United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Reply to (File Number): 2022-I-0020
TS Number: TS#22-0303
Ecosphere Number: 2023-0133471
Ecosphere File Name: SNF Sand Lake Recreation Improvements and Heavy Thinning Treatments

To: Shawn Rivera
District Ranger – Hebo Ranger District, Siuslaw National Forest
U.S. Forest Service
31525 Highway 22
Hebo, OR 97122

From: Kessina Lee, State Supervisor, Oregon Fish and Wildlife Office
Portland, Oregon

Subject: Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments

Dear Mr. Rivera:

This letter transmits the U. S. Fish and Wildlife Service's (Service) Biological Opinion (attached) on the proposed Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments located in the Siuslaw National Forest, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (Act). The U.S. Forest Service requested formal consultation on the Northern spotted owl (*Strix occidentalis caurina*), the Marbled murrelet (*Brachyramphus marmoratus*), and their critical habitats. We received your September 21, 2023, request for formal consultation on September 21, 2023.

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action and the cumulative effects, we conclude that the proposed action ***may affect, and is likely to adversely affect***, the following species and/or its designated critical habitat (CH):

- Threatened northern spotted owl (*Strix occidentalis caurina*; spotted owl), and
- Threatened marbled murrelet (*Brachyramphus marmoratus; murrelet*) and its critical habitat.

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action and the cumulative effects, we conclude that the proposed action ***may affect, and is not likely to adversely affect***,

- Threatened northern spotted owl (*Strix occidentalis caurina*; spotted owl) critical habitat.

The U.S. Forest Service made a ***no effect*** determination for the following species and/or their critical habitats (CH) which are not further analyzed in this Opinion or the Letter of Concurrence:

- Threatened Pacific marten coastal distinct population segment (*Martes caurina humboldtensis*) and its proposed CH;
- Threatened Western snowy plover (*Charadrius nivosus nivosus)* and its CH;
- Threatened Oregon silverspot butterfly (*Speyeria zerene Hippolyta)* and its CH;
- Endangered Leatherback Sea Turtle (*Dermochelys coriacea)* and its CH;
- Endangered Loggerhead Sea Turtle (*Caretta caretta)* and its CH;
- Threatened Olive Ridley Sea Turtle (*Lepidochelys olivacea)* and its CH, and;
- Endangered Short-tailed Albatross (*Phoebastria [=Diomedea] albatrus)* and its CH.

The attached Biological Opinion is based on information provided in your Biological Assessment, discussions, and other sources of information cited in the Biological Opinion. Our Concurrence on effects to northern spotted owl critical habitat is included in Section 1.3 of the Biological Opinion. A complete record of this consultation is available from the Oregon Fish and Wildlife Office.

If you have any questions regarding the attached Biological Opinion, or our shared responsibilities under Act, please contact:

Gretchen Newberry at (503) 758-7632 or Gretchen_Newberry@fws.gov; or
Mike Blow at (503) 807-6196 or John_Blow@fws.gov.

Sincerely,

KESSINA LEE Digitally signed by KESSINA LEE
Date: 2024.01.26 09:07:42
-08'00'

Kessina Lee
State Supervisor

Attachment:
SNF Sand Lake Recreation Improvements and Heavy Thinning Treatments Biological Opinion 2023

cc:
Deanna Williams, U.S. Forest Service
Crystal Barnes, U.S. Forest Service

Endangered Species Act - Section 7 Consultation

Biological Opinion

Siuslaw National Forest Hebo Ranger District's
Sand Lake Recreation Improvements and
Heavy Thinning Treatments in
Tillamook County, Oregon

U.S. Fish and Wildlife Service Reference:

Ecosphere Project Species Consultation Code: 2023-0133471
Ecosphere File Name: SNF Sand Lake Recreation Improvements and Heavy Thinning Treatments
TS#22-0303
File Number: 2022-I-0020

Federal Action Agency:

U.S. Forest Service

Consultation Conducted By:

U.S. Fish and Wildlife Service,
Oregon Fish and Wildlife Office

KESSINA LEE Digitally signed by KESSINA LEE
Date: 2024.01.26 09:05:18 -08'00'

Kessina Lee State Supervisor	Date

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1 Introduction

This document represents the U. S. Fish and Wildlife Service's (Service) Biological Opinion (BO or BiOp) based on our review of the proposed Siuslaw National Forest (SNF) Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments project in Tillamook County, Oregon, and its effects on northern spotted owls (*Strix occidentalis caurina*), and marbled murrelet (*Brachyramphus marmoratus*; murrelet) and their critical habitats in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et *seq*.). We received your September 21, 2023, request for formal consultation on September 21, 2023.

This Biological Opinion is based on information provided in your Biological Assessment (BA) for the proposed project, discussions with action agency staff and consultants, species experts, and other information. A complete record of this consultation is on file at this office.

Any reference to the "action agency" refers to USFS in this Opinion, unless otherwise noted. All references to tables and figure refer to this Opinion (and not the BA) unless otherwise noted.

1.1 Background and Consultation History

The following discussion was adapted from the USFS description of the proposed action presented in the BA. See pages 5 of the BA under the Section "Consultation History".

The Siuslaw National Forest, Hebo Ranger District completed consultation with the U.S. Fish & Wildlife Service for the Sand Lake Restoration Project on December 19, 2016 (Letter of Concurrence reference OIEOFWO0-2017-I-0105). The Biological Assessment originally prepared and consulted on for the Sand Lake Project: Biological Assessment Regarding Habitat Modification Projects that are Not Likely to Adversely Affect the Northern Spotted Owl, the Marbled Murrelet or their Critical Habitats within the North Coast Province, FY 2017-2018, proposed by the Northwest Oregon District, Bureau of Land Management and the Siuslaw National Forest, did not include heavy thinning treatments nor the proposed actions associated with the Recreational Improvements project within the action area. The original consultation focused on light/moderate thinning. Actions associated with this consultation such as light to moderate thinning, road reconstruction, herbicidal use, individual tree removal, snag and down wood creation, and prescribed fire are addressed and covered within the action area under the 2017-2018 NLAA Habitat Modification Consultation (OIEOFWO0-2017-I-0105). However, the individual tree removal associated within the Recreational Improvements project action area was not included within the 2017-2018 NLAA Habitat Modification LOC and therefore addressed in this consultation. This Opinion also includes updated language for definitions, Project Design Features and other information that has changed since 2016.

Siuslaw National Forest Biologists and U.S. Fish & Wildlife Service Level 1 Teams began discussing this project on December 16, 2019; and February 20, 2020; with additional meetings for clarification and resolution of concerns on May 5 and 19, 2021. On March 1, 2022, the Siuslaw NF submitted a BA (referred to as "the 2022 BA version") that did not include all the necessary information and the FWS requested more information for the following: 1) understanding the project within the current habitat landscape for both the northern spotted owl and the marbled murrelet; 2) the dispersal capability of the area for the northern spotted owl and if the thinning, which may be good for the species in the long term, may adversely affect the species in the short term; and 3) potential increase in predation on the marbled murrelet as a result of the planned recreation trails and infrastructure could result in adverse effects.

The Level 1 Team met on numerous dates in 2022 and 2023 to further clarify information in the 2022 BA version, to update and apply the most current research, and to examine any necessary revisions for the BA.

1.2 Species Included in this Biological Opinion.

The action agency, in coordination with the Service, determined the proposed action will affect the northern spotted owl (NSO), and the marbled murrelet (MAMU), and their designated critical habitats (CH) in a manner and extent not previously considered in the 2022 BA version.

Table 1 below shows species included and excluded from this Opinion and the attached concurrence, and the resulting effects to the species or its critical habitat (if designated) due to implementing the proposed action. The USFS is solely responsible for any ''no-effect'' determination and which species are included in this consultation. Species not included in this consultation, and species with "no effect" determinations made by the USFS, are included in the table solely to conveniently reference those outcomes in this biological Opinion, including any PDC that prohibit their inclusion in the BA and this Opinion.

Table 1: Species Included and Excluded from this Opinion and the Concurrence

ESA-Listed Species	ESA Status[3]	Effect to Species or Its Critical Habitat		Listing Date / Federal Register	Critical Habitat Designation Date / Federal Register
		Species	Critical Habitat		
Birds					
Northern Spotted Owl *(Strix occidentalis caurina)*	T	LAA	NLAA	6/26/1990 55 FR 26114	11/10/2021 86 FR 62606 and 12/4/2012 77 FR 71876
Marbled Murrelet (*Brachyramphus marmoratus*)	T	LAA	LAA	10/01/1992 57 FR 45328	10/5/2011 76 FR 61599
Short-tailed Albatross [1] (*Phoebastria [=Diomedea] albatrus)*	E	No Effect	No Effect	07/31/2000 65 FR 46643 46654	None
Western snowy plover [1] (*Charadrius nivosus nivosus)*	T	No Effect	No Effect	03/05/1993 58 FR 12864 12874	06/19/2012 77 FR 36727 36869

ESA-Listed Species	ESA Status[3]	Effect to Species or Its Critical Habitat		Listing Date / Federal Register	Critical Habitat Designation Date / Federal Register
		Species	Critical Habitat		
Mammals					
Pacific marten coastal distinct population segment [2] (*Martes caurina humboldtensis*)	T	No Effect	No Effect	10/08/2020 85 FR 63806 63830	10/25/2021 86 FR 58831 58858
Prairie Species – Animals					
Oregon Silverspot Butterfly [1, 2] (*Speyeria zerene hippolyta*)	T	No Effect	No Effect	07/02/1980 45 FR 44935	07/02/1980 45 FR 44935
Reptiles					
Leatherback Sea Turtle [1] (*Dermochelys coriacea)*	E	No Effect	No Effect	06/02/1970 35 FR 8491 8498	03/23/1979 44 FR 17710 17712
Loggerhead Sea Turtle North Pacific population segment [1] (*Caretta caretta)*	E	No Effect	No Effect	09/22/2011 76 FR 58868 58952	None
Olive Ridley Sea Turtle [1] (*Lepidochelys olivacea)*	T	No Effect	No Effect	07/28/1978 43 FR 32800 32811	None

LAA: May affect and is likely to adversely affect the species or its designated critical habitat.
NLAA: May affect and is not likely to adversely affect the species or its designated critical habitat.
[1] Habitat does not occur in or near the action area.
[2] Action area is outside of known populations of species.
[3] E = Endangered. T = Threatened

Table 2: Acronyms and Abbreviations

Acronym/Abbreviation	Name
AMA	Adaptive Management Area (NWFP)
ARBO	Aquatic Restoration Biological Opinion
ASQ	Allowable Sale Quantity – Timber harvest in Harvest Land Base
BA	Biological Assessment
BO or BiOp	Biological Opinion, or Opinion
CCP	Comprehensive Conservation Plan, USFWS
CH/CHU	Critical Habitat/Critical Habitat Unit
CSA	Conservation Support Areas (Recovery Plan)
DBH or dbh	Diameter Breast Height (measurement of tree diameter at approximately 4 feet from ground on the uphill side of the trunk)
DDR	District Designated Reserve
DPS	Distinct Population Segment
DTR	Danger Tree Removal
EIS	Environmental Impact Statement
ERFO	Emergency Relief for Federally Owned [Roads]
ESA	Endangered Species Act
FOI	Forest Operations Inventory (management stands),
GIS	Geographic Information System
HCP	Habitat Conservation Plans
HD	Harvest – Habitat Downgraded
HFP	Habitat Fitness Potential
HM	Harvest – Habitat Maintain
HR	Harvest – Habitat Remove
ITR	Individual Tree Removal
LITA	Low Intensity Timber Area
LSR	Late Successional Reserve (NWFP)
LAA	May affect, likely to adversely affect
MMBF	Million board feet (of timber)
NE	No effect
NEPA	National Environmental Policy Act
NF	National Forest
NLAA	May affect, not likely to adversely affect
NRF	Nesting, roosting, foraging habitat for northern spotted owls
NWFP	Northwest Forest Plan
ODFW	Oregon Department of Fish and Wildlife
ONHIC	Oregon Natural Heritage Information Center
PBF	Physical or Biological Feature
PDC	Project Design Criteria

Acronym/Abbreviation	Name
PFF	Post-fire foraging habitat for northern spotted owls
RA10	Recovery Action 10 (from Revised Recovery Plan, NSO, 2011)
RA32	Recovery Action 32 (from Revised Recovery Plan, NSO, 2011)
REO	Regional Ecosystem Office (USFS)
ROD	Record of Decision (NEPA)
ROW	Rights of Way
RR	Riparian Reserve
SHA	Safe Harbor Agreement
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Department of the Interior, Fish and Wildlife Service; or Service
WNHP	Washington National Heritage Program
WUI	Wildland Urban Interface

1.3 Concurrence

The Forest Service requested our concurrence with a "may affect, not likely to adversely affect" determination for the northern spotted owl designated critical habitat, in accordance with section 7(a)(2) of the Act.

A detailed description of the proposed action is provided in the BA and is summarized below in the Description of the Proposed Action section of the Opinion.

Critical habitat for the northern spotted owl covers the majority of the Sand Lake Recreation Improvements and Recreational Use portions of the Project Area. There is no critical habitat for northern spotted owl in the Heavy Thinning portion of the Project Area. The Project Design Criteria (PDC) will protect stand composition, key structures and stand functions of the Physical and Biological Features (PBF) for the life history of the spotted owl in the Sand Lake Recreation Improvements portion of the Project Area. However, the Skills Park area will remove one acre of dispersal habitat (PBF 4) and prevent that 1 acre of critical habitat that is currently habitat capable, from developing the structures and functions of dispersal or suitable northern spotted owl habitat since it will be managed in perpetuity as an open area for the skills park within a habitat capable area. Considering that this removal effect within CH is only to 1 acre of CH, the effects of removing and preventing this 1 acre from developing into NSO suitable or dispersal habitat do not constitute a substantive effect. Of the dispersal habitat-maintained treatments within NSO CH, another 4.5 acres total, spread amongst five small areas, will be maintained, but prevented from developing into NSO suitable habitat in order to serve as four less than one acre parking areas in previously disturbed areas next to roads, and 2.5 acres of shaded skills park area with 40% canopy cover. However, this small effect to future late seral habitat is not considered to be significant at the stand, project area, or NSO CH subunit scale. Further details are found below in the breakdown by PBF effects analysis for NSO CH.

See also Table 16: Action Description and Deconstruction with Exposure and Effects Matrix for the Northern Spotted Owl.

The effects of the action section refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are consequences of that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

When determining whether an action is likely to adversely affect critical habitat, the USFWS recommends evaluating the effects of a proposed action at a scale that is relevant to the spotted owl life-history functions supplied by the primary constituent elements (PCEs, also known as PBFs or primary biological features) of habitat (77 FR 71939). The primary constituent elements identified in the revised spotted owl critical habitat rule include (1) forest types in early-, mid-, or late-seral stages that support the spotted owl across its geographic range but may currently be considered unsuitable for dispersal or NRF; (2) nesting and roosting habitat; (3) foraging habitat; and (4) dispersal habitat (77 FR 72051-72052). Removal of a PCE of northern spotted owl critical habitat is almost always a likely to adversely affect determination, but exceptions may include removal of small linear strips of habitat or isolated patches of habitat, especially those on the extreme of the subspecies range or where long-term quality will be very low.

Project Actions with Effects to Northern Spotted Owl Designated Critical Habitat

Project Categories/activities are described in greater detail in Section 2. A more comprehensive description of the changes to forest/vegetation conditions due to habitat modification are found in the spotted owl Section 9.3.3. This section does not restate much of that info and focuses on conclusions specific to CH for NSO.

The discussion below focuses solely on effects to PBFs of spotted owl CH. Section 2 and 9.3 of this Opinion contain tables from the BA that describe the expected quantities of Project Categories (activities) to be implemented in CH for the spatial and temporal scales discussed in the BA.

Regardless of any Project Category and the expected effect of an activity, it is the responsibility of the action agency project biologist to ensure effects to CH are considered, applicable PDC are applied and effects to CH are reported in post-implementation monitoring. Any activity that would preclude or significantly delay the further development of PBFs (e.g., increasing the age, and structural complexity of the present PBFs) compared to no-treatment, *may affect and is likely to adversely affect* CH due to indirect/long-term effects to habitat and associated PBFs of CH. Significant differences are measured in as little as 10 years when comparing treatment versus no-treatment scenarios. That period could be slightly greater when the benefits of any treatment are demonstrated and pronounced. However, the effects to NSO CH from this project are so small in relation to the amount of NSO habitat and CH in the project area and critical habitat unit and subunit, that the effects do not rise to a level we consider significant. Therefore, the effects of the Sand Lake Project, **may affect, and are not likely to adversely affect** NSO CH.

Effects to the Primary Biological Features or Primary Constituent Elements of Critical Habitat

PBF 1 – Forest types in early, mid, or late-seral stages that support the northern spotted owl.

PBF 1 is about forest types that support the northern spotted owl and are capable of developing into dispersal or suitable NRF habitat. The projects will treat but maintain 873 acres of critical habitat of which there are 112 acres of nesting and roosting habitat, 312 acres of foraging habitat and 449 acres of dispersal habitat. All acres of critical habitat that are treated will be within the Sand Lake Recreation project and no acres of critical habitat will be treated within the Heavy Thinning project. None of the acres of critical habitat to be treated are considered currently unsuitable habitat that is capable of developing into dispersal or suitable NRF habitat (Table 6). Habitat functionality will be maintained in all habitat types in CH from the Sand Lake Project, with the exception of one acre of dispersal habitat removal for the Skills Park. This one acre will be prevented from developing into mid or late seral stages of habitat that supports NSO. However, the scale of this one acre of effect is so small in the context of the stand, project area and NSO CH subunit scale, that it is considered an insignificant effect to PBF 1. There will be 2.25 acres of dispersal habitat that will be maintained as dispersal habitat for the skills park and four, less than one acre previously disturbed, small areas next to roads, also totaling 2.25 acres, that will be maintained as dispersal habitat with large trees and canopy, but no understory or groundcover. These five small areas that total 4.5 acres split amongst 5 small areas will be prevented from developing into NRF or late-seral stages of forest that supports NSO. However, due to the small scale of this effect to future late seral forest habitat, and the fact that current habitat functionality will be maintained, the consequence from this 2.25 acres and four, less than one-acre areas also totaling 2.25 acres of dispersal maintain treatments are insignificant at the scale of the stand, project area, and NSO CH subunit scale. The other, larger scale treatments that maintain habitat functionality in dispersal and suitable habitat are also considered to be insignificant to NSO CH and PBF 1 because they maintain the current habitat functionality and do not prevent the habitat from developing into more complex, late seral type forest habitat that supports NSO and PBF 1.

PBF 2 – Nesting and Roosting Habitat

The Project will treat but maintain 874 acres of critical habitat of which 112 acres of nesting and roosting (NR) habitat will remain nesting and roosting habitat after the project's completion. All acres of critical habitat that are treated will be within the Sand Lake Recreation project and no acres of critical habitat will be treated within the heavy thinning project (Table 6). Treat but maintain treatments for NR habitat (PBF 2) in CH are the result of individual tree removal to construct and maintain trails. The maintain treatments for NR habitat do not constitute a significant effect to PBF 2 because habitat functionality will be maintained.

PBF 3 – Foraging Habitat

The Project will treat but maintain 874 acres of critical habitat of which 312 acres of foraging will remain foraging habitat after the project's completion. All acres of critical habitat that are treated will be within the Sand Lake Recreation project and no acres of critical habitat will be treated within the heavy thinning project (Table 6). Treat but maintain treatments for Foraging habitat (PBF 3) in CH are the result of individual tree removal to construct and maintain trails. The maintain treatments for Foraging habitat do not constitute a significant effect to PBF 3 because habitat functionality will be maintained.

PBF 4 – Dispersal Habitat

The Project will treat but maintain 873 acres of critical habitat of which 449 acres of dispersal habitat will remain dispersal habitat after the project's completion. 1 acre of dispersal habitat (PBF 4) will be removed and maintained as an open area for the skills park, preventing it from developing into NSO habitat. However, the scale of this effect is so minimal at the project area, and NSO CH subunit scale, that we do not consider it a significant effect and do not expect it to affect NSO dispersal at the stand, project area, or CH subunit scale. All acres of critical habitat that are treated will be within the Sand Lake Recreation project and no acres of critical habitat will be treated within the heavy thinning project (Table 6). 444.5 acres of the 449 treat but maintain acres of treatments for dispersal habitat (PBF 4) in CH are the result of individual tree removal to construct and maintain trails. The maintain treatments for dispersal habitat do not constitute a significant effect to PBF 4 because habitat functionality will be maintained. 4.5 acres of the 449 acres of treat but maintain treatments for dispersal habitat (PBF 4) will be maintained as dispersal habitat, but prevented from developing into suitable habitat as 2.25 acres will be for the skills park and 2.25 acres will be for the four parking areas each of which is less than one acre in size (sizes range from 0.23 to 0.9 acres) and are areas where the ground is already bare and disturbed adjacent to a road. These 4.5 acres total, split among five different areas where dispersal habitat will be maintained, but prevented from developing into NRF habitat are not considered to be significant due to the current habitat functionality being maintained, and due to their small sizes and relative smallness of the scale of effect when considered in the context of the NSO habitat that exists and will be maintained at the stand, project area, and NSO CH subunit scale.

Effects of Habitat Removal and Downgrade Relative to in Action Available CH and Suitable Habitat Area

The following Effects of the Action are adapted from the "Spotted Owl Suitable and Critical Habitat" section in the BA Spotted Owl Status section. See pages 39 of the BA. See also Table 4.

The project area and the Siuslaw National Forest fall with the NCO-5 Critical Habitat Subunit. The NCO-5 subunit consists of approximately 142,937 acres in Yamhill, Lincoln, Tillamook, and Polk Counties, Oregon, and contains lands managed by the State of Oregon, BLM, and USFS (USFWS [Federal Register] 2012). Recent data from the NWFP 25-year review showed roughly 129,556 acres of capable habitat (dispersal) and of that, 72,242 acres is suitable nesting, roosting, foraging habitat within NCO-5 (Davis et al. 2022).

For the Siuslaw National Forest, 409,887 acres of NSO capable and 266,877 acres of suitable habitat exist across the landscape (Davis et al. 2022). Within the analysis area, there are 9,172 acres of designated critical habitat. No suitable or critical habitat falls within the Heavy Thinning and Early Successional Habitat Creation action area (Figure 10). Portions of the Mountain Bike Trail project overlap with critical and suitable NSO habitat (Figure 10). The mountain bike trail system will occur within 11.5 acres of critical habitat and within 2.6 acres of suitable NSO habitat (Table 4). Additionally, the Skills Park and all 4 parking areas overlap with critical habitat, but do not occur within suitable habitat (Figure 10).

Cumulative effects

Cumulative effects are those effects of future State, Tribal, local or private activities (not involving Federal activities) that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR § 402.02 Definitions). A Memorandum to the Director of Fish and Wildlife Service, August 27, 1982, *Cumulative Effects to be Considered Under Section 7 of the Endangered Species Act* set forth the legal requirements for consideration by federal agencies of the cumulative effects. "A non-federal action is *reasonably certain* to occur if the action requires approval of a state or local resource or land use control agency and such agencies have approved the action, and the project is ready to proceed...these indicators must show *more than the possibility* that the non-federal project will occur; they must demonstrate with *reasonable certainty that it will occur*." 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. See also "Activities reasonably certain to occur" within 50 CFR § 402.19(a).

We anticipate that non-federal land management actions in western Oregon would continue at current levels. We have no knowledge or expectation of any change in future State, Tribal, local or private actions that are reasonably certain to occur or would be related to implementation of the NCO RMP or the NWFP.

State and private lands within the action area support mostly marginal habitats for the spotted owl and do not notably contribute to the viability of these species. Most assessments of the functionality of spotted owl territories that overlap on State tribal and private lands use a worst-case assumption that the non-federal lands do not provide owl habitat. If lands are surveyed and spotted owls are not detected, then private land managers often cut most of the trees on the land, rendering it unsuitable for spotted owls. Habitat conditions on these lands are expected to decrease within the foreseeable future and, as a result, delay the recovery of the species.

Cumulative effects to spotted owls are an ongoing concern and would likely continue in the future within the action area and the State of Oregon. The Oregon Forest Practice Rules require protection of a 70-acre nest patch area around active nest sites only, and do not provide any protection or conservation of other surrounding habitat. For a species that requires up to several thousand acres of habitat to persist, these rules allow for the progressive elimination of active spotted owl sites. Removal of large amounts of habitat around 70-acre nest patch areas will eventually render the nest patch areas non-functional and displacement of spotted owls is the likely outcome. Non-federal timber lands, however, support some dispersal habitat for spotted owls and may contribute, at least temporarily (e.g., until the next harvest rotation) to the reproduction, health, and condition of spotted owls on adjacent Federal land. Habitat conditions on non-federal lands are not expected to improve significantly within the foreseeable future and, as a result, are not expected to contribute to the survival and recovery of the spotted owl.

Cumulative effects to critical habitat within the action area are limited because the vast majority of the critical habitat in NCO-5 (92.3%) is on federal lands, with the remaining 7.7% (11,067 acres) being State of Oregon lands. The only critical habitat in the project area and the entire Siuslaw National Forest lies within the NCO-5 NSO CH subunit. In contrast, the adjacent NSO CH subunit, NCO-4 includes more State-managed lands (117,033 acres (65%) are State of Oregon lands) (USFWS 2012: p. 71926-71927, 71920-71922, 71929).

The Oregon Department of Forestry is developing a Habitat Conservation Plan (HCP) for Western Oregon State Forests. The Oregon Department of State Lands is developing a Habitat Conservation Planning for the Elliott State Forest, located east of Coos Bay, Oregon and outside of the action area of this Opinion. Under the draft plan, the Elliott State Forest, an area of approximately 83,000 acres will be managed as a research forest by Oregon State University. The HCP and the associated National Environmental Policy Act processes are ongoing, and we have not yet completed the ESA section 7 consultations for these HCPs. Any effects of implementing Santiam State Forest management under the new HCP will be addressed when the proposed action sufficiently developed. On August 22, 2023, the Confederated Tribes of Grand Ronde submitted Natural Resources Management Plan for Reservation and Tribal Trust Timber Lands: 2024-2033 Biological Assessment for section 7 consultation. This includes the Reservation, 10,211 acres and the Coal Creek Property, 884 acres, and trust lands around Grand Ronde that are managed for forestry. The Grand Ronde Reservation comprises approximately 10,212 acres on the east side of the Coast Range. The Reservation is located in Yamhill County, approximately 3 miles north of the town of Grand Ronde and outside of but adjacent to the action area of this Opinion. In the action area, the Service and action agency are unaware of any proposed future State actions within the action area that would affect critical habitat. The projects in this Opinion will occur on 100% federal lands.

Summary of Effects to the PBFs of Northern Spotted Owl Critical Habitat

We expect insignificant effects to PBFs 1-4 as their habitats will be maintained at their current level at the Sand Lake Recreation Project within the zone of critical habitat. There is no critical habitat within the Heavy Thinning Project area.

Therefore, the determination of the USFWS is that the proposed action *may affect but is not likely to adversely affect* northern spotted owl critical habitat.

2 Proposed Action Description

The following discussion was adapted from the USFS description of the proposed action presented in the BA. See pages 23-30 of the BA under the Section "Description of the Proposed Action".

See also:

- Table 16: Action Description and Deconstruction with Exposure and Effects Matrix for the Northern Spotted Owl
- Table 17: Action Description and Deconstruction with Exposure and Effects Matrix for the Marbled Murrelet

2.1 Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The following is presented in the USFS description of action area in the BA. See pages 19-22 of the BA.

The Sand Lake Watershed is located on the Central Oregon Coast in Tillamook County. The project occurs at multiple sites in the watershed, primarily along the western portions of Forest Service Road #1004, Tillamook County, OR (Figure 1). The Sand Lake project action area includes the following:

- The Sand Lake Adaptive Management Area units proposed for heavy thinning/early-successional treatments (Figure 2 and 3).
- The entire Sand Lake mountain bike trail system including proposed parking areas, and skills park (Figure 4).

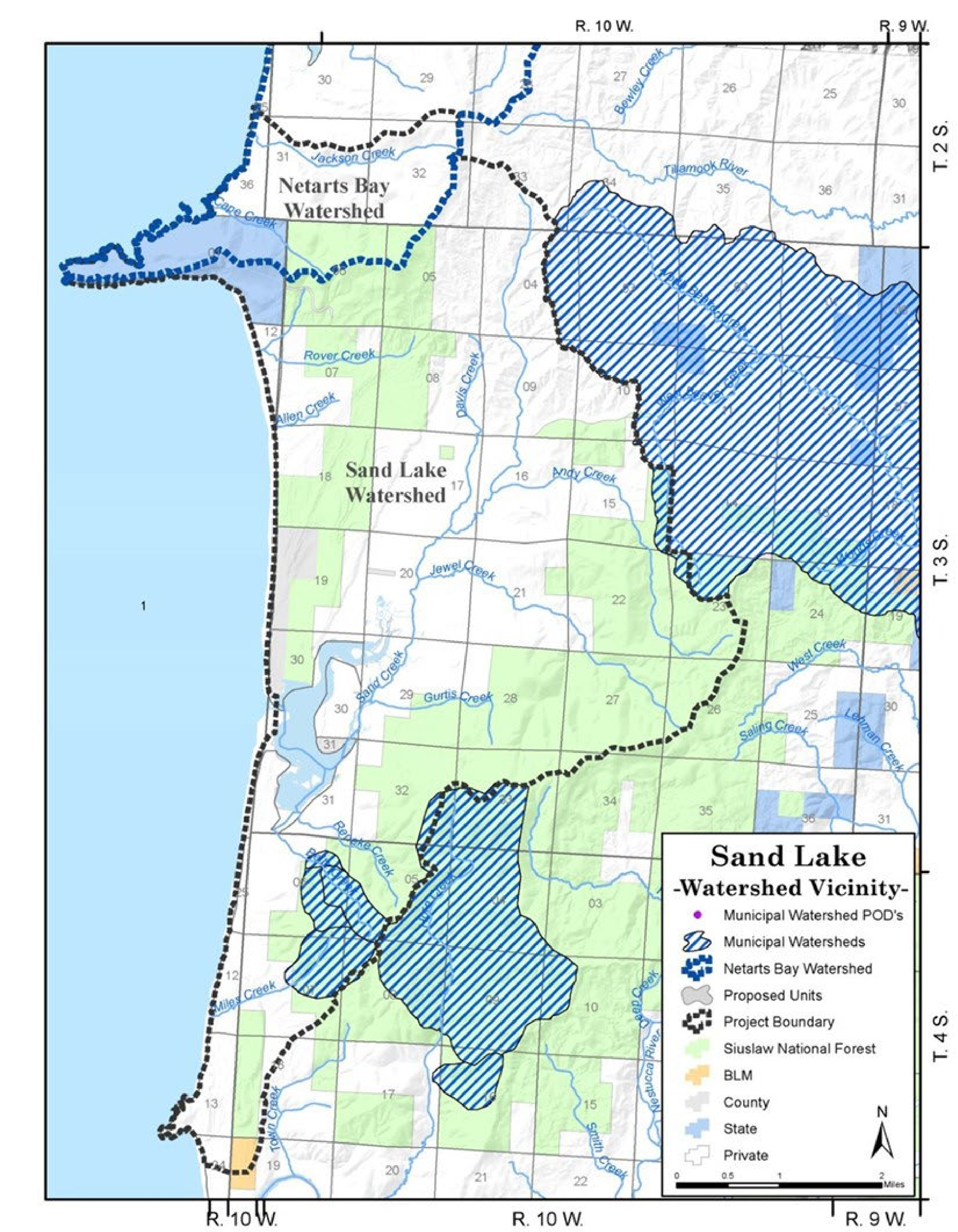

Figure 1 (Figure 1 of the BA): Sand Lake Watershed and Project Boundary

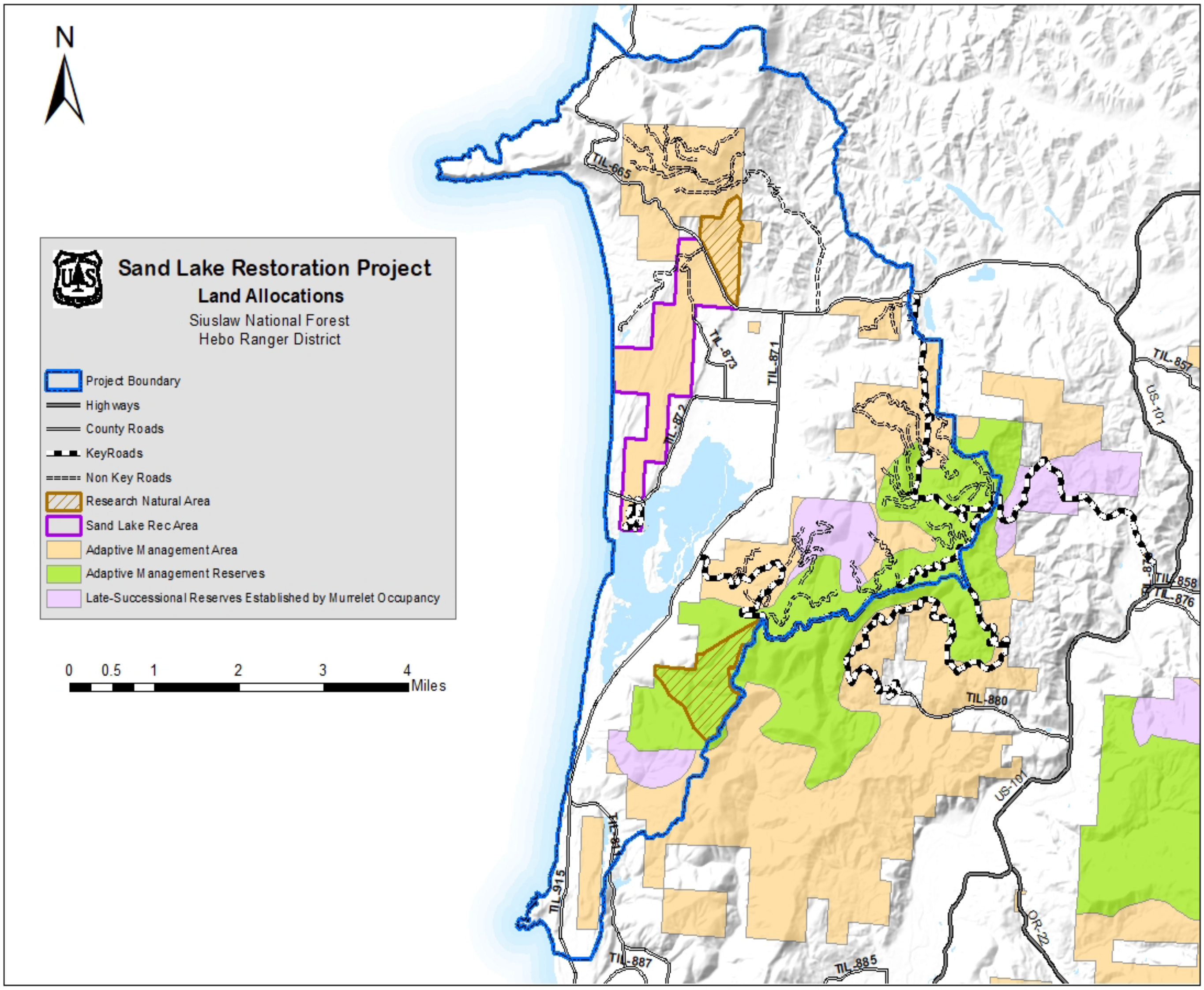

Figure 2 (Figure 2 of the BA): Sand Lake Project Area Boundary and Land Use Allocations (LUA).

