs or coarse woody debris that fall across the active stream channel. Keep adequate lengths of material on the banks to anchor it in place. If not possible to make the log stable, it may be removed.
Water Dependent Facilities	

BMP Number	BMP Description
REC 5	Construct boat ramps and approaches with hardened surfaces. Minimize riprap to a 4 foot width to protect concrete ramps. Docks must not be wider than 6 feet, and not include any treated wood.
Dispersed Recreation	
REC 32	Site camps for permitted group overnight camping would be greater than 150 feet from surface water.

Swimming, boating and Other Water-Based Activities. Recreationists using streams may interact with rearing or spawning fish when they are in the water, for example, wading, swimming, or boating. Under the proposed action, BLM provides the opportunity for recreationists to access the land and use the streams, and by maintaining recreational facilities the proposed action does concentrate public access at these locations. These locations include campgrounds and boat ramps, as well as other recreation sites. Disturbance by recreationists may cause rearing fish to leave cover and become more susceptible to predation. Disturbance of adults at the spawning sites may delay some spawning. BLM identified recreation facilities within a site-potential tree distance (216 feet) of occupied habitat or critical habitat for ESA-listed species (Table C22). These facilities concentrate recreationists and represent the likely and most predictable areas where disturbance may occur. Although these sites may concentrate the disturbance, this may limit the disturbance area to the immediate site. This is most concentrated in the McKenzie bull trout area where several of these facilities occur within a relatively short distance within one site potential tree height of critical habitat. The two sucker recovery units have recreational facilities that are widely distributed throughout the units. Although the potential for increased predation and spawning delay may occasionally occur, disturbance by recreationists is expected to be of a minor nature due to the limited number of sites within most the analysis units.

Under the proposed action, the Motorized Boating project category could include the construction or replacement of boat docks and boat ramps, which would be subject to subsequent section 7 consultation. The effects of these activities, including the effects of over-water structures, pile driving, and boating activity have been analyzed extensively in many previous biological opinions, including the SLOPES IV In-water Structures (NMFS 2011b), including increased shading, reduction in prey, increased predation, hydroacoustic effects, and disturbance and displacement.

However, it is possible that some degree of adverse effects (albeit small in number) will occur to bull trout and listed suckers from this activities.

The very limited number of bull trout likely to be present adjacent to BLM recreational facilities along the McKenzie River makes it extremely unlikely that these adverse effects would rise to a level that would cause mortality or injury. The small amount of the McKenzie River under BLM ownership also limits the extent of any adverse effects as any individual bull trout that might be affected can easily flee to areas outside of the recreational influence.

For suckers, direct mortality or injury may occur from boat strikes, or fishing. Wading and swimming in areas where sucker eggs are located can cause sedimentation that would smother

and kill sucker eggs. Disturbance from swimming, wading and similar activities may also cause disturbance causing fish to flee and thus disrupt their normal behaviors.

All of these recreational activities include use of the BLM road system to access BLM recreational and visitor opportunities. The use of the road system is analyzed under the Trails and Travel Management section in section.

Because of the way that the BLM has defined its programs in the proposed action, the public motorized travel trails and non-motorized trails systems used for recreation purposes are part of the Trails and Transportation Management program. Consequently, the effects of public motorized travel and non-motorized trails were evaluated in the effects analysis section for the Trails and Transportation Management program, and the reader is directed to that section for the analysis.

Three activity categories of the BLM Recreation and Visitors Services program in the decision area have been evaluated in past programmatic consultations for their effects to ESA-listed Pacific salmon and associated designated critical habitat, and to bull trout. The resultant BOs are known as the Northwest Oregon Programmatic BO (USFWS 2008) and the Western Oregon Programmatic BO (NMFS 2011a). Both BOs are currently in effect. Note that the Service issued our BO for effects to bull trout in response to a 2008 BA (USFS and BLM 2008), while the NMFS issued their BO in response to a 2010 BA. The three activity categories are:

1. Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use
2. Miscellaneous Special Use Permits and Leases
3. Commercial Rafting Permits

The effects analyses for the 2008 and 2010 BAs and BOs are incorporated herein by reference. BLM activities occurring under the three categories would utilize the PDCs of the 2008 and 2010 BAs, and follow the terms and conditions of the 2008 and 2011 BOs, to minimize adverse effects to ESA-listed fish species and designated critical habitat.

The effects analysis presented below summarizes the effects of the three recreation activity categories of the two programmatic consultations. It then combines the effects of the three categories already addressed in the programmatic consultations with that of the public motorized travel trails and non-motorized trails analysis presented in the Trails and Travel Management program effects analysis, to arrive at an effects analysis for the entirety of the Recreation and Visitors Service program.

Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use

This category is described in the Northwest Oregon Programmatic BA (BLM and FS 2008) as providing access to and use of existing public recreational activities (*e.g.*, campgrounds, picnic areas, trails, boat ramps) and existing Federal and Tribal land administration, including safety and property damage reduction. Program activities are described in the BA as:

- Hazard tree management (at developed and dispersed recreation facilities, along trails, at rights-of-way, and for adjacent non-Federal land)
- Facility maintenance, repair, and upgrade
- Trail maintenance and off-highway vehicle trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)
- Brushing, tread work, minor realignment, saw-out of downed trees within a trail
- Boulder placement which limit vehicular activity associated with dispersed camp sites
- Construction and maintenance of small bridges in recreation sites and on trails

The BA used the following criteria to determine the ESA effect determination for these actions:

“A determination of LAA will result when maintenance or use activities occur within 150’ of LFH when the activity is reasonably certain to result in meaningfully measurable changes to sediment, chemical contaminant, stream temperature, or instream large wood recruitment to LFH, or when routine facilities maintenance occurs within the ordinary high water mark of LFH. Routine trail maintenance is NLAA when the activity is >150’ from LFH and/or will not result in meaningfully measurable sediment or chemical delivery, increase in stream temperature or reductions of in-stream large wood recruitment to LFH.”

The Service’s BO (USFWS 2008) identified adverse effects to habitat indicators and to bull trout, including injury or death and disturbance. At that time there was no designated critical habitat for bull trout on federal land in northwest Oregon.

The description of this activity category in the Western Oregon Programmatic BA (USFS *et al.*, 2010) was slightly different than in the 2008 BA, incorporating a new sub-category of adjusting in-channel hazard trees:

- Tree hazard management at developed and dispersed recreation facilities, trails, rights-of-way, and adjacent non Federal land
- Facility maintenance, repair, and upgrade
- Trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)
- Brushing, tread work, and saw-out of downed trees within trail, including adjustment of in-channel hazard trees in streams or rivers regularly used for surface water recreation (*e.g.*, boating, rafting, kayaking, tubing, etc.)
- Boulder placement to limit vehicular activity associated with dispersed camp sites; and
- Maintenance of small bridges in recreation sites and on trails.

The 2010 BA used the same criteria to determine the ESA effect determination as in the 2008 BA, described above. The NMFS BO (NMFS 2011a) identified adverse effects to habitat indicators, biological effects to salmonids and to PBFs of designated critical habitat from Category 1 activities. Similarly adverse effects would be expected to bull trout and listed suckers from habitat modification through additions of sediment, disturbance of substrates and loss of stream shade.

Miscellaneous Special Use Permits and Leases

This category is described in the Northwest Oregon Programmatic BA (BLM and USFS 2008) and the Western Oregon Programmatic BA (USFS *et al.*, 2010) as miscellaneous designated activities authorized or permitted on Federal land. A recreation event is almost any kind of outdoor activity where participants exchange money or pay a fee for the opportunity to hold an event on federal lands. Examples of recreation event activities include: Nordic ski races; bike races; or private club outings, etc. A free permit is required for non-commercial group uses such as weddings, family gatherings or political rallies.

Program activities also include permits for (but not limited to): group recreation; outfitters and guides for non-aquatic activities (such as leading horseback rides); use of Federally owned structures; resort operation on Federal land; and summer home/recreational residence maintenance, including hazard tree removal, and administration; organizational camps; target ranges; fences; and weather stations. Special use permits are issued to members of the public.

The 2008 BA (BLM and USFS 2008) and the Service BO (USFWS 2008) identified insignificant or discountable effects to habitat indicators that may be affected by this recreation category's actions, resulting in an NLAA determination for effects to the species. At that time there was no designated critical habitat for bull trout on federal land in northwest Oregon.

The 2010 BA used the following criteria for arriving at an NLAA effect determination: "Permits are NLAA actions when >150' from LFH and/or when permitted activities are reasonably certain to not result in meaningfully measurable changes to stream temperature, in-stream large wood recruitment potential, or water quality (sediment or chemical contaminant delivery)."

The NMFS BO (NMFS 2010) effects analysis concluded that issuing special use permits for summer homes/recreational residences resorts and organizational camps would result in adverse effects to two habitat indicators: water temperature and large wood. The BO also identifies adverse biological effects and adverse effects to PBFs of designated critical habitat from effects to water temperature and large wood. Consequently, NMFS identified a term and condition for this circumstance: "Special use permits or leases involving non-Federal structures, associated facilities and other areas (*e.g.*, access roads, driveways) that have existing or prospective soil compaction, native vegetation suppression, or native vegetation removal within 150 feet of LFH shall be considered LAA.