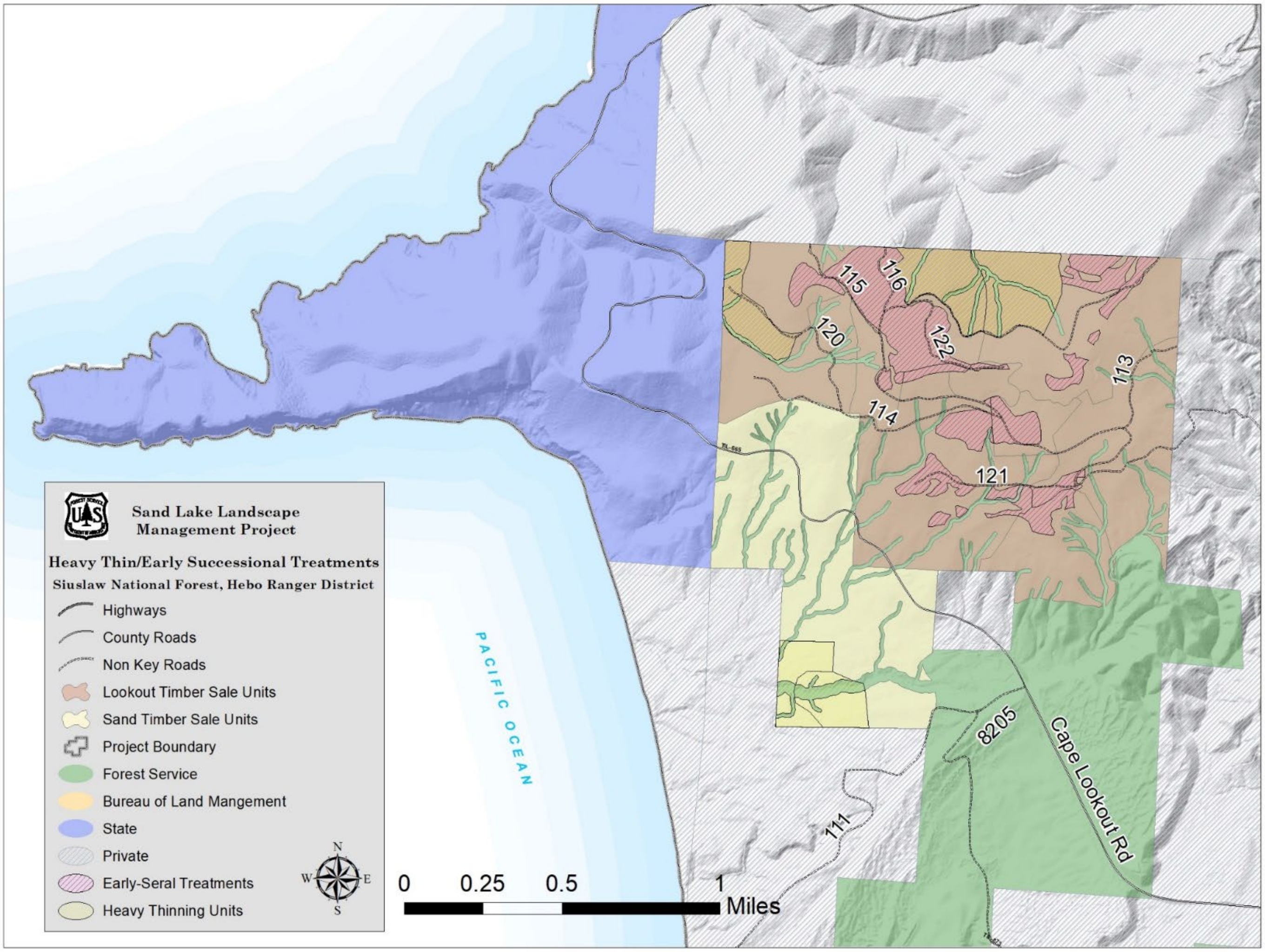

Figure 3 (Figure 3 of the BA): Heavy Thinning and Early Successional Treatments within Sand Lake Planning Area.

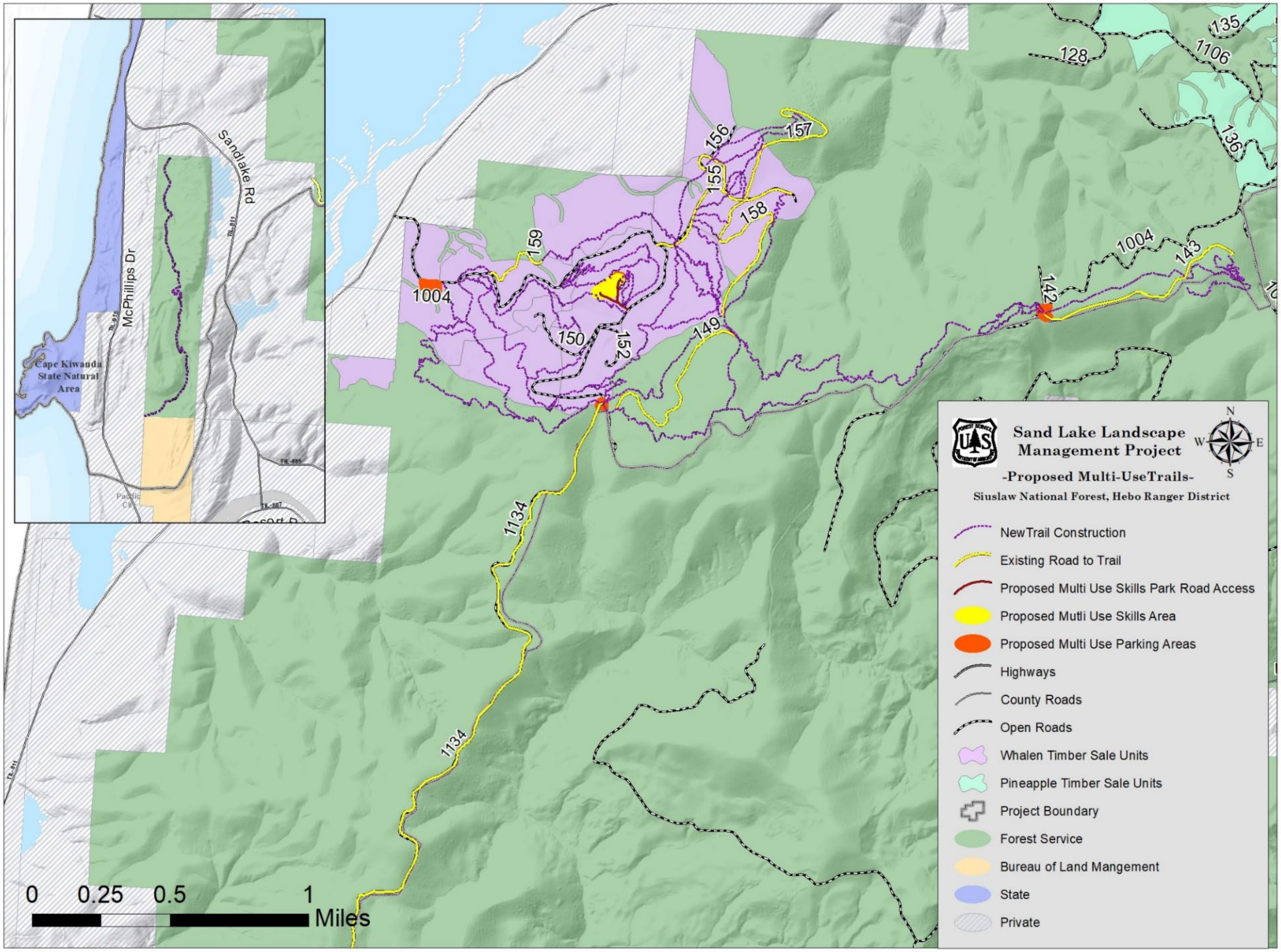

Figure 4 (Figure 4 of the BA): Proposed Multi-Use Trail system within the Sand Lake Planning Area.

2.2 Project Category Descriptions

Proposed actions are comprised of two main projects: 1) Heavy Thinning and Early Successional (Seral) Treatments, and 2) Recreational Improvements.

Table 3: Proposed Actions with Descriptions
From Table 3 in the BA.

Action	Action Area Location	Description
Mountain Bike Trail Construction	Recreational Improvements (South Block); proposed mountain bike trail corridors	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. Excavator. Individual tree removal.
Parking Lot Construction	Recreational Improvements (South Block)	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Use chainsaws to remove hazardous trees within immediate area of parking lots and within 1.5 site potential tree heights (325 ft.) of the parking lot boundary. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. Excavator. Placement of gravel within parking area footprint. Individual tree removal.
Skills Park Construction	Recreational Improvements (South Block)	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs and any hazardous trees within immediate area of skills park and within the skills park area boundary. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator. Reconstruct existing road to permanent access road (0.72 acres).
Trail Maintenance	Recreational Improvements (South Block); along proposed mountain bike trail routes.	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs over trails. Moving of earth with hand tools and small machinery such as a 3,000 lb. Excavator. Individual tree removal.
Individual Tree Removal	Parking Lots, Skills Park, and Trail System	Involves the removal of hazardous trees with chainsaws within 1.5 times the site potential tree height of areas with human safety concerns.
Recreational Operation-use	Recreational Improvements (South Block); Skills Park, Trails, and Parking Lots	Management of human trash, restroom facility maintenance, skills park terrain upkeep. Public travel to and from site.
Creation of 5-acre Gaps	Early Seral Units (North Block)	Tree removal, chainsaw use, heavy equipment for logging and hauling.
Heavy Thinning to 30% CC	Heavy Thinning Units (North Block)	Timber hauling, chainsaw use, heavy equipment for logging.

Prescribed Burning	Heavy Thinning and Early Seral Treatment Units (North Block)	Pile burning and understory brush burning. Staging of engine and equipment use. Use of hand tools and dozer to cut fire break/line.

Project Categories (i.e., activities) addressed in this Opinion are defined and limited by the description of the Project Categories, Definitions used for this Opinion, and Project Design Criteria as described within this Biological Opinion and in the BA. Collectively, these specifications constitute the proposed action, including limits on the manner and extent of the proposed action and resulting effects. All PDC are required and considered part of the proposed action, including administrative PDC for pre- and post-implementation coordination, pre- and post-implementation review, and all reporting and monitoring as described in the PDC. Collectively, these measures ensure the proposed action will be implemented within the manner and extent of effects analyzed.

2.2.1 Heavy Thinning Project Categories

The following is presented in the USFS description of project in the BA. See pages 24-27 of the BA.

In natural late-successional forests, at any one point in time, there exist patches of early-successional (ES) habitat created by smaller scale disturbances. To include the full diversity of habitat components within the northern block, we identified 269 potential acres to receive a total of 236 acres of early-successional and heavy thinning treatments (Table 4). All timing of activities will follow restrictions for reducing disturbance and disruption during marbled murrelet and spotted owl breeding seasons where appropriate (Table 8). Desired future conditions in these treatment areas include:

- Full diversity of habitat components appropriate for the present plant associations be present on the landscape, including areas of low tree cover.
- Variable canopy cover with areas below 40%, with the understanding that canopy cover will increase as succession proceeds.
- Diverse communities of shrubs and forbs appropriate for the present plant associations, with emphasis on plants important for herbivores, pollinators, and birds.
- Structural features such as snags and downed wood are present and maintained.
- Presence of invasive weeds is minimized with the goal of native plant cover dominating.
- Hardwood trees are a component of the overstory, where appropriate.

Heavy Thinning and 2-5 Acre Gap/Opening Treatments:

Heavy thinning down to 30% canopy cover will occur in up to, but not exceed, 136 acres; and early-successional treatments which include the creation of 2 acre gaps and 5 acre openings will occur up to, but not exceed, 100 acres. Equipment will include chainsaws, heavy machinery, and haul trucks for removal of trees. The following actions will occur in the areas designated to receive ES treatments (Figure 3):

- Creation of up to 100 acres of early-successional habitat with residual canopy cover of 40%.
- Creation of openings up to 5 acres in size.
- Gap creation with total removal of tree cover through commercial harvest up to 2 acres in size.
- Gap creation through creating patches of snags, leading to eventual low canopy cover up to 2 acres in size.
- Radial Tree Releases (leaving a healthy dominant tree and creating a large opening around it)
- Planting and/or release of hardwood trees species
- Prescribed Burning
- Ground-based logging equipment will treat approximately 41 acres within the heavy thinning units (Table 4).
- Skyline logging equipment will treat approximately 95 acres of heavy thinning units and all the early successional units for a total of up to 195 acres (Table 4).
- Helicopter logging equipment will not be used.
- No more than 100 total acres of early-successional openings will be created.
- Any opening larger than 2 acres will maintain a low density of residual conifer trees with potential to form high quality habitat structure and to continue the development of late-successional habitat characteristics within the treatment area.
- At least 40% average canopy cover will be maintained across the 1,095-acre contiguous Adaptive Management Area (AMA) area (northern area of the Sand Lake EA project area).
- Openings will not be maintained over time, instead they will provide ephemeral Early Seral (ES) habitat in which forest succession can proceed.
- Timeline for implementation will follow Project Design Criteria to reduce disturbance and disruption to NSO and MAMU as applicable; all operations will occur outside of the critical breeding seasons for both murrelets and spotted owls (Table 8 and 9).

Additional Actions Covered Under the 2017-2018 NLAA Habitat Modification LOC:

The actions listed below and effects are covered and discussed in the 2017-2018 NLAA Habitat Modification LOC. These actions are associated with the Sand Lake Restoration project and tied to the light to moderate thinning timber harvest actions. Units and acreages associated with these actions are not included in the effects analysis of this consultation. The Heavy Thinning and Early Seral Treatment units were initially analyzed for light to moderate thinning, but the treatment type was changed to heavy thinning after signing of the Environmental Assessment Decision Record and therefore initiated the need for new consultation. However, actions associated with the road construction, prescribed burning, and restoration activities did not change and are included within the scope and action area of the 2017-2018 NLAA Habitat Modification BA and associated LOC.

Road Reconstruction:

Road treatments on approximately 7 miles of closed roads will occur to access the heavy thinning and early seral treatment units with no new roads created. Reconstruction activities will involve use of heavy equipment and focus on improving drainage, template stabilization and preventing sediment delivery to streams. The roads will be administratively closed to motor vehicle use with the expectation of future decommissioning once the need for the road ends. Maintenance on haul roads includes rock re-surfacing, blading and shaping road surfaces, roadside brushing andcleaning drainage structures such as ditches and culverts. Logging out and cleaning sloughs and slides are incidental and ongoing maintenance activities within the road prism.

Prescribed Fire, Fuels Reduction, and Vegetation Treatments:

- Understory Burning and Pile Burning:
    - Burning (55 acres), Partial burning (28 acres), No burning (185 acres)
- Reduce residual logging slash: scattering, chipping, mastication.
    - Limited use of heavy equipment.
- Brush and tree seedling control treatments.
- Manual and herbicide treatments.

Restoration Activities:

- Create wildlife habitat as deadwood structure within ES units:
    - Wildlife trees (snags) and downed wood
    - Chain saw use: directional felling and topping.
- Planting of native trees and hardwoods to increase stand diversity,
- Planting and seeding of native shrubs/forbs to increase herbivore forage,
- Planting of native flowering plants to benefit pollinators,
- Invasive/non-native plant control to limit fruiting shrub growth in openings (avian subsidy)
    - Implement Early Detection-Rapid Response (EDRR) strategy.

2.2.2 Sand Lake Recreation Project Categories

The following is presented in the USFS description of project in the BA. See pages 27-30 of the BA.

The Hebo Ranger District proposes to develop recreation improvements in a forested setting as follows (Figure 4):

- a new expanded network of multi-use trails designed for mountain biking enthusiasts and hikers.
- a mountain bike skills development park for beginners or group activities
- four designated vehicle parking areas for trailhead access and shuttle turn-arounds with additional parking within the skills development park.

This recreation improvement project addresses the demand for sustainable, multi-use trails across the Nation and specifically on the Oregon Coast. One trail will tie in directly to the coastal community of Pacific City and will achieve Oregon's #1 Statewide Trail Goal of connecting trails to towns and public places (Figure 4). Implementation of these recreational trail and infrastructure improvements will occur in a planned sequence after each specific phase of the Whalen Knob Timber Restoration Thinning Project progresses across the local landscape. To reduce disturbance and disruption to any nesting murrelet or spotted owl pairs, all trail, skills park, and parking lot construction will occur outside of the critical breeding season and follow daily timing restrictions when within the species' disruption distances (Table 8 and 9).

Mountain Bike Trail Construction:

The network of trails will be constructed and maintained to Forest Service (FS) trail standards as detailed in the Trails Management Handbook, Forest Service Handbook (FSH) 2309.18. The trails will be designed to accommodate mountain bike use and designed for all rider skill levels with an emphasis on beginner and intermediate levels. Trails will be built and maintained by partners, contractors, volunteers, and Forest Service personnel. As mentioned above, trail system will utilize existing open and closed roads in addition to creation of new trail systems. A total of 30 miles of trail will be established with 22.5 miles of new trails, 2.5 miles on existing closed roads, and 5 miles on existing open roads. Trail width will range from 24-48 inches with some corners up to 60 inches for turning radius functions. Trail vegetation clearing limits are set to a height of 10 ft. And width of 72 inches. Equestrian riders will be permitted on all trails except the 1.5 miles of new trail construction connecting to Pacific City (Figure 4). Motorized transportation is prohibited; electric bikes are not addressed in this consultation. (USFS considers electric bikes as motorized vehicles at this time, and they are only permitted on "motorized trails". These trails will be designated as "non-motorized".) Equipment used to construct trails will involve hand-tools, chainsaws, weed eaters to clear limbs and brush, plus remove down logs. Moving of earth to create the trail footprint will involve the use of small heavy machinery such as a 3,000 lb. and 10,000 lb. Excavator.

Trail Maintenance:

Trail maintenance activities will occur along all trail corridors and use the same equipment as stated in the Mountain Bike Trail Construction section. This action is expected to occur on an annual basis and specifically involves the following tasks:

- Tread Maintenance: removal of slough, berms, and loose rocks
- Drainage Maintenance: building and maintaining water-bars and check dams, maintaining, or constructing fords and stream crossings, and cleaning inlets and outlets of culverts.
- Vegetation Management: clearing out fallen trees, cutting brush to the clearing limits.
- Signage: Installation and maintenance of trail signs

Parking Lot Construction:

Access to the trail system requires constructing and maintaining vehicle parking areas. Parking areas are proposed at four locations totaling 2.25 acres and sizes of each parking area range from 0.23 to 0.9 acres. Parking areas will be created as follows at designated locations:

- Using existing landscape features or features from timber management activities:
    - wide road shoulders, landings, or junctions between roads
    - overstory trees will not be removed, thereby maintaining canopy cover limits as stated in the PDCs.
- Parking sites will be engineered and hardened with rock, some with shuttle turn-arounds which limits individual vehicle use (thereby reducing on-site food coolers and food waste production)
- Establish signage kiosks/bulletin boards at each parking area with "Pack it in, Pack it out" educational messages along with information on the importance of limiting organic and inorganic waste to reduce the attraction of corvids (and predation impact on threatened and endangered species (TES).
- Maintenance of facilities: CXT (concrete, pit-vault style toilet restrooms associated with recreation sites) cleaning/pumping, trash removal, and weed control.
- Ongoing monitoring of illegal dumping along FS Roads 1004 and 1006 by USFS Law Enforcement, recreation staff, and occasional IDT staff (interdisciplinary team) as well as a designated Tillamook County Sheriff (Sand Lake Rec area contract patrol) and **TORTA** proponents (Tillamook Off Road Trail Alliance) of the Sand Lake Mountain Bike Trail System.
    - Tillamook County Sheriff Sand Lake info: https://www.tillamooksheriff.com/sand-lake
    - TORTA is a volunteer based non-profit organization founded for the enjoyment of bike enthusiasts in Tillamook County: https://www.tortamtb.com

Gurtis Creek Parking Area: Located at the bottom of the Middle Crest section of trails off the Sand Lake Road/Three Capes Scenic Route (area C-#1315), this area will provide approximately 25-30 vehicle spots. Infrastructure at the site will include: a restroom or portable toilet (concrete, pit-vault style toilet restrooms associated with recreation sites), turn-around for vehicle shuttling, and animal proof trash receptacles. This parking area will be established as the main trailhead.

Skills Park Parking Area: Located at the base of the Whalen Knob skills area, this area will provide approximately 15 vehicle spots. This area will utilize a former system road which was never mapped or recorded for access. This parking area utilizes the cleared landing area from the Whalen Knob timber restoration thinning project. Infrastructure at the site includes trailhead signing, kiosk, Pack It IN/OUT trash management, and CXT restroom. Installation of animal proof trash receptacles is not guaranteed at this site, but future planning may include this feature depending on need.

Middle Crest Parking Area: Located at the junction of Middle Crest and Miles Mountain Road. This area will provide approximately 4-6 vehicle spots alongside the road. This parking area will be established with signage with educational messages about the importance of removing organic and inorganic human litter to reduce the attraction of corvids.

Buzzard Butte Parking Area: Located at the junction of the Three Blind Mice section of trails and Buzzard Butte section. This area will provide approximately 10-15 vehicle spots. Infrastructure at the site will include trailhead signing, kiosk, a portable toilet and Pack It IN/OUT trash management, plus area for a turn-around for shuttling. Trailhead signage will include educational messages about the importance of limiting organic and inorganic human litter to reduce the attraction of corvids. A CXT restroom and animal proof trash receptacles will be installed to match visitor use and patterning after Third phase construction of trails.

Mountain Bike Skills Park Construction:

The top of Whalen Knob is a proposed bike skills development area for all ages. This area is approximately 3.25 acres in size and has a gentle slope that is perfect for creating features such as beginner jumps, roller/berm trails, and rock gardens. These skill development "lessons" prepare mountain bikers for similar features encountered within the expanded trail system network. The Whalen Knob skills area will also act as a centralized meeting area for small groups that are spending the day in the forest.

The entire skills park will be within a managed stand scheduled to be thinned (greater than or equal to 40% canopy cover). Post thinning, overstory trees will not be removed from the skills park, parking, and day use picnic area (fee charged). An existing road (0.15 miles) for thinning access (EA Phase 1) will be converted to a permanent road to allow access to the skills park.

Individual Tree Removal (ITR):

Individual tree removal pertains to the removal of danger/hazard trees that may pose a human safety concern. Trees to be removed can be live, hazard trees, or killed through fire, insects, disease, blow down and other means. Down trees and snags will be removed if they pose a human safety concern. ITR will not modify the functionality of the stands and will maintain habitat conditions for the spotted owl and murrelet as listed in the PDC section of this consultation. This action will occur during the construction phases of the parking lots, skills park, and trail system, plus will occur in perpetuity as needed. ITR involves the removal of hazardous trees with chainsaws within 1.5 times the site potential tree height of areas with human safety concerns. Typically, ITR will occur within 150 ft from roads, administrative facilities, and trailheads, but the area of removal will depend on the site's tree height; this process is further discussed in the analysis methodology section of this consultation.

The zone within the action area slated for individual tree removal will occur in the footprint of previously harvested thinning units associated with the Whalen Knob Timber Restoration Thinning Project. Because hazard/danger trees are removed during timber sale operations, we anticipate a low number of additional hazard trees will be removed during the construction phases of the parking lots, trail system, and skills park. However, the need to remove such trees will be in perpetuity. The area around the parking lots and skills park will have the highest volume of human traffic and ITR will occur year-round as needed. The hazard/danger tree removal zone along the trail corridor will have ITR restricted to outside of the critical breeding season for both NSO and MAMU with daily timing restrictions implemented in the late breeding season (Table 9) when within 110 yds of unsurveyed, suitable murrelet habitat; and/or within 65 yds of suitable, unsurveyed spotted owl habitat. Hazard and danger tree removal is planned to occur outside of the critical breeding season for NSO and MAMU during parking lot, trail system and skill park construction, and for ongoing hazard/danger tree maintenance after construction in perpetuity. However, due to human safety concerns there will be a need to remove hazard and danger trees during the critical breeding season, but daily timing restrictions would occur for MAMU (in accordance with Table 8) if ITR occurs during the critical breeding season. Due to the very limited, and small areas where ITR will occur within disruption distances to suitable NSO or MAMU habitat for ongoing maintenance, and due to hazard/danger tree removal occurring during the Whalen Knob Timber Restoration Thinning Project, and during construction of the trail, parking area and skills park areas outside of the critical breeding period for NSO and MAMU, ITR actions for ongoing maintenance of hazard/danger tree management during the critical breeding season are not expected to take more than one day in any one area and will have daily timing restrictions for MAMU in accordance with Table 8. It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply). Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation. This consultation does not cover the removal of active NSO or MAMU nest trees during the breeding season. In the event a nest tree must be removed, it will be after the breeding season and covered under a separate emergency consultation.

Recreational Use:

Recreational use is directly associated with human use of the site. This will include mountain biking, hiking, facilities upkeep, and public travel to and from the site. The development of the recreational features will increase human disturbance and vehicular traffic in the area. This increase will also lead to the need to manage human waste and trash at the site. Further details of the projects' actions are described in Table 16 and 17.

2.3 Quantification of the Proposed Action

The following tables from the BA quantify the proposed action based on the Project Categories described in Section 2.2.

Table 4: Heavy Thinning and Early Successional Unit information, current conditions, and harvest methods.
From Table 4 in BA.

Treatment	Unit GIS ACRES[1]	HCC Stand Number[2]	Year of Origin	Age 2022	Current Veg	Trees Per Acre (TPA)	Basal Area (BA)	Quadratic Mean Diameter (QMD)	Residual Canopy Cover (CC)	Harvest Method
Early Successional	10.6	301218	1968	54	Hemlock	519	388	11.7	40%	Skyline
Early Successional	21.5	309001	1960	62	Hemlock	243	349	16.2	40%	Skyline
Early Successional	52.4	309004	1958	64	Sitka Spruce	276	354	15.3	40%	Skyline
Early Successional	5.0	309005	1964	58	Hemlock	235	284	14.9	40%	Skyline
Early Successional	26.7	309007	1960	62	Hemlock	298	326	14.2	40%	Skyline
Early Successional	6.6	309011	1958	64	Douglas-fir	219	385	17.9	40%	Skyline
Early Successional	6.5	309123	1960	62	Hemlock	416	329	12	40%	Skyline
Early Successional	2.4	309124	1946	76	Sitka Spruce	442	404	12.9	40%	Skyline
Early Successional	1.1	309128	1985	37	Sitka Spruce	271	313	14.6	40%	Skyline
Heavy Thinning	20.0	309010	1960	62	Hemlock	249	354	16.1	30%	Ground based
Heavy Thinning	21.0	309126	1978	44	Hemlock	242	173	11.5	30%	Ground based
Heavy Thinning	38.0	309002	1963	59	Hemlock	332	374	14.4	30%	Skyline

Treatment	Unit GIS ACRES[1]	HCC Stand Number[2]	Year of Origin	Age 2022	Current Veg	Trees Per Acre (TPA)	Basal Area (BA)	Quadratic Mean Diameter (QMD)	Residual Canopy Cover (CC)	Harvest Method
Heavy Thinning	25.0	309003	1961	61	Sitka Spruce	226	297	15.5	30%	Skyline
Heavy Thinning	32.0	309004	1958	64	Sitka Spruce	276	354	15.3	30%	Skyline

[1] Total acres in this column will be higher than total treatment acres. Total treated acres will not exceed 236 acres.

[2] Historic Clear Cut numerical identifier

Table 5: Acres of NSO Critical Habitat and habitat type within immediate action footprint. Note that some acres overlap over two or more projects.

From Table 8 of BA.

Project Action*	NSO Critical Habitat	NSO Suitable	NSO Dispersal
Heavy Thinning	0	0	136
2-5 Acre Gap Creation	0	0	100
Mountain Bike Trail Construction	11.5	2.6	37.4
Parking Lot Construction	1.86	0	1.86
Skills Park Construction	3.25	0	3.25
Individual Tree Removal**	1130	447	587

*Recreational Use does not directly modify habitat and is not listed in this table. Effects from the Recreational Use are analyzed as disturbance/disruption and discussed in the NSO section below.

**Individual Tree Removal (ITR) is the largest area of analysis and overlaps with all Recreational Improvement Project actions listed above. ITR acreage totals are used to calculate total habitat effects as they relate to NSO habitat categories listed in Table 6. The 375 ft. potential ITR zone contains 1130 acres of CH in total, but of those acres, the NSO Index habitat model plots 256 acres as unsuitable (See Appendix A for explanation).

Table 6:Summary of effects to NSO and critical habitat from actions.
From Table 9 of the BA.

Habitat Effects Category	Heavy Thinning and Early Seral Project Acres Impacted		Recreational Improvements Project Acres Impacted*	
	NSO Habitat	Critical Habitat	NSO Habitat	Critical Habitat
Habitat Removal Nesting/Roosting	0	0	0	0
Habitat Removal Foraging	0	0	0	0
Habitat Removal Dispersal	236	0	1	1
Habitat Downgrade Nesting/Roosting to Dispersal	0	0	0	0
Habitat Downgrade Foraging to Dispersal	0	0	0	0
Habitat Maintained Nesting/Roosting	N/A	0	118	112
Habitat Maintained Foraging	N/A	0	329	312
Habitat Maintained Dispersal	0	0	586	449

*Individual Tree Removal is the largest area of analysis and overlaps with all Recreational Improvement Project actions listed above in Table 5. ITR acreage totals are used to calculate total habitat effects as they relate to NSO habitat categories listed in this table (Table 6).

Table 7: Acres of MAMU critical and suitable habitat within the project area with summary of effects from project actions.
From Table 10 in the BA.

Project Action*	MAMU Critical Habitat	MAMU Suitable	Effect Outcome to Critical Habitat	Effect Outcome to Suitable
Heavy Thinning	0	0	Not Present No Effect[1]	Not Present No Effect[1]
2-5 Acre Gap Creation	0	0	Not Present No Effect[1]	Not Present No Effect
Mountain Bike Trail Construction	8.7	6	Habitat Maintained	Habitat Maintained
Parking Lot Construction	.83	.83	Habitat Downgrade	Habitat Downgrade
Skills Park Construction	0	0	Not Present No Effect[1]	Not Present No Effect[1]
Individual Tree Removal**	837	625	Habitat Maintained	Habitat Maintained

[1]No effect determination made by the USFS.
*Recreational Use does not directly modify habitat and is not listed in this table. Effects from the Recreational Use are analyzed as disturbance/disruption and discussed in the MAMU section below.

2.4 Project Design Criteria (PDC)

All PDC are part of the proposed action, and their implementation is required. PDC serve as conservation measures in this Opinion. Definitions in section 2.4 and Project Categories in Section 2.2 are also required specifications in this Opinion, including to properly understand and implement PDC.

2.4.1 PDC - General PDC that Apply to All Activities Regardless of Location

The following is presented in the USFS description of PDC in the BA.

1. The SNF will incorporate all PDCs and conservation measures identified within this consultation, and any relevant aquatic and terrestrial conservation measures, into project environmental analyses, contract language, and implementation plans. All activities covered under this consultation must be designed and implemented consistent with the assumptions of this consultation as stated in the activity type descriptions and quantities, definitions, and all project design criteria.

2. Projects will be consistent with applicable standards and guidelines of the Siuslaw National Forest land management plans, as amended. All proposed activities should consider the analyses for the management of federally listed species contained in pertinent watershed analyses and late-successional reserve assessments, as amended.

3. A wildlife biologist shall participate in the planning and design of all projects affecting listed species.

4. The unit wildlife biologist is responsible for determining whether species surveys are required including consistency with “surveyed to protocol when necessary.

5. The unit wildlife biologist is responsible for all effects determinations and for ensuring a project is consistent with all aspects of this consultation. This responsibility includes consistency with project design, implementation, and monitoring requirements of this consultation.

6. **Annual Reporting** At the end of each calendar year, each administrative unit will complete a project implementation and monitoring report to show status of their individual projects under this consultation. This report will document whether individual projects are ongoing, completed, or dropped, and it will document reductions in actual impacts to critical, dispersal, and suitable habitat for NSO, and impacts to suitable MAMU habitat. This report will be forwarded to the Fish and Wildlife Service annually until all projects have been completed on the ground. Monitoring completes the regulatory requirements of the ESA by documenting the actual effects to the subject species.

7. Project monitoring will ensure that actual levels of effects do not exceed the levels anticipated by this consultation. If incidental take or adverse effects exceed the amounts described within the incidental take statement under the associated Biological Opinion, then the administrative unit shall cease such activities, inform the Interagency Level 1 Team, and initiate formal consultation with the FWS.

8. Review process for new information, modifications to the action, and/or new species listing/CH: This PDC describes the process that the agencies will use to assess whether reinitiation of consultation is triggered by new information, modifications to the action, and/or new species listings or critical habitat designated per 50 CFR 402.16(a)(2), (a)(3), or (a)(4). New information, project modifications, or new species listing, or critical habitat designation are not automatic reinitiation triggers in and of themselves. The agencies should assess the relevant event or information to determine if the manner or extent of effects to species or critical habitat were previously considered. For example, this review process would be used after disturbances such as a large wildfire in the action area, if the USFS seeks substantive changes to the proposed action, or if the Service lists a new species or designates new critical habitat and there is uncertainty whether the action may affect that newly listed species or newly designated critical habitat in a manner or to an extent not previously considered. This review does not include situations already addressed and considered in the PDCs where regular monitoring or other updates are incorporated.