Commercial Rafting Permits

This recreation category is described in the 2008 BA as permits for outfitters and guides for surface water recreating (commercial river rafting), and other aquatic activities such as kayaking

competitions on Federal land. The 2010 BA describes the category as permits issued to fishing guides, whitewater rafting companies and canoe and kayak clubs. For both BAs, it is stated that permits may include commercial activities over a season or single events such as a weekend rafting race. PDCs require special use permit applications be evaluated by fishery biologists to assure stipulations are included in the permit that reduce or minimize disturbance to ESA listed fish, and impacts to riparian areas and water quality.

The 2008 Service BO determined that there were adverse effects to several habitat indicators and adverse biological effects to bull trout, concluding in an LAA effect determination. The 2011 NMFS BO concluded measurable negative localized short-term effects to substrate from fine sediment, as well as biological effects to ESA-listed Pacific salmon species, from this activity. Increases in fine sediment can reduce spawning opportunities, reduce foraging opportunities and decrease overall water quality thus limiting habitat function for ESA-listed fish.

Public Motorized Travel Trails and Non-motorized trail maintenance and use

The effects of using and maintaining the public motorized travel trails and non-motorized trails systems has been evaluated elsewhere in this BO in the Trails and Travel Management effects analysis section. The conclusion was that elements of this activity have adverse effects to the species and to designated critical habitat for bull trout, shortnose suckers and Lost River suckers.

Table C24 is a synthesis of effects to the indicators from all components of the Recreation and Visitors Service program, including those effects identified in the two programmatic BOs (USFWS 2008, NMFS 2011a) and those evaluated for the Trails and Travel Management program elsewhere in this BO.

Table C24. A synthesis of effects to indicators from implementing the Recreation and Visitors Services program as interpreted from the two programmatic consultations BAs and BOs (BLM and USFS 2008, USFS *et al.*, 2010, USFWS 2008, NMFS 2011a) and the analysis of effects of public motorized travel trails and Non-motorized trails use and maintenance in the Trails and Travel Management section in BLM 2016b, pp. 396-397.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Measurable negative , localized
Sediment/turbidity/substrate	Short-term negative , localized
Water temperature	Measurable negative (adverse), localized
Peak/base flows	Effects to peak/base flows were not evaluated in the programmatic BOs for the recreation activities. However, public motorized travel and non-motorized trail systems are hydrologically connected to stream channels and concentrate flows in a manner similar to roads (see section ZZZ above for analysis), but at a smaller scale. The effect would be insignificant negative and localized.
Riparian Reserve function and vegetation diversity	Measurable negative , localized
Chemical contamination / nutrients	Measurable negative , localized
Roads within Riparian Reserves	Measurable negative (adverse), localized

Direct Effects to the Species from the Recreation and Visitors Services Program

Some components of the Recreation and Visitors Services program will result in disturbance and/or injury of ESA-listed fish species, and will result in an adverse effect to the species. Disturbance of fish from in-water activities by the general public and those under permit (such as commercial rafting, kayaking, etc.) would result in fish moving, potentially increasing stress and vulnerability to predation. People using recreation sites may injure some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles.

Localized increases in turbidity will cause fish to move from preferred sites such as feeding stations and alter behavior patterns for a short time. Localized water temperature increases may occur as a result of loss of shade vegetation at heavily used recreation sites along streams. Water temperature increases cause adverse physiological and behavioral effects to ESA-listed bull trout (shortnose and Lost River sucker are more tolerant of temperature increases). Fine sediments reducing interstitial spaces between substrate cobble, and loss of large wood (for example, from removal of instream hazards for boaters) may negatively impact cover for fish, resulting in an increased risk of predation. Fine sediments in substrate will also reduce production of macroinvertebrates utilized as forage, resulting in reduced growth rates for ESA-listed fish.

Summary

The indicator analysis presented above in Table C24 determined that there would be measurable negative effects to each of the habitat indicators except for peak/base flows, from a sub-set of actions of the Recreation and Visitors Services Programs. Many of these effects would be localized and short-term. However, some would be long-term, such as effects to water temperature and potential large and small wood recruitment from suppressed vegetation at developed recreation sites. It was also determined that there would be direct effects to the species, resulting in disturbance (displacement of fish from territories as a result of turbidity plumes, fine sediment in interstitial spaces between streambed cobbles or from human disturbance) and potential injury or death (people using recreation sites may injure some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles). These actions constitute adverse effects to the species. The Service believes that the impact to populations will be minor based on the distribution of these activities and limited exposure bull trout and ESA-listed suckers are likely to receive.

While there are certainly localized impacts associated with BLM-managed campgrounds, the Service does not anticipate any substantial increases to the number or physical footprint of these facilities. Many of these impacts were present immediately following the original construction of the facilities, and have not measurably changed in several decades. There are a limited number of recreation facilities found in areas occupied by ESA-listed fish. Given the spatially limited footprint of those facilities, the Service does not anticipate measurable impacts to ESA-listed fish or to designated critical habitat from their continued operation. Therefore the effects are considered insignificant.

As mentioned previously, the majority of impacts associated with road maintenance and general use are covered in more depth in the Forest Management, and Trails and Travel Management

sections of this BO. Road use stemming from recreational driving would represent a relatively small component of a respective road's annual use, and would tend to be spread out over space and time, further limiting the potential impact signature of this use.

9. Special Forest Products

Harvest or gathering of SFP, such as ferns, firewood, mushrooms, and certain other products, has the potential to affect ESA-listed fish species when the activities occur within Riparian Reserves. The SFP program underwent ESA consultation, concluding in two BOs that remain in effect. The Northwest Oregon Programmatic BO (USFWS 2008) addresses effects to bull trout. The Western Oregon Programmatic BO (NMFS 2011a) addressed effects to ESA-listed Pacific salmon species and their designated critical habitat. The effects analyses from both BOs are herein incorporated by reference. The Service anticipates that effects to ESA-listed suckers would be similar to those of other fish analyzed in the two afore mentioned documents, and incorporates them by reference. The BO includes a Project Design Criterion to limit ESA effects:

“Fisheries, hydrology or other qualified personnel should review collection areas proposed within riparian areas, and set boundaries or other limits as necessary to ensure that collection activities will not adversely affect riparian and aquatic habitat functions.”

Any future SFP activity under the PRMP that would result in ESA effects greater than “NLAA” to the species or designated critical habitat would be subject to an individual ESA consultation.

Effects to Environmental Baseline Indicators from the Special Forest Products Program

Large and Small Wood

A subset of Special Forest Products activities would occur within Riparian Reserves. The potential to affect large and small wood recruitment to stream channels is extremely limited. Site excavations for plant transplants typically have a small footprint and rarely impact vegetation. Vegetation that may be affected would primarily be low growing vegetation such as grasses, shrubs and forbs. Firewood collection is often opportunistic, taking a fallen tree by the side of a road. Firewood is also offered from cull log decks left after commercial timber sales are completed. Effects to small and large wood recruitment to streams would be extremely unlikely to occur. Therefore, there would be a discountable effect to the indicator.

Summary of effects to large and small wood

The effect to the indicator would be discountable because it is extremely unlikely that any trees would be damaged or removed by site excavation.

Sediment/Turbidity/Substrate

A subset of SFP activities under the PRMP would occur within Riparian Reserves. Many of the activities do not disturb soil, such as collection of boughs, fern fronds, salal, huckleberry, berries, and mosses. Others have a small footprint of soil disturbance such as digging up a plant

for transplant, digging for roots, or plucking a mushroom. Firewood gathering, and post and pole collection may also disturb the soil surface, but sites usually occur on relatively flat ground not prone to soil transport by erosion. Duff, down wood, and low lying vegetation between the sites and any stream channels occupied by ESA-listed fish would effectively prevent the delivery of fine sediment to streams. It is extremely unlikely that there would be a quantity of fine sediment reaching streams as a result of these activities that would result in meaningfully measurable effects to turbidity, fine sediment in spawning gravel or fine sediment in the interstitial spaces between cobbles used as habitat by ESA-listed fish. Consequently, there will be a discountable effect to the indicator.

Summary of effects to sediment/turbidity/substrate

The effect to the indicator would be discountable. Soil disturbance typically occurs in small areas and it is extremely unlikely that the amount of fine sediment reaching stream channels occupied by ESA-listed fish would result in meaningfully measurable effects to turbidity, fine sediment in spawning gravel or fine sediment in the interstitial spaces between cobbles used as habitat.

Water Temperature

A subset of SFP activities under the PRMP would occur within Riparian Reserves. Very little vegetation that provides shade to stream channels would be harvested or gathered as SFP. Many of the plants are understory plants that provide little or no shade, and only parts of many of the plants would be collected (fronds, leaves and branches). Firewood, and post and pole collection sites often utilize dead standing trees that do not provide much shade, and are usually located away from stream channels. The potential to affect water temperature by these activities is extremely limited. At most, there would not be meaningfully measurable effects to water temperature. Consequently, there will be an insignificant effect to the indicator which would have immeasurable effects to listed fish.

Summary of effects to water temperature

The effect to the indicator would be insignificant because little to no shade vegetation would be removed along any streams occupied by ESA-listed fish. Effects could not be meaningfully measured.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

SFP actions do not include road construction or other flow-concentrating mechanisms or actions at a scale that would affect peak or base flow. Therefore, there would be no effect to the indicator.

Summary of effects to peak and base flows

There would be no effect to the indicator because there is no road construction or other flow-concentrating mechanisms or actions at a scale that would affect peak or base flow.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. The effects to the Large and Small wood indicator, the Sediment/Turbidity/Substrate indicator, the Water Temperature indicator, and the Chemical Contamination and Nutrients indicator (see below) have been determined to be discountable negative, or insignificant negative. There is no mechanism to affect the Roads within Riparian Reserves indicator, as described below.

Because sediment delivery to stream channels in amounts resulting in meaningfully measurable effects is extremely unlikely to occur, there is no mechanism to affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of low-growing riparian vegetation may be reduced in the short-term by removal of an occasional plant for transplant or cutting of a Christmas tree, but the effects would be insignificant.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of insignificant, discountable and no effects to several functions of Riparian Reserves. Consequently, there will be an overall insignificant effect to the indicator.

Chemical Contamination and Nutrients

The only potential for chemical contamination would be an accidental spill of fuel for a chain-saw or wood splitter machine. If it were spilled, it would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low. There is no mechanism to affect nutrients. The overall effect would be discountable.

Summary of effects to chemical contamination and nutrients

The effect would be ***discountable***. It is extremely unlikely that the small amount of fuel that may be spilled would reach a stream channel and cause a meaningfully measurable effect to water quality in an area occupied by ESA-listed fish.

Roads within Riparian Reserves

There is no mechanism (no effect) to affect the indicator. Collecting or harvesting SFP does not affect the quantity of roads, their connectivity with stream channels, or any migration barriers.

Summary of effects to roads within riparian reserves

There is no causal mechanism (no effect) to affect the indicator.

Direct Effects to the Species from the Special Forest Products Program

There is no mechanism (***no effect***) of the SFP program that would result in direct effects to the species. No activities occur within streams, and any collection or harvesting activity would not result in disturbance.

Summary

The indicator analysis results are summarized in Table C25.

Table C25. Summary of indicator analysis results for the Special Forest Products Program (BLM 2016b, p. 401).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Discountable
Water temperature	Insignificant
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Insignificant
Chemical contamination / nutrients	Discountable
Roads within Riparian Reserves	No effect

10. Sustainable Energy

The three components of the PRMP Sustainable Energy Program are biomass, wind and geothermal. Biomass in the form of slash would be available for the purpose of generating energy under the PRMP. Slash is wood residue such as tree-tops, limbs, cull material and broken pieces from harvested merchantable timber. It can also include non-merchantable hardwoods and sub-merchantable wood material removed from fire-prone stands. Slash is an outcome of the Forest Management program. The effects to ESA-listed fish and designated critical habitat from Forest Management activities under the PRMP are described elsewhere in this section. The effects of removing slash from harvest units and hauling it to a biomass energy production plant would be a subset of those effects to the indicators described for Forest Management activities. The effects to the indicators that are specific to the removal and haul of slash are summarized below.

A second issue addressed is how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations. The PRMP identifies 564,591 acres of land with designations resulting in avoidance or exclusion from siting wind energy developments and energy transmission ROW.

This does not result in any causal mechanisms to affect any fish habitat characteristics or PBF of critical habitat, nor are there any mechanisms to directly impact individual fish.

The third issue addressed is how the PRMP would affect the development of geothermal energy resources. Geothermal energy is managed as a fluid mineral by the BLM, and there is no current geothermal development occurring on BLM-administered lands within the planning area. Under the PRMP, leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. The PRMP leasable stipulations do not result in any causal mechanisms to affect any fish habitat characteristics or PBF of critical habitat, nor are there any mechanisms to directly impact individual fish.

Effects to Environmental Baseline Indicators from the Sustainable Energy Program

Slash can be gathered in several ways:

- At landings where there has been whole-tree cable yarding, and the limbing/bucking occurs at the landing
- Where slash is yarded from within the harvest unit by cable to the landing
- From within the unit by ground-based heavy equipment

Large and Small Wood

Slash is a by-product of trees already felled. The mechanism to affect the availability of the tree to serve as current or future large or small wood has already taken place before the slash is created. Besides, trees that are the source of slash are from the outer zone of Riparian Reserves, which is at least 120 feet from fish-bearing or perennial streams. The limbs, tops, cull material and broken pieces that constitute slash would not be large enough to reach the stream channel from that distance. Therefore, there would be no effect to the indicator from slash removal from timber harvest units.

Summary of effects to large and small wood

There would be no effect to the indicator. It comes from trees that are already felled, and therefore is not a causative mechanism for the current or future availability of large or small wood.

Sediment/Turbidity/Substrate

Activities to gather slash would take place a minimum of 120 feet from fish-bearing or perennial streams, and 50 feet from non-fish bearing, intermittent streams. These are sufficient distances to effectively capture the small amount of fine sediment that may be generated by gathering slash from harvest units. It would be prevented from reaching stream channels by the

duff layer and ground cover vegetation of the forest floor. Winter haul of slash has the potential to generate fine sediments off of road surfaces that may reach stream channels. There may be a negative effect to the indicator from road surface fine sediment.

Summary of effects to sediment/turbidity/substrate

There may be a negative effect to the indicator from road surface fine sediment during winter haul.

Water Temperature

Slash is a by-product of trees that are already felled. The mechanism to affect shade canopy has already taken place before the slash is created. There would be no effect to shade and water temperature from the gathering and haul of slash.

Summary of effects to water temperature

There would be no effect to the indicator from the gathering and haul of slash.

Peak and Base Flows

Slash is a by-product of trees that are already felled. The mechanism to affect peak or base flows has already taken place before the slash is created. There would be no effect to peak or base flows from the gathering and haul of slash.

Summary of effects to peak/base flows

There would be no effect to the indicator from the gathering and haul of slash.

Riparian Reserve Function and Vegetation Diversity

The gathering and haul of slash has no causal mechanism to affect the Riparian Reserve functions of providing large and small wood, and maintaining shade to streams as described earlier in this section.

Slash gathering occurs in the outer zones of Riparian Reserves and would not affect channel geometry or other habitat-forming processes.

The Riparian Reserve function of filtering sediment, nutrients, and chemical contaminants would not be measurably affected. If slash were left in the harvest unit (and not burned) it would be at least 120 feet away from fish-bearing or perennial streams and 50 feet away from non-fish-bearing intermittent streams. These distances by themselves would be sufficient to maintain filtering functions.

Trees are already felled before slash is created. The mechanism to contribute to vegetation diversity has already taken place before slash is created. The gathering and haul of slash neither

contributes to nor detracts from the diversity of riparian vegetation, and therefore will have no effect on this indicator.

Summary of effects to riparian reserve function and vegetation diversity

There would be no measurable effect to the indicator from the gathering and haul of slash. The only function that may be affected is the sediment, nutrient and chemical contamination filtering function, and the effects to it are insignificant as the ability of duff, slash and vegetation to act as a filter will continue to function adequately.

Chemical Contamination and Nutrients

Contract requirements specify spill containment measures for all machinery and equipment used in timber harvest activities. Heavy equipment is fueled on landings. Spills associated with loading equipment may occur but are also likely to be very small and would occur within the road prism. A fuel spill kit is required of operators in case of accidental spill, to minimize adverse aquatic effects. Chainsaws use minimal amounts of gas and any spills would likely be very small. The no harvest inner zones of Riparian Reserves are sufficient to minimize potential transport of spilled fuels and fluids to stream channels during timber falling and ground-based harvest, reducing any negative effects to the point where they could not be meaningfully measured and is considered insignificant.

The haul component has contract requirements for spill abatement. Experience with past timber haul without incident (communication between trucks is excellent and accidents are rare) reduces the possibility of aquatic habitat contamination to a discountable risk.

The removal of slash from harvest units would reduce the potential for nutrient enrichment of stream channels from decaying or burned slash. This would have an immeasurable (insignificant) effect to the indicator as slash would still be present within 120 of streams where ESA-listed fish live.

Summary of effects to chemical contamination/nutrients

Effects from heavy equipment use would be insignificant at most due to contract requirements for fueling locations and spill kits. Experience with analogous past timber haul reduces the possibility of aquatic habitat contamination to a discountable risk. Removal of slash would have an immeasurable (insignificant) effect. Overall, there would be an insignificant effect to the indicator and to listed fish.

Roads within Riparian Reserves

Roads used for the haul of slash would occur on existing roads. There would be neither construction nor decommissioning of roads as a result of slash haul. There would be no effect to the indicator.

Summary of effects to roads within riparian reserves

There would be no increase or decrease in roads as a result of slash haul. Therefore, there would be no effect to the indicator.

Direct Effects to the Species from the Sustainable Energy Program

The gathering and haul of timber harvest slash to biomass energy production plants has no causal mechanism (no effect) that would result in effects to ESA-listed fish species.

Summary

The indicator analysis results for effects of gathering and hauling slash for biomass energy production purposes are summarized in Table C26. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities.

Overall the impact to ESA-listed fish is adverse. This is due to sediment entering streams during the winter haul of slash. If winter haul is used measurable increases of sediment could enter streams causing changes to substrate characteristics, impeding spawning, causing disturbance to fish, and reducing prey opportunities. All other aspects of this project activity are either insignificant or have no effect on ESA-listed fish.