   Consistent with streamlined consultation procedures and Level 1 Team and individual member roles:
   At any time, the SNF may submit a written request to the Level 1 Team to review new information, proposed project modifications, or new species listings/critical habitat to evaluate whether reinitiation of consultation on the proposed action is required. Requests will anticipate the amount of time required for review based on situation-specifics (estimated one to six months). The request should include the relevant information tailored to the specific situation, including relevant analyses in the BA and Opinion. The nature, amount and format of information needed will vary based on the situation, including any

necessary maps and details of the relevant ESA-listed species. The submitting agency should include its recommendation and rationale for whether reinitiation is required under the applicable trigger(s).

When review is requested, the Level 1 Team will provide an estimate of the time necessary to complete the review and any necessary additional information, staff or analysis needed, which will vary based on the complexity and urgency of the situation. The Level 1 Team will review the information and document its recommendation and rationale for whether reinitiation of consultation is required, and any modifications to the action that may prevent effects from occurring that were not already considered in the Opinion, or to avoid effects to newly listed species or newly designated critical habitat.

This documentation will be used to inform the Level 2 Team consistent with established processes. This documentation will include whether the Level 1 Team developed the recommendation with consensus, and whether further resolution or determination is requested or required from the Level 2 Team.

Consistent with streamlined consultation procedures and Level 2 Team roles:
The Level 2 Team will respond as appropriate to the Level 1 Team recommendation and rationale, including with any need to engage further with the Level 1 Team, or to recommend action to the Level 3 Team.

If reinitiation is required, the agencies will meet to determine the appropriate next steps, including a reinitiated consultation timetable and associated actions. Once consultation is reinitiated, the action agency is subject to the limits on its actions described in 50 CFR 402.09.

9. The SNF may propose a process to amend this consultation to correct deficiencies, address errata, and to provide flexibility to include additional similar actions or methods, without reinitiating consultation on the entire proposed action. Existing political, social, technological, scientific, or capacity constraints that currently exclude certain types of projects may change in a manner or degree that would allow their inclusion in this consultation at a future date. For example, a new activity type, design element or implementation method may need to proceed through several individual consultations before project design criteria are refined to the degree that they inform routine project design resulting in predictable well-known effects to ESA-listed species (including the potential for incidental take). Once project design becomes routine and effects determinations predictable, the SNF may propose changes to the project categories or PDC in this consultation. New methods, activities, or other program changes can be proposed for inclusion into this consultation via the Level 1 Team. The Level 1 Team shall present a consistency document to the Level 2 Team (the heads of the respective ranger districts in the planning provinces, and the Service Field Office). The Level 2 Team will then review the proposal and decide whether the change is appropriate for and consistent with this consultation. Further, the Level 2 Team can propose new projects, accompanied by a

consistency document, for inclusion into this consultation. The consistency document shall include the following information for the Service to consider:

a. Project type, description.
b. How any effects to ecological processes, modification of ESA-listed species' habitats and disruption to ESA-listed species would be addressed.
c. Project effects, including beneficial effects to ESA-listed species and/or their CH.
d. Consistency with NLAA and LAA effects analyzed in the consultation, including anticipated take of ESA-listed species.
e. Any new conservation measures and PDC necessary to implement the proposed project.
f. Minor corrections in the form of errata will be made to this consultation and the associated Letter of Concurrence as necessary. Errata, with written approval of the Service, will be provided to the ranger districts.

2.4.2 PDC – Spotted Owl and Marbled Murrelet for All Projects

The following is presented in the USFS description of PDC in the BA.

1. Project construction activities must occur outside of the applicable disruption distances for spotted owls and murrelets during the breeding season. See Tables 8 and 9 for the specific distances that pertain to activities during the breeding season (critical and late).
2. If activities would affect unsurveyed suitable murrelet habitat, occupied murrelet habitat, or murrelet nesting structure during the late breeding season (August 5-September 15), then they must begin at least two hours after sunrise and end at least two hours before sunset, with the exception of light maintenance and log hauling on established routes.
3. Trees with spotted owl nesting structure or murrelet nesting structure will not be cut or removed unless they pose a safety concern to humans or infrastructure. Any removal of such trees must be covered under an emergency consultation.
4. Within 300 feet of occupied murrelet habitat, unsurveyed suitable murrelet habitat, or murrelet nest structure, canopy cover must be maintained at >40%, no gaps will be created within one potential tree height of suitable habitat and any gaps created in the remaining area may not exceed ¼ acre (including construction of landings).
5. No construction of new permanent roads (as determined by the administrative unit's road classification process) in critical habitat of murrelets or spotted owls or suitable habitat of spotted owls.
6. No treatments may occur within the nest patch of any known spotted owl site or potential owl site.
7. No cutting of trees within the core of a known *active* spotted owl site.
8. No thinning may occur within the core area of an active owl site with a quantity of suitable habitat within the home range that is already below optimal levels (50% suitable habitat in the core area and 40 % suitable habitat in the provincial home range) if the activity could adversely affect spotted owls. It is up to the unit biologist to determine the quantity and quality of habitat.

9. Regeneration harvest of murrelet or northern spotted owl suitable or critical habitat is not addressed by this consultation.
10. To minimize the risk of attracting predators to activity areas, all garbage (especially food products) must be contained or removed weekly from the vicinity of any activity.

2.4.3 PDC – Heavy Thinning and Early Seral Habitat Creation Projects

The following is presented in the USFS description of PDC in the BA.

11. Canopy cover in heavy thinning units will be maintained at >30% and average canopy cover for the entire North Block AMA will be maintained at 40%. The calculation of canopy cover will take into account corridors, landings, roads and early seral habitat units and will be done at the scale of the harvest unit.
12. In gaps larger than 2 acres in size, residual trees will be selected to have the greatest resistance to windthrow possible. Douglas-fir is preferred, Sitka spruce or western red cedar may be used, if necessary, western hemlock will not be selected unless no other species is available. Residual trees will have height to diameter ratio below 75; 60 or less is preferred.
13. No more than 100 total acres of early-successional patches will be created.
14. Heavy thinning treatment and Early Successional treatments which create gaps larger than 1 acre or lower the canopy cover of the stand to <40% will not occur in suitable or critical habitat for spotted owls or marbled murrelets.
15. Heavy thinning treatment and Early Successional treatments which create gaps larger than 1 acre or lower the canopy cover of the stand to <40% will not occur in Late Successional Reserve or Adaptive Management Reserve land allocations. These treatments are planned to occur in areas of the project within the Adaptive Management Area land allocation.
16. Heavy thinning treatment and Early Successional treatments which create gaps larger than 1 acre or lower the canopy cover of the stand to <40% will occur outside of any known or predicted owl site.
17. Prescribed Burning - Minimize the loss of large woody debris by implementing prescribed burns during the spring or under “spring-like conditions”. Conditions are generally considered “spring-like” when the 1,000-hour fuels (> 3 inches in diameter) have fuel moistures of 25 percent or greater, soil and duff moistures are damp, limiting duff consumption. Mortality of overstory trees is expected to be low under these conditions.
18. Throughout the entire nesting seasons of spotted owls and marbled murrelets, burning shall be conducted at least 0.25 mile away from suitable nesting habitats to minimize adults, nestlings, or fledgling exposure to smoke.

2.4.4 PDC – Recreational Improvement Projects

The following is presented in the USFS description of PDC in the BA.

19. During trail construction, conifer trees greater than 10” dbh will not be cut without review and approval of the unit wildlife biologist and canopy cover must be maintained at ≥60% in

NSO nesting, roosting, and foraging habitat, and ≥40% in dispersal habitat. Overhead tree limb clearing will be limited to a height of no more than 10 ft.

20. Construction of facilities including restrooms and trash cans and placement of items designed to encourage loitering such as picnic tables or benches would occur outside of suitable habitat for owls and murrelets. Coordinate placement with the unit wildlife biologist.
21. Any trash receptables that are installed shall be emptied once a week to avoid trash accumulating outside of the container. Animal proof receptacles will be placed at the Gurtis Creek and Buzzard Butte parking areas.
22. Educational signage must be installed at trailheads, skills park, and parking areas to inform public about Leave No Trace principals and negative effects of trash litter to marbled murrelets and the environment.
23. All CXT restroom vent pipes must be covered with a screened mesh to prevent entry by birds.
24. Parking areas will be ≤ 1 acre in size, located in areas outside of spotted owl core areas, and sited in areas of existing disturbance such as wide road shoulders, existing landings or junctions between roads. Canopy cover will be maintained at ≥40%.
25. No overstory tree removal will occur as part of the skills park construction. This area is in a unit proposed for thinning, and all tree removal will follow the silvicultural prescription for this stand.

2.5 Definitions

2.5.1 General Definitions

The following is presented in the USFS definitions in the BA. See pages 3-5 of the BA.

For the purposes of this consultation, the following definitions are used, including those specific to assessing potential effects to the northern spotted owl and marbled murrelet (also referred to as spotted owl and murrelet).

Conservation Measures**:** Any required or recommended actions implemented to reduce effects to listed species, including those specified in species recovery plans, conservation agreements, or the NWFP. These actions include project design criteria, best management practices, management objectives, management direction, and standard implementation practices. These actions also include species-specific or project-specific measures developed by the Level 1 Team or a FS interdisciplinary team. Depending on their origin, conservation measures apply to a variety of plant and wildlife species, not just those listed under the ESA.

Recovery Objectives: Specific or generalized desired outcomes to benefit the habitat, environment and recovery of ESA-listed species, including those found in recovery plans and recovery actions. For example, the spotted owl recovery plan (USFWS 2011) describes recovery objectives (p. II-1) and their relationship to recovery criteria and recovery actions (p. I-4). Recovery objectives are applicable to any ESA-listed species.

Residual Tree: Live trees left within harvest units to provide a legacy of desirable habitat components for wildlife.

***Land Use Allocation*:** The identification in a land use plan of the activities and foreseeable development that are allowed, restricted, or excluded for all or part of the planning area, based on desired future conditions. Land use allocations on the Siuslaw NF are based on the NWFP and include adaptive management areas, adaptive management reserves, congressionally reserved areas, late-successional reserves, managed late-successional areas, matrix, and riparian reserves.

- Adaptive Management Areas (AMA) – Ten adaptive management areas are identified, each with an objective to develop and test new management approaches to integrate and achieve ecological and economic health, and other social objectives.
- Adaptive Management Reserves (AMR) – Late-Successional Reserve with an overlay of Adaptive Management Area.
- Administratively Withdrawn Areas (AWA) – Identified in current Forest and District Plans or draft plan preferred alternatives and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest.
- Congressionally Reserved Areas (CRA)– This includes Wilderness, Wild and Scenic Rivers, National Monuments as well as other federal lands administered by the Forest Service.
- Late-Successional Reserves (LSR)– Late-successional reserves are identified with an objective to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the Northern spotted owl. Limited stand management is permitted, subject to review by the regional ecosystem office.
- Matrix (Matrix)– Consists of those federal lands outside the six categories of designated areas listed here.
- Riparian Reserve (RR) – A key element of the aquatic conservation strategy, the Riparian reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species.

Canopy Cover: The measurement of canopy density used in this consultation. Canopy cover is the proportion of ground area (forest floor) directly covered by the vertical projection of the tree crowns (aerial view). For this consultation, canopy cover will be calculated at the scale of the contiguous area where trees are cut plus other new openings such as landings, decking/sorting areas, gaps, skips/retention areas and roads *created by the management activity within or adjacent to the contiguous area where trees are cut.* Canopy cover calculation also includes the harvested portion of other land use allocations only when they are within or adjacent to the contiguous area where trees are cut. Canopy cover calculation does not include existing roads, new roads and other openings not adjacent to the contiguous area where trees are cut, or untreated portions of other land allocations such as Riparian Reserves (regardless of their location). This method examines the area where treatment would modify species' habitats, including no-treat areas only when within the actual harvest footprint. Therefore, this method and spatial scale of calculating canopy cover, ensures accurate assessment of any effects to ESA-listed species' habitats due to management activities.

Stand: This consultation uses ecology and ESA-listed species habitat-based definitions to delineate stands of existing forest or forest-capable lands. This approach incorporates common ecology and silviculture concepts and facilitates spotted owl and murrelet habitat assessments. This approach also facilitates correct effect determinations for management that affects spotted owl and murrelet habitats. This type of stand delineation may not coincide with anthropogenic boundaries (e.g., roads or land-manager boundary) or NWFP land use allocations. A forest stand is a mostly or entirely contiguous aggregation of trees with similar characteristics such as: species, species associations, forest series, composition, structure and other unifying features such as the age cohort of dominant/codominant trees. This aggregation is sufficiently uniform to be distinguishable from adjacent stands. Under this consultation, forested-stands are typically classified based on common general forest types (e.g., hardwood dominated, conifer dominated, mixed hardwood-conifer), age, and corresponding attributes for spotted owl or murrelet habitat types. Typically, a stand-replacing disturbance (e.g., fire, windthrow, disease or harvest) or a major influence from site conditions (e.g., soil type or hydrology regime) defines the spatial extent of a stand and its resulting characteristics.

Surveyed to Protocol**:** This phrase pertains to conducting clearance surveys in accordance with a protocol that is officially supported by the USFWS, or an alternative method approved by the Level 1 or Level 2 Team. For species without approved survey protocols, in situations that require surveys before an action can proceed, the USFWS would be consulted to ensure that survey methods are appropriate.

- Spotted Owls: If an area is surveyed according to the 2012 protocol, or in the case of land that falls within Demography Study Areas, the Demography Area survey protocol, then it is considered "surveyed to protocol."
- Marbled Murrelets: If an area is surveyed according to the Pacific Seabird Group's (PSG) murrelet protocol (Evans Mack 2003), then it is considered "surveyed to protocol."

2.5.2 Spotted Owl Definitions

The following is presented in the USFS definitions in the BA.

Known Spotted Owl Site**:** An area known to be historically or currently occupied by a resident single or territorial pair of spotted owls as defined by the USFWS survey protocol. The specific site center location is determined by the unit wildlife biologist based on the best available information (see site center definition). A site may be determined to be inactive or unoccupied only in accordance with the current survey protocol or other USFWS-accepted protocols (e.g., demography area protocols). Known sites are sometimes also inconsistently referred to as "historic spotted owl sites," when surveys have not been conducted in the recent past.

Potential Spotted Owl Site**:** An area able to support resident spotted owls (i.e., a potential breeding pair), but spotted owls have not been detected and surveys have not been conducted to protocol.

Potential sites are derived from Recovery Action 10 (USFWS 2011) and used for determining effects to spotted owls when survey data are lacking or insufficient.

Spotted Owl Site (and Site Center): The spotted owl recovery plan (USFWS 2011) defines a site as "Any location where territorial spotted owls are known to be present, were historically present, or may be present in unsurveyed habitat." Site centers are based on one or more activity centers and are mapped and curated as point data. The concept of a site includes its site center plus its nest patch, core area and territory based on a resident single or territorial pair. A site may have multiple activity centers and territories associated with it. In large part, administrative data policy determines if and how site center, activity center, nest patch, core area, home range and territory locations are established, curated, mapped and attributed in databases. The key difference between a site center and annual activity centers, is that site centers are typically fixed for management purposes, whereas activity centers reflect annual activity locations. Both fixed and annual points are necessary for consultation and species management. Mapped (i.e., fixed) site center locations facilitate assessing effects of current management activities within a site territory, while also providing simplified tabular and spatial data to inform future management, including avoidance of current and potential future effects to site territories. Annual activity centers provide information to manage for recent/current spotted owl locations, including disruption. However, regardless of data curation practices, current and past spotted owl detection locations, activity centers, site centers (including alternates), and associated territories (regardless of whether or not mapped) should always be considered when managing for spotted owls and determining effects under ESA consultation (habitat modification and disturbance/disruption). Considering and incorporating this information constitutes application of best available science. Potential impacts should be analyzed for all territories associated with a given site, including consideration for all spotted owl detections, nest trees, and activity centers.

Spotted Owl Activity Center: An annual point location based on spotted owl behavior location(s) in the following priority: a nest location, juvenile or concentrated pair activity, or a single individual activity. Activity centers may vary annually. Territories are inferred from activity centers. Note: Non-territorial detection points may be important to defining activity centers, especially when considered over multiple years. See definition of site center for any differences compared to activity center.

Spotted Owl Nest Patch (or Stand)**:** The area encompassed by either a 300-meter radius circle or at least a 70-acre area delineated around the best contiguous spotted owl habitat (based on survey data or habitat analysis by the unit wildlife biologist) based on known spotted owl nest trees or an area where a spotted owl would be most likely to select a nest tree (generally on Federally administered land) for a known or potential owl activity center (USFWS 2011).

Spotted Owl Core Area**:** The area encompassed by either a 0.5-mile radius circle around a known or potential spotted owl site or at least a 500-acre area delineated around the best habitat (based on survey data or habitat analysis by the unit wildlife biologist) where a spotted owl would be most likely to nest, roost, forage and rear young in the territory of a known or potential site (USFWS 2011).

Spotted Owl Home Range (or Median Provincial Home Range)**:** An estimated area of habitat used by a spotted owl pair. For the Coast Range Physiographic Province, this estimated area conforms to a 1.5-mile radius circle around a known or potential spotted owl activity center (USFWS 2011). Home range is equivalent to territory for many applications. Home range contains a core area and a nest patch.

Spotted Owl Territory: An area, inferred from an activity center, which is or potentially could be occupied by a resident single or territorial pair of spotted owls (i.e., an area that facilitates a resident spotted owl single or pair). Each territory consists of one or more circular home ranges. Because telemetry data are often not available, habitat usage based on circles centered on the activity center, best available habitat information, and/or survey data are used to describe these three areas based on the definitions presented above. Over time, a resident single or territorial pair may have multiple activity centers, thus leading to multiple (i.e., alternate) territories associated with a given known site. Note: If protocol-level surveys or other pertinent information demonstrate that a resident single or breeding pair currently occupies one of several territories associated with a site, and an action may affect and is likely to adversely affect one of the other site's territories, then the action would still adversely affect the pair or single. Adverse effects to the functionality of an alternate territory of an occupied site typically are recognized as incidental take and require an incidental take statement from the USFWS because past survey data and the literature indicate spotted owls regularly move back and forth among territories over the course of their lifetimes. See description of home range for any difference compared to territory.

2.5.3 Spotted Owl Habitat Definitions

The following is presented in the USFS definitions in the BA. See pages 7-9 of the BA.

Spotted Owl Critical Habitat (CH)**:** The specific areas within the Federally designated CH for spotted owls that a) were occupied by the spotted owl at the time of listing, contain the physical or biological features essential to its conservation, and may need special management or protection; or b) were unoccupied at time of listing but are essential to the conservation of the species (USFWS 2012).

Spotted Owl Habitat**:** A general term that encompasses any spotted owl habitat types, including nesting-roosting, dispersal, and foraging habitats. It is important to recognize that nesting-roosting habitat also provides for spotted owl foraging and dispersal, and foraging habitat also provides for spotted owl dispersal.

Non-Forest and Non-Capable Forest Habitat**:** These are two categories of lands that are very unlikely to develop into forest habitat for owls. Current non-forest areas (e.g., parking lots, lakes, talus slopes) and/or areas unlikely to develop into forest capable of supporting spotted owl life history needs (e.g., areas with poor soil conditions). These land categories also do not provide for any PBFs of spotted owl CH.

Young Forest**:** Forest-capable areas with or without current young forest. These areas do not currently contain spotted owl dispersal, foraging, or nesting/roosting habitat, but they have the capability and likelihood of becoming this habitat. Although not currently usable habitat, these areas are key components of healthy forest ecosystems, and within the range of natural conditions seen before anthropogenic disturbance. When this stand type is found within CH, it provides for PBF 1. Conservation and recovery of the spotted owl is in part dependent on young forest-capable areas developing into suitable habitat to provide for population growth and combat natural disturbance regimes (e.g., fire, insects, disease) (USFWS 2012).

***Spotted Owl Dispersal Habitat*:** Habitat that supports the transience and colonization phases of spotted owl dispersal, which spotted owls can fly through. In this consultation, dispersal habitat is distinct from NR and foraging habitat for accounting purposes and provides for PBFs 1 and 4 when occurring in critical habitat (CH). Stands for dispersing are generally characterized as (USFWS 2012):

- Habitat supporting the transience phase of dispersal, which includes:
    - Stands with adequate tree size and canopy cover to provide protection from avian predators and minimal foraging opportunities; in general, this may include, but is not limited to, trees with at least 11 in dbh and a minimum 40 percent canopy cover; and
    - Younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, if such stands contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase.
- Habitat supporting the colonization phase of dispersal, which is:
    - Equivalent to nesting and roosting habitat with sufficient foraging opportunities (either in the nesting and roosting habitat and or with additional foraging habitat) but may be smaller in area than that needed to support nesting pairs.

Spotted Owl Dispersal-Capable Landscape: Lands presumed capable of supporting spotted owl movement based on habitat amount and arrangement thresholds modeled by Davis et al (2022).

Spotted Owl Dispersal-Limited Landscape: Lands presumed incapable of supporting owl movement based on habitat amount and arrangement thresholds modeled by Davis et al (2022).

***Spotted Owl Foraging Habitat*:** Habitat that provides for spotted owl foraging. This habitat varies greatly across the range of the species. In this consultation, spotted owl foraging habitat is considered to be distinct from Nesting-Roosting (NR) and Dispersal Habitat for accounting purposes, and provides for PBFs 1, 3, and 4 when occurring in critical habitat. Foraging habitat also provides for high quality dispersal opportunities and will be analyzed as such. Stands supporting foraging spotted owls in the West Cascades/Coast Ranges of Oregon are generally characterized as (USFWS 2011):

Stands of nesting and roosting habitat, younger forests with some structural characteristics (legacy features) of old forests, hardwood forest patches, and edges between old forest and hardwoods that exhibit (USFWS 2011):

- Moderate to high canopy cover (60 to over 80 percent).
- A diversity of tree diameters and heights.
- Increasing density of trees greater than or equal to 31 in diameter at breast height (dbh) increases foraging habitat quality (especially above 12 trees per ac).
- Increasing density of trees 20 to 31 in dbh increases foraging habitat quality (especially above 24 trees per ac).

- Increasing snag basal area, snag volume (the product of snag diameter, height, estimated top diameter, and including a taper function), and density of snags greater than 20 in dbh all contribute to increasing foraging habitat quality, especially above 4 snags per acre.
- Large accumulations of fallen trees and other woody debris on the ground; and
- Sufficient open space below the canopy for spotted owls to fly.

Spotted Owl Nesting and Roosting Habitat (NR)**:** USFWS (2012) states, **"**Nesting and roosting habitat provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks for adults and young. In many cases this habitat type also provides for foraging."

In this consultation, spotted owl nesting and roosting (NR) habitat is mutually exclusive of foraging habitat and dispersal habitat for accounting and reporting purposes. NR Habitat provides for spotted owl nesting, roosting, foraging, and dispersal. In CH, NR provides for PBFs 1-4. NR also provides for high quality foraging and dispersal opportunities and will be analyzed as such.

Stands for nesting and roosting are generally characterized by (USFWS 2012):

- Moderate to high canopy cover (60 to over 80 percent).
- Multilayered, multispecies canopies with large (20–30 in or greater dbh) overstory trees.
- High basal area (greater than 240 ft^2/ac).
- High diversity of different diameters of trees.
- 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 fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly.

Spotted Owl Suitable Habitat**:** A term that encompasses nesting-roosting habitat and foraging (NRF) habitat. Suitable habitat also provides for the highest quality dispersal opportunities and will be analyzed as such. Within CH, suitable habitat provides for Physical or Biological Features (PBFs) 1-4 (USFWS 2012).

Unsurveyed Spotted Owl Suitable Habitat: Areas containing spotted owl suitable habitat, and known or potential site nest patches, that were not **surveyed to protocol** (as defined in this consultation). In this consultation, unsurveyed spotted owl suitable and nest patch habitat is assumed to be occupied. All suitable or nest patch habitat that would be adversely affected due to habitat modification or disruption must be surveyed. The only exception to this is if the unit wildlife biologist determines that the unsurveyed suitable or nest patch habitat in the area occurs at such a low quantity and/or in such isolation that it would not provide habitat for nesting, roosting, or foraging spotted owls.

2.5.4 Marbled Murrelet Habitat Definitions

The following is presented in the USFS definitions in the BA. See pages 9-12 of the BA.

Marbled Murrelet Suitable Habitat**:** A general term for nesting habitat that encompasses both higher-quality and minimally suitable habitats.

***Marbled Murrelet Higher-quality Suitable Habitat*:** Marbled murrelet nesting habitat ranging in quality from structurally complex habitat (see definition below) to any portion of a 5-acre moving circle that contains at least 6 trees with murrelet **nesting structure.**

***Marbled Murrelet Minimally Suitable Habitat*:** Forested areas with a low density of murrelet nesting structure, usually in younger mid-seral forest stands (e.g., some 50–80-year-old stands). Specifically, any portion of a 5-acre moving circle of the analysis area that contains 1-5 trees with **nesting structure.**

> *Five acre moving circle:*
>
> A five-acre moving circle can be created in ArcGIS using a radius of 263.3 feet. Based on the specific need for this consultation or management, the circle is moved across lands to identify the presence and density of trees with murrelet nesting structure. The five-acre circle method is used solely to define whether murrelet suitable habitat is present and its type (i.e., minimally-suitable or higher-quality) based on the local density of trees with nesting structure (Appendix A).

***Murrelet Nesting Structure*:** A conifer tree with all the following characteristics or trees functioning together to provide the following characteristics (which are not always visible from the ground) (USFWS 1997):

- It occurs within 50 miles (81 km) of the coast;
- It is a conifer;
- It is ≥ 19.1 in. (49 cm) (dbh) in diameter and > 107 ft. (33 m) in height, although smaller trees have been documented in Alaska;
- It has ≥ one platform with the following characteristics
  - It is ≥ 4 in. (10 cm) wide;
  - It has nesting substrate (e.g., moss, epiphytes, duff);
  - It is in the live crown of the tree, either on the tree with nesting structure or on an adjacent tree;
  - It is located ≥ 32.5 ft. (9.9 m) above the ground;
- It has an access route through the canopy that a murrelet could use to approach and land on the platform. As access should be viewed from above the canopy and we are assessing habitat from below the canopy, this aspect of nesting habitat may not always be visible. Nelson and Wilson (2002) suggest canopy layering, canopy gaps, and natural (streams, gaps) or man-made edges as measures of access.

Note: Trees do not have to be occupied by nesting marbled murrelets to qualify as nesting structure. The averages presented above are based on data presented in the Murrelet Recovery Plan that were collected at murrelet nests in Oregon (USFWS 1997). Any tree that does not meet all these characteristics is unlikely to support nesting murrelets. However, not all these characteristics are visible from the ground in all situations. Therefore, the unit wildlife biologist shall make site-specific determinations on the presence of murrelet nesting structures.

Marbled Murrelet Occupied Habitat: Also referred to as **occupied habitat.** Suitable habitat that is delineated, mapped, and protected based on **occupancy** as defined in the current survey protocol (or other methods or behavior approved by the Level 1 Team). Occupied habitat is used to establish an **occupied site** under the NWFP. Areas surveyed to protocol and not found to be occupied by murrelets are considered unoccupied. As used in this consultation, the term unoccupied is equivalent to the definition of ‘’probable absence” as defined in Evans Mack et al. (2003).

Marbled Murrelet Unsurveyed Suitable Habitat: Also referred to as **unsurveyed habitat.** In this consultation, areas containing murrelet suitable habitat that were not **surveyed to protocol** as defined in this consultation (i.e., currently Evans Mack, Diane, et al. 2003, or other methods approved by the Level 1 Team). The current survey protocol determination of unoccupied is valid for 5 years after surveys are completed. After 5 consecutive years without surveys, the status of unoccupied reverts back to unsurveyed habitat. For this consultation, unsurveyed suitable habitat is assumed to be **occupied habitat** for murrelets, except when the project is consistent with Option 3 of the Level 2 policy and located 20 miles or greater from the coast (Appendix B). Option 3 is rarely available in the Siuslaw NF due to harvest history or occurring adjacent to higher quality suitable habitat.

***Occupied Site*:** The area protected as defined under the NWFP when marbled murrelet occupancy has been established**.** Occupancy is established as defined in the PSG survey protocol (Evans Mack et al. 2003) or other methods or behaviors approved by the Level 1 Team. <u>Note</u>: A NWFP occupied site definition should not be confused with the PSG occupied site definition which uses a different spatial delineation method: potential habitat within the proposed project area and within a contiguous 0.25 mile of the project area boundary (Evans Mack et al. 2003).

<u>Spatial Delineation Methods for Occupied Habitat in the NWFP:</u>

“All contiguous existing and recruitment habitat for marbled murrelets (i.e., stands that are capable of becoming marbled murrelet habitat within 25 years) within a 0.5-mile radius will be protected. The 0.5-mile radius circle should be centered on either the behavior indicating occupation, or within 0.5 miles of the location of the behavior, whichever maximizes interior old-growth habitat.”. <u>Note</u>: In this context, “protected” indicates that management activities would not adversely affect the occupied site due to habitat modification or disruption. Additionally, if the lands are not LSR then the land use allocation is redesignated to LSR.

<u>Occupancy:</u>

The current PSG survey protocol determination of occupancy is as follows:

“An **occupied site** is a site where at least one of the following subcanopy behaviors or conditions occurs:

discovery of an active nest, a recent nest as evidenced by a fecal ring or eggshell fragments on structures in the forest canopy, or an old nest cup and landing pad;

discovery of a downy chick, an egg, or eggshell fragments on the forest floor;

birds flying below, through, into, or out of the forest canopy within or adjacent to a site of potential habitat. This includes birds flying over or along roads, young stands, or recently-harvested areas adjacent to potential habitat. However, only the adjacent site of potential habitat, not the non-habitat, should be classified as occupied. If birds are observed along a road where there is more than one site that the birds could be using, additional surveys may be required in some cases to determine which is occupied, if these sites are not part of the same survey area. Some subcanopy flights, such as low-flying birds observed in steep canyons or crossing ridge lines in non-habitat areas, are not associated with the site of interest and should not be considered occupied behaviors. Questions about flight behavior and occupancy should be directed to your regulatory agency for resolution.

birds perching, landing, or attempting to land on branches;

birds calling from a stationary location within the site. A detection should be considered 'stationary' when three or more calls are heard at less than 100 m (328 feet) from the observer, and the position of the bird does not appear to change. Detection of stationary calling is rare in most regions" (Evans Mack et al. 2003).

Note: Depending on the specific situation, other behaviors may also be used to indicate occupancy, such as: circling near the canopy, sub-canopy dives, wingbeats, "jet sounds", or sub-canopy vocalizations as described in Evans Mack et al. (2003) and/or as approved by the Level 1 Team.

***Marbled Murrelet Buffer Habitat*:** The 300 feet of forest adjacent to murrelet suitable habitat (including individual trees with **nesting structure**), regardless of age or structure, including **young forest**. For this consultation, all buffer habitat that occurs within murrelet CH is also considered part of PBF 2 (i.e., forested lands of a height equal to at least one-half site potential tree height, regardless of contiguity, within 0.5 miles of individual trees with potential murrelet nesting platforms). In this consultation, Buffer habitat includes young forest (regardless of current forest age, but not including suitable habitat) for the purposes of effects analysis. Areas not capable of growing forest are not considered buffer habitat. To prevent double counting, young forest within buffer habitat will only be classified and analyzed as buffer habitat. Young forest not within buffer habitat will only be classified and analyzed as young forest.

***Young Forest (in the range of the murrelet)*:** Forest-capable lands that currently do not provide any type of murrelet **suitable habitat**. In this consultation, young forest within 300 feet of suitable habitat constitutes as **buffer habitat** with respect to effects analysis (regardless of current forest age, but not including suitable habitat). Young forest includes both current forest and current non-forest lands <u>when forest-capable,</u> because the presence of young forest is likely forthcoming due to natural regeneration or planting. Young forest in murrelet CH and within 0.5 mile of suitable habitat, supports PBF 2 for the purposes of effects analysis. Areas non-capable of growing forest are not considered young forest. To prevent double counting, young forest within buffer habitat will only be classified and analyzed as buffer habitat. Young forest not within buffer habitat will only be classified and analyzed as young forest.

2.5.5 Spotted Owl and Marbled Murrelet Habitat Alteration Definitions

The following is presented in the USFS definitions in the BA. See pages 12-15 of the BA.

This section references habitat definitions discussed previously in this consultation. Refer to those definitions when necessary to interpret and implement the habitat alteration definitions below.

Habitat Downgraded**:** Land management activities that convert spotted owl nesting/roosting habitat to foraging or dispersal habitat or convert foraging habitat to dispersal habitat. In the context of this definition, murrelet habitat can never be downgraded: post-treatment stands that presently function as murrelet habitat either continue to support their original nesting/roosting function (i.e., murrelet habitat is maintained) or they do not (i.e., murrelet habitat is removed).

Habitat Functionality**:** The function that a particular stand serves in relation to providing habitat for an ESA-listed species. For example, a finding that "Pre-treatment habitat functionality of spotted owl nesting/roosting habitat would be maintained after treatment," means that affected stands that served as nesting/roosting habitat before treatment would continue to serve as nesting/roosting habitat after treatment, even though habitat quality may be diminished. In this consultation, any statement that habitat functionality *would not* be maintained after treatment indicates the activity would remove habitat outright or downgrade it to a different lesser habitat type immediately after treatment. See further discussion under Project Categories and habitat type definitions in this consultation, for distinctions between habitat being maintained versus downgraded or removed.

Habitat Maintained**:** Land management activities that alter ESA-listed species habitat, but maintain the pre-treatment habitat type and functionality. At least the minimal elements of pre-treatment habitat are maintained, and the affected stand will continue to support the life history requirements of the associated ESA-listed species.

- To **maintain spotted owl dispersal habitat** means that a canopy cover of at least 40 percent, and other habitat elements (e.g., snags, down wood, a multi-layered canopy, and older hardwoods), are maintained after treatment to adequately provide for spotted owl dispersal. For additional information, see the definition of **Spotted Owl Dispersal Habitat** in the Spotted Owl Habitat Definitions section of this consultation.
- To **maintain suitable habitat for spotted owls** means that a canopy cover of at least 60 percent, <u>and</u> other habitat elements (e.g., snags, down wood, large overstory trees, tree-height class-diversity, and older hardwoods), are maintained after treatment to adequately provide for spotted owl nesting, roosting, and foraging within the stand. <u>Note</u>: maintenance of a at least 60 percent canopy cover alone is not adequate to maintain suitable habitat. Sufficient amounts and combinations of the aforementioned habitat elements must also be present. For additional information, see the definition of **Spotted Owl Suitable Habitat** in the Spotted Owl Habitat Definitions section of this consultation.