Table C26. Summary of indicator analysis results for the Sustainable Energy program (BLM 2016b, p. 405).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	No effect. There is no causal mechanism to affect potential large or small wood.
Sediment/turbidity/substrate	Negative (short-term as a result of winter haul). If no winter haul, then the effect would be insignificant.
Water temperature	No effect. There is no causal mechanism to affect potential water temperature.
Peak/base flows	No effect. There is no causal mechanism to affect peak or base flows.
Riparian Reserve function and vegetation diversity	Insignificant due to filtering capability function for fine sediment, nutrients and chemical contaminants.
Chemical contamination / nutrients	Insignificant from possible spills of petroleum products from equipment.
Roads within Riparian Reserves	No effect. There is no causal mechanism to affect the indicator.

11. Trails and Travel Management

This program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest

Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program section of this BO. The effects of new roads constructed within Riparian Reserves for discretionary right-of-way grants are presented in the Lands and Realty program section of this BO. For both programs, the effects of new road construction and/or other road-related activities contributed to an effect determination of “*May Affect, Likely to Adversely Affect*” the species and to designated critical habitat. Please refer to the Forest Management program and Lands and Realty program sections of this BO for the analysis of the effects of roads. The analysis in this section is focused on the effects of the other two components of the Trails and Travel Management program: public motorized travel designations and the trail system.

There are 21 BMPs (BLM 2016b, Appendix C) that apply to public motorized travel trails that would reduce effects to ESA-listed fish habitat and designated critical habitat (Table C27).

Table C27. BMPS for Public Motorized Travel trails (BLM 2016b, p. 406).

BMP Number	BMP Description
REC 6	Locate new OHV trails on stable locations (<i>e.g.</i> , ridge tops, benches, and gentle-to-moderate side slopes). Minimize trail construction on steep slopes where runoff could channel to a waterbody.
REC 7	Design, construct, and maintain trail width, grades, curves, and switchbacks suitable to the terrain and designated use. Use and maintain surfacing materials suitable to the site and use, to withstand traffic and to minimize runoff and erosion.
REC 8	Suspend construction or maintenance of trails, where erosion and runoff into water bodies would occur.
REC 9	Locate staging areas outside Riparian Reserve. Design or upgrade staging areas to prevent sediment/pollutant delivery to wetlands, floodplains, and water bodies (<i>e.g.</i> , rocking or hardening, drainage through grading or shaping).
REC 10	Designate class of vehicle suitable for the trail location, width, trail surfaces and waterbody crossings, to prevent erosion and potential sediment delivery.
REC 11	Designate season of use if the trail bed is prone to erosion, rutting, gullyng or compaction, due to high soil moisture, standing water or snowmelt.
REC 12	Use existing road crossings of streams and floodplains on low-volume roads and partially decommissioned roads that tie with the trail system, where safety permits.
REC 13	Minimize low-water stream crossings for constructed or existing trails. Cross stream on stable substrate (<i>e.g.</i> , bedrock, cobble) in areas of low streambanks. Block alternate stream-crossing routes where OHV wheel slippage (acceleration/ braking) would tear down banks or deliver sediment.
REC 14	Avoid OHV use in ponds and wetlands, and navigating up or down streams and side-channels. Use suitable barriers where feasible.

BMP Number	BMP Description
REC 15	Design improved stream crossings (culverts and bridges) for the 100-year flood event. Stream crossings with listed fish must meet ARBO II (NMFS 2013 and USFWS 2013) fish passage design criteria (See Roads and Landings section for stream crossing BMPs).
REC 16	In OHV bridge structures, avoid chemically treated materials at water level contact points where leachate or solids may enter waterbodies.
REC 17	Use a temporary flow diversion bypass to minimize downstream turbidity, when constructing in perennial stream crossings (See Roads and Landings section for Stream Crossing BMPs).
REC 18	When constructing or maintaining trails within Riparian Reserve, do not cut the portion of logs or down woody material that extend into the active stream channel. Provide for adequate stabilization of the logs if not doing so would create a safety hazard.
REC 19	Harden trail approaches to stream crossings using materials such as geotextile fabric and rock aggregate.
REC 20	Hydrologically disconnect trails from waterbodies to the extent practicable. Install drainage features (<i>e.g.</i> , drain dips, lead-off ditches) on approaches to stream crossings as needed to divert runoff and reinforce with rock for longevity.
REC 21	Where trails intersect road ditches, provide erosion resistant crossings. Divert water from the trail to keep from reaching wetlands, floodplains, and water bodies.
REC 22	If trail width is too wide for the designated use (such as old roads converted to trails), consider tilling one side of the trail, covering with brush, and seeding or planting.
REC 23	Repair rills and gullies to keep sediment from reaching wetlands, floodplains, and water bodies.
REC 24	Construct and repair water bars, drain dips, and lead-off ditches as needed. These features may need rock reinforcement to promote longevity. Self-maintaining drain dips or lead-off features are the preferred design.
REC 25	Monitor trail condition to identify surface maintenance and drainage needs to prevent or minimize sediment delivery to waterbodies.
REC 26	Close and rehabilitate unauthorized trails, where needed, to protect sensitive areas and water quality.

The BLM has done a geospatial analysis of trails allowing motorized use. Within the 2,487,106 acres where public motorized travel use is currently designated in western Oregon, there are no crossings of streams with designated critical habitat for any ESA-listed fish species. There appears to be one public motorized travel crossing on a stream with distribution of ESA-listed Upper Willamette River steelhead. The motorized use trail ends just beyond the crossing. The stream is Mohawk Creek, a tributary to Shotgun Creek in the McKenzie River basin. No bull trout are known to inhabit Mohawk Creek.

Hiking Trails

The BLM manages 63 individual trails and trail systems that total over 395 miles in the Western Oregon decision area. Trail-based recreation opportunities within the decision area include trail systems for motorized and non-motorized users, providing a range of available activities across various recreation settings. Popular activities include hiking, mountain biking, horseback riding, and public motorized travel use. Table C28 displays trail BMPs (BLM 2016b, Appendix C, p. 730) that would reduce effects to ESA-listed fish habitat and designated critical habitat.

Table C28. BMPs for hiking trails and hiking/public motorized travel trail closures (BLM 2016b, pp. 408-409).

Hiking Trails	
BMP Number	BMP Description
REC 27	When constructing or maintaining trails within Riparian Reserves, do not cut any portion of logs or coarse woody debris that extend into the active stream channel. Use alternative passage options, such as earthen ramps, small notch steps, or slight trail realignments, to facilitate maintenance of intact logs. Cut and stabilize if necessary for safe passage and safety.
Trail Closure	
BMP Number	BMP Description
REC 28	Remove existing stream crossings or bridges (See Road Decommissioning. BMPs).
REC 29	Position fill or waste material in a location that would avoid direct or indirect sediment discharge to streams or wetlands.
REC 30	Plant restored stream banks with native vegetation, mulch, and then plant with water-tolerant species where appropriate.
REC 31	Barricade and allow nearby vegetation to grow into closed trails.

Public motorized use of existing roads

The BLM manages a large and complex road system within the planning area, which includes approximately 15,000 miles of roads (BLM 2016c, p. 775). The BLM proposes to manage public motorized access to these roads using three categories of use: open, limited, and closed, as described in the proposed action (BLM 2016b, p. 101). The PRMP designates no areas as “open” to public motorized access. This section of the document assesses the public motorized use of existing BLM roads in the “limited” designation. The PRMP designates 156,036 acres as “closed,” and by definition, prohibits public motorized travel activities; therefore roads within these areas will not be used by the public and no associated effects to listed species result. Public motorized access in areas designated as limited to existing roads and trails and BLM administrative use is included as part of the agency action for this consultation and would occur upon adoption of the RMP without further BLM decision-making processes and ESA compliance.

Analyzed in this section is the non-commercial public motorized use of existing roads within the “limited” designation. Use of the existing road system by vehicles falls within two broad categories, commercial and non-commercial, as well as subcategories of BLM or non-BLM related activities. Commercial use includes both BLM related and non-BLM related actions and these are analyzed in several different sections of this document. These other road uses will also

be subject to future ESA consultation when new BLM actions are proposed. Examples of the BLM actions include timber hauling from private timberland or some other commodity associated with non-BLM activities which require a reciprocal right-of-way agreement with BLM. Additionally, BLM commercial use includes road use associated with timber haul from a BLM timber sale. Because non-commercial public motorized use of existing roads will not require additional ESA Section 7 consultation, these designations and subsequent environmental effects are analyzed independently of the other road uses described above.

Road use may result in a variety of environmental consequences, such as degradation of water quality, stream substrate, and pool quality (GLEC 2008) as described below. Soil erosion is a natural occurrence in a forested landscape, aided by water, climate, gravity, soil properties, and lack of vegetative cover. Forest roads are unnatural, compacted surfaces and offer opportunities for accelerated erosion and potential sediment delivery to stream channels from a variety of sources, including small slumps and slides into the roadway from the cut bank, water channeling from the road or ditches if not properly directed and controlled, and blocked culverts and road fill washouts during floods. Sediment sources from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (BLM 2008, pp. 343-346). The FEIS (BLM 2016c, p. 786) described the road network functional classification as collector roads, local roads, and resource roads that serve different functions within a transportation system. These classification categories provide a sense of traffic volumes where collector roads carry the highest traffic volume of the three, local roads next, and resource roads the lowest traffic volume. In addition to traffic volume, road surface type influences the variables deemed most significant to the consequence of using these roads, that is, sedimentation and contaminants.