The direction to "maintain" habitat elements references the presence of those elements already existing in a stand before treatment. It does not indicate those elements must be created by the management activity. Silvicultural prescriptions should account for any potential variance in actual versus modeled canopy closure after treatment to ensure specifications in this consultation are implemented. For example, prescriptions should aim for 45% canopy cover when maintaining 40% canopy cover. The administrative unit wildlife biologist is responsible for ensuring that proposed silvicultural activities in this category will maintain the characteristics of spotted owl suitable habitat in affected stands. In addition, the administrative unit wildlife biologist is responsible for assessing the juxtaposition of the affected suitable habitat within the surrounding forest landscape to ensure that any other effects to spotted owls are determined and documented (i.e., forest management surrounding suitable habitat can affect its function). Available scientific literature indicates that forest stands can be altered in a manner that does not necessarily change the habitat function in support of spotted owl life history requirements (Thrailkill 2006). Examples of silvicultural activities that may fall into this category are light to moderate thinning, salvage, individual tree removal, and prescribed burning.

To **maintain suitable habitat for murrelets** means that management will maintain the ability of treated stands to support nesting, including no removal of known nest trees or trees with **nesting structure.** For example, after management treatment, higher-quality suitable murrelet habitat will be maintained if the stand will continue to contain the following: numerous potential nesting structures in large blocks of forest that contain multi-layered and multi-species canopies, numerous large trees, and moderate to high total canopy cover. Another example, minimally suitable habitat in a dense conifer plantation will be maintained in accordance with Option 3 as described in the Level 2 policy of October 13, 2011 (Appendix B).

- To **maintain buffer habitat for murrelets** means that management will maintain buffer habitat conditions, including a canopy cover of at least 40% with any created gaps less than or equal to 0.25 acres. Management will minimize environmental changes within adjacent murrelet suitable habitat; prevent loss of habitat from wind throw; not overly fragment habitat; not increase the amount of interior forest habitat; and potentially help reduce predation events at murrelet nests.

Habitat Removed**:** Land management activities that alter spotted owl dispersal or suitable habitat, or murrelet buffer or suitable habitat, to an extent that pre-treatment habitat functionality is not retained or downgraded. For example, murrelet nesting habitat that no longer provides for nesting, or spotted owl dispersal habitat that no longer provides for dispersal.

Impair Functionality of a Spotted Owl Territory**:** An adverse effect that occurs when a land management activity causes or results in any of the following[2]:

- adversely affects a nest patch, as determined by the unit wildlife biologist.
- reduces the acreage of suitable habitat in the home range below approximately 40%[3];
- reduces the acreage of suitable habitat in the core use area below approximately 50%;
- causes further reduction of suitable habitat below 40% in the home range of a territory which already has less than 40% of its acreage in suitable habitat.
- causes further reduction of suitable habitat below 50% in the core use area of a territory which already has less than 50% of its acreage in suitable habitat.

In cases where suitable habitat is already below recommended levels (i.e., below 40% in the home range and/or 50% in the core area) removal of younger dispersal stands that are providing some foraging opportunities (which may be considered "foraging habitat" under this consultation; see definition of "foraging habitat" above) may impair the functionality of a territory. It is assumed that this outcome occurs when a land management activity:

- causes a home range to have less than 40% of its acreage in spotted owl habitat, including both suitable and dispersal habitat.
- causes a core use area to have less than 50% of its acreage in spotted owl habitat, including both suitable and dispersal habitat.
- causes further reduction of total spotted owl habitat (i.e., the sum total of both suitable and dispersal habitat) below 40% in the home range of a territory which already has less than 40% total spotted owl habitat.
- causes further reduction of total spotted owl habitat (i.e., the sum total of both suitable and dispersal habitat) below 50% in the core use area of a territory which already has less than 50% total spotted owl habitat.

Other considerations:

Before a management activity is implemented, if the unit wildlife biologist determines with reasonably certainty that a spotted owl territory that will be affected by an activity under this consultation is no longer capable of supporting a resident single or territorial pair of spotted owls (e.g., due to substantial habitat removal on adjacent private lands), then the biologist may provide supporting evidence and rationale of that determination to the Level 1 Team. If the Level 1 Team concurs, such territories would be no longer considered viable for purposes of characterizing the environmental baseline for the spotted owl in that portion of the action area.

With implementation of the proposed action considered herein, certain cases may arise where the functionality of a spotted owl territory would not be impaired, but the effects of a proposed land management action may meet the above criteria. Such actions may sometimes be covered under a consistency review process (see PDC). For example, a consistency review might apply for a project where an affected territory has less than 50% of the core area and/or less than 40% of the home range in suitable habitat, but any removal or downgrade of suitable habitat would occur in a relatively small amount on the periphery of the home range.

The project wildlife biologist may identify a non-circular nest patch or core use area for a spotted owl site. This should contain at least 70 acres and 503 acres of suitable habitat (i.e., the same area as the 300-meter circular nest patch and 0.5-mile circular core area). Documentation of this change will be recorded in the project file in the Forest Service corporate database. If additional support is needed for this process, the local unit biologist will discuss this with the Forest Biologist.

2.5.6 Disturbance and Disruption Distances for Spotted Owl and Marbled Murrelet

The following is presented in the USFS definitions in the BA. See pages 15-18 of the BA.

Disturbance versus disruption to ESA-listed species:

Disturbance results when a management activity causes a listed species to be distracted from its normal behavior without altering key behaviors or being subject to injury or harm.

Disruption results when a management activity causes a listed species to be distracted to the extent that normal behavior is significantly altered or precluded, and an individual is subject to injury or harm. These key behavior alterations from disruption include those that modify or preclude breeding or rearing of young or those that subject young to harm or injury (e.g., predation). Examples of disruption effects to breeding owls or young include discouraging adults from establishing a nest, nest abandonment, egg mortality due to exposure, increased chance of predation of eggs and hatchlings, interruption of egg incubation, depressed feeding rates of females or young, predation of fledglings, and any physiological effects to hatchlings and fledglings that result in injury or death (e.g., exhaustion and heat or cold exposure). This consultation primarily discusses noise, line-of-sight, or smoke activities that can cause disturbance or disruption. Habitat modification can also directly or indirectly disturb or disrupt species as an individual moves in attempt to avoid habitat loss and any associated disruption or disturbance (e.g., harvest causing spotted owl young to prematurely attempt to move away from a nest patch or core area, especially when accessible nearby habitat is not available).

> <u>Murrelet:</u> In the critical breeding season (April 1-September 15), disturbance and disruption distances are measured from nesting structure. The unit wildlife biologist must assess potential disturbance/disruption associated with activities near suitable murrelet habitat. Within sites, distances for murrelets are measured from the edge of occupied or unsurveyed suitable habitat (Table 8).
>
> <u>Spotted owls</u>: In the early critical breeding season (March 1-July 7), disturbance and disruption distances are measured from the nest tree (if location known) or the edge of a nest patch (if nest tree location unknown). Once the young have fledged, typically in the latter part of the breeding season (i.e., July 8 to September 30), disturbance and disruption distances are measured from the known or presumed location of young at time of disruption. If the location of young is not known, disturbance/disruption distances are measured from the edge of the nest patch. In the latest parts of the breeding season, spotted owl young have been observed moving beyond the generic radius distance of the nest patch radius (300 meters).

Breeding Period: The breeding period for spotted owls is March 1 through September 30 in the Coast Ranges. The critical breeding period is March 1 through July 7 (Table 9).

Disturbance Distance**:** The distance from the activity boundary (or disturbance event) likely to cause a spotted owl or marbled murrelet, if present, to be distracted from its normal behavior. Except as stated in Table 8, the disturbance distance is 0.25 miles from nesting spotted owls or murrelets during the breeding period.

Disruption Distance**:** The distance from the activity boundary (or disruption even) outward within which the action is likely to adversely affect a spotted owl or marbled murrelet and cause them, if present, to be distracted to such an extent as to disrupt its normal behavior and create the likelihood of injury 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 8, during the dates shown in Table 9, may disrupt the normal behavior patterns of spotted owls or murrelets if the species were present. A combination of concurrent or prolonged activities may affect spotted owls in a manner different to or beyond those described for individual activities (e.g., multiple concurrent long duration disturbing activities may collectively result in disruption). If a spotted owl site or murrelet habitat is surveyed to protocol (USFWS 2012b and Evans Mack et al. 2003, or other method approved by the Level 1 Team) and a species is determined to be non-nesting, then the unit wildlife biologist may decide that seasonal restrictions can be modified or waived in a manner that would not result in disturbance or disruption *during the year of survey*. If pre-project surveys are not conducted to protocol, then the site or habitat is assumed to be occupied.

It is the Opinion of the Level 1 Team that chain saw and heavy equipment noise activities that occur for a duration of less than one day are not likely to cause a reduction in breeding success (due to the short duration) and therefore would not be a disrupting activity causing adverse effects (assuming no additional disturbance activities are simultaneously occurring). However, daily timing restrictions for murrelets would still apply to ensure disruption does not occur.

Adverse behavior alterations from disruption include those that modify or preclude breeding or rearing of young or those that subject young to harm or injury (e.g., predation). Examples of disruption effects to breeding owls or young include: discouraging adults from establishing a nest, nest abandonment, egg mortality due to exposure, increased chance of predation of eggs and hatchlings, interruption of egg incubation, depressed feeding rates of females or young, predation of fledglings, and any physiological effects to hatchlings and fledglings that result in injury or death (e.g., exhaustion and heat or cold exposure).

This biological assessment primarily discusses noise, line-of-sight, or smoke activities that can cause disturbance or disruption. Habitat modification can also directly or indirectly disturb or disrupt species when an individual moves in attempt to avoid habitat loss and any associated disruption or disturbance. This can result in adverse effects if the individual does not have available habitat to move to (e.g., young of the year attempting to move away from a disturbance, but incapable of flying to nearby habitat).

- *The unit wildlife biologist is responsible for ensuring that the correct disturbance/disruption distance is applied and the correct effects determination made for each project and all of its component activities. Often these decisions involve more consideration and additional measures beyond the simplified general direction in Tables 8 and 9.*

A combination of concurrent or prolonged activities may affect spotted owls in a manner different to or beyond those described for individual activities (e.g., multiple concurrent long- duration disturbance activities may collectively result in disruption). Other situation-specific factors such as topography, habitat conditions, or forest vegetation can also influence the distance at which an activity can disturb/disrupt spotted owls or murrelets. For example, topography may dilute or enhance the effects of noise or line-of-sight disturbances.

- *The unit biologist should examine the amount, intensity, duration, frequency, timing and combination of all activities to determine whether spotted owl and marbled murrelet would be disturbed or disrupted and at what distances and time. Biologists should also consider barred* *owl competition and, if relevant, an individual spotted owl's or murrelet's ability to evade disturbance by moving to another habitat stand.*

When relevant, the project-specific need and capability of an adult or juvenile spotted owl to safely avoid or escape disturbance/disruption should also be examined based on the availability and accessibility of nearby habitat, and other situation-specific factors (e.g., whether young have access to habitat to use to avoid a disturbance in the later part of the breeding season). The unit wildlife biologist may increase or decrease disturbance or disruption distances according to the best available survey data, scientific information and consideration of site-specific conditions, such as the topography and considerations for the timing, duration, frequency and magnitude of all disturbance activities.

If a spotted owl site or murrelet habitat is Surveyed to Protocol (USFWS 2012 and Evans Mack 2003 respectively, or other methods or behaviors approved by the Level 1 Team) and a species is determined to be non-nesting, then the unit wildlife biologist may decide that seasonal restrictions can be modified or waived in a manner that would not result in disturbance or disruption *during the year of survey*. If pre-project surveys are not conducted to protocol, then the site or suitable habitat is assumed to be occupied and managed as such with respect to implementing this consultation.

<u>Disturbance/Disruption Less Than One Day in Duration:</u>

The opinion of the Level 1 Team is that smaller amounts of chain saw and heavy equipment noise activities that occur for a duration of less than one day, in a single location not near a known or potential nest tree, are not likely to cause a reduction in breeding success (due to the short duration and spatial extent) and therefore, would not be a disrupting activity (assuming no additional disturbance activities are simultaneously occurring). *This is a generalized determination that may not apply in some situations* (e.g., heavy equipment in the immediate vicinity of a spotted owl nest tree, on single or multiple days in the early breeding season). However, daily timing restrictions for murrelets would still apply to ensure disruption does not occur.

Table 8: Disturbance and Disruption Activities and Distances for Spotted Owls and Murrelets.

Disturbance Source	Disturbance Distance During the Entire Breeding Season	Disruption Distance During the Critical Breeding Season	Disruption Distance During the Late Breeding Season*
Light maintenance of roads, campgrounds, and administrative facilities	0.25 mile	No restrictions; NA[1]	No restrictions; NA
Log hauling on open roads	0.25 mile	No restrictions; NA[2]	No restrictions; NA
Chainsaws (includes felling hazard/danger trees), Drones	0.25 mile	65 yards (spotted owls), 110 yards (murrelets)[2]	No distance restrictions, but time-of-day restrictions required for murrelets*
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	0.25 mile	65 yards (spotted owls), 110 yards (murrelets)[2]	No distance restrictions, but time-of-day restrictions required for murrelets*
Pile-driving (steel H piles, pipe piles), rock crushing, and screening equipment	0.25 mile	120 yards[3]	No distance restrictions, but time-of-day restrictions required for murrelets*

Blasting	1 mile	0.25 mile3	100 yards (spotted owls)[4], 0.25-mile (murrelets)[3]
**Helicopter: Chinook 47d (described as a large helicopter in the rest of this document)	0.5 mile	265 yards[5]	100 yards (hovering only)[6]
**Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	0.25 mile	150 yards[7]	50 yards (hovering only)[6]
**Helicopters: K-MAX, Bell 206 L4, Hughes 500	0.25 mile	110 yards8	50 yards (hovering only)[6]
**Small fixed-wing aircraft (Cessna 185, etc.)	0.25 mile	110 yards	No distance restrictions, but time-of-day restrictions required for murrelets*
Tree Climbing	25 yards (spotted owls), 110 yards (murrelets)	25 yards (spotted owls), 110 yards (murrelets)[9]	No distance restrictions, but time-of-day restrictions required for murrelets*
Burning (prescribed fires, pile burning)	0.25 mile (spotted owls), 1 mile (murrelets)	0.25 mile[10]	No distance restrictions, but time-of-day restrictions required for murrelets*
Drone Use	0.25 mile	65 yards (spotted owls), 110 yards (murrelets)	N/A (spotted owls, as long as spotted owls are not pursued), 110 yards (murrelets)
Other activities	35 yards (spotted owls), 100 yards (murrelets)	35 yards (spotted owls), 100 yards (murrelets)	35 yards (spotted owls), 100 yards (murrelets)

*Daily timing restrictions: If activities would affect unsurveyed suitable murrelet habitat or occupied murrelet habitat during the late breeding season, then they must begin at least two hours after sunrise and end at least two hours before sunset, with the exception of light maintenance and log hauling on established routes. Otherwise, activities must occur outside the disruption distances that apply during the critical breeding season.

**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 spotted owls or murrelets would be occupying plus the 50 yards disruption distance.

It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply).

1 NA = not applicable. Based on information presented in Tempel and Gutiérrez (2003, p. 700), Delaney et al. (1999, p. 69), and Kerns and Allwardt (1992, p. 9), we anticipate that the few 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. We anticipate that the few marbled 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 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. 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 2012b, 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 substantial behavioral responses (e.g., flushing) from exposure to continuous sounds from impact pile driving.

4 Exposure to peak sound levels that are >140 dBA is 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 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. 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. 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.

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 (USDA USFS 2008, chapters 5, 6).

8 Based on Delaney et al. (1999, p. 74), which concluded that a buffer of 105 m (115yards) for helicopter overflights would eliminate flush responses from military helicopter overflights. The estimated 92 dBA sound contours for these helicopters are less than 110 yards (e.g., K-MAX (100 feet) (USDA USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m) (Grubb et al. 2010, p. 1277).

9 Distance for spotted owls is 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 meters. Distance for murrelets is 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 2011b, pp. 6-9).

10 Based on recommendations presented in Smoke Effects to Northern Spotted Owls (USFWS 2008, p. 4). The disruption distance for prescribed burning during the critical breeding period is based on concerns with dense, persistent smoke occurring at a site where spotted owls are nesting. Many factors influence how much smoke is produced and how far and in which direction it will travel when burning.

The following hypothetical situation provides an example of how to use: Pile-driving is being used adjacent to a spotted owl known site during the critical breeding period, less than 120 yards from the site. In this scenario (within the disruption distance), spotted owls could be disrupted to the point of likely adversely affecting the owls or their young. However, if the pile-driving were being used further than 120 yards away from the known site during the same time period (within the 0.25-mile disturbance distance, but beyond the 120-yard disruption distance), this activity would only slightly disturb owls, not disrupt their normal behavior and would Therefore, not be likely to adversely affect the owls. See disruption related PDC for more relevant information.

Table 9: Breeding Periods for Northern Spotted Owl and Marbled Murrelet in the northern Oregon Coast Range.
From Table 2 of the BA

Species	Entire Breeding Season	Critical Breeding Season	Late Breeding Season
Spotted owl (nesting)	March 1 – September 30	March 1 – July 7	July 8 to Sep. 30
Murrelet (nesting)	April 1 – September 15	April 1 – August 5	August 6 to Sep. 15

3 Analytical Framework for Jeopardy and Adverse Modification

3.1 Jeopardy Determination

In accordance with our regulations (see 50 CFR 402.02, 402.14(g)), the jeopardy determination in this Biological Opinion relies on the following four components:

1. *The Status of the Species* evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population retains sufficient abundance, distribution, and diversity to persist and retains the potential for recovery (see Endangered Species Consultation Handbook, March 1998, pp. 4-19 to 4-22).

2. *The Environmental Baseline* section of this biological Opinion evaluates the past and current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the effects of the proposed action; including the anticipated condition of the species contemporaneous to the term of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species.

3. *The Effects of the Action* section of this biological Opinion evaluates all consequences to the species that are reasonably certain to be caused by the proposed action (i.e., the consequences would not occur but for the proposed action and are reasonably certain to occur) and how those consequences are likely to influence the survival and recovery of the species.

4. *The Cumulative Effects* section of this biological Opinion evaluates the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation, on the species and its habitat, and how those effects are likely to influence the survival and recovery of the species.

In accordance with policy and regulation, the jeopardy determination is made by formulating the Service's Opinion as to whether the proposed Federal action, including its consequences, taken together with the status of the species, environmental baseline, and cumulative effects, reasonably would be expected to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution of that species.

NOTE: If recovery units were defined in the final published recovery plan for the species for use in completing jeopardy analyses, pursuant to Service policy (Section 7 Handbook, USDI 1998, p. 4-36) when an action appreciably impairs or precludes the capability of such a recovery unit of providing both the ongoing survival and recovery function assigned to it, that action may represent jeopardy to the species. Thus, if recovery units were defined in the final published recovery plan for the species for use in completing the jeopardy analysis, the Biological Opinion will include a description of how the action affects not only the recovery unit's capability, but also the relationship of the recovery unit to both the survival and recovery of the listed species as well.

3.2 Destruction or Adverse Modification of Critical Habitat

A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) of critical habitat was published on August 27, 2019 (84 FR 44976). The final rule became effective on October 28, 2019. The revised definition states:

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species."

In accordance with regulations and regional implementing guidance, the destruction or adverse modification (DAM) determination in this Biological Opinion relies on the following four components:

1. The *Status of Critical Habitat* section evaluates the range-wide condition of the critical habitat (CH) in terms of essential habitat features, primary constituent elements, or physical and biological features that provide for the conservation of the listed species; the factors responsible for that condition; and the intended value of the CH for the conservation of the listed species (see Endangered Species Consultation Handbook, March 1998, pp. 4-19 to 4-22).

2. The *Environmental Baseline* section of this biological Opinion evaluates the past and current condition of the CH in the action area absent the effects of the proposed action; including the anticipated condition of the species and its CH contemporaneous to the term of the proposed action; the factors responsible for that condition; and the conservation value of CH in the action area for the conservation of the listed species.

3. The *Effects of the Action* section of this biological Opinion evaluates all consequences to CH that are reasonably certain to be caused by the proposed action (i.e., the consequences would not occur but for the proposed action and are reasonably certain to occur) and how those consequences are likely to influence the conservation value of the affected CH for the species in the action area.

4. *Cumulative Effects* section of this biological Opinion evaluates the effects to CH of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation, and how those effects are likely to influence the conservation value of the affected CH for the species in the action area.

In accordance with regulation, the DAM determination is made by formulating the Service's Opinion as to whether the effects of the proposed Federal action, taken together with the status of the critical habitat, environmental baseline, and cumulative effects, reasonably would be expected to result in a direct or indirect alteration that appreciably diminishes the value of CH for the conservation of the species.

For purposes of making the DAM determination, the Service evaluates if the consequences of the proposed Federal action on critical habitat, taken together with cumulative effects, when added to the current range-wide condition of critical habitat, are likely to impair or preclude the capacity of critical habitat as a whole to serve its intended function for the conservation of the listed species. The key to making this finding is clearly establishing the role of critical habitat in the action area relative to the value of critical habitat as a whole, and how the effects of the proposed action, taken together with cumulative effects, are likely to alter that role.

Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical or 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 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. However, the shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features. For those reasons, in this Biological Opinion, references to PCEs or essential features should be viewed as synonymous with PBFs. All of these terms characterize the key components of critical habitat that provide for the conservation of the listed species.

4 Status of Spotted Owl

Also see Appendix D, Status of the Species for Northern Spotted Owl and its Critical Habitat. Also see spotted owl habitat definitions in BA Section 2.5.2, 2.5.3 and 2.5.5 of this Opinion.

4.1 Status and Habitat Background

The Service conducted an extensive analysis of spotted owl status in preparing the final revised recovery plan (USFWS 2011). The spotted owl was listed as a threatened species in 1990 due to the widespread loss of suitable habitat across its range, and the inadequacy of existing regulatory mechanisms to conserve the species (55 FR 26114 [June 26, 1990]: USFWS 1990). Although loss of habitat due to timber harvest on Federal lands has been greatly reduced for the past two decades under the Northwest Forest Plan, the legacy effects of past and current habitat loss continue to threaten spotted owl populations throughout its range because regrowth of suitable habitat requires many decades (USFWS 2011, pp. vi, I-7). In the interim, many local populations of the spotted owl continue to decline, especially in the northern parts of its range where populations have declined by as much as 80 percent since 1990. This decline is due to these legacy effects and to the ongoing range expansion and increasing competition from the non-native barred owl. Collectively, these factors represent a significant threat to the continued existence of the spotted owl (USFWS 2011, p. I-7). The conservation needs of the spotted owl continue to include reversing the destruction, degradation and fragmentation of nesting, roosting, and foraging habitat; ensuring adequate dispersal habitat and connectivity between large blocks of high-quality habitat; and controlling barred owls (USFWS 2011, pp. II 2-4).

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]). After a 5-year status review documented the declining status of the northern spotted owl (Service 2019, entire), the Service concluded that changing the status of the spotted owl from threatened to endangered was warranted but precluded by higher priority actions (85 FR 81144 [December 15, 2020]).

Spotted owl populations are declining across the range (Franklin et al., 2021, p. 12). While 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 2011a, 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. Based on 10 study areas that have been tracked since 1995, the average annual rate of population reduction changes from 1995 through 2017 was a 5.3 percent range-wide (Franklin et al., 2021, p. 12). This rate of decline has not been consistent throughout the entire 22-year monitoring period, but rather, it was gradual in the earlier years and has become steeper in recent years. The rates of population decline vary by study area, with the greatest rates of decline occurring in Washington, followed by the Oregon Coast Ranges and Klamath (Franklin et al., 2021, pp. 11-13).

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 substantial factor driving the declining population trends across the range of the species (Forsman et al., 2011, pp. 63-64). Most recently, apparent survival, recruitment, and territory colonization and extinction rates were the key vital rates associated with barred owl presence in spotted owl populations (Franklin et al., 2021, pp. 9-18). Without barred owl management, near-term extirpation of northern spotted owls is likely in portions of the range, and the small populations that may remain in other parts of the range will be highly vulnerable to extirpation due to wildfire or other stressors, resulting in eventual extinction (Franklin et al., 2021, p. 19).

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 a threat to the spotted owl, as habitat continues to be lost to, timber harvest, wildfires, and other natural disturbances (Davis et al., 2022, entire "25-year report"). Monitoring of spotted owl habitat in the NWFP area from 1993 to 2017 indicated a net gain in nesting/roosting habitat from 8.89 million acres to 9.16 million acres on Federal lands during the monitoring period, a gain of about 3.0 percent (Davis et al., 2022, p. 29). Across all lands (Federal and non-federal), nesting/roosting habitat increased from approximately 12.37 million acres to 12.63 million acres, a net gain of 2.1 percent (Davis et al., 2022, p. 32). 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.

The 25-year report provides specific estimates for harvest and fire loss for each physiographic province within the NWFP area (Davis, et al., 2022, p. 29-32). On federal lands within the Oregon Western Cascades province between 1993 to 2017 (which does not include the 2020-2022 fires), spotted owl nesting/roosting forest development exceeded losses, with an 82,500 acre (3.7 percent) overall increase in nesting/roosting forest. The net gain includes the recruitment of 224,300 acres of nesting/roosting forest and losses of approximately 68,500 acres and 68,000 acres from timber harvest and wildfire, respectively.

On federal lands within the Oregon Coast Range province between 1993 to 2017, spotted owl nesting/roosting forest development had a net gain of 145,800 acres (35.3 percent) of nesting/roosting forest. The net gain includes the recruitment of 169,100 acres of nesting/roosting forest and losses of approximately 22,900 acres and 200 acres from timber harvest and wildfires, respectively (Davis et al., 2022 p. 29-32).

Even while accounting for the effects of competition with barred owls, habitat availability and climatic patterns also appear to influence survival, occupancy, recruitment, and, to a lesser extent, fecundity (Dugger et al., 2016, entire). Occupancy, colonization, and extirpation of spotted owl territories are all influenced by the amount of habitat present, and territory extinction is also related to climate factors (Franklin et al., 2021, pp. 13, 16, 18). Habitat availability also influences the likelihood of spotted owl population persistence, and this effect is similar in magnitude to the effect of competition with barred owls (Yackulic et al., 2019, p. 4). Dugger et al., (2011, pp. 2463-2467) described additive effects associated with territory composition and presence of barred owls; the effects of reduced old forest in the core habitat areas were compounded when barred owls were present - extinction rates of northern spotted owl territories nearly tripled when barred owls were detected.

The 2011 Revised Recovery Plan for the Northern Spotted Owl (Recovery Plan) (USFWS 2011a, entire) identified past and ongoing habitat loss and competition from barred owls as the primary threats to the survival and recovery of spotted owls at this time. The Recovery Plan includes Recovery Actions specific to addressing barred owl competition and habitat loss. For barred owl competition, Recovery Actions include the implementation of a barred owl removal experiment, management to reduce the effect of barred owls on spotted owls, and the retention and restoration of high-quality spotted owl habitat to buffer the effects of barred owl competition in the short term (USFWS 2011a, p. III-65, 67). The USFWS is currently working with land managers to develop a management strategy for the barred owl. This may include active barred owl removal thorough the range of the spotted owl. Findings from the recently completed barred owl removal experiment (Wiens et al., 2021, entire) and other relevant information will be used to inform this effort. The BA did not consider implementation of a barred owl control program with respect to developing the proposed action or determine any resulting effects. This Opinion adopted the same analytical approach.

4.2 Habitat Associations

The following discussion informs the analysis within this Opinion. Collectively, this information provides the context used to develop the general analytical framework described within this document through a synthesis of the best available science.

Since complete range-wide population surveys for spotted owls are not available, it is a well-established analytical approach to analyze the effects of proposed activities on the spotted owl based on the extent, duration and timing of habitat-altering activities. Effects are based on how habitat alteration activities are likely to affect spotted owl nesting, roosting, foraging, and dispersal behavior based on known spatial and habitat use relationships exhibited by the spotted owl (USDA USFS and USDI BLM 1994, Lehmkuhl and Raphael 1993, Raphael et al., 1996, Meyer et al., 1998, and Courtney et al., 2004).

The amount of forest habitat likely to be used by spotted owls is based on the known range of habitat conditions used by spotted owls for nesting, roosting, and foraging (Thomas et al., 1990; Courtney et al., 2004). In addition, the basis for finding that a proposed action is likely to significantly impair the breeding, feeding, sheltering and/or dispersal of affected spotted owls relies on the scientifically recognized range of habitat conditions that are known to adequately provide for spotted owl life history requirements.

Spotted owls exhibit consistent patterns of habitat association, and these patterns provide the foundation for assessing the potential effects caused by land management activities. In the 1990 Conservation Strategy for the Northern Spotted Owl, the Interagency Scientific Committee (Thomas et al., 1990) stated that:

"With the exception of recent studies in the coastal redwoods of California, all studies of habitat use suggest that old-growth forests are superior habitat for spotted owls. Throughout their range and across all seasons, spotted owls consistently concentrated their foraging and roosting in old-growth or mixed-age stands of mature and old-growth trees. Structural components that distinguish superior spotted owl habitat in Washington, Oregon, and northwestern California include: a multilayered, multispecies canopy dominated by large (>30 inches dbh) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods; a moderate to high (60-80 percent) canopy closure; substantial decadence in the form of large, live coniferous trees with deformities- such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags; ground cover characterized by large accumulations of logs and other woody debris; and a canopy that is open enough to allow owls to fly within and beneath it."

The habitat attributes and conclusions of the Interagency Scientific Committee were echoed in the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al., 2004), and in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011a), which stated: "Spotted owls generally rely on older forested habitats (Carroll and Johnson 2008) because such forests contain the structures and characteristics required for nesting, roosting, and foraging."

4.2.1 Spotted Owl Spatial Use of Sites and Home Range Territories

A major advance in our understanding of spotted owl habitat relationships from Thomas et al., (1990) to the present is that we now have a much better understanding of the spatial scale of habitat selection (see Hunter et al., 1995, Meyer et al., 1998, Zabel et al., 2003, Wiens et al., 2014) and the relationships of habitat to spotted owl fitness (Franklin et al., 2000, Olson et al., 2004, Dugger et al., 2005). Generally, guidance for management activities addressing territorial organisms is spatially explicit and such activities are applied to an area corresponding to the movements and activity patterns of the individuals of the organism occupying the territory or territories. Spotted owls are territorial predators that range widely in search of food but are 'anchored' during the breeding season to a nest site. That is, spotted owls are central-place foragers (Rosenberg and McKelvey 1999). Foraging close to the nest reduces travel time and energetic expenditures of adults and also increases the ability of the adults to remain nearby and protect their young. Several studies have shown that the selection of nest sites by spotted owls is related to the amount of older forest habitat at multiple spatial scales (Ripple et al., 1991, Ripple et al., 1997, Swindle et al., 1999, and Perkins 2000). Based on this research, evaluations of spotted owl use of an area appear to be most meaningful at two spatial scales: 1) the home range and 2) the core area. Habitat selection at a larger home range scale is likely dependent first on the selection at the smaller core area (Johnson 1980 for hierarchy of habitat selection).

The home range is the "area traversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943:351, cited in Service 2009). Within home ranges, areas receiving concentrated use, typically surrounding the nest site and favored foraging areas, are called core areas (Bingham and Noon 1997). Establishing the exact spatial extent of a spotted owl's home range and core area based on relative use within a home range typically requires use of radiotelemetry. Because of the intensity and high cost of radiotelemetry, action agencies are generally not able to conduct this type of study for specific projects. Therefore, for purposes of assessing a project's potential impacts to the spotted owl, circles centered on spotted owl nest sites or activity centers that approximate the median core areas and home range areas of spotted owls monitored in previous radio-telemetry studies (see home range estimates in Thomas et al., 1990 and reaffirmed in Courtney et al., 2004) will be used unless more specific information is available.

Circles serve as proxies for the area where the amount and configuration of habitat within those radii has been shown to affect occupancy, survival, reproduction, and related fitness. For this Opinion, local data from regional demography study areas and other local information are used to determine the home range and core area configurations and to evaluate the effects of proposed activities on spotted owls. While circles are a useful surrogate, the BA, Section 1.3.4 also states:

The unit wildlife biologist may delineate non-circular areas for a nest patch, core area or home range for a spotted owl site. This process is appropriate to accurately depict the environmental baseline and to inform accurate effects determinations within spotted owl sites—especially after substantial changes in habitat conditions (e.g., timber harvest or wildfire). Any non-circular delineations should contain the same or greater amounts of habitat as specified for the standard analytical process using province-specific circular delineations: 70 acres in the nest patch; 503 acres in the core area and 2895 acres (1.2 miles, west cascades province) or 4524 acres (1.5 miles, coast range province) in the home range. Delineation should carefully consider habitat conditions and known spotted owl local use patterns. Priority should be given to best habitat type(s), especially inclusion of suitable habitat. Non-circular delineations should typically be maintained as a reference position for management and not continually edited over time. This process should be documented and recorded in the appropriate project files and BLM/USFS corporate databases. The Service can provide additional guidance if needed. Identification of non-circular nest patch, core area or home range should not occur repeatedly or solely to reduce the effect of an action.

Resources such as food and breeding and resting sites can be patchily distributed in heterogeneous landscapes, such as those prevalent throughout the action area. In such landscapes, animals are likely to disproportionately use areas that contain relatively higher densities of important resources (Powell 2000), with concentrated use close to their nests. These disproportionately used areas are referred to as "core areas" (Bingham and Noon 1997). Thomas et al., (1990) found that amounts of suitable habitat within 0.7 miles (986 acres) of spotted owl activity centers were important to spotted owl life history functions, and the amount of suitable habitat around nest sites was significantly greater than the amount of suitable spotted owl habitat in random circles. The findings of Thomas et al., (1990) illustrate the importance of the amount of suitable habitat within a spotted owl territory to support the life history requirements of the spotted owl. The results of subsequent studies (see below) also indicated that a 0.5-mile radius circular area encompassing 500 acres around spotted owl activity centers is likely a more appropriate scale at which to evaluate the amounts of suitable habitat required by breeding spotted owls (USFWS 2009 and USFWS 2011a Appendix C). These studies relied on three primary sources of information to support the 500-acre core area size: (1) the distribution of locations of radio-telemetered spotted owls; (2) the territorial spacing patterns of spotted owls; and (3) the results of studies comparing relative habitat selection by spotted owls at different scales.

Due to the impracticality of conducting radiotelemetry on each individual owl potentially affected, the BLM and USFS typically use circles as surrogates for approximating spotted owl home range and core areas to inform impacts to the species. It is recognized that spotted owls may adjust the shape of their home ranges to encompass as much older forest habitat as possible (Carey et al., 1992). As such, the use of circles may not exactly overlap the areas used by spotted owls which may be partially defined by other factors such as topographic features (e.g., drainages), abundance and availability of prey species, and the distribution and/or abundance of competitors and predators (Anthony and Wagner 1998 and Courtney et al., 2004). However, the practice of using circles has a biological basis (Lehmkuhl and Raphael 1993) and has been utilized by many researchers (Thomas et al., 1990, Ripple et al., 1991, Lehmkuhl and Raphael 1993, Ripple et al., 1997, Swindle et al., 1999, Perkins 2000, Franklin et al., 2000, Olson et al., 2004, Dugger et al., 2005, and summary in Courtney et al., 2004) to provide a uniform method for quantifying (comparing/contrasting) spotted owl habitat. The use of circles also seems appropriate for species, like the spotted owl, characterized as a central place species (Rosenberg and McKelvey 1999).

The following estimates by the NWFP for Home Ranges in different Provinces help inform a spotted owl spatial analysis for Oregon: Coast Ranges Province = 4,524 acres or a circle with a 1.5-mile radius; West Cascades Province = 2,895 acres or a circle with a 1.2-mile radius; and the Klamath Province = 3,398 acres or a circle with a 1.3- mile radius. Within a home range, the smaller core-use area estimates of 500 acres or a circle with a 0.5-mile radius inform the spotted owl core-use area analysis for each of the aforementioned provinces (Thomas et al., 1990, USFWS 1992, Carey et al., 1992, Anthony and Wagner 1998, Irwin et al., 2000, Courtney et al., 2004, Glenn et al., 2004 and USFWS 2011a). In general, for analysis purposes, the core-use/home range area circle(s) will be centered on a spotted owl activity center that represents the area that spotted owls are likely to use for nesting, roosting, and foraging in any given year. Where available, local information on home range and core-use areas is used, recognizing that circles are rough proxies, and their value is that the amount and configuration of habitat within those radii has been shown to affect occupancy, survival, reproduction, and related fitness.

Known sites are also referred to as “spotted owl sites” in this Opinion. The described analytical processes, including all effects determinations, were developed to assess the effects of proposed federal actions implemented by the CRGNSA, WIL, MHNF and NOD BLM. This definition may not be applicable to other planning provinces or other biological Opinions.

Home Range (1.2- or 1.5-mile radius)

The home range represents a minimum area for spotted owls to carry out all life history needs, particularly during the nesting season. Home range sizes of spotted owl pairs have been estimated on five study areas in Washington, Oregon and California since 1990 (see Courtney et al., 2004, Table 5-1). Fourteen years after Thomas et al., (1990 p. 194), Courtney et al., (2004: Chapter 9) concluded that, home range estimates remained similar and valid, although subsequent spotted owl research had refined these conservation needs. This is supported by later researchers such as Wiens et al., (2014). The home range surrounds the nest patch and core area. This Opinion assumes a 1.5-mile radius home range for the Mary's Peak, Siuslaw, and Tillamook Field Offices, which occur in the Coast Range. This Opinion assumes a 1.2-mile radius home range for the Cascades and Upper Willamette Field Offices, which occur in the West Cascades, and for all the Willamette National Forest, Mt Hood National Forest, and the CRGNSA.

Core Area (0.5-mile radius, 500 acres)

The core area represents the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham & Noon (1997) defined the core area as that portion of a spotted owl home range that received disproportionately high use for nesting, roosting, and access to prey. Although Courtney et al., (2004:5-5) observed that core area sizes varied greatly among spotted owls, Bingham & Noon (1997), Wagner & Anthony (1999), Franklin et al., (2000), and Irwin et al., (2000) collectively suggested a core area of about 500 acres. The core area surrounds a nest patch and is located in the best available habitat that is likely to support concentrated use for nesting, roosting, and rearing of young during the nesting season. Barring more site-specific information (e.g., habitat type and orientation), this area is delineated using a 0.5-mile radius circle.

Nest Patch (300 meter or 984 feet radius, 70 acres)

The nest patch represents an area where a spotted owl is likely to select a nest tree or trees. Nest patch size has been shown to be an important attribute for site selection by spotted owls. More specifically, models developed by Swindle et al., (1997) and Perkins (2000) showed that the 200–300-meter radius (sometimes greater) encompassing approximately 75 acres around a nest patch is important to spotted owls and having as much of the 300-meter radius in suitable habitat was critical to nest position on the landscape. Miller (1989) found that on average, the extent of forested area used by juvenile spotted owls prior to dispersal averaged approximately 70 acres.

Meyer et al., (1998) found that old-growth patch size (i.e., larger patches) was strongly related to spotted owl site selection in Oregon. In reviewing the results of Table 5-2 in Courtney et al., (2004), it does appear that spotted owls select nest sites on the landscape to maximize the amount of older forest habitat near the nest (USFWS, 2005).

Known site centers and corresponding nest patches are based on known nest trees or pair activity centers. Potential site centers and nest patches are located in the best available habitat likely to facilitate spotted owl nesting by providing suitable nest trees and rearing of young immediately after leaving the nest tree. Potential site center locations consider the typical nearest neighbor distance to nearby known and potential sites, and avoidance of barred owl "core use areas", when this information is available. Barring more site-specific information (e.g., habitat type and orientation), this area is delineated using a 300-meter radius circle or a polygon at least 70 acres that were identified based on available suitable habitat and centered around known nest trees (or activity centers, where the location of nest trees is unknown). For more information on delineating potential sites see the BA, Appendix C.

4.2.2 Habitat Availability in Core Areas and Home Ranges

Core Area

The best available information to date indicates that spotted owl fitness is positively correlated with large patch sizes of older forest or large forest patches containing a high proportion of older forest (Franklin et al., 2000, Olson et al., 2004 and Dugger et al., 2005). Habitat-based fitness, or habitat fitness potential (HFP), is the "fitness conferred on an individual occupying a territory of certain habitat characteristics" (Franklin et al., 2000). HFP is a function of both the survival and reproduction of individuals within a given territory. For example, the data sets analyzed by Franklin et al., (2000) were re-analyzed to evaluate the relationship between HFP and the simple proportion of older forest within spotted owl core areas. The results of that analysis (USFWS 2007, pp. 134-136), indicate a quadratic relationship between spotted owl HFP and older forest conditions, with optimum HFP occurring when 53 percent of the estimated core area consisted of older forest (Franklin et al., 2000). More than half (55 percent) of the high-quality (with a HFP greater than 1) spotted owl territories had core areas comprised of 50 to 65 percent older forest. In a similar study in southern Oregon, Dugger et al., (2005) found that spotted owl HFP was positively related to the proportion of older forest in the core area, although the strength of the relationship decreases with increased proportions. Roughly 72 percent of core areas with a HFP greater than 1.0 had more than 50 percent older forest, whereas core areas with a HFP of less than 1.0 never contained more than 50 percent older forest.

Mean percent cover of old forest within spotted owl core areas in southwest Oregon and northwest California have varied widely among studies (about 35 to 60 percent) (Hunter et al., 1995, Ripple et al., 1997, Gutiérrez et al., 1998, Meyer et al., 1998, Franklin et al., 2000 and Dugger et al., 2005). It is difficult to assess how much of this variation was due to differences in ecological setting, spatial scale, habitat classification, and individual variation among owls. Nonetheless, the central tendency of these results was roughly 50-60 percent older forest habitat within spotted owl core areas.

Home Range

In the 1992 draft recovery plan for the spotted owl (USFWS 1992), Bart (1995) evaluated the suggestion that at least 40 percent of the estimated home range be retained as suitable habitat. Using demographic data from throughout the spotted owl's range, including Oregon, Bart (1995) calculated that spotted owl populations are stable when the average proportion of nesting, roosting and forage habitat in the home range is 30 to 50 percent. In the region of the action area, Olson et al., (2004) found that spotted owl occupancy was positively correlated with the amount of mid and late-seral forest. Spotted owl demography and the presence of spotted owls appear to be positively associated with an intermediate amount of horizontal heterogeneity in forest habitat at the home range scale (Schilling et al., 2013). Findings reported in more recent papers (see USFWS 2009) have been consistent with those of Bart (1995).

4.2.3 Site Occupancy

Habitat-based assessments and/or modeling have been used in various studies to estimate the presence (occupancy) of breeding spotted owls. These tools are important for evaluating the species-habitat relationships. Bart (1995) reported that occupied spotted owl core areas contained at least 30 to 50 percent mature and old growth forest. Spotted owl demographic performance, particularly occupancy, increases with increasing amounts of suitable habitat in the core area. Meyer et al., (1998) examined landscape indices associated with spotted owl sites versus random plots on BLM-administered lands throughout Oregon. Across provinces, landscape indices highly correlated with the probability of spotted owl occupancy included the percent of older forest (approximately 30 percent or more) within the 500 acres surrounding the site (analogous to a core area). This predictive value decreased with increasing distance from the site. Territory occupancy decreased following the harvest of suitable habitat in the vicinity of the affected core area. In their northwest California study area, Zabel et al., (2003) found that the highest probability of spotted owl occupancy occurred when the core area was comprised of 60-70 percent nesting/roosting habitat. Stepping up to the larger home range scale, Thomas et al., (1990), Bart and Forsman (1992), Bart (1995), Olson et al., 2004, and Dugger et al., (2005) suggest that when spotted owl home ranges are comprised of less than 40 to 60 percent nesting, roosting and forage (i.e., suitable) habitat, they were more likely to have lower occupancy and fitness.

Many different combinations of forest habitat structure and amount at various spatial scales may support viable spotted owl territories sufficient for the survival and reproduction of individual owls. Despite consistent patterns of habitat selection by spotted owls, structural conditions of forest habitats occupied by spotted owls are highly variable. However, overall, the best available information suggests that: (1) the probability of spotted owls occupying a given patch of forest habitat increases when core areas contain a range of forest habitat conditions that support the essential life history requirements of individual spotted owls; and (2) the survival and fitness of spotted owls are positively correlated with larger patch sizes of older forest or larger patches of forest habitat with a high proportion of older forest (Franklin et al., 2000; Olson et al., 2005; Dugger et al., 2005).

4.2.4 Extent of Habitat Alteration Likely to Cause Death or Injury to Territorial Spotted Owls.

Also see spotted owl definitions in Section 2.5.2, 2.5.3 and 2.5.5 including discussion of Impair Functionality of a Spotted Owl Site, Impairment of an Occupied Spotted Owl Site.

The USFWS has used the threshold of maintaining 40 percent suitable habitat in a spotted owl home range as a general guideline to avoid harm (incidental take) from a timber harvest action (USFWS 2009, p 28). This means that if post treatment suitable habitat drops below approximately 40 percent in the home range, impacts to breeding spotted owls at that scale are considered to have impacts to the spotted owl pair's ability to use the site to support their life history needs (see sections on "Core Area" and "Home Range" above (for a summary of the research on this issue). Best available information and the professional judgment of spotted owl experts support a finding that under those conditions the spotted owls may not attempt to breed, may have lower breeding success, or may move to a new site, thus increasing their chance of predation as they search areas with which they are not familiar, causing loss of reproduction and/or increasing the likelihood of injury or death of the affected spotted owls. For similar reasons, the USFWS has used a 50 percent suitable habitat rule at the scale of a spotted owl core area (500 acres - 0.5-mile radius circle around nest tree) to determine if timber harvest actions are likely to cause death or injury of the spotted owl (USFWS 2009, pp 28-29). If the amount of suitable habitat in a pair's core area is less than 250 acres (postharvest), the spotted owls may not attempt to breed, may have lower breeding success, or move to a new site, thus increasing their chance of predation as they search areas with which they are not familiar, causing loss of reproduction and/or increasing the likelihood of injury or death of the affected spotted owls. Any habitat removal at or in the immediate vicinity of a spotted owl nest site (nest patch – about 70 acres) is also considered to cause spotted owls to move off their nest site; again, the spotted owls may not attempt to breed or move to a new site. All these behaviors increase the chance of predation as the owls search unfamiliar areas causing loss of reproduction and/or increasing the likelihood of injury or death of the affected spotted owls.

4.3 Nonterritorial and Dispersing Spotted Owls

Spotted owl populations consist of territorial (resident) individuals, for which we have documented territoriality throughout much of the species' range, but populations also include nonterritorial (therefore, non-breeding) adult and subadult spotted owls, also termed "floaters" in this discussion. For this discussion, floater spotted owls include both natal and adult/subadult non-breeding dispersers. Non-territorial spotted owls may cryptically reside within otherwise occupied territories (Franklin 1992, p. 823), or use a series of temporary home ranges to systematically sample or "prospect" the underlying network of resident territories along a somewhat erratic dispersal path (Forsman et al., 2002, p. 30). Individuals that vacate territories due to failed reproduction or other reasons (e.g., barred owl competition, habitat degradation, death of mate) may also become nonterritorial until they recolonize vacant territories or establish new territories (Jenkins et al., 2021, p. 1, 3). There has been a significant increase in the percent of territorial spotted owls that dispersed from their territories, from approximately 7 percent in 1990 to 25 percent of all monitored owls in 2017 (Jenkins et al., 2021, p. 8). At the same time, there was a concomitant increase in barred owls and decline in the spotted owl population. Understanding the contribution of non-territorial spotted owls to the overall population is increasingly important.

Nonterritorial spotted owls are difficult to detect in surveys because many floaters either do not respond to surveys or respond in a tenuous fashion such that they are difficult to capture or resight (Forsman et al., 2002, p. 26). Also, distinguishing between floaters and territorial individuals during surveys can sometimes be difficult. Because they are difficult to detect or classify, the number and distribution of nonterritorial individuals are poorly known for any given spotted owl population. Male and female nonterritorial spotted owls are recruited into the population differently; males typically remain in the subpopulation where they were born and females often disperse farther to other subpopulations where they exist as floaters before becoming territorial (Franklin 1992, p. 822-823).

While population is only measured by territorial spotted owls, nonterritorial spotted owls likely contribute an important role in population regulation (Foresman et al., 2002, p. 4). However, Glenn et al., 2004 found spotted owl population change to be more sensitive to territorial adult survival than to recruitment of either juveniles or adults (2010, p. 2543). Also, the rate of population change in spotted owls is most sensitive to variation in adult female survival and relatively insensitive to variation in fecundity and age at first reproduction (Noon and Biles 1990, p. 23). As such, the degree to which floaters influence or regulate populations is unknown. Because spotted owl populations are regulated by territorial behavior, declines in the number of territorial individuals would be dampened by the increased recruitment of floaters. If the number of floaters is sizable, then the number of territory holders would appear stable for some time before a decline is observed.

Barred owls are increasingly common throughout the entire action area, including two or more pairs within a single spotted owl territory. With the barred owl displacement of spotted owls from their territories an increase in the floater population may be expected. However, as the barred owl is reducing spotted owl demographic rates overall, it is likely the number of floaters has also decreased and is not replacing the territorial population. This is supported in the recent review of spotted owl response to barred owl removal where Wiens et al., (2021) found spotted owl survival increased, but only found a weak association with recruitment. The authors hypothesize this is a consequence of the extreme low recruitment seen across all demography study areas, due in part to years of low reproduction (pp. 5, 7, 9). Barred owls also influence the ability to detect spotted owls in surveys.

Management of conditions for floaters may be an important component for recovery of the spotted owl. Penteriani et al., note in their review of avian studies, including the spotted owl, that "…the availability of floaters may make the difference between a stable population and a declining population approaching the extinction threshold (2011, p. 236)." Maintaining areas for non-breeding spotted owls to persist on the landscape may help floaters who are waiting for territories to open up (Gutierrez et al., 1985, p. 36). Such "settlement areas" may provide the resources needed for floaters to survive and contribute to the population (Penteriani et al., 2011, p. 235, 237). In order to manage for floaters across the landscape, Miller et al., 1997 (p. 148) suggests that older forest connectivity corridors and maintaining older forest patches in close proximity to occupied territories could "serve as colonization areas for dispersing birds waiting to enter the breeding population" and would also support dispersal corridors.

Managing habitat for nonterritorial spotted owls (in addition to occupied territories) benefits the species as a whole. The influence of barred owls likely reduces the extent of such benefits. Jenkins et al., found that only 27 percent of spotted owls that left a territory occupied by barred owls found a territory without barred owl detections (2021, p. 11). However, with the decrease of the spotted owl population in Oregon (Franklin et al., 2021, pp. 11-13) and the increase in dispersal of territorial spotted owls (Jenkins et al., 2021, p. 8), maintaining areas for both territorial and non-territorial spotted owls can be important to the species and facilitate potential options for barred owl management within the next few years.

The proposed action includes PDC and other measures in the BLM RMP and USFS NWFP which would benefit dispersing juvenile, adult and subadult spotted owls, including establishment of new territories. These include habitat management for Reserves (Riparian Reserves and LSRs), RA32 habitat, PDC to avoid impairing sites due to projects in LSRs, PDC to help maintain landscape dispersal (AOCs), and the availability of viable but unoccupied spotted owl site territories. The estimated number of unoccupied but viable and non-impaired spotted owl site territories is nearly six times the current estimated number of occupied sites in the action area (Section 8.1.20 of the BA).

4.4 Barred Owls

Additional information on barred owls is found in Appendix D-Northern Spotted Owl Status of the Species.

4.4.1 Barred Owl Habitat and Competition with Spotted Owl

Although habitat remains a key consideration for spotted owl recovery, the 2011 Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011a, pp. III-62-68) identifies competition from the barred owl as an important threat to the spotted owl, and the USFWS now recognizes it as the most pressing threat to species' recovery. Interspecific competition between barred owls and spotted owls is the primary driver of spotted owl population decline seen throughout spotted owl range (Franklin et al., 2021). Interspecific competition has been defined as "an interaction between members of two or more species that, as a consequence of either exploitation of a shared resource or of interference related to that resource, has a negative effect on fitness-related characteristics of at least one species" (Wiens 1989, p. 7). Barred owls exert pressure on northern spotted owls through interference competition, where barred owls deny spotted owls access to resources (e.g., older forest for breeding) through territorial interaction and through exploitation competition where barred owls use some or all of the resources necessary for spotted owl fitness (e.g., prey species) reducing their availability (Wiens et al. 2014). Demographic evidence strongly suggests that barred owls are a dominant competitor (Franklin et al. 2021).

Barred owls are more aggressive, and more habitat generalists, but also use the same habitats and prey as spotted owls (USFWS 2011a, p. III-62-68). A consensus in the literature documents the negative influence barred owls are having on northern spotted owl site occupancy, fecundity, reproduction, apparent survival, and detectability. That data indicates that over the last 25+ years, barred owls are increasing in number and contributing to declines in northern spotted owl populations (Olson et al., 2005, p. 924; Forsman et al., 2011, pp. 69-70), Dugger et al., 2011, pp. 2463-2467; Dugger et al., 2016, pp. 70-96); Franklin et al., 2021, entire). There is evidence that barred owls are occurring in higher densities than spotted owls in many parts of the range (i.e., from 3 to 8 barred owl territories for each spotted owl territory; Hamer et al., 2007; Singleton et al., 2010; Wiens et al., 2011, 2014). In a recent study, the highest densities found were in the Oregon Coast Range, with up to 20 barred owls per northern spotted owl territory reported (Wiens et al., 2017, p. 12).

The meta-analysis of the multi-year barred owl removal experiment (Wiens et al., 2021, entire) in five study areas across the range demonstrated that removal of invasive barred owls had a strong, positive effect on survival of native northern spotted owls. This subsequently reduced long-term population declines from a mean annual decline of 12.1% without barred owl removal to a 0.2% decline in areas with removal, (Wiens et al., 2021, p. 1). Dugger et al., (2011, entire) modeled extinction and colonization rates for spotted owl pairs in the South Cascade Demographic Study Area where barred owls were detected on some home ranges. They found that extinction rates for spotted owls increased with decreasing amounts of old forest in the core area, and that the effect was 2-3 times greater when barred owls were detected. They also found that colonization rates for spotted owls decreased as the distance between patches of old forest increased (i.e., increased habitat loss and fragmentation) and that barred owl presence similarly decreased the rate of colonization of spotted owl pairs. They concluded that conserving large blocks of contiguous old-forest habitat was important for reducing interference competition between the two owl species. They mapped old-forest habitat as generally >100 years of age with trees DBH >35 cm (Dugger et al., 2011, Appendix A). Wiens (2012, pp. 45-49) also found that the relative probability of spotted owls selecting a location for reproduction was reduced if the location was in close proximity to the core-use area of a barred owl.

A common question is whether timber harvest and other silvicultural activities may directly or indirectly affect barred owl population levels or the interactions between barred owls and spotted owls. Three topics of interest are briefly summarized below with respect to analytical assumptions in the BA and this Opinion: a) whether timber harvest could expand the range of barred owls in the action area; b) whether timber harvest that thins stands, creates early seral vegetation communities, or creates edges, could favor barred owls over spotted owls in the action area; and c) whether timber harvest that removes or downgrades spotted owl habitat, especially older forest, affects the amount or nature of barred owl-spotted owl competition and resulting effects to spotted owls. The conclusions below are incorporated into the effects analyses in this Opinion.

Could logging expand the range of barred owls within the action area?

The barred owl's range now completely overlaps that of the spotted owl, having expanded through the spotted owl's range in California (Gutiérrez et al., 2004, pp. 7-12 to 7-13; Steger et al., 2006, p. 226, Long and Wolf 2019, p. 1283). Barred owls appear to select for the same forest cover types as northern spotted owls; primarily older forest (Wiens et al., 2014, Irwin et al., 2020), although barred owls appear to select for relatively flatter slopes (Wiens et al., 2014; Singleton et al., 2010; Mangan et al., 2019). The most recent range-wide meta-analysis indicated that barred owl colonization of northern spotted owl territories was more likely in lower-elevation territories in most study areas (Franklin et al., 2021, pp. 13, 18). We provide information above showing that barred owls are widely established in the action area. Based on survey and monitoring data, as well as other information on barred owl population trends, barred owls are well established in the action area and commonly detected during spotted owl surveys.

Conclusion: While this remains an important question in some parts of the spotted owl's range, because barred owls are widespread and increasing throughout the BA action area, this question is moot with respect to the BA and this Opinion.

Could silvicultural treatments that thin, create early seral, or create edge habitat favor barred owls over spotted owls in the action area?

A detailed review for the spotted owl recovery plan found that while barred owls may tolerate or utilize lower quality habitats not used by spotted owls, there is much evidence that barred owls prefer old-growth and other older forest habitat, not early seral or edge habitat (USFWS 2011a, pp. B-10-12; Wiens et al., 2014). Throughout the spotted owl's range and within the BA action area, barred owl populations are increasing while spotted owls are declining, apparently independently of forest management history in the area (Courtney et al., 2004, pp. 7-37).

Wiens (2014, entire) conducted a detailed study of the interaction between barred and spotted owls in the moist temperate forests of western Oregon by radio tracking 29 spotted owls and 28 barred owls in 36 neighboring territories over a 2-year period. He found that both owl species had similar use of young, mid-seral, and mature forests and that both species avoided areas within 135 meters of forest/non-forest edges. Both species avoided open areas and young forests less than 60 years of age and used mature conifer forests (60-120 years of age) proportional to their availability within the landscape (second order selection). Wiens' study contains the most detailed published information applicable to the action area, including comparing the use of younger forest by the two species.

Conclusion: The available information does not provide support for the concept that thinning young forest, or the creation of early seral habitat or forest edge directly and selectively favors barred owls over spotted owls in the action area — beyond the general assumption that barred owls may be more tolerant of lesser quality habitats.

Could timber harvest that removes or downgrades spotted owl habitat, especially older forest, affect the amount or nature of barred owl-spotted owl competition and resulting effects to spotted owls?

It is well documented and established that the amount and quality of spotted owl habitat, especially "older forest", in a landscape clearly affects spotted owl movement, survival and reproduction in a general sense, including at the spotted owl territory scale.. However, evidence on details of specific relationships between the amount of spotted owl habitat, including older forest, and competition between barred and spotted owls seems to vary based on spatial and temporal scales of consideration, especially where spotted owls otherwise having sufficient habitat for movement, survival and reproduction. Details on these relationships also vary with respect to the questions of whether habitat management can eliminate or reduce barred-spotted owl competition versus worsening or accelerating this competition in extant spotted owl territories or populations.

Habitat management and barred owls beyond the spotted owl territory/home range scale:

The meta-analysis of the multi-year barred owl removal experiment (Wiens et al. 2021, entire) in five study areas across the range demonstrated that removal of invasive barred owls had a strong, positive effect on survival of native northern spotted owls. This subsequently reduced long-term population declines from a mean annual decline of 12.1% without barred owl removal to a 0.2% decline in areas with removal, (Wiens et al. 2021, p. 1). Dugger et al. (2011, entire) modeled extinction and colonization rates for spotted owl pairs in the South Cascade Demographic Study Area where barred owls were detected on some home ranges. They found that extinction rates for spotted owls increased with decreasing amounts of old forest in the core area, and that the effect was 2-3 times greater when barred owls were detected. They also found that colonization rates for spotted owls decreased as the distance between patches of old forest increased (i.e., increased habitat loss and fragmentation) and that barred owl presence similarly decreased the rate of colonization of spotted owl pairs. They concluded that conserving large blocks of contiguous old-forest habitat was important for reducing interference competition between the two owl species. They mapped old-forest habitat as generally >100 years of age with trees DBH >35 cm (Dugger et al. 2011, Appendix A). Wiens (2012, pp. 45-49) also found that the relative probability of spotted owls selecting a location for reproduction was reduced if the location was in close proximity to the core-use area of a barred owl.

The strong correlation between barred owl colonization concurrent with spotted owl site extinction indicates spotted owls, at the population level, are unable to out compete for resources at the rangewide scale (Franklin et al. 2021, p. 15-18, Wiens et al. 2021, p. 7). Barred and spotted owls exhibit both exploitation competition over prey and habitat, and interference competition through territory exclusion (Yackulic et al. 2014, p. 275.) In this case, “useable” habitat is primarily older, late-successional, forest-habitat. Franklin and others (2021) warn that while habitat loss had little influence on population trends on the rangewide scale, habitat loss remains a likely important factor in localized areas (p. 15). The authors caution that while barred owl presence was the dominating negative force on spotted owl populations across the range, it does not mean that changes to habitat are not important at a finer scale (Franklin et al. 2021, p. 18). Occupancy modeling indicated a positive influence of available habitat on colonization, even though the overall trend was negatively associated with barred owl presence (Franklin et al. 2021, p. 13). Because of this, the authors emphasize the importance of protecting existing habitat to maintain areas available for spotted owl re-colonization, although, re-colonization is likely contingent on barred owl population reductions.

While the importance of habitat, including old forest, for spotted owl population health is well established, the Service is unaware of any analysis that looked at the proportion of spotted owl habitat, including old forest, in a landscape where barred owls are well established, and found clear relationships between habitat and a substantial mitigation of downward spotted owl population trends, once a threshold amount of habitat was reached (USFWS 2011 Recovery Plan, 2012 CH, USDI BLM 2016, Franklin et al.. 2021). In effect, these types of relationships may exist, but are not well understood at larger geographic or population scales, especially when sufficient amounts of habitat are otherwise available to spotted owls. We have evidence that barred owls can greatly outnumber spotted owls in areas where habitat, including older habitat, is abundant or presumably not the primary limiting factor in sustaining higher population levels. In much of the spotted owl's range, barred owls have demonstrated an ability to rapidly expand in range and population. Most research and modeling show a general expectation of eventual wide scale and continuing declines in spotted owl populations regardless of management retention of habitat, (USDI BLM 2016a, Figure 3-188, p. 959; Wiens et al. 2014; Yackulic et al. 2019, Franklin et al. 2021). However, details of those assertions, including the rate of spotted owl population decline and barred owl population increase, depend on the location, existing spotted owl habitat conditions, and the spatial and temporal scales examined. Authors hypothesized two trajectories for spotted owl populations. In one scenario, spotted owls will continue to decline until populations across the range are extinct. In a second scenario, which is weakly supported by slowing rates of decline in two of the study areas, spotted owl populations may stabilize at smaller populations sizes. This, however, will leave populations vulnerable to catastrophic or adverse genetic effects (Franklin et al. 2021, p. 18-19).

Information presented above and below indicates that both barred owls and spotted owls prefer older forest habitat, although spotted owls are more reliant on older forests for roosting foraging and breeding. The Spotted Owl Recovery Plan recognized this mutual preference, and greater spotted owl reliance, on older forest by stating: "Because barred owls compete with spotted owls for habitat and resources for breeding, feeding, and sheltering, ongoing loss of habitat has the potential to intensify the competition by reducing the total amount of these resources available to the spotted owl and bring barred owls into closer proximity with the spotted owl." (USFWS 2011a, p. I-9). To help reduce or minimize this threat, the USFWS developed Recovery Action 32 (USFWS 2011a, p. III-67) which recommends conserving and restoring older, multi-layered forests across the range of the spotted owl. As discussed below, several researchers have found, and/or recommended, protection of older forest as a prioritized element of spotted owl conservation and recovery when barred owls are present.

Habitat management and barred owls at the spotted owl site territory/home range scale:

General effects to spotted owls from barred owls at the spotted owl territory scale:

Based on extensive survey and monitoring data and other regional trend information, within the action area, spotted owl populations are low and declining and the barred owl population is high and increasing. The likelihood of one or more barred owls using or residing habitat within most spotted owl territories is high and increasing, especially in the North Coast planning province. This includes a reasonable potential for multiple (2-4) barred owl pairs residing within a single spotted owl site territory. Barred owls are now an established part of the environmental baseline for spotted owls in most of the action area, including influence on whether and how spotted owls use existing habitat. At the spotted owl territory scale, barred owl effects on spotted owl presence, survival and reproduction are numerous, substantial and well documented. Barred and spotted owls share similar habitats and are 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, Holm et al. 2016, Long and Wolf 2019, Irwin et al. 2020). At all spatial scales, barred and spotted owls are competing for 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; Wiens et al., 2014, pp. 24 and 33). In the 2021 meta-analysis of spotted owl population changes, Franklin et al. (2021 pp. 1, 9-18) noted: "Barred owl presence on spotted owl territories was the primary factor negatively affecting apparent survival, recruitment, and ultimately, rates of population change. Analysis of spotted and barred owl detections in an occupancy framework corroborated the capture-recapture analyses with barred owl presence increasing territorial extinction and decreasing territorial colonization of spotted owls." The presence of barred owls has led to an increase in northern spotted owl territorial extinction rates (Olson et al. 2005; Kroll et al. 2010; Dugger et al. 2011, 2016; Sovern et al. 2014; Yackulic et al. 2014). Sovern et al. (2014); and Dugger et al. (2016) reported strong evidence that the presence of barred owls was negatively associated with spotted owl colonization rates, and strongly positively associated with spotted owl extinction rates within a spotted owl site territory.

Spotted owl territory-scale habitats and barred owls:

The most recent range-wide population meta-analysis (et al. 2021, pp. 13, 18) found that spotted owl sites with greater amounts of spotted owl habitat supported increased colonization and decreased spotted owl site extinction, even when barred owls were present. Yackulic (2019, pp. 4-6) and others found that the influence of habitat amounts on spotted owl population extirpation was similar in magnitude to the influence of barred owls. Because barred owls compete with northern spotted owls for common habitat and resources for breeding, feeding and sheltering, ongoing loss of spotted owl territory habitat when barred owls are present, is likely to intensify this intraspecific competition by reducing the total amount of these resources available to spotted owls and by bringing barred owls into closer proximity with the northern spotted owl (Wiens et al. 2014, p. 28, Dugger et al. 2011, p. 2467; Forsman et al. 2011, pp. 69-70). Spotted owls may attempt to reduce competitive interactions with barred owls by spatial avoidance. However, in doing so, they may limit their available resources (e.g., selecting lower quality foraging habitat) and experience increases in predation risk, as suggested by the high incidence of avian predation on spotted owls in one study (Wiens et al. 2014 p. 37) where most verified predation was from species other than barred owls.

Spotted owl territory-scale older forest habitat and barred owls:

Dugger et al. (2005), Olson et al. (2004), Franklin et al. (2000) and others have independently found that the amount of old forest in spotted owl territories had a positive influence on their survival. Davis et al. (2016 p. 14 and Figure 1) reported a strong negative correlation between spotted owl territories with barred owl detections and habitat quality. Dugger et al. (2011, pp. 2463-2467) described synergistic effects associated with spotted owl territory composition and the presence of barred owls; and even though some northern spotted owl pairs retained their territories and continued to survive and successfully reproduce during their study, even when barred owls were present, the effect of suitable habitat (mature and old forest) alteration on spotted owl pair survival (estimated as the probability of extinction of a single territory) may be exacerbated by 2-3 times (Dugger et al. 2011, pp. 2462, 2463, 2465) when barred owls were present. Wiens et al. (2014 p. 38) found the presence of barred owls in a spotted owl territory reduced the amount of old forest available to spotted owls: and they found a strong, positive relationship between seasonal (6-month) survival probabilities of both species and the proportion of old (>120 yr.) conifer forest within individual home ranges, which suggested that availability of old forest was a potential limiting factor in the competitive relationship between these two species (Wiens et al. 2014 pp. 1-2, 30 and Figure 13). Wiens et al. (2014) and others found that both barred and spotted owls use mid- and late-seral forests, and both species prefer older forests (> 120 years), especially for nesting. Wiens et al. (2014 p. 30) also noted that: "dietary analysis illustrated that barred owls foraged opportunistically across a broad range of prey types and sizes, whereas spotted owls specialized on arboreal and semiarboreal mammals associated with older conifer forest". Furthermore, barred owls appear to use or tolerate a greater range of forest types compared to spotted owls (Dugger et al. 2011, p. 2466; Wiens et al. 2014, p. 32), while requiring less habitat due to home ranges 2-4 times smaller than for spotted owls.