Water quality: Water quality is adversely affected by fine sediment and stormwater contaminants generated by vehicular travel on the roads. Fine sediment generating from surface erosion caused by vehicular traffic may transport to streams through ditchlines or directly into streams. Fine sediments transport in the stream as suspended particles reducing water clarity and potentially altering invertebrate communities. Pollution from vehicles also results in degradation of water quality from petroleum products and heavy metals, such as copper and zinc. In extreme situations, even water temperature may be affected by the increase of fine and coarse sediments to the stream especially where hyporheic flows are reduced. However, this contaminant material will likely be largely flushed from the system during periods of high flow.

Only a portion of road related on-site soil loss results in delivery as sediment to a stream or waterbody. More often, soil is redistributed on the slope (Swanson *et al.* 1982)is analysis considers roads within 200 feet of a stream to be the most likely and greatest contributors of fine sediment due to road use. We find to be a conservative and reasonable approach and use this 200-foot delivery zone to assess road use impacts from sediments and contaminants.

The BLM's sediment delivery estimates reflect all road use and sediment delivery contributions (BLM 2008); therefore, sediment delivery specifically caused by public motorized use is less, but we do not have the information to quantitatively separate out these various causal mechanisms.

The BLM predicted that the use of the roads will vary across the landscape based on the proximity of the road to major communities. Roads closer to major communities likely will experience the largest traffic volumes and therefore produce the greater sediment compared to similar roads (for example construction design, geology, and age) further from the cities.

Within each of the major river basins associated with the species considered in this consultation, road density varies considerably. Road surface type also varies regionally due to climate characteristics, where the proportion of paved roads is higher in the wetter coast range compared to the drier southwest and Klamath portions of the planning area. We assessed the number of road miles within 200-feet of a stream per analysis unit (Lost River and Upper Klamath Recovery Units for suckers, and the McKenzie basin for bull trout). The McKenzie basin analysis unit has the highest road miles within 200 feet (about 102 miles on BLM and 345 total miles within the action area). However, the extremely limited distribution of bull trout within the basin (only the mainstem McKenzie River and possibly the lowest reach of Gate Creek) make the actual exposure much lower than this overall miles of road. The Upper Klamath Recovery Unit for suckers has the second highest number of road miles of the three analysis units (approximately 99 miles on BLM and 277 miles total in the action area) within the 200 foot sediment delivery zone. The Lost River Recovery Unit for suckers has the lowest number of road miles (about 76 miles on BLM and 228 total miles in the action area) within the 200 foot sediment delivery zone. Where there are roads with unknown surface types we assume they are natural surface roads, therefore representing the highest risk for sedimentation of the surface types.

Table C29. Total miles of roads in the action area within 200 feet of a stream presented by surface type and located within analysis unit of the various species within the action area.

Road Surface	Road miles		
	McKenzie Basin (Bull Trout)	Upper Klamath Recovery Unit (Suckers)	Lost River Recovery Unit (Suckers)
Aggregate	254.1	77.2	20.7
Natural	13.6	60.2	39.9
Paved	41.7	21.8	5.9
Unknown	35.6	117.9	161.6
Total	345	277.1	228.1

Aggregate surfacing (*i.e.*, generally angular gravel) dominates the road miles within the Upper Klamath and McKenzie analysis units with natural surface (*i.e.*, dirt) dominating in the Lost River Recovery Unit for suckers. When these analysis units are considered in juxtaposition with human population centers and surface erosion classes within the planning area, we conclude

sedimentation risk from road use will be highest in the McKenzie basin because of its proximity to the Eugene-Springfield area, and occurs in a much higher precipitation zone than the other two analysis units which are on the drier eastside of the cascades. As previously noted the small distribution of bull trout habitat within the basin (less than one mile) and small population of bull trout would limit the impact of these effects to the species.

In addition to increased sedimentation due to road use, chemical contaminants from vehicles degrade water quality. Stormwater runoff from impervious surfaces delivers a wide variety of pollutants to aquatic ecosystems, such as metals (*e.g.*, copper and zinc), petroleum-related compounds (polynuclear aromatic hydrocarbons), along with the sediment washed off the road surface (Driscoll *et al.* 1990; Buckler and Granato 1999; Colman *et al.* 2001; Kayhanian *et al.* 2003). While some authors discuss how aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by the next high flow (Anderson *et al.* 1996; Alpers *et al.* 2000a, 2000b). Other authors such as Lee and Jones-Lee (1993, p. 234) question the actual impacts of contaminants from street generated stormwater to actually impede water quality in water bodies. Often, contaminant concentrations become rapidly diluted as they encounter larger stream flows. Because of the small amount of impervious surface presented by paved roads within the forest environment, and the relatively low levels of vehicle traffic the introduction of contaminants from stormwater into streams is likely to be quite small and localized. Ditchlines and hillslopes that carry stormwater within the forest environment are heavily vegetated. This vegetation serves as an effective barrier to reduce the amount of contaminants that ever reach streams. Once high flows encounter these low level stormwater contaminants they are readily flushed from the system, in some cases out to the ocean. Because of limited area (mainly paved roads) that could contribute stormwater within the action area, contaminants are expected to become unmeasurable in a very short distance. All aquatic habitat analyzed within this BO is located far from the coast and above numerous dams and impoundments that would further reduced the effects of contaminants downstream.

BLM roads most likely to contribute contaminants to streams are the same segments of paved roads and aggregate roads described in the previous sediment discussion. Natural surface roads are less likely to function as an impervious surface because liquids can percolate into them, and therefore are less likely to contribute contaminants to streams. Although aggregate roads may have a pervious top surface, depending on the depth of gravel, aggregate roads are considered impervious due to no, or reduced, water percolation to the soil (NRC 2009). The road database includes a large number of road miles with an unknown surface type. Previously we assumed these roads are native surface and therefore not likely to contribute significantly to stormwater contaminates.

We consider the fate and transport of stormwater contaminates from BLM roads differently from roads within the urban environment, but nonetheless, ditch lines, culvert and bridge crossings, road side conditions, such as riprapped streambanks, provide efficient stormwater transport to streams. Vegetated ditch lines and cross drains assist in stormwater treatment by filtering the stormwater, but we make the assumption here that roads within the 200 foot sediment delivery zone may also transport stormwater contaminants. Where cross drains carry the water onto the forest floor, given sufficient distance to a stream and ground cover, filtration is likely to occur. Even designed urban stormwater treatment facilities have a threshold for

treatment capacity; therefore we anticipate stormwater will exceed the filtering capabilities of roadside ditches and vegetation in some situations. Traffic volume for BLM roads is much lower than the urban environment where most of the stormwater studies have occurred. Kayhanian *et al.* (2003) described the relative differences in pollutant concentrations between urban and nonurban highways. Based on their research findings the urban highways had higher concentrations for some pollutants, yet nonurban highways were found to have higher concentrations of total suspended sediments, total dissolved solids, turbidity, NH₃, and diazinon. Kayhanian *et al.* (2003) concluded some of these pollutants were likely from non-transportation sources.

Effects to Environmental Baseline Indicators from the Trails and Travel Management Programs

Effects of hiking trail maintenance, public motorized travel trail maintenance and associated public use to bull trout and ESA-listed Pacific salmon species, and their respective designated critical habitat, are addressed in the Northwest Oregon Programmatic Biological Opinion (USFWS 2008) and the Western Oregon Programmatic Biological Opinion (NMFS 2011a). The category was more encompassing and titled “*Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use.*” The analyses are incorporated here by reference. The effects described in the BO’s included the effects at boat ramps, campgrounds, day-use sites, etc., as well as hiking and public motorized travel trails. The analysis below interprets the effects in the BO’s with regard to trails only.

The program activities regarding hiking and public motorized travel trails included:

- Tree hazard management at trails
- Trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)
- Brushing, tread work, and saw-out of downed trees within trails
- Maintenance of small bridges on trails
- Public use of trails

The effect determinations in the biological assessments (USFS *et al.* 2008, USFS *et al.* 2010) was LAA the species and to designated critical habitat for maintenance or use activities occurring within 150’ of listed fish habitat (LFH) when the activity is reasonably certain to result in meaningfully measurable changes to sediment, chemical contaminants, stream temperature, or instream large wood recruitment to listed fish habitat (LFH). The analyses in the biological assessments are incorporated by reference. The effect determinations in the NMFS BO were LAA to both the species and to designated critical habitat. The effect determination in the Service’s BO was LAA to bull trout, and later reinitiated this consultation to include designated critical habitat.

Ongoing, non-commercial use of the BLM road system

Stormwater pollutants are a well-known source of adverse effects to salmon and steelhead, even at ambient levels (Loge *et al.* 2006, Hecht *et al.* 2007; Johnson *et al.* 2007; Sandahl *et al.* 2007; Spromberg and Meador 2006). These pollutants accumulate in the prey and tissues of juvenile salmon where, depending on the level of exposure, they cause a variety of lethal and sublethal effects including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (Fresh *et al.* 2005; Hecht *et al.* 2007; LCREP 2007). Thus the introduction of stormwater from segments of paved within 200 feet of streams creates an adverse effect on the water quality indicator for chemical contamination/nutrients.

Increased sedimentation and turbidity from use of roads will adversely affect the water quality indicator sediment/turbidity/substrate. Effects of increased sediment can include gill abrasion, filling of interstitial spaces between cobble or gravel, reduced visibility and hiding cover, and reduced prey through reducing the production of macroinvertebrates.

A summary of effects to the indicators utilized in this BA, interpreted from the analysis within the biological assessments (USFS *et al.* 2008, USFS *et al.* 2010) and the two BO's (USFWS 2008, NMFS 2011a), is presented below in Table C30.

Table C30. Effects to indicators for the BLM transportation system, hiking trails and public motorized travel trails programs as interpreted from the programmatic consultation biological assessments (USFS *et al.* 2008, USFS *et al.* 2010) and BO's (USFWS 2008, NMFS 2011a) for the category of *Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use.*

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Adverse
Sediment/turbidity/substrate	Adverse
Water temperature	Adverse
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Adverse
Chemical contamination / nutrients	Adverse
Roads within Riparian Reserves	Insignificant

In addition, the Service's BO stated that high use sites may result in disturbance to fish that may be great enough to cause fish to move to other stream sections, resulting in a low probability of

localized adverse impacts. However, this is for high use recreation sites, and the effect at a trail crossing would result in far less disturbance. Consequently, the Service does not believe that there would be a direct effect to ESA-listed fish resulting in disturbance to the species as a result of trail use or maintenance.

The NMFS BO considered non-habitat effects. A conclusion was that people using recreation sites are likely to injure or kill some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles. The Service concludes that this would be a very rare event for hiking trails or public motorized travel trails. There is only one documented public motorized travel crossing of a stream with occupancy of ESA-listed fish. That is for UWR steelhead in Mohawk Creek, a tributary to Shotgun Creek. While this is in the McKenzie River basin, it is not occupied by bull trout so we don't believe any bull trout will be impacted by this crossing.

Summary of Effects to Environmental Baseline

The effects of managing the BLM road system (construction, maintenance and decommissioning) to fish habitat and to PBFs of designated critical habitat is of much greater magnitude than the effects of the other two components of the Trails and Travel Management program. Public motorized travel use under the PRMP would be limited to designated or existing roads and trails. Effects of use and maintenance of public motorized travel roads and trails under these designations would be similar to that of roads for timber haul, but at a much lower magnitude. The use and maintenance of the 395 miles of trails in the decision area have the lowest magnitude of effects of the three components of the program.

The effect determination for the Trail and Travel Management program is based upon the most impacting effect determination for any of its three component parts. It has been determined elsewhere in this BO that the effects of road construction, maintenance and decommissioning for the Forest Management program and the Lands and Realty program will potentially contribute to an adverse effect determination to listed fish species and to designated critical habitat for each of these programs. The use of the existing road system will contribute sediment and increase turbidity in streams. Stormwater entering streams from paved roads will increase chemical contamination of waterways to some degree. There are measurable negative effects to habitat indicators and to PBFs of designated critical habitat. It was determined that disturbance, injury or death to the species could potentially occur. The reader is also referred to the effects to indicators and to PBFs of critical habitat sections for the Forest Management program and the Lands and Realty program.

The effects of the maintenance and use of hiking trails and public motorized travel trails was evaluated in past programmatic consultations with NMFS and the Service. The effects were summarized in Table C30, above and incorporated by reference. There were measurable negative effects to several of the habitat indicators used in this BO: Large and small wood; sediment/turbidity/substrate; water temperature; Riparian Reserve function and vegetation diversity; and, chemical contamination/nutrients.

Considering the effects analysis elsewhere in this BO for effects of the roads program, and the effects analysis for the maintenance and use of hiking trails and public motorized travel trails in

existing concluded consultations, the overall ESA effect determination for the effects of the PRMP Trails and Travel Management program is negative to ESA-listed fish species. These effects to ESA-listed fish include increased sediment and turbidity, changes in substrate characteristics, and increases in contaminants which lead to disruption, decreased spawning opportunities, decreased foraging opportunities through reductions in prey and decreased visibility.

The Northwest Oregon Programmatic BO (USFWS 2008) did not address effects of the maintenance and public use of hiking or public motorized travel trails to shortnose or Lost River suckers. The analysis of effects to indicators by the road components of the Forest Management program, and the Lands and Realty program, elsewhere in this document, does apply to effects to shortnose and Lost River suckers. The Service concludes that the effects analysis of the two concluded programmatic ESA consultations that included effects of the maintenance and public use of hiking and public motorized travel trails for bull trout and Pacific salmon species, applies in its entirety to the effects to shortnose and Lost River suckers.

12. Wild Horses

The Pokegama Herd Management Area (HMA) is the only HMA within the planning area. It encompasses a total of 85,022 acres in Oregon and California and includes private, state, and Federal lands. About 83 percent of the HMA (70,550 acres) is within the planning area, and about 23 percent of the HMA is on BLM-administered lands managed by the Klamath Falls Field Office. The remainder of the HMA within the planning area is on private land.

The Pokegama herd primarily occupies the private land within the HMA. Private landowners allow wild horses on their lands, if the herd size is maintained within the established appropriate management level, and that the horses do not range outside the HMA. The Pokegama herd spends 94 percent of its time in meadows, open areas, and in tree cover on the edge of meadows (Gottlieb 1993).

The diet of the Pokegama herd is predominantly grasses and grass-like species as determined by analysis of horse fecal material collected from within the HMA between January 1979 and February of 1981 (Table C31) (BLM 2002).

Table C31. Diet of wild horses in the Pokegama Wild Horse Management Area.

Vegetation Type	Winter	Spring	Summer	Fall
Grasses	88%	95.5%	95.0%	95.5%
Shrubs	0%	1.0%	0.4%	0.0%
Forbs	8%	1.8%	3.0%	2.0%
Trees	5%	2.0%	2.0%	2.5%

Their primary water sources include creeks, springs, and reservoirs. Most developed water sources for the Pokegama herd (70-80 percent) are on private land. The BLM and private landowners have constructed several exclosures to protect riparian areas from wild horses.

The Pokegama herd is currently within the appropriate management level of 30 to 50 horses, based on the HMA management plan. Since designation of the HMA in 1971, census counts of the Pokegama wild horse population have ranged from 25 in 1972 to 55 in 2000. The 2012 census counted 24 horses, although the BLM estimates the current herd size is 30 to 40 horses. The BLM completed captures in 1996 and 2000, removing 20 and 18 horses, respectively.

The portion of the HMA within the planning area lies within the boundaries of the Dixie and Edge Creek livestock grazing allotments. There is abundant forage and available water within the two allotments in the HMA.

Critical habitat for shortnose sucker and Lost River sucker is designated in the Klamath River, which forms the east boundary of the Pokegama HMA. The topography of the Klamath River canyon is steep, there are abundant food and water sources above the canyon where the horses are commonly found, and wild horses are rarely seen in the canyon in the Oregon part of the HMA. There are deer trails that wind down to the river in places, and could conceivably be used by horses.

During the spring and summer, the horses are generally in the northern and central portions of the HMA (BLM 2002). Due to the typically high winter snow accumulations in the northern and central portions of the HMA, the horses concentrate in the southern portion (California) from December through March, although they can be found there at any time of the year.

Effects to Environmental Baseline Indicators from the Wild Horse Program

Large and Small Wood

Trees are not a significant part of the diet of wild horses as indicated by the information in Table C31. BLM (2002) hypothesized that the horses were eating small, tender branches off young or seedling trees – perhaps in tree plantation areas. Wild horses rarely are seen in the Klamath River canyon within the planning area, and they don't target trees for food. These facts lead to the conclusion that an effect to future wood recruitment to the Klamath River would be extremely unlikely to occur. Therefore it is a discountable effect.

Summary of effects to large and small wood

The effect to large and small wood recruitment is discountable because wild horses rarely are seen in the Klamath River canyon within the planning area, and trees are not a very small part of the diet of wild horses in the Pokegama HMA.

Sediment/Turbidity/Substrate

Wild horses in the HMA are known to congregate around water sources during the dry summer period. This concentration of use, along with concentrated use by elk and livestock, has caused trampling of streambanks in parts of the HMA (BLM 2002). This led to the construction of exclosures on portions of Wild Gal and Hayden Creek during the 1980s. A portion of Long Prairie Creek was fenced in 2001. These locations are not occupied by shortnose suckers or Lost River suckers, nor are they designated critical habitat. During the winter there are ample water

sources, during the season that wild horses are likely to be found in the Klamath River canyon. There should not be concentrated use by wild horses during the winter along the bank of the Klamath River that would lead to meaningfully measured amounts of fine sediment entering the river because of the distance between the location of most of the horses and the river, and the steep topography that largely excludes horse from entering the Klamath River. Therefore, there would be an insignificant effect to the Sediment/Turbidity/Substrate indicator.

Summary of effects to sediment/turbidity/substrate

There would be an insignificant effect to the indicator. Wild horse use of the Klamath River canyon within the planning area is rare. During the winter season when they are most likely to enter the canyon, there are ample water sources that would not lead to concentrated use along riverbanks. Any fine sediment entering the river would not result in meaningfully measurable effects to the indicator.