Additionally, because northern spotted owls have a more limited diet than barred owls, they require a larger territory to support their needs and likely expend more energy foraging in a territory compared to barred owls (USFWS 2019 p. 69). Use of a larger territory may also result in increases in predation risk, as suggested by the high incidence of various types of avian predation on spotted owls in the Wiens et al. (2014 p. 37) study. As generalists, barred owls can forage in a wider variety of habitats than northern spotted owls. Barred owls can move into open areas outside of forested habitats to forage (Holt and Bitter 2007, p. 10), and are more apt to forage in meadow and riparian areas than northern spotted owls (Hamer et al. 2001, pp. 255–226; Wiens et al. 2014, p. 21-22). Wiens et al. (2014, p. 32) found that northern spotted owls spent more time foraging on steep slopes dominated by old conifers (>120 year) while barred owls used a broader range of forest types and frequently used flatter, riparian areas with large hardwood and conifer trees; and they found through pellet analyses that spotted owl prey were more associated with older conifer forest, compared to prey for barred owls. Wiens et al. (2014 p. 1) concluded that: "When viewed collectively, our results support the hypothesis that interference competition with barred owls for territorial space can constrain the availability of critical resources required for successful recruitment and reproduction of spotted owls. Availability of old forests and associated prey species appeared to be the most strongly limiting factors in the competitive relationship between these species, indicating that further loss of these conditions can lead to increases in competitive pressure (Wiens et al. 2014 p. 1).

Barred owls and their competitive effects with spotted owls are now an established attribute of the action area environmental baseline. Therefore, habitat management must be evaluated with respect to changes in spotted owl habitat and also changes in barred owl populations and behaviors, including competition with spotted owls and their resources.

When considering the best available science findings and the combination of barred owl competition and habitat removal, it is the Service's opinion that within a spotted owl occupied territory, when barred owls are present, spotted owl habitat removal or downgrade, especially of older forest, can:

increase the amount of spotted-barred owl encounters as both species increasingly compete for the same reduced forested habitat resources for foraging, roosting and breeding;

intensify the effects of spotted-barred owl encounters;

reduce spotted owl use of older forests for foraging and roosting due to habitat removal or exclusion due to barred owls;

alter spotted owl breeding season territory behavior and result in increased energy expenditure and increased risk of general avian predation as spotted owls attempt to modify the shape or extent of their territory;

disproportionately affect spotted owls versus barred owls due to spotted owls having a greater reliance on older forest.

increase the likelihood of spotted owl territory extinction.

The above factors directly and indirectly reduce spotted owl fitness, survival and reproduction within an occupied site territory.

Conclusions: Based on the above information, the Service concludes that within an occupied spotted owl territory when barred owls are present: the effects to spotted owls from spotted owl habitat removal or downgrade, especially old forest, are additive to the effects of barred-spotted owl competition. In combination, this increases barred-spotted owl competition encounters and intensifies resulting effects to spotted owls, thereby resulting in total effects to spotted owls that are greater than for habitat removal alone. These determinations apply at the individual spotted owl occupied territory scale even though we have no evidence that management can significantly reduce or eliminate effects to spotted owls due to competition with barred owls, especially once barred owls are well established.

These effects are likely to vary in occurrence and intensity depending on the behavior of an individual spotted owl and circumstances within a specific territory. The conservation measures proposed by BLM and USFS incorporated into the BA, including PDC 11c in particular, provide for this additional check in occupied territories to confirm that proposed habitat modification affecting an occupied site will not rise to the level of harm/incidental take, taking in account the additive effects of habitat modification in conjunction with barred owl competition.

4.4.2 Barred Owl Management Plan

The Service is developing a management plan to control barred owls. Existing data indicate that barred owl control can increase spotted owl survival and recruitment (Wiens et al., 2021, Diller et al., 2016) (USFWS 2016 pp. 619-621, Figures 33 and 34). However, the intensity, timing and locations of any barred owl management plan, and expected results from its implementation, are still being developed by the Service. Implementation of management plan to control/remove barred owls was not assumed or relied upon in the development of the BA proposed action and the effects analysis in the BA and this Opinion.

4.4.3 Barred Owl Status

Barred owls currently appear to be the primary threat to northern spotted owls. Having expanded along the coast as far south as Marin County, California and in the Sierra Nevada, as far south as the Greenhorn Mountains in northern Kern County, California (Gutiérrez et al. 2004, pp. 7-12 to 7-13; Steger et al. 2006, p. 226, Long and Wolf 2019, p. 1283), the barred owl's range now completely overlaps that of the northern spotted owl. Evidence that barred owls are occurring in higher densities than northern spotted owls in many parts of the range (3 to 8 barred owl territories/northern spotted owl; Hamer et al. 2007; Singleton et al. 2010; Wiens et al. 2011, 2014), now including the portion of the northern spotted owl range within California (Diller et al. 2016, Dugger et al. 2016). In a recent study, the highest densities found were in the Oregon Coast Range, with up to 20 barred owls per northern spotted owl territory reported (Wiens et al. 2017, p. 12).

Interspecific competition between barred owls and spotted owls is the primary driver of spotted owl population decline seen throughout spotted owl range (Franklin et al., 2021). Interspecific competition has been defined as "an interaction between members of two or more species that, as a consequence of either exploitation of a shared resource or of interference related to that resource, has a negative effect on fitness-related characteristics of at least one species" (Wiens 1989, p. 7). Barred owls exert pressure on northern spotted owls through interference competition, where barred owls deny spotted owls access to resources (e.g., older forests) through territorial interaction and through exploitation competition where barred owls use some or all of the resources necessary for spotted owl fitness (e.g., prey species) reducing their availability (Wiens et al. 2014). Demographic evidence strongly suggests that barred owls are a dominant competitor (Franklin et al. 2021).

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, Holm et al. 2016, Long and Wolf 2019, Irwin et al. 2020). 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 northern 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 may be taking northern spotted owls' primary prey only as a generalist, northern spotted owls may be affected by a sufficient reduction in the density of these prey items due to barred owls, leading to a depletion of prey to the extent that the northern 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). These impacts are likely to have direct and indirect effects on ecosystem processes (Holm et al. 2016, p. 618)

In addition to competition for prey, barred owls are competing for habitats (Hamer et al. 1989, p. 55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274; Wiens et al., 2014, pp. 24 and 33). Barred owls were initially thought to be more closely associated with early successional forests than northern 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, more 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 the fire prone forests of eastern Washington, a telemetry study conducted on barred and northern spotted owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while northern 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). Several other studies in western Washington have similarly shown that when barred owls are present, northern spotted owl habitat use shifts upslope and into areas with steeper slopes and more marginal habitat (Gremel et al. 2005,

p. 17; Mangan et al. 2019, p. 10; Pearson and Livezey 2003, p. 274, Irwin et al. 2020). The most recent rangewide meta-analysis indicated that barred owl colonization of northern spotted owl territories was more likely in lower-elevation territories in most study areas (Franklin et al. 2021, pp. 13, 18).

In addition to resource competition, barred owls have been documented to physically attack northern spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a northern spotted owl (Leskiw and Gutiérrez 1998, p. 226).

A consensus in the literature documents the negative influence barred owls are having on northern spotted owl site occupancy, fecundity, reproduction, apparent survival, and detectability, and that data indicates that over the last 26 years, they are contributing to declines in northern spotted owl populations (Olson et al. 2005, p. 924; Forsman et al. 2011, pp. 69-70), Dugger et al. 2011, pp. 2463-2467; Dugger et al. 2016, pp. 70-96); Franklin et al. 2021, entire). As barred owls have expanded, the occupancy of historical northern spotted owl territories is declining (Franklin et al. 2021, p. 17). Even 20 years ago, site occupancy of northern spotted owls in Washington and Oregon was 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 northern 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 northern spotted owl circles than occupied northern spotted owl circles (centered on historical northern 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 northern spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at northern spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a northern spotted owl territory would be occupied by a pair of northern 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 northern spotted owls from territories in Oregon. More recently, results from a barred owl and northern spotted owl radio-telemetry study in Washington reported two northern spotted owls fleeing their territories and traveling six and 15 miles, believed to be as a result of frequent direct encounters with barred owls; both northern spotted owls were subsequently found dead (Irwin et al. 2010, p. 3-4).

Numerous studies suggest that barred owls are negatively affecting northern spotted owl survival and reproduction. Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of northern 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) described synergistic effects associated with territory composition and presence of barred owls; some northern 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 northern 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 northern spotted owls, both through its immediate effects on local extinction and by indirectly lowering colonization (Yackulic et al., 2014, pp. 271-273).

Most recently, apparent survival, recruitment, and territory colonization and extinction rates were the key vital rates associated with barred owl presence in northern spotted owl populations (Franklin et al. 2021, pp. 9-18). Franklin et al. (2021, p. 19) suggested that without barred owl removal management, near-term extirpation of northern spotted owls is likely in portions of the range, and the small populations that may remain in other parts of the range will be highly vulnerable to extirpation due to wildfire or other stressors, resulting in eventual extinction.

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of northern 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 northern 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 northern spotted owls because northern spotted owls often cannot be relocated after they are displaced by barred owls (Forsman, E. pers. comm. 2006, cited in Service 2011b, p. B-11). Dugger et al. (2011, pp. 2463-2467) confirmed the synergistic effects of barred owls and territory habitat characteristics on extirpation and colonization rates of territories by northern spotted owls. Extirpation rates of northern spotted owl territories nearly tripled when barred owls were detected (Dugger et al. 2011, p. 2464).

Monitoring and management of northern 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). Evidence that northern spotted owls were responding less frequently during surveys led the Service and its many research partners to update the northern spotted owl survey protocol (Service 2012b) and develop a survey protocol using autonomous recording units (Service 2021, entire). The recent changes to the northern spotted owl survey protocol were based on the probability of detecting northern spotted owls when barred owls are present (See Service Memorandum, revised January 9, 2012, "Northern Spotted Owl Survey Protocol" and attached "Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls" for guidance and methodology).

There is no evidence that the increasing trend in barred owls has stabilized in any portion of the northern spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized" (Gutiérrez et al. 2004, pp. 7-38). To date, this situation does not appear to have changed.

The most recent meta-analysis of 26 years of survey and capture-recapture data at 11 study areas across the range of the northern spotted owl (Franklin et al. 2021, entire) indicated barred owl presence on northern spotted owl territories was the primary factor negatively affecting apparent survival, fecundity and recruitment, increasing territorial extirpation, decreasing territorial colonization of northern spotted owls, and ultimately, continued rates of population decline. In addition to lowering northern spotted owl survival and reproduction, competition with barred owl appears to impair the ability of younger northern spotted owls to acquire breeding territories (Franklin et al. 2021, p. 18).

Dugger et al. (2016) found that the removal of barred owls in the Green Diamond study area in northern California had rapid, positive effects on northern spotted owl survival and rates of population change. The meta-analysis of the larger, multi-year barred owl removal experiment (Wiens et al. 2021, entire) in 5 study areas across the range demonstrated that removal of invasive barred owls had a strong, positive effect on survival of native northern spotted owls, and subsequently reduced long-term population declines. Barred owl removal had a positive, but weaker, effect on recruitment of northern spotted owls, which was likely a consequence of consistently depressed reproduction of northern spotted owls (and diminished availability of new recruits) during the later years of the study. Removal of barred owls also influenced the dispersal dynamics of resident northern spotted owls in at least two study areas where NSO from territories without barred owl removal had an increased estimated probability of movement to territories in treatment areas where barred owls had been removed. Both studies suggest that, along with habitat conservation and management, barred owl removal may be able to slow or reverse northern spotted owl population declines on at least a localized scale (Diller et al. 2016, Wiens et al. 2021).

The rate of decline of spotted owl populations in control areas, where barred owl removal did not occur, by the end of the barred owl removal experiment was severe (approximately 12 percent per year), indicating an increasingly high risk of northern spotted owl populations to local extirpations without barred owl control (Wiens et al. 2021 p. 7). Results of all barred owl control experiments across the range indicated that persistence and recovery of northern spotted owl populations are possible with active control of the barred owl threat, at least over the short term, in managed areas (Wiens et al. 2021, p. 7). However, recovery of northern spotted owls will also require short and long-term availability of older forests and suitable northern spotted owl habitat on the landscape (Wiens et al. 2021, p. 7, Franklin et al. 2021, p.18).

5 Status of Spotted Owl Critical Habitat

See Appendix D, Status of the Species for Northern Spotted Owl and its Critical Habitat.

6 Status of Marbled Murrelet

See Appendix C, Status of the Species For Marbled Murrelet and its Critical Habitat.

7 Status of Marbled Murrelet Critical Habitat

See Appendix C, Status of the Species For Marbled Murrelet and its Critical Habitat.

8 Environmental Baseline

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

8.1 Spotted Owl

For a complete discussion of the spotted owl environmental baseline see the BA, pages 37-41. That section describes conditions on and near Siuslaw National Forest lands within the action area, including:

- Modeled NSO dispersal habitat within the Heavy Thinning and Early Successional Treatment project area (Figure 5)
- (Figure 6): Modeled NSO dispersal habitat within the Recreational Improvements project area.
- (Figure 7): Overlap of highly suitable habitat and potential NSO core areas and home ranges.
- (Figure 8): NSO dispersal capable and limited habitat within the Sand Lake project area. Capable is defined as pixels with >40% dispersal forest within a 15.5 mi radius roving circular window (Davis et al. 2011).
- (Figure 9): Areas with highest potential for NSO nesting trees within Hebo Ranger District (Glenn et al. 2017). Sand Lake Heavy Thinning and Mountain Bike Trail projects depicted in red. The green areas represent most probable areas for nest tree locations and black dots represent documented NSO activity centers. Hashed areas represent sites with confirmed nest trees or juveniles.

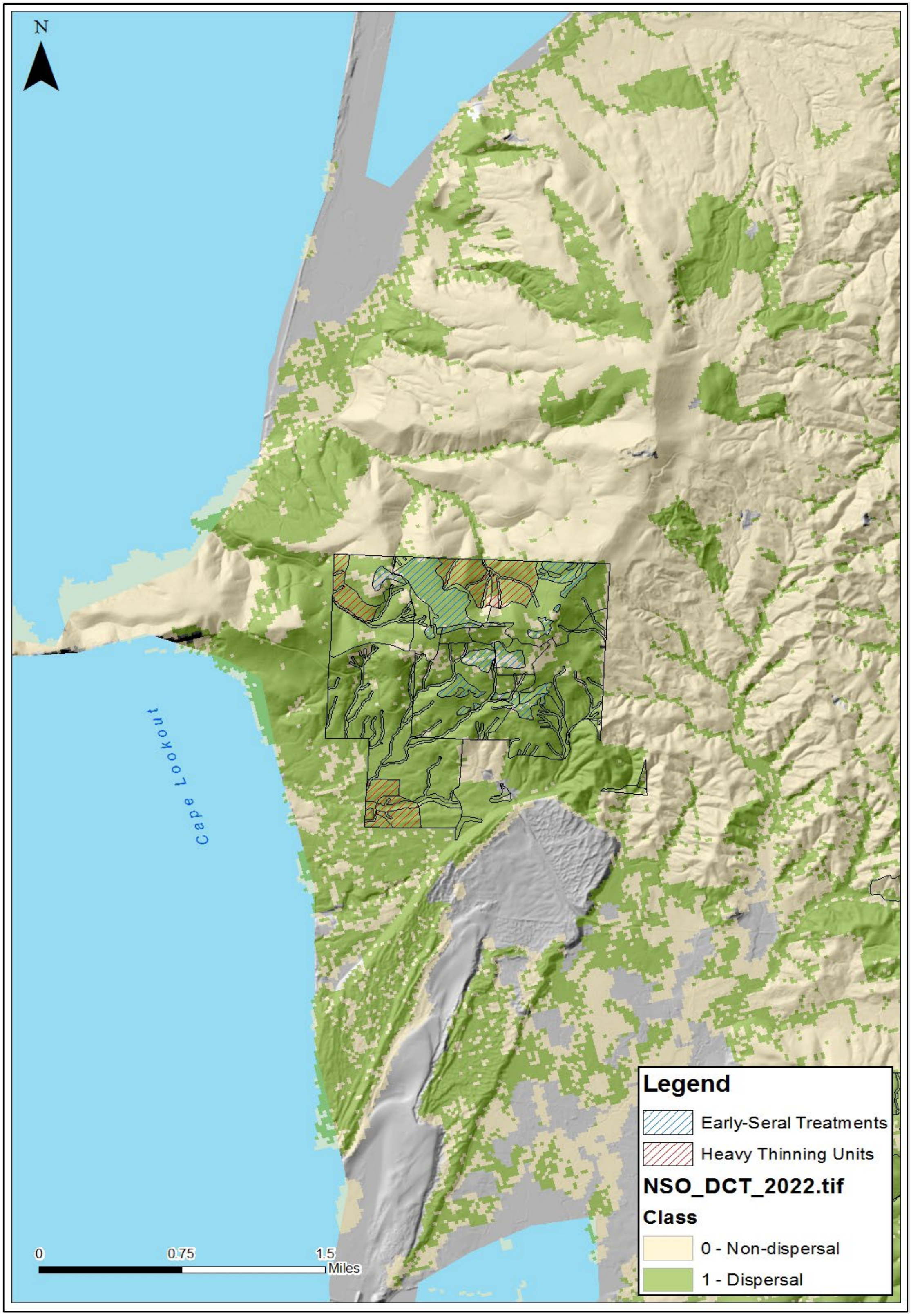

Figure 5: Modeled NSO dispersal habitat within the Heavy Thinning and Early Successional Treatment project area (Figure 12 of the BA).

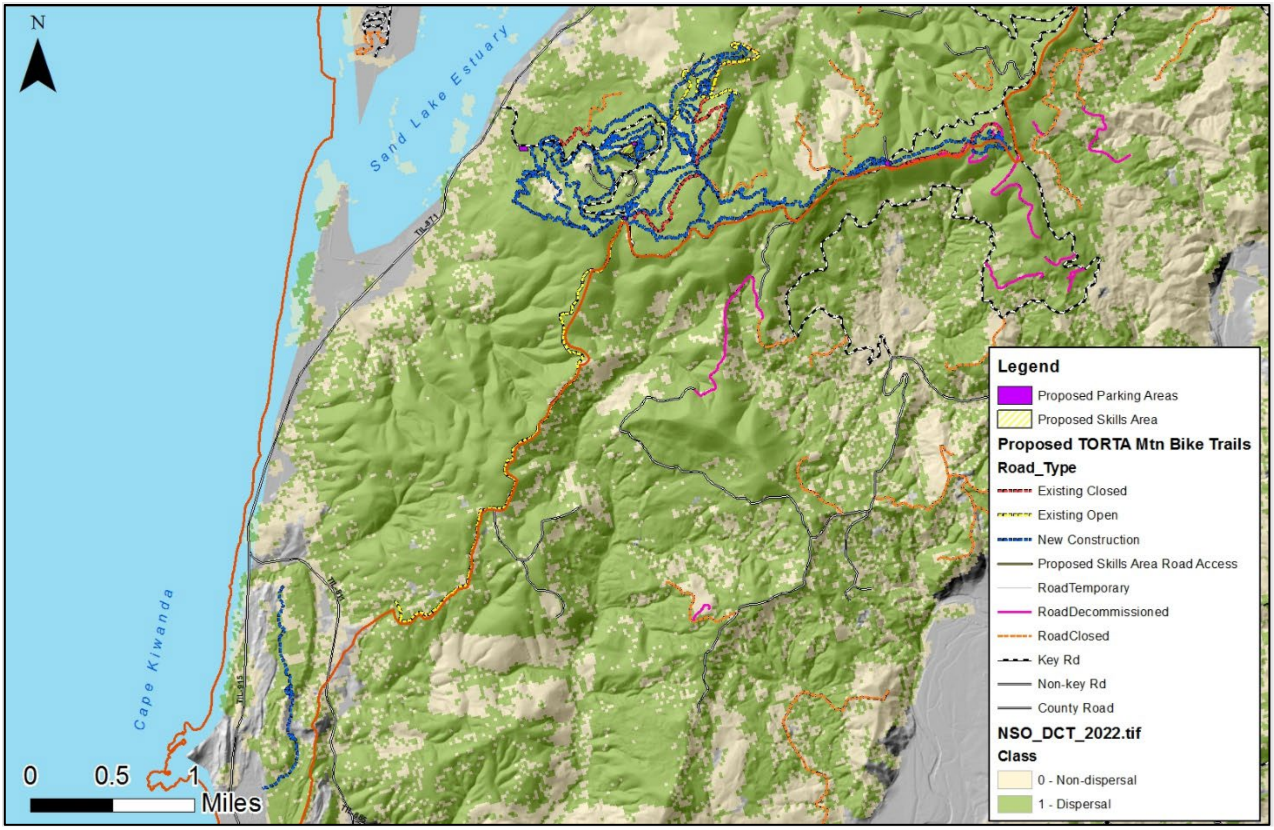

Figure 6: (Figure 13 from the BA) Modeled NSO dispersal habitat within the Recreational Improvements project area.

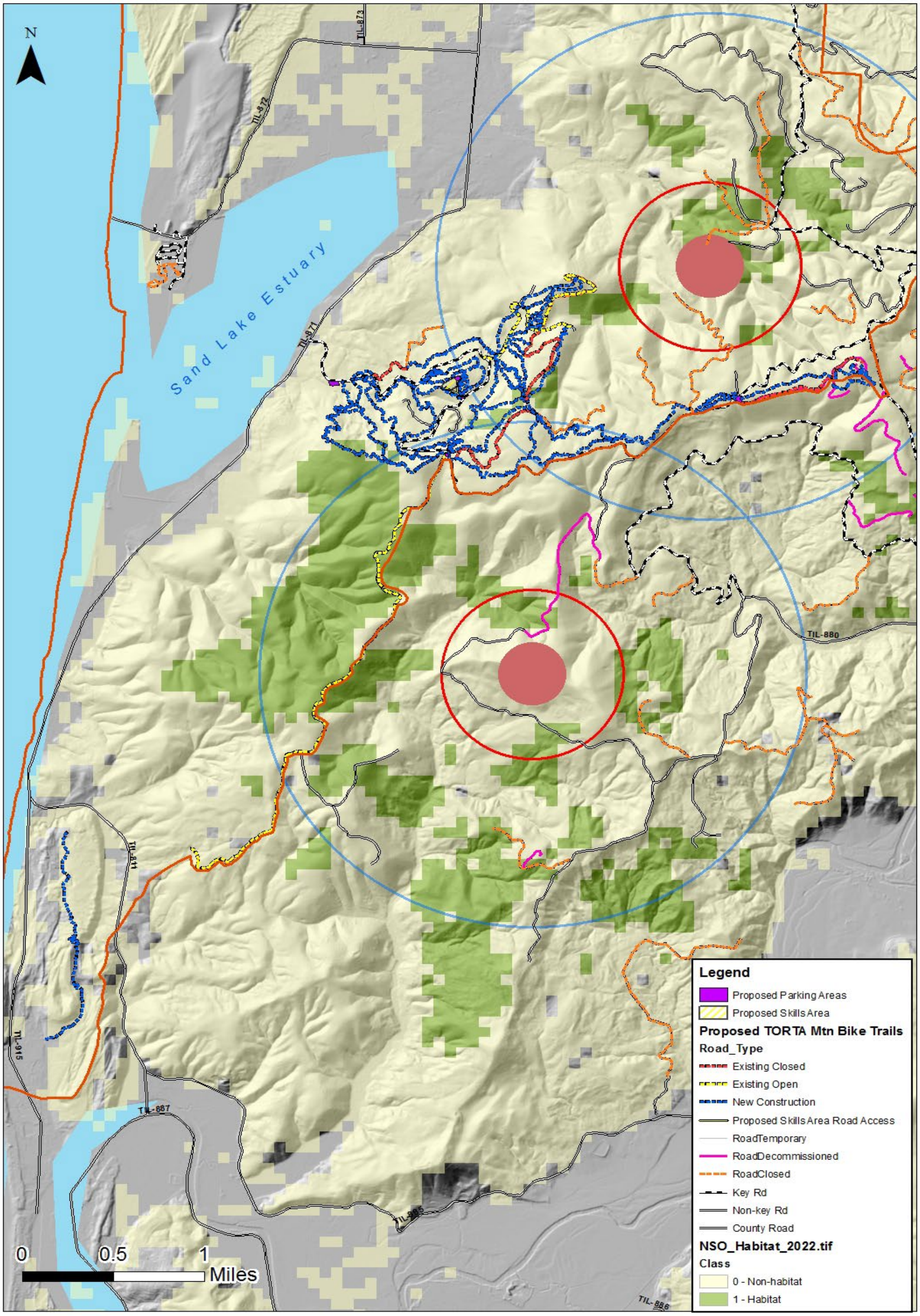

Figure 7:(Figure 14 from the BA) Overlap of highly suitable habitat and potential NSO core areas and home ranges.

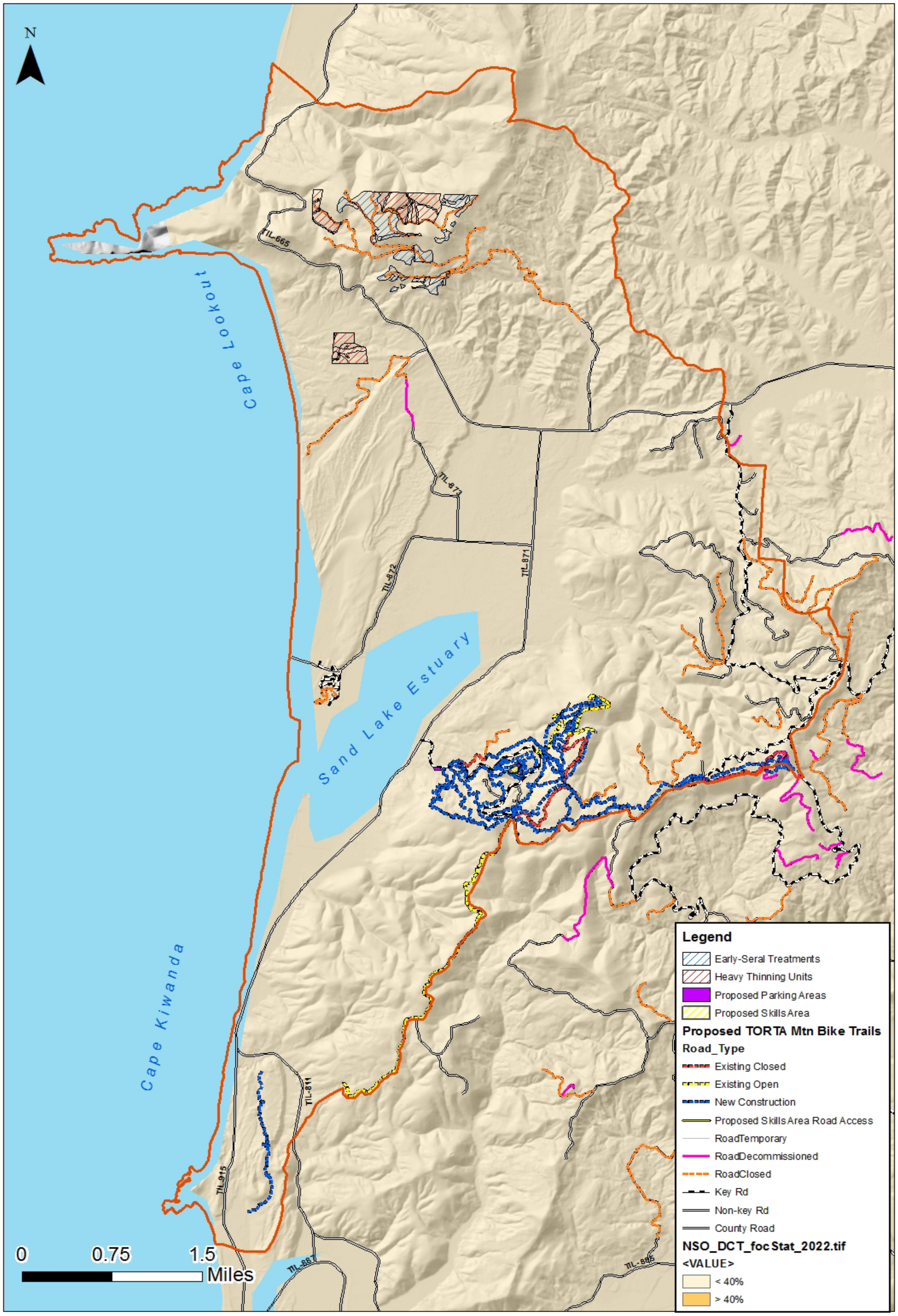

Figure 8: (Figure 15 from the BA) NSO dispersal capable and limited habitat within the Sand Lake project area. Capable is defined as pixels with >40% dispersal forest within a 15.5 mi radius roving circular window (Davis et al. 2011).

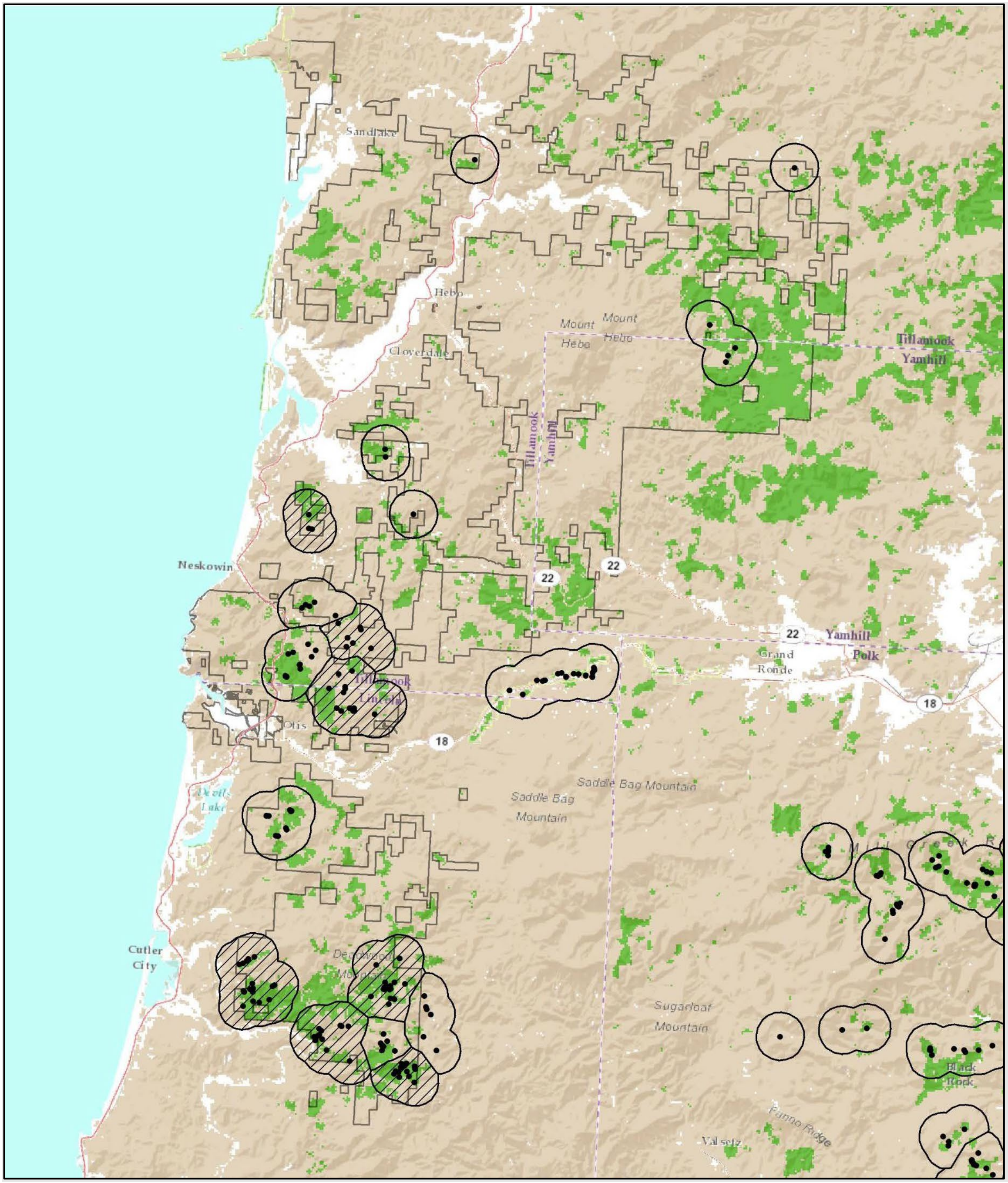

Figure 9: (Figure 16 from the BA): Areas with highest potential for NSO nesting trees within Hebo Ranger District (Glenn et al. 2017).

The green areas represent most probable areas for nest tree locations and black dots represent documented NSO activity centers. Hashed areas represent sites with confirmed nest trees or juveniles.

8.2 Spotted Owl Critical Habitat

For a complete discussion of the spotted owl critical habitat environmental baseline see the BA, pages 37-41. That section describes conditions on and near Siuslaw National Forest lands within the action area, including:

- Acres of spotted owl critical and habitat type habitat within the action area footprint Table 5;
- Critical and suitable NSO habitat within the Sand Lake Project area (Figure 10).