Water Temperature

The preferred diet of wild horses in the Pokegama HMA includes grasses and forbs. It is 95 to 98 percent of their diet during any season of the year (Table C31). These are not typically shade-producing plants along stream channels, except for the most narrow stream channels. Gottlieb (1993) observed habitat use by wild horses in the Pokegama HMA. Her observation was that wild horses showed a preference for meadow and open areas, remaining in or on the edge of this habitat type. This suggests that they were not concentrated within riparian areas. Considering these facts, and that wild horses are rarely seen in the Klamath River canyon within the planning area, it is extremely unlikely (discountable) that wild horse use would lead to an increase in water temperature in waters occupied by shortnose sucker or Lost River sucker.

Summary of effects to water temperature

There is a discountable probability of an effect to the water temperature indicator. It is extremely unlikely that shade along any stream occupied by shortnose or Lost River sucker would be reduced by wild horses to the point that a detectable change in water temperature would occur.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. There is no mechanism (no effect) to affect peak or base flows.

Summary of effects to peak and base flows

There is no mechanism to affect (no effect) peak or base flows.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. As described earlier in this section, there is a discountable negative effect to both the Large and Small wood indicator, and the Water Temperature indicator. There would be an insignificant effect to the Sediment/Turbidity/Substrate indicator as well. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator as a result of wild horse urine and fecal matter that would not be concentrated in riparian areas of the Klamath River canyon within the planning area.

The nominal amount of sediment delivery to the Klamath River within the planning area as a result of wild horse use would not measurably affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the river with its floodplain. Some use of riparian plants as forage may occur within the Klamath River canyon within the planning area, but it would not be concentrated and should not reduce the overall diversity of riparian plants. There is no mechanism of wild horse use to affect the Roads within Riparian Reserves indicator.

Considering the analysis presented above, there would be an insignificant effect to the Riparian Reserve function and Vegetation Diversity indicator.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of insignificant and discountable negative effects, as well as a “no effect” to several functions of Riparian Reserves. Consequently, the overall effect to the indicator is insignificant. Minor reductions in the ability of riparian vegetation could occur, but these increases could not be meaningfully measured, and would not be sufficient to change pool ratios or substrate characteristics within the Klamath River where ESA-listed suckers occur.

Chemical Contamination and Nutrients

Urine and fecal matter are potential chemical contaminants and sources of nutrients. Wild horses are rarely seen in the Klamath River canyon in the planning area. If they do enter the canyon they would likely be there in the winter when water sources are abundant, thereby not resulting in concentrated use within riparian areas. Therefore, urine and fecal matter should not be concentrated where it may measurably contaminate water in the Klamath River. There is an insignificant effect to the indicator.

Summary of effects to chemical contamination and nutrients

Wild horse urine and fecal matter should not be concentrated within riparian areas of the Klamath River to the point where it would lead to meaningfully measurable contamination of the river. This results in an insignificant effect to the indicator which would be too small to disrupt normal sucker behaviors or life functions.

Roads within Riparian Reserves

Wild horse use does not have a (no effect) mechanism to create or remove roads.

Summary of effects to roads within riparian reserves

Wild horse use does not have a (no effect) mechanism to create or remove roads.

Direct Effects to the Species from the Wild Horse Program

Any potential interaction between a wild horse and either sucker species would occur in the Klamath River canyon. Horses would only use the margin of the river occasionally, likely during the winter months, and not in any large numbers. This could lead to a rare occasion when either sucker species may notice a horse and move from its location momentarily. It is extremely unlikely that any suckers would be trampled as the only time wild horses are likely to be present is during the winter when high flows abound. This probability of these scenarios occurring is considered discountable.

Summary

The indicator analysis results are summarized in Table C32. The most impacting effect to the indicator is displayed. If there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities. Small, unmeasurable changes in sediment, riparian vegetation and nutrients could occur in the Klamath River, however these changes are considered insignificant to suckers, and are unlikely to produce changes in normal sucker behavior, or life history.

Table C32. Summary of indicator analysis results for the Wild Horse program (BLM 2016b, p. 416).

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Insignificant
Water temperature	Discountable
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Insignificant
Chemical contamination / nutrients	Insignificant
Roads within Riparian Reserves	No effect

Summary of habitat indicator analyses by PRMP program

The potential effects to each habitat indicator by an action of a PRMP program are summarized in Table C33. Please read the effects analysis sections above for details regarding the effects by indicator. Note that the effects shown in the table reflect the most impacting effect. Different elements of an action may have a range of effects to an indicator, ranging from no effect, a discountable or insignificant effect, or an adverse effect.

The adverse effects displayed in Table C33 reflect a sub-set of actions under each program. Depending upon the site-specific proximity to ESA-listed fish habitat, and the exposure of that habitat to the potential effects of an action, the effects for an entire action may be less than adverse.

Table C33. Summary of potential effects by habitat indicator for PRMP programs (BLM 2016b, pp. 417-418).

PRMP Program	Potential Effects by Habitat Indicator						
	A = adverse, D = discountable, I = insignificant, NE = no effect.						
	Large and Small Wood	Sediment/Turbidity/Substrate	Water Temperature	Peak/Base Flows	Riparian Reserve Function and Vegetation Diversity	Chemical contamination/nutrients	Roads within Riparian Reserves
1. Cultural Resources	D	I	I	D	I	NE	NE
2. Fire and Fuels	I	A	A	A	A	I	I
3. Fisheries	I	A	D	I	A	I	I
4. Forest Management	A	A	D	A	A	A	I
5. Hydrology	I	A	D	I	A	I	I
6. Invasive species	I	A	D ¹	I	A	A	I
7. Lands and Realty	A	A	I	I	A	I	A
8. Livestock grazing ²	I	A	A	A	A	A	NE
9. Minerals ³	N	A	I	N	N	A	NE
10. Paleontological Resources	D	I	I	D	I	NE	NE
11. Recreation & Visitors Services	A	A	A	I	A	A	A
12. Soil Resources	I	A	D	I	A	I	I
13. Special Forest Products	D	D	I	NE	I	D	NE
14. Sustainable Energy ⁴	NE	A	NE	NE	I	I	NE
15. Trails & Travel Management	A	A	A	I	A	A	I
16. Wildlife	I	A	D	I	A	I	I
17. Wild Horses	D	I	D	NE	I	I	NE

¹Effects are discountable except for the category of Sudden Oak Death Treatments where the effect is measurable negative (adverse).

²Effects are for a subset of allotments within the shortnose sucker and Lost River sucker recovery units.

³The effects depicted for the Minerals program are for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USFS *et al.* 2010, NMFS 2011a). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USFS 2015). The effects depicted in Table C33 are a synthesis of the effects analyses for both types of minerals mining. The adverse effects to the Chemical Contamination / Nutrients indicator is for methylmercury contamination in estuaries. It does not affect other ESU/DPS/RUs including McKenzie River bull trout. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

⁴The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Adverse effects are for winter haul only. Other aspects of the Sustainable Energy program in the FEIS are: (1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and (2) how leasable stipulations such as no surface occupancy would

negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PBF of designated critical habitat, nor are there any mechanisms to directly impact individual fish.

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APPENDIX D CLIMATE CHANGE

General Overview

Global climate change is arguably the most pressing environmental issue of our time, and there is growing evidence that recent climate change has impacted a wide range of ecological systems (Ådahl *et al.* 2006; Stenseth *et al.* 2002; Walther *et al.* 2002; IPCC 2014). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

With concern growing among scientists about the effects of human-caused climate change on ecological systems, an ever-increasing number of studies are demonstrating effects of climate and weather on the demography of numerous species (Jenouvrier *et al.* 2003, Rodríguez and Bustamante 2003, Glenn *et al.* 2010, McKelvey *et al.* 2013, Dugger *et al.* 2016). To develop sound conservation plans for at-risk species, it is essential to understand the processes driving population regulation and to identify factors that cause population fluctuations (White 2000). Although habitat loss and degradation are often the most significant factors influencing species declines and extinctions (Doak 1995), abiotic factors such as weather and climate can also be important, particularly for small populations (Boyce 1992).

Climate, which is the long-term average of weather, affects the distribution and abundance of species throughout the world (Ontiveros and Pleguezuelos 2003) and has been linked to large-scale patterns in demographic variability (Ådahl *et al.* 2006). In many areas, weather conditions vary widely by season as well as on an annual basis. In addition, climate and weather vary spatially, and effects can be strong at extremes of species' ranges or for small, isolated populations that are at greater risk of extinction from catastrophic events (Lande 1993). Population processes are affected by both large-scale fluctuations in climate conditions and by local weather variation.

In the past 100 years, the Earth's climate has warmed by approximately 0.6° C (Walther *et al.* 2002), and both temperature and precipitation are predicted to increase in many areas of the world as the concentration of greenhouse gases continues to rise (IPCC 2014). On a regional scale the effects of global climate change can be quite variable, with temperature and precipitation increasing in some areas and decreasing in others. In general, climatologists predict that there will be an increase in variability and occurrence of extreme weather events. Climate change has been shown to have consequences on the phenology and physiology of organisms (Forchhammer *et al.* 1999, Creswell and McCleary 2003), range and distribution of species (Inkley *et al.* 2004, Burns *et al.* 2003, Copeland *et al.* 2010, McKelvey *et al.* 2010), composition of and interaction within communities, and the structure and dynamics of ecosystems (Walther *et al.* 2002). Long-term studies have documented earlier arrival of migratory birds (Sparks 1999), earlier reproduction of amphibians (Forchhammer *et al.* 1998) and birds (Sanz 2002), and earlier eruption of leaf buds (Sparks and Yates 1997). In addition to specific physiological requirements of individual species, the driving forces in these shifts are believed to be changes in

temperature and precipitation (Inkley *et al.* 2004). Other responses to climate change included changes in the degree of primary and secondary sexual characteristics (Möller 2004), changes in the competitive interactions among species (Ahola *et al.* 2007), and phenological disjunction where a species' behavior becomes out of synchrony with its environment (Crick 2004). Although many factors influence population dynamics, certain species may be particularly susceptible to population declines from variation in weather conditions (Walther *et al.* 2002, Beever *et al.* 2010).

As noted by the BLM in their EIS for the PRMP (BLM 2016), stream temperatures in the Pacific Northwest and across North America have been increasing (Bartholow 2005, Kaushal *et al.* 2010, Dalton *et al.* 2013). Climate modeling indicates that by the mid-21st century, peak flows from snowmelt would occur 3–4 weeks earlier in the Pacific Northwest as compared to the current timing (Dalton *et al.* 2013 and references therein). All streams in western Oregon would be rain-dominant by the end of the century (Dalton *et al.* 2013 and references therein, Figure 3.2; Klos *et al.* 2014). Rain-dominant streams tend to experience peak flows earlier than snow-dominant systems; therefore, some streams originating in the Cascades would experience earlier peak flows and reduced spring and summer flows (Dalton *et al.* 2013). If winter precipitation increases as projected, peak flows would increase in magnitude, but timing would otherwise not change in systems that are already rain-dominated (Dalton *et al.* 2013). Mean annual streamflow could initially decrease by the 2020s and then increase through the end of the century by 0.6 to 5.5 percent, apparently driven by projected increases in winter precipitation (Wu *et al.* 2012). Mean summer streamflow is expected to continually decrease to approximately 30 percent less than current levels by the end of the century (Wu *et al.* 2012).

Global climate change has the potential to produce entirely new environmental conditions, making predictions about future ecological consequences a more daunting challenge. Recent forecasts (Mote *et al.* 2008) indicate that climate change will have long-term and variable impacts on forest habitat at local and regional scales. Locally, this could involve shifts in tree species composition that influence habitat suitability. Regionally, there could be losses of habitat availability caused by advances or retreats of entire vegetative communities, and perhaps prey communities as well. Effects of climate change, including fire and pest incidence, will not only affect currently suitable habitat for the northern spotted owl, they will also likely alter or interrupt forest growth and development processes that influence forest turnover rates and the emergence of suitable habitat attributes in new locations. These changes are predicted to be driven by changes in patterns of temperature and precipitation that are projected to occur under climate change scenarios (Mote *et al.* 2008).

Temperature and Precipitation

In the Pacific Northwest, mean annual temperatures rose 0.8° C (1.5°F) in the 20th century and are expected to continue to warm from 0.1° to 0.6 °C (0.2 ° to 1 ° F) per decade (Mote and Salathe 2010, p. 29). Global climate models project an increase of 1 to 2 percent in annual average precipitation, with some predicting wetter autumns and winters with drier summers (Mote and Salathe 2010, p. 29). University of Washington researchers (Salathe *et al.* 2009) have developed finer-resolution regional, predictive climate models that account for local terrain and other factors that affect weather (*e.g.*, snow cover, cloudiness, soil moisture, and circulation

patterns) in the Pacific Northwest. Throughout the range of the northern spotted owl, predicted increases in mean annual temperature range from 0.6 to 2.4 °C (33.0 to 37.4 °F) by the year 2050 (Figure 3.7 in U.S. Climate Change Science Program 2008). Mean monthly maximum temperatures are predicted to rise by 3.0 to 4.5 °C (37.0 to 40.04°F) by 2099 (Figure 1 in Lenihan *et al.* 2008b). These models agree with the global climate models in projecting warmer, drier summers and warmer, wetter autumns and winters for much of the Pacific Northwest, which will likely result in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events.

On the cooler, moister west side of the Cascades, the summer water deficit is projected to increase two- to three-fold over current conditions (Littell 2009). East of the Cascade Crest, summer water deficits may increase to a lesser extent (Elsner *et al.* 2009). Researchers expect some ecosystems to become more water-limited, more sensitive to variability in temperature, and more prone to disturbance (McKenzie *et al.* 2009). There is evidence that the productivity of many high-elevation forests, where low summer temperature and winter snowpack limits the length of the growing season, is increasing in the Pacific Northwest as temperatures rise, potentially increasing the elevation of the tree line (Graumlich *et al.* 1989,entire; Case and Peterson 2009). Conversely, productivity and tree growth in many low-elevation Pacific Northwest forests is likely to decrease due to the longer, warmer summers (Case and Peterson 2009). This may result in a change in species composition or reduction in the acreage of existing low-elevation forests.

Seasonality of precipitation may be strongly affected by climate change (Cayan *et al.*, 2005). In the next century, winter precipitation across the entire range of the northern spotted owl is forecast to increase by 5 to 15 percent above the amounts for the 1958 through 2008 reference period, with the greatest increases in the Cascade Ranges and Olympic Peninsula. Summer precipitation is predicted to decrease by 10 to 35 percent over the same period, with the greatest change rates also in the Cascades and Olympic Peninsula. Forecasts of spring and fall precipitation show a mixed outcome, with decreases of 5 to 20 percent throughout northern California, and increases of 0 to 15 percent over the remainder of the species' range (Karl *et al.*, 2009 p. 31).

Forest Composition

Climate change forecasts indicate significant effects on the tree species composition of western forests over the next century, with long term implications for the composition and structure of northern spotted owl habitat. The general predicted trend in North American forests is declining occupancy by conifers and displacement by hardwoods (Karl *et al.* 2009). In interior northwestern California, conifer-dominated forests are expected to decline sharply by 40 to 60 percent by 2100, with proportional increases in mixed forests with hardwoods as sub-dominant or dominant species (Lenihan *et al.* 2008). Lenihan *et al.* (2008) also predict a pattern of hardwoods displacing conifers in coastal and interior-coastal areas within the species' range; but they point out that an important predictor of future outcomes is continued public support for fire suppression programs. In simulations without fire suppression they found the same effect in coastal areas, but additionally found displacement of conifer forest by advancing woodland and savannah in the eastern Cascade Ranges.

Disturbance Patterns

Climate change is affecting the location, size and intensity of insect outbreaks, which in turn affect fire (frequency, intensity, and extent) and other forest processes (Joyce *et al.* 2008; Littell *et al.* 2009; Latta *et al.* 2010; Spies *et al.* 2010). Warming temperatures have led to mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, with large-scale effects in some western forests, including in the eastern Cascades. In warmer winters more mountain pine beetles survive, which shortens their generation time, resulting in larger and more severe outbreaks. Drought can heighten the susceptibility of host trees to attack (Littell *et al.* 2010).

Stand-replacing events and disturbances have also been predicted to speed up ecological conversions (*e.g.*, forests to shrublands) (Joyce *et al.* 2008; Blate *et al.* 2009). Dry forests are at greater risk to large scale disturbances (Agee and Skinner 2005; Mitchell *et al.* 2009), but recent research suggests large-scale disturbances will become more likely in west-side forests that have not traditionally been thought of as fire prone (Littell *et al.* 2010).

Summary

As noted above, numerous studies have documented changes in species distribution, movement, and demography associated with changing climatic conditions. In addition, changes in forest composition and structure as well as ecosystem structure and function resulting from climate change may impact availability of habitat for a range of species. Under the PRMP, there will be an increase in the total area of forest reserves on BLM lands to include approximately 80 percent of BLM ownership. In addition, the BLM's management direction for most reserved lands will increase the rate of development of late-successional conditions. Both of these actions will aid in the conservation of large blocks of late successional forest habitat for wildlife species that depend on late-successional forest in the face of changing climatic conditions, and they should ameliorate some of the potential adverse impacts of climate change and allow for resilience of listed species in the coming decades on BLM lands.

The BLM's management direction for Fire, Fuels, and Wildfire response is designed to conserve forest habitat for numerous forest-dependent species across large landscapes by slowing or altering fire behavior which can result in stand-replacing fires. Because actions where these practices will be initiated are at high risk from impending wildfire, the resulting impacts on fish and wildlife habitat should be beneficial to most species compared to if wildfire suppression activities did not occur.

Anticipated habitat changes associated with climate change need to be addressed for aquatic as well as terrestrial species. The effects of the proposed action, with few localized exceptions, are likely to maintain and moderate anticipated habitat changes associated with climate change. Lawrence *et al.* (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (*i.e.*, bass). Salmonid species that exhibit a stream-type life history are likely to be exposed to progressively greater stressors (*e.g.*, increased water temperatures, higher peak flows, lower summer flows, disease) resulting in

greater dependence on early life history strategies (*i.e.*, fry, fingerling, and sub-yearling strategies). The proposed action's riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors. By maintaining stream shade and water temperature the viability of the yearling life history strategy will be maintained. Similar to terrestrial species, we expect these measures to provide for the persistence and resilience of aquatic species on BLM lands.

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