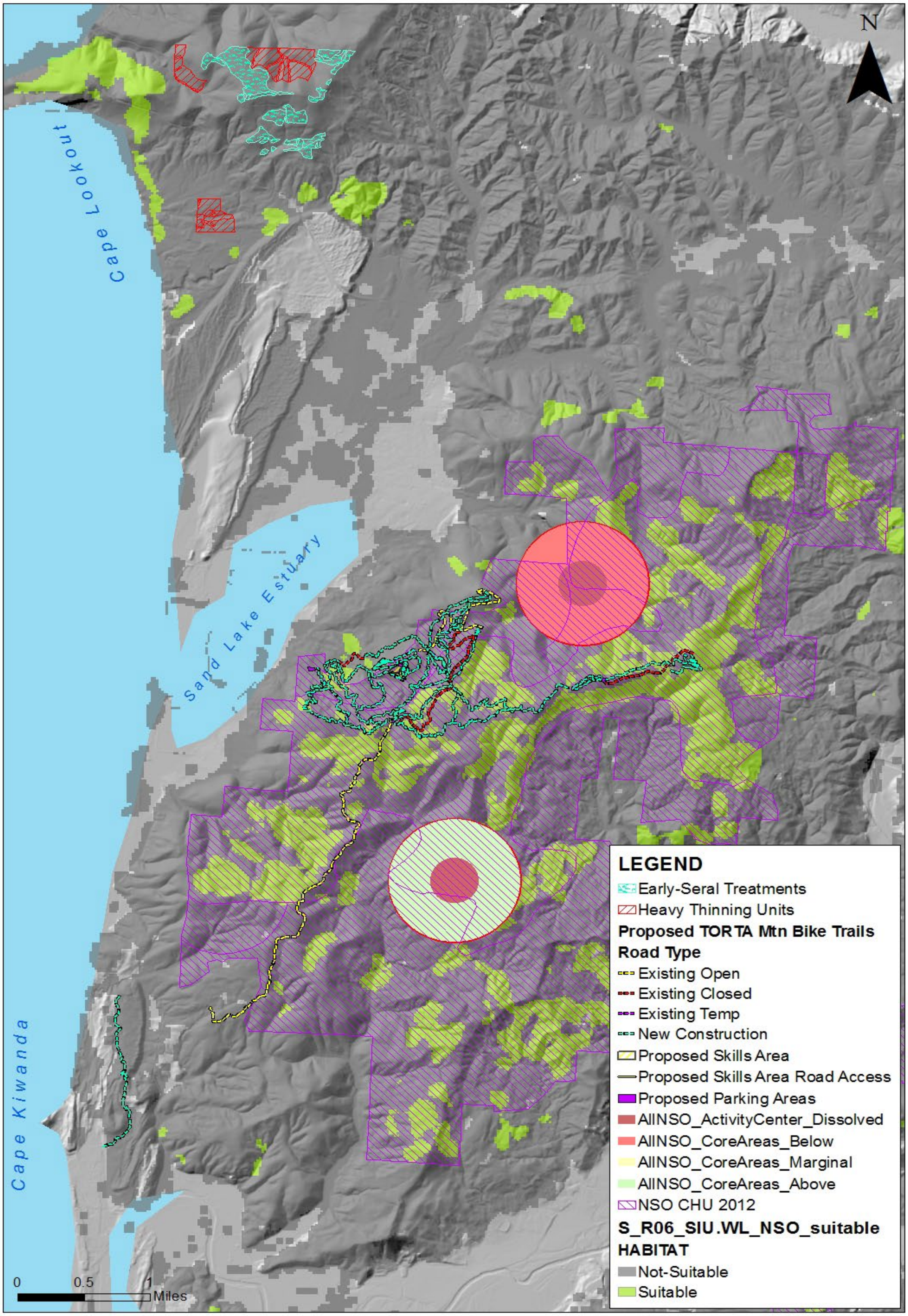

Figure 10: (Figure 6 in the BA) Critical and suitable NSO habitat within the Sand Lake Project area.

8.3 Marbled Murrelet

For a complete discussion of the spotted owl environmental baseline see the BA, pages 37-38, 42-45. That section describes conditions on and near Siuslaw National Forest lands within the action area, including:

- (Figure 11): Results from marbled murrelet habitat assessments in the Heavy Thinning project area (North Block)
- (Figure 12): Results from marbled murrelet habitat and 1 km food subsidies assessment in the Mountain Bike Trail project area (South Block)

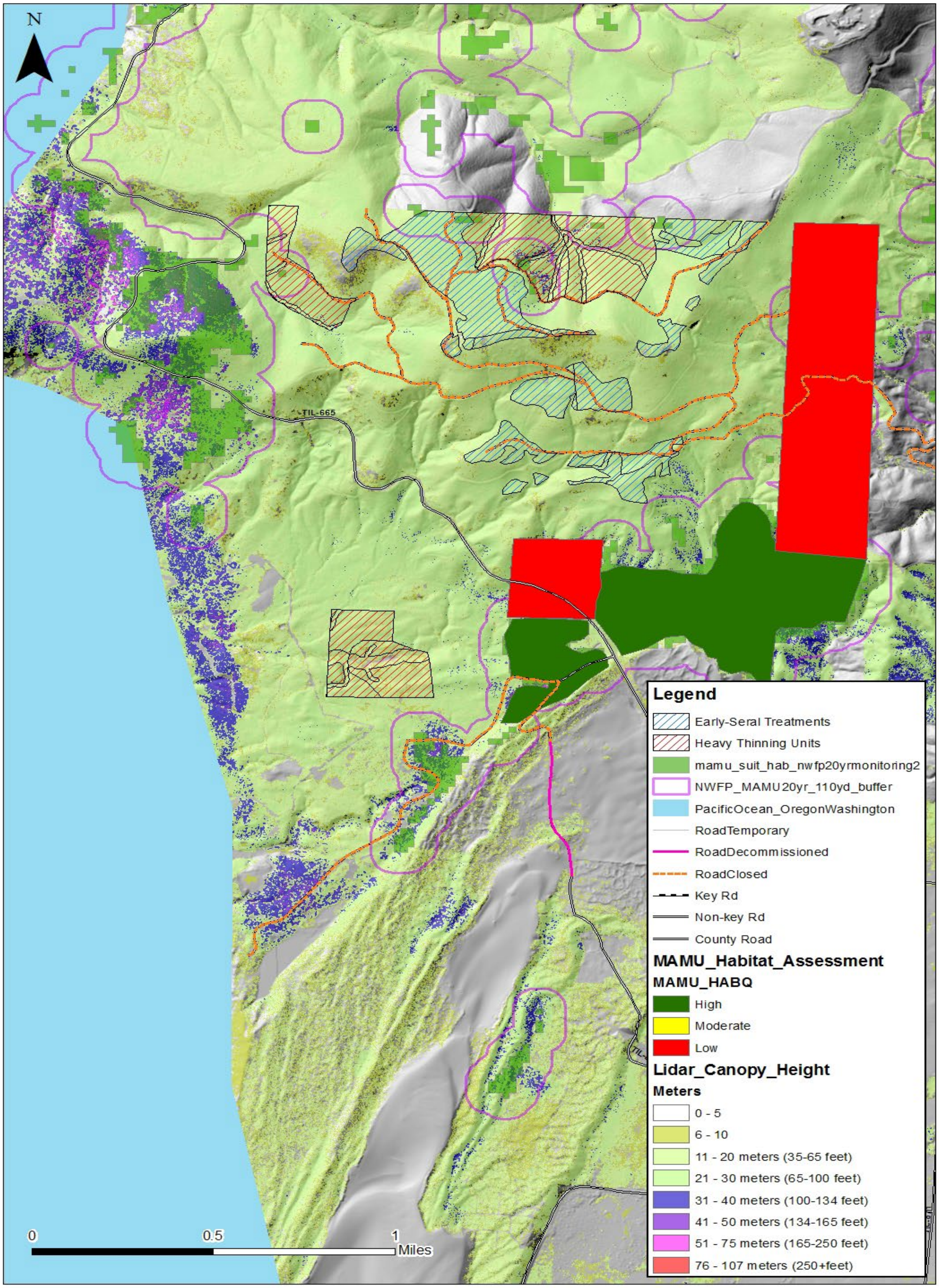

Figure 11:(Figure 9 from the BA) Results from marbled murrelet habitat assessments in the Heavy Thinning project area (North Block).

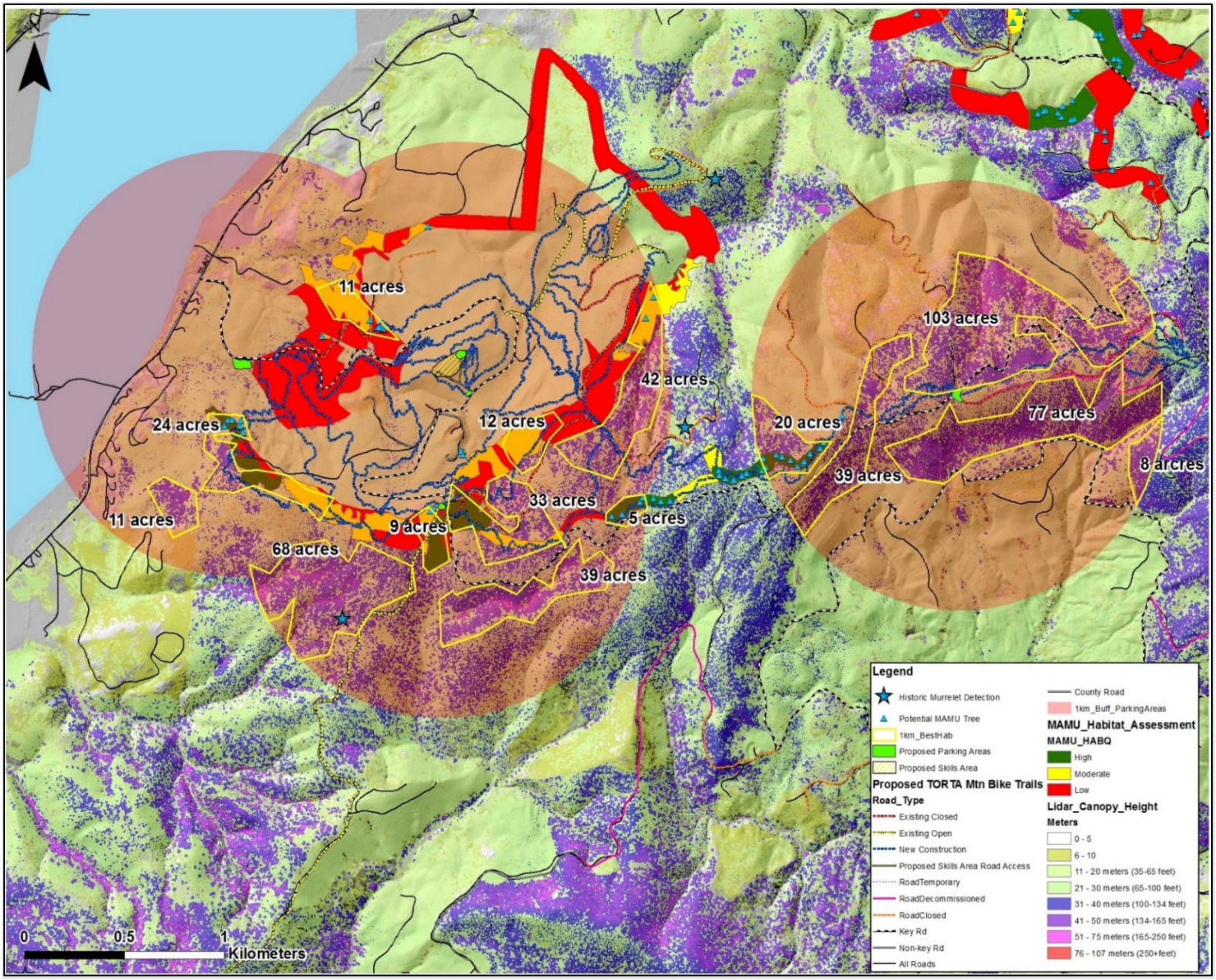

Figure 12: (Figure 10 from the BA) Results from marbled murrelet habitat and 1 km food subsidies assessment in the Mountain Bike Trail project area (South Block).

8.4 Marbled Murrelet Critical Habitat

For a complete discussion of the spotted owl environmental baseline see the BA, pages 37-38, 42-45. That section describes conditions on and near Siuslaw National Forest lands within the action area, including:

- Acres of MAMU critical habitat and suitable habitat within the project area with a summary of effects from potential actions (Table 7)
- Critical and suitable marbled murrelet habitat within the Sand Lake Project area (Figure 13).

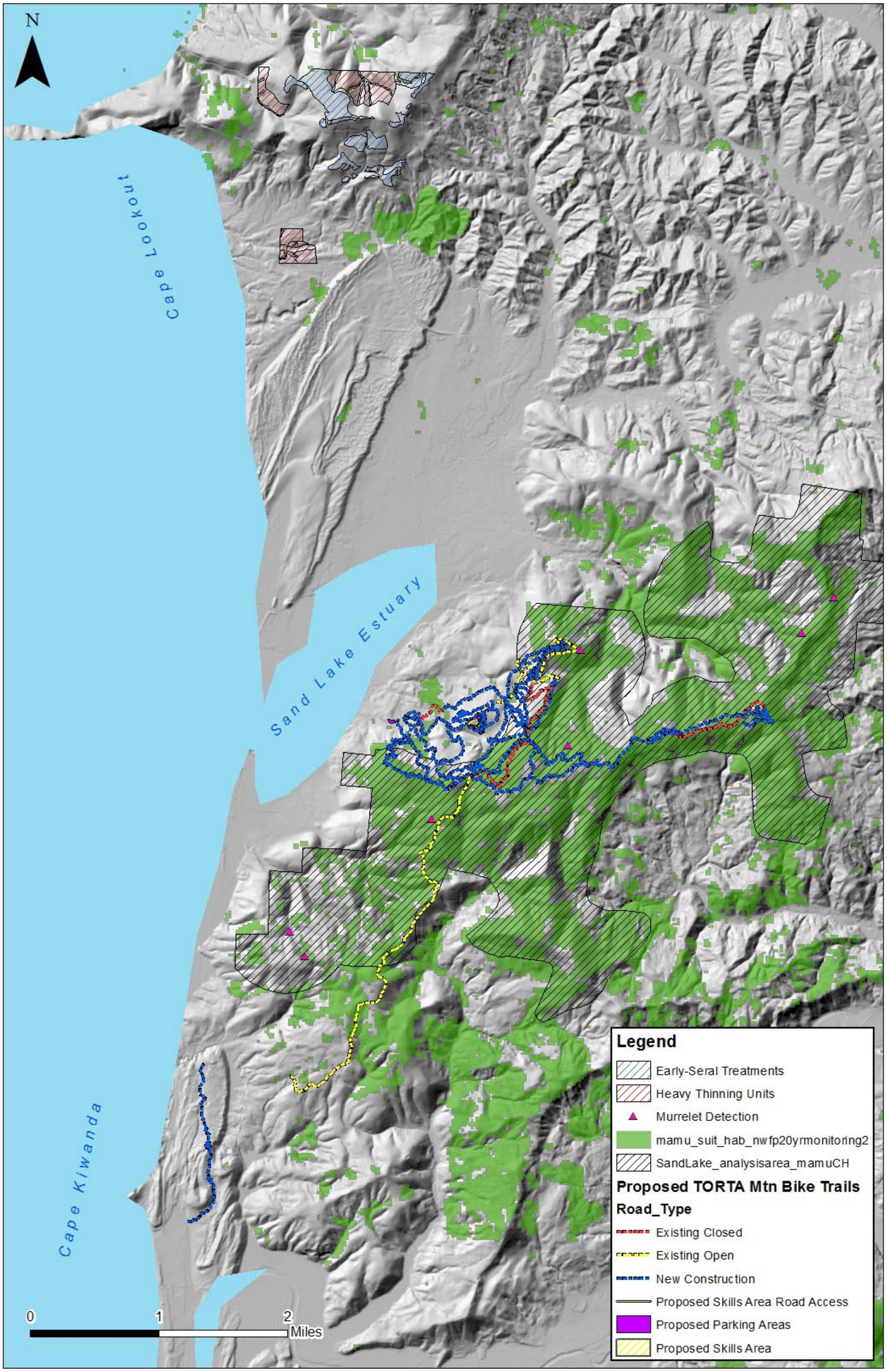

Figure 13: (Figure 7 of the BA) Critical and suitable marbled murrelet habitat within Sand Lake Project area.

8.5 Climate Change

The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2014a, pp. 119-120). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014a, p. 119). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time. The nature of the effect depends on the species, the magnitude and speed of climate change, and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014b, pp. 64, 67-69, 94, 299).

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 2011, pp. III-5 - 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° C to 0.6° C (0.2° F to 1° F) per decade (Mote and Salathé 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 (Salathé 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. Modeling specific for Pacific Northwest forests predicts an increase of fire season environments that are conducive to large forest wildfires (Davis et al. 2017, p. 184). 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).

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in a diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010, pp. 72-73). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littell et al. 2009, p. 15). Additionally, the changing climate will likely alter the species composition of forest ecosystems.

9 Effects of the Action

The following Effects of the Action are excerpted or adapted from, and supplement, information in the BA. For more information see pages 45-67 of the BA under the sections entitled "Effects Analysis Methodology" and "Effects Analysis Determinations – Federally Protected Resources".

Effects of the action are all direct and indirect consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (i.e., formerly called interrelated or interdependent actions), that will be added to the environmental baseline. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). Cumulative effects, discussed by Species in this Opinion, are those resulting from future State, or private activities (not involving Federal activities) that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR § 402.02).

The USFWS evaluates the degree of effect resulting from a proposed action by considering the proximity, distribution, timing, type, duration, frequency, intensity, and severity of effects (USDI and USDC 1998). The standard to be analyzed here is whether the proposed action will "reduce appreciably the likelihood of both the survival and recovery of NSO in the wild by reducing the reproduction, numbers, or. distribution of the species."

The following analysis considers the potential adverse effects of the action on spotted owl, marbled murrelet, and its designated Critical Habitat.

BA PDC, including selected excerpts discussed in further detail in this Opinion (Section 2.4), define and limit adverse effects to these species and their CH, including prohibiting effects that would cause injury or mortality to spotted owls.

The following information is provided to inform the effects discussions that follow:

- The proposed action effects to species or their CH will be consistent with those described in Table 16, "Action Description and Deconstruction with Exposure and Effects Matrix for the Northern Spotted Owl" and Table 17, "Action Description and Deconstruction with Exposure and Effects Matrix for the Marbled Murrelet".
- The proposed action will be designed and implemented consistent with all specifications in the BA (key specifications are reiterated in this Opinion)—including all Project Category Descriptions, Definitions and Project Design Criteria. Adherence to all specifications is required, including to limit the quantity, manner and extent of the effects of the proposed action.
- As stated above, the (collective) proposed action ***may affect, and is likely to adversely affect,*** the northern spotted owl and marbled murrelet; and marbled murrelet critical habitat. However, individual projects or project components, may be implemented in a manner that instead ***may affect, and would not likely adversely affect***, species or its critical habitat.

These lesser effect outcomes may be described below because they could occur and for informative purposes—including to help define or avoid adverse effects of individual project components in some situations.

- Quantification of the proposed actions and any effects by activity are shown in the BA and this Opinion (Section 2.3). Some activities also include a summary of that quantification in the discussion below.
- USFS biologists are responsible to design, implement, monitor and report activities so they will remain consistent with all specifications and the resulting effects described in the BA and this Section of the Opinion; thereby ensuring that reinitiation of consultation would not be required.

Table 10: Effect Outcomes from Sand Lake Project Action Types for ESA Listed Species
From Table 7 of the BA

Species	Determination [2]		Analysis Rationale
Heavy Thinning and Early Seral Treatments			
Northern Spotted Owl *(Strix occidentalis caurina)* Federally threatened	**Habitat Modification**	**LAA**	Removal of dispersal habitat with canopy cover below 40% is considered as removal of dispersal habitat and although the amount of removal is minimal at only 2.9% of the available dispersal habitat within the action area, the Sand Lake Watershed is classified as dispersal limited and further reduction in dispersal results in adverse effects.
	Disturbance/ Disruption	**NLAA**	NSO nesting, roosting, foraging activities not expected within distance limitations (PDC-based) of treatments.
	Critical Habitat	**NE**	Critical Habitat is not present in action area.
Marbled Murrelet *(Brachyramphus marmoratus)* Federally threatened	**Habitat Modification**	**NLAA**	Suitable habitat is not present within treatment units. Young, dense forest with lack of potential nest trees.
	Predation and Disturbance/ Disruption	**NLAA**	Suitable habitat is not present within units and no treatments within 110 yds of suitable habitat.
	Critical Habitat	**NE**	Critical Habitat is not present in action area.
Sand Lake Recreation Improvements (and Recreation Use)			
Northern Spotted Owl *(Strix occidentalis caurina)* Federally threatened	**Habitat Modification**	**NLAA**	Overstory trees retained and $\geq$ 40 or 60% canopy cover in dispersal and/or foraging only habitats. No Modification of Habitat Functionality.
	Disturbance/ Disruption	**NLAA**	NSO nesting activities w/ roosting not expected within distance limitations (PDC-based) of Rec treatments and Rec use.
	Critical Habitat	**NLAA**	CH covers majority of area. PDCs will protect stand composition, key structures and stand functions (PBFs) for life history of NSO, however Skills Park area is permanent loss of 1 acre of critical habitat within a habitat capable area.
Marbled Murrelet *(Brachyramphus marmoratus)* Federally threatened	**Habitat Modification**	**LAA**	Project will downgrade existing suitable habitat to buffer habitat with parking areas in critical habitat maintained at 40% canopy cover.
	Predation and Disturbance/ Disruption	**LAA**	Corvid abundance expected to increase from baseline levels in Skills Park and parking areas (all trailheads are within parking areas).
	Critical Habitat	**LAA**	Critical Habitat covers approx. half of project area where minimal intensity treatments and Rec use overlap Critical Habitat . Parking areas will downgrade suitable habitat to buffer habitat within critical habitat.

[1] Areas affected directly or indirectly by proposed Federal action and not merely the immediate area of the project footprint.

[2] NE= No Effect, NLAA= Not Likely to Adversely Affect, LAA= Likely to Adversely Affect

In summary, the Heavy Thinning and Early Successional Treatments will result in adverse effects to the northern spotted owl from the removal of dispersal habitat and is not likely to adversely affect murrelets because suitable habitat is not present; critical habitat is not present for either species and therefore not impacted by the action in the Heavy Thinning and Early Seral portion of the project area (Table 4 and 7). The Recreational Improvements portion of the project will result in adverse effects to MAMU and designated critical habitat for MAMU from habitat modification/downgrade of suitable habitat into buffer habitat to create four, less than one acre parking lots in previously disturbed areas within MAMU CH, and from increased predation and disruption from increased human presence and increased corvid populations. (Table 7). Although the skills park will result in a permanent loss of 1 acre of dispersal habitat in NSO CH and will prevent 2.25 acres of dispersal habitat in NSO CH from developing into suitable habitat, effects are considered minimal and not likely to adversely affect NSO CH or the spotted owl's recovery or persistence on the landscape (Table 6). Tables 4, 5, and 6 summarize and quantify each action's effects to NSO and MAMU by habitat type.

9.1 Overview of Heavy Thinning Project

The following overview is excerpted or adapted from information in the BA. For more information see pages 24-27 of the BA, entitled "Heavy Thinning and Early Successional Treatments within the North Block".

In natural late-successional forests, at any one point in time, there exist patches of early-successional (ES) habitat created by smaller scale disturbances. To include the full diversity of habitat components within the northern block, the Siuslaw National Forest (SNF) identified 269 potential acres to receive a total of 236 acres of early-successional and heavy thinning treatments (Table 4). All timing of activities will follow restrictions for reducing disturbance and disruption during marbled murrelet and spotted owl breeding seasons where appropriate (Table 5). Desired future conditions in these treatment areas include:

- Full diversity of habitat components appropriate for the present plant associations be present on the landscape, including areas of low tree cover.
- Variable canopy cover with some areas below 40%.
- Diverse communities of shrubs and forbs appropriate for the present plant associations, with emphasis on plants important for herbivores, pollinators, and birds.
- Structural features such as snags and downed wood are present and maintained.
- Presence of invasive weeds is minimized with the goal of native plant cover dominating.
- Hardwood trees are a component of the overstory, where appropriate.

Heavy Thinning and 2-5 Acre Gap/Opening Treatments:

Heavy thinning down to 30% canopy cover will occur in up to, but not exceed, 136 acres; and early-successional (ES) treatments which include the creation of 2-acre gaps and 5 acre openings will occur up to, but not exceed, 100 acres. Equipment will include chainsaws, heavy machinery, and haul trucks for removal of trees. The following actions will occur in the areas designated to receive ES treatments (Figure 3):

- Creation of up to 100 acres of early-successional habitat with residual canopy cover of 40%.
- Creation of openings up to 5 acres in size.
- Gap creation with total removal of tree cover through commercial harvest up to 2 acres in size.
- Gap creation through creating patches of snags, leading to eventual low canopy cover up to 2 acres in size.
- Radial Tree Releases (leaving a healthy dominant tree and creating a large opening around it).
- Planting and/or release of hardwood trees species.
- Prescribed Burning.
- Ground-based logging equipment will treat approximately 41 acres within the heavy thinning units (Table 4).
- Skyline logging equipment will treat approximately 95 acres of heavy thinning units and all the early successional units for a total of up to 195 acres (Table 4).
- Helicopter logging equipment will not be used.

Not all ES treatments would be applied in every identified area or at the same time. At the point of implementation, managers will choose which treatments will best direct the suite of current conditions on the landscape towards an accelerated transition into the desired future condition of a diverse and multi-canopy late-successional forest. Various staff (recreation, timber, botany, law enforcement) including the avian point count crew (wildlife) will be monitoring conditions on the ground in the project area. The above treatments will be implemented with the following design criteria:

- No more than 100 total acres of early-successional openings will be created.
- Any opening larger than 2 acres will maintain a low density of residual conifer trees with potential to form high quality habitat structure and to continue the development of late-successional habitat characteristics within the treatment area.
- At least **40% average canopy cover will be maintained across the 1,095-acre contiguous AMA** area (northern area of the Sand Lake EA project area).

- Openings will not be maintained over time, instead they will provide ephemeral ES habitat in which forest succession can proceed.

- Timeline for implementation will follow Project Design Criteria to reduce disturbance and disruption to NSO and MAMU as applicable; all operations will occur outside of the critical breeding seasons for both murrelets and spotted owls (Table 8 and 9).

Additional Actions Covered Under the 2017-2018 NLAA Habitat Modification LOC

The actions listed below and effects are covered and discussed in the 2017-2018 NLAA Habitat Modification LOC. These actions are associated with the Sand Lake Restoration project and tied to the light to moderate thinning timber harvest actions. Units and acreages associated with these actions are not included in the effects analysis of this consultation. The Heavy Thinning and Early Seral Treatment units were initially analyzed for light to moderate thinning, but the treatment type was changed to heavy thinning after signing of the Environmental Assessment Decision Record and therefore initiated the need for new consultation. However, actions associated with the road construction, prescribed burning, and restoration activities did not change and are included within the scope and action area of the 2017-2018 NLAA Habitat Modification BA.

Road Reconstruction

Road treatments on approximately 7 miles of closed roads will occur to access the heavy thinning and early seral treatment units with no new roads created. Reconstruction activities will involve use of heavy equipment and focus on improving drainage, template stabilization and preventing sediment delivery to streams. The roads will be administratively closed to motor vehicle use with the expectation of future decommissioning once the need for the road ends. Maintenance on haul roads includes rock re-surfacing, blading and shaping road surfaces, roadside brushing andcleaning drainage structures such as ditches and culverts. Logging out and cleaning sloughs and slides are incidental and ongoing maintenance activities within the road prism.

Prescribed Fire, Fuels Reduction, and Vegetation Treatments

- Understory Burning and Pile Burning:
  - Burning (55 acres), Partial burning (28 acres), No burning (185 acres)
- Reduce residual logging slash: scattering, chipping, mastication.
  - Limited use of heavy equipment.
- Brush and tree seedling control treatments.
- Manual and herbicide treatments.

Restoration Activities

- Create wildlife habitat as deadwood structure within Early Seral (ES) units:
  - Wildlife trees (snags) and downed wood

    - Chain saw use: directional felling and topping.
- Planting of native trees and hardwoods to increase stand diversity,
- Planting and seeding of native shrubs/forbs to increase herbivore forage,
- Planting of native flowering plants to benefit pollinators,
- Invasive/non-native plant control to limit fruiting shrub growth in openings (avian subsidy)
    - Implement Early Detection-Rapid Response (EDRR) strategy.

9.2 Overview of Sand Lake Recreation Project

The following overview is adapted from information in the BA. For more information see pages 27-30 of the BA, entitled "Sand Lake Recreation Improvements (South Block)".

The Hebo Ranger District proposes to develop recreation improvements in a forested setting as follows (Figure 4):

- a new expanded network of multi-use trails designed for mountain biking enthusiasts and hikers.
- a mountain bike skills development park for beginners or group activities
- four designated vehicle parking areas for trailhead access and shuttle turn-arounds with additional parking within the skills development park.

This recreation improvement project addresses the demand for sustainable, multi-use trails across the Nation and specifically on the Oregon Coast. One trail would tie in directly to the coastal community of Pacific City and would achieve Oregon's #1 Statewide Trail Goal of connecting trails to towns and public places (Figure 4). Implementation of these recreational trail and infrastructure improvements would occur in a planned sequence after each specific phase of the Whalen Knob Timber Restoration Thinning Project progresses across the local landscape. To reduce disturbance and disruption to any nesting murrelet or spotted owl pairs, all trail, skills park, and parking lot construction will occur outside of the critical breeding season and follow daily timing restrictions when within the species' disruption distances (Table 8 and 9).

Mountain Bike Trail Construction:

The network of trails will be constructed and maintained to Forest Service (FS) trail standards as detailed in the Trails Management Handbook, Forest Service Handbook (FSH) 2309.18. The trails will be designed to accommodate mountain bike use and designed for all rider skill levels with an emphasis on beginner and intermediate levels. Trails will be built and maintained by partners, contractors, volunteers, and Forest Service personnel. As mentioned above, trail system will utilize existing open and closed roads in addition to creation of new trail systems. A total of 30 miles of trail will be established and consist of 22.5 miles of new trails, 2.5 miles of trails on existing closed roads, and 5 miles of trails on existing open roads. Trail width will range from 24-48 inches with some corners up to 60 inches for turning radius functions. Trail vegetation clearing limits are set to a height of 10 ft. and a width of 72 inches. Equestrian riders will be permitted on all trails except the 1.5 miles of new trail construction connecting to Pacific City (Figure 4). Motorized transportation is prohibited on all trails; and electric bikes are not addressed in this consultation. Equipment used to construct trails will involve hand-tools, chainsaws, weed eaters to clear limbs and brush, plus remove down logs. Moving of earth to create the trail footprint will involve the use of small heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.

Trail Maintenance:

Trail maintenance activities will occur along all trail corridors and use the same equipment as stated in the Mountain Bike Trail Construction section. This action will occur annually and specifically involves the following tasks:

- Tread Maintenance: removal of slough, berms, and loose rocks
- Drainage Maintenance: building and maintaining water-bars and check dams, maintaining, or constructing fords and stream crossings, and cleaning inlets and outlets of culverts.
- Vegetation Management: clearing out fallen trees, cutting brush to the clearing limits.
- Signage: Installation and maintenance of trail signs

Parking Lot Construction:

Access to the trail system requires constructing and maintaining vehicle parking areas. Parking areas are proposed at four locations totaling 2.25 acres and sizes range from 0.23 to 0.9 acres in size. Parking areas would be created as follows at designated locations:

- Using existing landscape features or features from timber management activities:
    - wide road shoulders, landings, or junctions between roads
    - overstory trees will not be removed, thereby maintaining a canopy cover limits.
- Parking sites will be engineered and hardened with rock, some with shuttle turn-arounds which limits individual vehicle use (thereby reducing on-site food coolers and food waste production)
- Signage kiosks/bulletin boards will be constructed at each parking area with "Pack it in, Pack it out" (Pack it IN/OUT) educational messages along with information on the importance of limiting organic and inorganic waste to reduce the attraction of corvids (and predation impact on Threatened and Endangered (TES) species).
- Maintenance of facilities: CXT cleaning/pumping, trash removal, and weed control.
- Ongoing monitoring of illegal dumping along FS Roads 1004 and 1006 by USFS Law Enforcement, recreation staff, and occasional IDT staff (interdisciplinary team) as well

as a designated Tillamook County Sheriff (Sand Lake Rec area contract patrol) and **TORTA** proponents (Tillamook Off Road Trail Alliance) of the Sand Lake Mountain Bike Trail System. areas within or immediately adjacent to suitable habitat.

- Tillamook County Sheriff Sand Lake info: https://www.tillamooksheriff.com/sand-lake
- TORTA is a volunteer based non-profit organization founded for the enjoyment of bike enthusiasts in Tillamook County: https://www.tortamtb.com/.

Gurtis Creek Parking Area: Located at the bottom of the Middle Crest section of trails off the Sand Lake Road/Three Capes Scenic Route (area C-#1315), this area will provide approximately 25-30 vehicle spots. Infrastructure at the site would include: a CXT restroom or portable toilet, turn-around for vehicle shuttling, and animal proof trash receptacles. This parking area will be established as the main trailhead.

Skills Park Parking Area: Located at the base of the Whalen Knob skills area, this area will provide approximately 15 vehicle spots. This area will utilize a former system road which was never mapped or recorded for access. This parking area utilizes the cleared landing area from the Whalen Knob Timber Restoration Thinning Project. Infrastructure at the site will include trailhead signing, kiosk, Pack It IN/OUT trash management, and CXT restroom. Installation of animal proof trash receptacles is not guaranteed at this site, but future planning may include this feature depending on need.

Middle Crest Parking Area: Located at the junction of Middle Crest and Miles Mountain Road. This area will provide approximately 4-6 spots alongside the road. This parking area will be established with signage with educational messages about the importance of removing organic and inorganic human litter to reduce the attraction of corvids.

Buzzard Butte Parking Area: Located at the junction of the Three Blind Mice section of trails and Buzzard Butte section. This area will provide approximately 10-15 vehicle spots. Infrastructure at the site will include trailhead signing, kiosk, a portable toilet and Pack It IN/OUT trash management, plus area for a turn-around for shuttling. Trailhead signage will include educational messages about the importance of limiting organic and inorganic human litter to reduce the attraction of corvids. A CXT restroom and animal proof trash receptacles will be installed to match visitor use and patterning after Third phase construction of trails.

Mountain Bike Skills Park Construction:

The top of Whalen Knob is a proposed bike skills development area for all ages. This area is approximately 3.5 acres in size and has a gentle slope that is perfect for creating features such as beginner jumps, roller/berm trails, and rock gardens. These skill development "lessons" prepare mountain bikers for similar features encountered within the expanded trail system network. The Whalen Knob skills area will also act as a centralized meeting area for small groups that are spending the day in the forest.

The entire skills park will occur in the footprint of previously harvested thinning units (thinned to ($\geq$ 40% canopy cover) in a managed stand associated with the separate Whalen Knob Timber

Restoration Thinning Project. Post thinning, overstory trees will not be removed from the skills park, parking, and day use picnic area (fee charged). An existing road (0.15 miles) for thinning access (EA Phase 1) will be converted to a permanent road to allow access to the skills park.

Individual Tree Removal (ITR):

Individual tree removal is the removal of danger/hazard trees that may pose a human safety concern. Trees to be removed can be live, dead or dying, hazard trees, including those affected by fire, insects, disease, windthrow and other natural disturbances. Down trees and snags will be removed if they pose a human safety concern. ITR will not modify the functionality of listed species' habitats in the affected stands, including that it will maintain pre-treatment habitat conditions for the spotted owl and murrelet as listed in the PDC section of this consultation.

This action will occur during the construction phases of the parking lots, skills park, and trail system, plus will occur in perpetuity as needed. Typically, ITR will occur within approximately 150 feet of roads, administrative facilities, and trailheads, but the area of removal will depend on the tree height. This process is further discussed in the analysis methodology section of this consultation.

The zone within the action area slated for individual tree removal will occur in the footprint of previously harvested thinning units associated with the Whalen Knob Timber Restoration Thinning Project. Because hazard/danger trees are removed during timber sale operations, we anticipate a low number of additional hazard trees will be removed during the construction phases of the parking lots, trail system, and skills park. However, the need to remove such trees will be in perpetuity.

The area around the parking lots and skills park will have the highest volume of human traffic and ITR will occur year-round as needed.

The hazard/danger tree removal zone along the trail corridor will be restricted to avoid adverse impacts to breeding behavior and success—ITR will occur outside of the critical breeding season for both NSO and MAMU with daily timing restrictions implemented in the late breeding season (Table 8 and 9) when within 110 yds of unsurveyed, suitable murrelet habitat; and/or within 65 yds of suitable, unsurveyed spotted owl habitat. Hazard and danger tree removal will occur outside of the critical breeding season for NSO and MAMU during parking lot, trail system and skill park construction, and for ongoing hazard/danger tree maintenance after construction in perpetuity.

However, due to human safety concerns there will be a need to remove hazard and danger trees during the critical breeding season, but daily timing restrictions would occur for MAMU (in accordance with Table 8) if ITR occurs during the critical breeding season. Due to the very limited, and small areas where ITR will occur within disruption distances to suitable NSO or MAMU habitat for ongoing maintenance, and due to hazard/danger tree removal occurring during the Whalen Knob Timber Restoration Thinning Project, and during construction of the trail, parking area and skills park areas outside of the critical breeding period for NSO and MAMU, ITR actions for ongoing maintenance of hazard/danger tree management during the critical breeding season are not expected to take more than one day in any one area and will have daily timing restrictions for MAMU in accordance with Table 8. It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply).

- Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation.
- This consultation does not cover the removal of active NSO or MAMU nest trees during the breeding season. In the event any known nest tree must be felled (i.e., any activity status), this will occur after the breeding season and covered under a separate emergency consultation.

Recreational Use:

Recreational use will include mountain biking, hiking, facilities upkeep, and public travel to and from the site. The development of the recreational features will increase human disturbance and vehicular traffic in the area.

9.3 Spotted Owl

9.3.1 Effects of the Action – General

Effects of the action are all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

Note that effects of the action must be both caused by the proposed action <u>and</u> reasonably certain to occur. The new section 7 regulations published in 2019 provide definitions of these terms at 50 CFR 402.17:

(a) Activities that are reasonably certain to occur. A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to:

(1) Past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;

(2) Existing plans for the activity; and

(3) Any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

(b) Consequences caused by the proposed action. To be considered an effect of a proposed action, a consequence must be caused by the proposed action (i.e., the consequence would not occur but for the proposed action and is reasonably certain to occur). A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Considerations for determining that a consequence to the species or critical habitat is not caused by the proposed action include, but are not limited to:

(1) The consequence is so remote in time from the action under consultation that it is not reasonably certain to occur; or

(2) The consequence is so geographically remote from the immediate area involved in the action that it is not reasonably certain to occur; or

(3) The consequence is only reached through a lengthy causal chain that involves so many steps as to make the consequence not reasonably certain to occur.

Direct effects to NSO may occur as a result of disturbance from noise above ambient levels from chainsaws, engines, pumps, small and heavy machinery. Direct effects to NSO are expected to be kept to insignificant levels due to occurring in or adjacent to dispersal habitat, or due to employment of conservation measures such as timing restrictions and buffer distances to unsurveyed or occupied suitable/NRF (nesting, roosting, foraging) habitat (Table 8 NSO disturbance disruption table). Indirect effects to NSO are expected to occur from impacts to designated critical habitat and to NSO NRF and dispersal habitat that occurs in the project area both within and outside of designated critical habitat. These indirect effects are expected to include both significant and insignificant effects. These impacts are the consequence of the following actions in NSO habitat: creation of landings, construction of temporary roads, creation of parking lots, creation and maintenance of trails and skills park, danger and hazard tree removal, and heavy thinning treatment.

The Sand Lake Project includes actions in 448 acres of suitable NSO habitat and 868 acres of dispersal-only NSO habitat, which totals 1,316 acres of northern spotted owl habitat within the 18,277 acre project area. There are 1,130 acres of designated critical habitat (CH) in the 18,277-acre project area, the Sand Lake Watershed. Of the 1,130 acres of designated critical habitat in the project area, there are 424 acres of NRF; 450 acres of dispersal; and 256 acres of unsuitable habitat which includes forest types that support the northern spotted owl and are capable of developing into dispersal or suitable NRF habitat.

9.3.2 Direct Effects to Northern Spotted Owl

Direct effects to NSO in the Sand Lake Project may occur as a result of disturbance from noise above ambient levels from increased human presence, recreation, chainsaws, engines, pumps, heavy equipment, and smoke from prescribed burning. Mechanical treatment will include the use of chainsaws, and heavy equipment. Planned prescribed fire may entail the use of heavy equipment, engines pumps, chainsaws, and produce smoke. All of these activities will result in intermittent noise above ambient conditions lasting hours, days, or weeks. Direct effects to NSO are expected to be kept to insignificant levels due to occurring in or adjacent to dispersal habitat, or due to employment of conservation measures (PDC found in Section 2.4) such as timing restrictions and buffer distances to unsurveyed or occupied suitable/NRF habitat for sources of noise that would cause adverse effects to spotted owl without a timing restriction (See Table 8 for details).

Spotted owls are susceptible to disturbance during the early nesting season. We define the spotted owl early nesting season in the northern Oregon Coast Range as March 1 to July 7. Early nesting season behavior includes nest site selection, egg laying, incubation, and brooding of nestlings to the point of fledging (Forsman et al. 1984, pp. 32-38). We have previously completed analyses of the effects of disturbance to spotted owls (USFWS 2006, entire). We concluded that spotted owl nesting behaviors may be disrupted by loud, intermittent noise and activity occurring in close proximity to an active nest during the early nesting season (USFWS 2006 entire). Early nesting season disturbances can result in adult spotted owls becoming agitated so that they flush from an active nest during incubation; a nestling to flush from the nest prior to being fully fledged; or an adult to abort a feeding of nestlings (USFWS 2003, p. 273). Disruption of normal nesting behaviors during the early nesting season is significant due to the potential for reduced fitness or survival of nestlings. There are currently no known pairs or nests in the project area, which has a history of surveys (from pages 38-39 of the BA):

"Recent surveys have not been conducted within the project area and current NSO occupancy is unknown. Past surveys conducted from 1990-2021 within the Siuslaw National Forest documented nest trees and activity centers within the Hebo Ranger District but none fell within the Sand Lake project area boundary (Figure 5). The last surveys within the district occurred in 2010 as part of the Oregon Coast Range Demographic Study Area. The demography crew identified two occupied owl sites, Cascade Ridge (MSNO 1847) and Prospect Creek (MSNO 3368), that they then monitored annually. In 2021, Lesmeister et al. (2022) conducted bioacoustics surveys within the Oregon Coast Range (COA) demographic study area on the Siuslaw: The four areas surveyed included: Drift Creek, Devil's Staircase, Cummins Creek, and Rock Creek; all areas are within the Central Coast Ranger District and none within the Hebo Ranger District or project area. Results from their study detected NSO at all locations and one new nest tree was located at Drift Creek (USDA Siuslaw nf_1990-2021 data layer). Utilizing information from the long term spotted owl demography study along with information on owl-landscape habitat configurations, potential owl sites were placed on the landscape where they most likely would occur based on knowledge of spotted owl habitat selection and demographics in the Oregon coast range. Using this modeled GIS layer, we identified overlap of two potential NSO site territories (home ranges) within the Mountain Bike Trail System and Skills Park areas of the project (Figure 10)."

Although the population trend of NSO continues to decline, a pair and nest could occur in the project area during Project implementation. The most likely place for this to occur is in nesting roosting habitat.

The USFWS generally considers adverse effects may occur to nesting spotted owls exposed to noise levels (in the absence of visual stimuli) at and above 92 dBA (decibels; "A" weighted scale) at nest sites.

Disturbance occurring during the latter half of the spotted owl breeding season (July 7 to Sep 30) is not expected to disrupt or impair spotted owl nesting behaviors. In the late nesting season, juvenile spotted owls have fledged and are able to thermoregulate, fly short distances, and are no longer completely dependent upon the adults for daily feedings (Forsman et al. 1984, p. 38). A flush response from either an adult or juvenile at this stage of development is not likely to reduce the juvenile owls' fitness or ability to survive. Therefore, those effects of disturbance, occurring after July 7, are considered insignificant.

If any active NSO sites are located, seasonal restrictions will be implemented to reduce the likelihood of adverse effect from disturbance on nesting pairs. Implementation of avoidance buffers as a conservation measure is expected to keep noise disturbance such as from chainsaws, and heavy equipment far enough from nest sites that disturbance will not illicit a flushing response from nesting owls. Conservation measures are expected to keep disturbance effects at an insignificant magnitude for known nesting pairs.

Key conservation measures for NSO (a complete list of PDC relevant to NSO are in Section 2.4):

- Operation of tracked machinery, heavy equipment, and chainsaws within 65 yards of northern spotted owl nesting habitat will also be seasonally restricted unless annual field surveys (Lint et al. 1999; USFWS 2012; 2021a) indicate that owls are not nesting.
- Throughout the entire nesting seasons of spotted owls, burning shall be conducted at least 0.25 mile away from suitable nesting habitats to minimize adults, nestlings, or fledgling exposure to smoke.
- Additional distances and timing restrictions for each disturbance source are specified in Table 8.

Any disturbance effects that may occur will be temporary and are most likely to occur through modification of normal behavioral activities and patterns. This may include changing foraging locations, behavior, and timing, and changing roost sites. Spotted owls may temporarily flush and may experience missed or altered feeding opportunities for themselves and their offspring. These changes in behavior in response to the Project disturbance may contribute to physiologic stress and may elevate the risk of predation to adults and owlets or lead to a slightly diminished physical condition if feeding opportunities are missed. Overall, we anticipate that effects of the Project may illicit responses from nesting spotted owls ranging from an alert response to flushing from the nest or temporary reduced feeding success. However, due to the employment of conservation measures, including the timing restrictions and buffer distances to NSO nesting habitat, these effects are expected to be kept to insignificant levels.

9.3.3 Nonterritorial Spotted Owls

Spotted owl populations consist of territorial (resident) individuals, for which we have documented occupancy throughout much of the species' range, but also include nonterritorial (therefore non-breeding) adult and subadult spotted owls, also termed "floaters." For this discussion non territorial spotted owls includes both natal dispersers (young of the year) and breeding-age dispersers (some subadults and all adults). Non-territorial spotted owls may cryptically reside within otherwise occupied territories (Franklin 1992, p. 823), or use a series of temporary home ranges to systematically sample or "prospect" the underlying network of resident territories along a somewhat erratic dispersal path (Forsman et al. 2002, p. 30). Individuals that vacate territories due to failed reproduction or other reasons (e.g., barred owl competition, habitat degradation, death of mate) may also become nonterritorial until they recolonize vacant territories or establish new territories (Jenkins et al. 2021, pp. 1, 3). There has been a significant increase in dispersal of territorial spotted owls from approximately 7 to 25 percent between 1990 to 2017 during a concomitant increase in barred owls and decline in the spotted owl population (Jenkins et al. 2021, p. 8), such that understanding non-territory holders is likely more important than it was in the past.

Nonterritorial spotted owls are difficult to detect in surveys because many floaters either do not respond to surveys or respond in a tenuous fashion such that they are difficult to capture or resight (Forsman et al. 2002, p. 26). Also, distinguishing between floaters and territorial individuals during surveys can sometimes be difficult. Because they are difficult to detect or classify, the number and distribution of nonterritorial individuals are poorly known for any given spotted owl population. Male and female nonterritorial spotted owls are recruited into the population differently because males typically remain in the subpopulation where they were born and females often disperse farther to other subpopulations where they exist as floaters before becoming territorial (Franklin 1992, pp. 822-823).

While a population is only measured by territorial spotted owls, nonterritorial spotted owls likely contribute an important role in population regulation (Foresman et al. 2002, p. 4). However, Glenn et al. found spotted owl population change to be more sensitive to territorial adult survival than to recruitment of either juveniles or adults (2010, p. 2543). Also, the rate of population change in spotted owls is most sensitive to variation in adult female survival and relatively insensitive to variation in fecundity and age at first reproduction (Noon and Biles 1990, p. 23). As such, the degree to which floaters influence or regulate populations is unknown. Because spotted owl populations are regulated by territorial behavior, declines in the number of territorial individuals would be dampened by the increased recruitment of floaters. If the number of floaters is sizable, then the number of territory holders would appear stable for some time before a decline is observed. Barred owls are increasingly common throughout the action area. With the barred owl displacement of spotted owls from their territories an increase in the floater population may be expected. However, as the barred owl is reducing spotted owl demographic rates overall, it is likely the number of floaters has also decreased and is not replacing the territorial population. This is supported in the recent review of spotted owl response to barred owl removal where Wiens et al. (2021) found spotted owl survival increased, but only found a weak association with recruitment. The authors hypothesize this is a consequence of the extreme low recruitment seen across all demography study areas, due in part to years of low reproduction (pp. 5, 7, 9). Barred owls also influence the ability to detect spotted owls in surveys.

Management of conditions for floaters may be an important component for recovery of the spotted owl. Penteriani et al. note in their review of avian studies, including the spotted owl, that "…the availability of floaters may make the difference between a stable population and a declining population approaching the extinction threshold (2011, p. 236)." Maintaining areas for non-breeding spotted owls to persist on the landscape may help floaters who are waiting for territories to open up (Gutiérrez et al. 1985, p. 63). Such "settlement areas" may provide the resources needed for floaters to survive and contribute to the population (Penteriani et al. 2011, pp. 235, 237). In order to manage for floaters across the landscape, Miller et al. 1997 (p. 148) suggests that older forest connectivity corridors and maintaining older forest patches in close proximity to occupied territories could "serve as colonization areas for dispersing birds waiting to enter the breeding population" and would also support dispersal corridors.

Managing habitat for nonterritorial spotted owls (in addition to occupied territories) benefits the species as a whole. The influence of barred owls likely reduces the extent of such benefits. For spotted owls that left a territory occupied by barred owls, only 27 percent found a territory without barred owl detections (Jenkins et al. 2021, p. 11). However, with the decrease of the spotted owl population in Oregon (Franklin et al. 2021, pp. 11-13) and the increase in dispersal of territorial spotted owls (Jenkins et al. 2021, p. 8), maintaining areas for both territorial and non-territorial spotted owls can be important to the species and facilitate potential options for barred owl management within the next few years.

The proposed action will support nonterritorial spotted owls by (1) retaining/maintaining all NRF/suitable habitat, (2) retaining habitat in areas that have been identified as potential NSO territories and (3) by maintaining at least 40% average canopy cover across the 1,095-acre contiguous AMA area (northern area of the Sand Lake EA project area), to minimize the effects of treatments to dispersal habitat. The purpose of the proposed action includes benefits for northern spotted owls in the long-term (10-years or more) through forest restoration actions such as thinning and prescribed fire that accelerate the development of more complex or later seral stage forest habitat including NSO suitable habitat, and increase the resistance and resilience of the forested landscape to withstand uncharacteristic disturbance such as large wildfires, thereby reducing the probability of large-scale and long-term NSO habitat removal.

9.3.4 Indirect Effects to Northern Spotted Owl

For the purpose of the following discussion of effects to northern spotted owl habitat, the degree of change to habitat function has been categorized using the following terms: removal, downgrade, and degrade/maintain. The term removal represents a complete loss of habitat function following an effect. Downgrade refers to a reduction in the function of habitat (i.e., an area that functioned as suitable habitat before the action provides only dispersal habitat following the action). Dispersal habitat cannot be downgraded, only degraded/maintained or removed because it is already the lowest functional class of habitat described for the northern spotted owl. Degrade/maintain indicates a reduction in habitat quality but not habitat function following the action. In NRF and dispersal habitat, ladder and surface fuel reduction will maintain habitat function but reduce or degrade habitat quality. Habitat effects from all actions being proposed within northern spotted owl habitat are summarized below (Table 14).

Table 14. Summary of effects to NSO and critical habitat from actions.

From Table 6 of the BA

Habitat Effects Category	Heavy Thinning and Early Seral Project Acres Impacted	Recreational Improvements Project Acres Impacted*

	NSO Habitat	Critical Habitat	NSO Habitat	Critical Habitat
Habitat Removal Nesting/Roosting	0	0	0	0
Habitat Removal Foraging	0	0	0	0
Habitat Removal Dispersal	236 (LAA)	0	1 (NLAA)	1 (NLAA)
Habitat Downgrade Nesting/Roosting to Dispersal	0	0	0	0
Habitat Downgrade Foraging to Dispersal	0	0	0	0
Habitat Maintained Nesting/Roosting	N/A	0	118 (NLAA)	112 (NLAA)
Habitat Maintained Foraging	N/A	0	329 (NLAA)	312 (NLAA)
Habitat Maintained Dispersal	0	0	586 (NLAA)	449 (NLAA)

The proposed action includes treatments that maintain the habitat functionality for 118 acres of nesting/roosting habitat (112 of which are NR acres in NSO CH), 329 acres of maintain treatments in foraging habitat (312 of which occur in NSO CH) (Table 14). None of these suitable/NRF acres occur in an activity center. 1,035 acres of dispersal habitat will be treated, but maintained. 449 acres of these dispersal-maintained treatments will occur in NSO CH. All of these maintain treatments will be the result of the recreational improvements project and are expected to result in insignificant effects to NSO due to habitat functionality being maintained. The 236 acres of dispersal habitat removal will be from the heavy thinning and early seral project and are expected to result in adverse/significant effects to NSO for a period of 10 to 20 years. There will be 1 acre of dispersal removal, which occurs in NSO CH and will be a consequence of the recreational improvement portion of the Project. Due to the very limited size of the 1 acre of dispersal habitat removal in CH in the recreation portion of the project area, and because this portion of the project area has much higher amounts of NSO habitat, this effect is expected to be insignificant for NSO. No acres of project actions occur in a known home range of NSO.

Shortly after their listing in 1990, the USFWS developed guidance for protecting spotted owl habitat in proximity to the nest tree or activity center (Bart 1995; USFWS 2011, p. A-10; p. III-61). This guidance describes various "thresholds" or amounts of suitable habitat within prescribed distances from the nest tree or activity center. The USFWS uses this guidance to evaluate the existing habitat condition, the effects of the proposed action, and the potential for incidental take of spotted owls. Removing habitat below threshold values increases the likelihood of site abandonment, reduced fecundity, and other significant impairments of normal behavioral patterns—including the ability of a site territory to provide for single or pair occupation and/or successful reproduction..

To be considered "at threshold" in the Oregon Coast Range, suitable/NRF habitat must comprise (1) 70 acres of the best habitat nearest the nest tree or activity center, (2) 50 percent of the core area within a 0.5-mile radius of the activity center, and (3) 40 percent of the home range within a 1.5 mile radius of the activity center. The priority for site condition is sites currently with >40 percent suitable habitat in the provincial home range (1.5-mile radius in Oregon Coast Range and >50 percent suitable habitat within the core area or breeding range (0.5 mile radius in Oregon Coast Range (USFWS 2011, A-8)). Even if no longer occupied by spotted owls, the Record of Decision (ROD; USDA and USDI 1994) specified that 100-acre cores of best habitat should be maintained as an "unmapped LSRs" (USDA and USDI 1994, pp. C-10 and C-39), and managed consistent with LSR objectives. This standard and guideline was developed for areas outside of "reserve" LUA's (e.g., Congressionally Reserved, Administratively Withdrawn, LSR, MLSA, and Riparian Reserves); "unmapped LSRs" may benefit other late-successional species or provide a "steppingstone" for spotted owls moving across the landscape.

There are no actions in known NSO activity centers from this project. There are no adverse effects to suitable/NRF habitat from this project within or outside of NSO activity centers.

Adverse effects to NSO from removal of 236 acres of dispersal habitat are expected to occur as a consequence of the heavy thinning portion of the project. The effect of 236 acres of dispersal habitat removal is expected to last up to 20 years until dispersal habitat functionality returns as a result of forest succession. Dispersal habitat is the only NSO habitat type present within the heavy thinning/early seral portion of the action area. Although canopy cover in the heavy thinning units will be reduced to, but maintained at >30%, average canopy cover for the entire North Block AMA will be maintained at 40%, which will minimize the effects of the dispersal removal to NSO. Effects may occur to NSO attempting to move through this area because the Project action will reduce the NSO habitat further below the 50-11-40 threshold for dispersal habitat. Thomas et al. (1990) recommended managing the forested landscape such that 50 percent of each quarter-township (or other landscape area) has a mean diameter at breast height (dbh) of at least 11 inches and a canopy closure of at least 40 percent (the 50-11-40 rule), which is the minimum level of habitat supporting the transient phase of dispersal (USFWS 2011, p. A-8). We consider these effects to dispersal habitat to be adverse because the area is already low in dispersal habitat. Removal of dispersal habitat with canopy cover below 40% is considered to be removal of dispersal habitat and although the amount of removal is minimal at only 2.9% of the available dispersal habitat within the action area, the Sand Lake Watershed is classified as dispersal limited and further reduction in dispersal results in adverse effects.

9.3.5 Effects to Northern Spotted Owl by Components of the Action

The following Effects of the Action are adapted from the “Northern Spotted Owl and Critical Habitat” section in the BA effects determinations. See pages 64-67 of the BA. See also Table 16: Action Description and Deconstruction with Exposure and Effects Matrix for the Northern Spotted Owl.

Heavy Thinning and Early Successional Habitat Treatments (North Block):

The proposed heavy thinning and early successional treatment area is a large, contiguous area of regenerating plantation referred to as the North Block. The oldest stands in this block are approaching 70 years of age while the youngest are 30 years old. Treatments will create forest openings like those that occur naturally in mature stands which provide benefits to a variety of species including certain birds, bats, herbivores, and pollinators. Secondary owl prey species like chipmunks and mice may potentially benefit from proposed treatments, however, proposed thinning to below 40% canopy cover, creation of gaps up to 2 acres with no residual trees, and creation of gaps up to 5 acres with few residual trees, will not benefit spotted owl or owl primary prey species like Humboldt's flying squirrel and red tree vole in the short-term (Manning et al. 2012). Suitable nesting, roosting and foraging habitat does not exist within the heavy thinning and early seral harvest portions of the project area (Figure 6), but the current proposed action will remove spotted owl dispersal habitat. The existing dispersal habitat is relatively isolated from large patches of contiguous mature forest with fragments of mature forest present at Cape Lookout State Park and in the Sand Lake Research Natural Area (Figure 5 and 10). While these adjacent mature stands are high quality owl habitat, they are very small in size and isolated (Figure 5). Additionally, there are no known or potential spotted owl sites/territories in or nearby the North Block (Figure 16). Dispersal habitat is not limited (i.e., does not comprise less than 40 percent of the area) in the more local area of the heavy thinning and early seral portion of the project area (Figure 5). However, the project does fall within a dispersal limited area (as defined by Davis et al. 2022) at the broader landscape scale of the Sand Lake Watershed and entire action area for the entire Project (Figure 8). Dispersal limited areas are defined as having less than 40% dispersal forest within a 15.5 mi radius roving circular window (Davis et al. 2022). This area within and surrounding the treatment units may provide cover for NSO to fly through the stands but due to its current structure, it does not support foraging (Table 11). Left untreated, the stands would have to mature, degrade, and regrow before beginning to support structure needed by breeding owls. If thinned to 40%, the stand would likely stay stagnant with only a slight increase in diameters with no large limbs or mid story structure established (USFS 2007). Treatment to 30% with gaps has been shown to create the largest trees and limbs with a complex understory in the least amount of time (USFS 2007). However, the location and large size of the treatment area may impose a travel barrier for owls trying to move through.

Long-term, these treatments are expected to increase nesting, roosting, and foraging habitat by accelerating the rate of late-successional forest development within the plantation which is beneficial to the spotted owl. This future habitat would link existing habitat at Cape Lookout State Park and the Sand Lake Research Natural Area potentially creating enough suitable habitat to support nesting owls. Although the project's intent is to expedite the development of late-successional habitat and, overtime, improve habitat conditions for NSO, the initial removal of up to 236 acres of dispersal will further reduce the amount of available dispersal habitat in a dispersal limited area which m*ay affect and is likely to adversely affect* spotted owls. These proposed treatments occur outside of designated spotted owl critical habitat and will have *no effect* on critical habitat.

Table 15: Heavy Thinning and Early Successional Treatment units stocking report data.
From Table 6 of the BA

HCC Stand NO	Year of Origin	Age 2022	Current Veg	MaxSDI	BA	TPA	QMD	SDI	RDI	CC	Canopy Layer	T>31"	T20-30	SPA 10-20	Snags>20	DWPA 10-20	DWPA>20	Canopy Space	Residual CC	Harvest Method
301218	1968	54	Hemlock	800	388	519	11.7	667.7373449	0.834671681	98%	Single	2	14	13	0	81	0	no	40%	Skyline
309001	1960	62	Hemlock	800	349	243	16.2	527.0816198	0.658852025	97%	Two	1	49	45	0	169	14	no	40%	Skyline
309002	1963	59	Hemlock	800	374	333	14.4	597.8827636	0.747353455	97%	Two	0	36	19	0	50	12	no	30%	Skyline
309003	1961	61	Sitka Spruce	750	297	226	15.5	456.6577313	0.608876975	96%	Single	1	37	21	0	44	35	no	30%	Skyline
309004	1958	64	Sitka Spruce	750	354	276	15.3	546.1838174	0.72824509	97%	Two	2	40	8	0	225	33	no	30%	Skyline
309005	1964	58	Hemlock	800	284	235	14.9	445.6889052	0.557111132	94%	Single	0	37	3	1	110	16	no	40%	Skyline
309007	1960	62	Hemlock	800	326	298	14.2	523.1654518	0.653956815	96%	Single	0	22	15	0	203	63	no	40%	Skyline
309010	1960	62	Hemlock	800	354	249	16.1	534.7550298	0.668443787	97%	Single	1	48	16	0	58	10	no	30%	Groundbased
309011	1958	64	Douglas-fir	600	385	219	17.9	557.5364039	0.92922734	99%	Single	0	65	35	0	54	0	no	40%	Skyline
309123	1960	62	Hemlock	800	329	416	12	557.4157434	0.696769679	97%	Two	0	36	13	0	102	59	no	40%	Skyline
309124	1946	76	Sitka Spruce	750	404	442	12.9	665.1487119	0.886864949	98%	Single	0	42	10	2	96	0	no	40%	Skyline
309126	1978	44	Hemlock	800	173	242	11.5	302.8554545	0.378569318	78%	Single	0	3	0	0	31	101	yes	30%	Groundbased
309128	1985	37	Sitka Spruce	750	313	271	14.6	497.4570893	0.663276119	97%	Single	0	26	0	0	419	0	no	40%	Skyline

Explanation for table: Relative Density Indexes (RDI) greater than 55% (0.55) indicate significantly overstocked units with most units exhibiting single canopy layering and little canopy space. Hemlock and Sitka Spruce are the dominant species within the stands and structurally, these species take on lower, more robust branching (Per Comm Gunther Castillon; Forest Silviculturist). Column header acronym definitions: HCC: Historic Clear Cut Unit; SDI: Stand Density Index; BA: Basal Area; TPA: Trees per Acre; QMD: Quadratic Mean Diameter; CC: Canopy Cover; T>31": Trees greater than 31" diameter at breast height; T20-30: Trees 20-30 diameter at breast height; SPA: Snags per Acre; DWPA 10-20: Down wood per acre 10-20 inches in diameter; DWPA>20: Down wood per acre greater than 20 inches in diameter.

Recreational Improvements:

Mountain Bike Trail Construction:

This activity and subsequent ongoing trail maintenance is not expected to remove overstory trees though it will remove understory vegetation and potentially inhibit future vegetation growth in the trail footprint. The entire proposed trail system occurs outside of known or potential spotted owl core areas, but portions of the trail system occur within the home range of two potential spotted owl territories (Figure 7). Most of the trail system, approximately 24 miles (11.5 acres), is within designated critical habitat and 18 miles (2.6 acres) within suitable NSO forage habitat (Figure 10). Approximately 12.5 miles (2 acres) of new trail will occur in mostly foraging habitat while the rest of the system will be in dispersal habitat (Figures 10 and 6). Given the narrow width of these trails (trail width of 24 to 60 inches with a vegetation clearance width of 72 inches and vegetation clearance height of 10 feet) and the linear dispersion on the landscape, impacts to understory vegetation are expected to be minimal at the stand level and canopy cover will stay well within the 60-80% range for suitable habitat. Overall, this activity is not expected to directly modify spotted owl habitat and will impact 11.5 acres of critical habitat from narrow, linear habitat maintain/degrade treatments for trail creation that would maintain habitat functionality. None of the proposed trail system features, including access roads, are within 65 yards of a known or potential spotted owl core area. The proposed mountain bike trail system *may affect but is not likely to adversely affect* spotted owls or designated critical habitat.

Parking Areas:

This activity will not remove overstory trees and will be primarily sited in areas of existing disturbance along a key forest service road (FS-1004). All four of the proposed parking areas will be located in dispersal habitat that is also designated critical habitat (see Concurrence, Section 1.3 of this Opinion for discussion of effects to NSO critical habitat). Parking lot footprints will be less than 1 acre in size and will maintain a canopy cover of 40%. None of the proposed parking areas are within a known or potential spotted owl core area. Due to the small size of the proposed parking areas (<1 acre each), their location outside of known or potential owl core areas, their location in areas of previous disturbance, and the generally minimal impact to spotted owl prey in suitable foraging habitat, the proposed action *may affect, but is not likely to adversely affect* spotted owls and is not *likely to adversely affect designated critical habitat.* While the creation of the parking areas will prevent the disturbed areas that will be turned into four, less than one acre parking areas from developing into suitable NSO habitat within designated critical habitat, the action will maintain the current dispersal habitat functionality and the scale of the effect to critical habitat is very small in proportion to the amount of NSO habitat and critical habitat in the recreation portion of the project area and within the designated critical habitat subunit.

Mountain Bike Skills Park:

The entire skills park is sited outside of known or potential spotted owl core areas but is entirely within designated spotted owl critical habitat. The site of the proposed skills park is currently spotted owl dispersal habitat and is expected to be maintained as dispersal habitat with no overstory tree removal proposed. The footprint of the skills park will include timber harvest landing areas; however, construction and operation of the skills park may prevent new tree seedling growth and alter the potential plant community on site. The site currently has the potential to develop into nesting, roosting, and foraging habitat. Dispersal habitat will be maintained post construction, the capability of the site to develop into higher quality owl habitat will likely be hindered from understory plant removal. Sufficient dispersal habitat would remain in the area because openings in the canopy from the existing landing would not exceed 1 acre and canopy cover will be maintained at ≥ 40% in the additional 2.25 acres surrounding the landing. The habitat will still support PBF-4 (dispersal) for NSO immediately after treatment. The potential impacts to owl prey species occur outside of suitable foraging habitat, and although the proposed skills park may preclude this area from developing into spotted owl nesting, roosting, foraging habitat, the size of the proposed action is minimal, outside of known or potential owl core areas, and therefore *may affect and is not likely to adversely affect* spotted owls and designated critical habitat.

Individual Tree Removal:

With PDC's in place, individual tree removal, which in this Project is for hazard and danger trees, will not modify habitat at the stand scale and habitat will be maintained. Nest tree removal will not be covered by this consultation and in the event a nest tree needs to be removed for human safety; this will trigger emergency consultation. Habitat will not be removed or downgraded from individual hazard and danger tree removal and habitat will be maintained with 40% canopy cover in dispersal habitat and 60% in suitable or NRF habitat. For the trail system, chainsaw use will be restricted to occur outside of the critical breeding season (March 1-July 15) along sections of trail within 65 yds of unsurveyed or occupied suitable habitat or any known or potential nest patch. Suitable habitat is not present at and beyond 65 yds of the skills park and all parking lots. The hazard/danger tree removal zone along the trail corridor will have ITR restricted to outside of the critical breeding season for both NSO and MAMU with daily timing restrictions implemented in the late breeding season (Table 8 and Table 9) when within 110 yds of unsurveyed, suitable murrelet habitat; and/or within 65 yds of suitable, unsurveyed spotted owl habitat. Hazard and danger trees can be removed during the critical breeding season, (with implementation of daily timing restrictions for MAMU) when within these disruption distances, when needed for human safety. Due to the nature of how small these areas are that are within disruption distances to suitable NSO and MAMU habitat, and that they occur in areas that have already been thinned with hazard tree removal during the Whalen Thin Project, and will have hazard/danger tree removal conducted during construction phases for trails, parking areas and skills park areas (outside of the critical breeding season), we do not expect the ITR action to take longer than 1 day to complete in any one area during the critical breeding season and daily timing restrictions will be followed (Table 8). It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply). Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation. With PDCs in place, PBFs of CH will not be affected, and the action *may affect, but is not likely to adversely affect* NSO or CH.

Recreational Use:

Trail system construction and subsequent use may change how spotted owls use the landscape with increased human presence in the area. Native species, including primary spotted owl prey such as Humboldt's flying squirrel and red tree vole, may respond negatively to human presence. Other species, including secondary spotted owl prey species like chipmunks and mice, may respond positively to human presence. These changes to prey species may elicit responses from predators. Both avian and mammalian predator composition may change in the immediate vicinity of the trail system and/or trail access parking areas. This may indirectly impact spotted owls by changing foraging potential and/or inter-species competition for prey though these potential effects are difficult to quantify. Mountain biking itself is not expected to generate above ambient noise levels.

Effects from human presence/intrusion cannot be minimized since the action occurs within Critical Habitat and suitable habitat year-round; constant human presence during the breeding season will occur. Habitat along the trail is currently serving as dispersal habitat with some foraging capabilities that does not meet the standards to be classified as foraging habitat, and only 2.6 acres is modeled as suitable or NRF that does include the minimum standards for foraging habitat, so nesting owls or breeding pairs are not expected to occur in the area. Habitat functionality will be maintained and will still support the transient/dispersal phase of NSO, PBF-4 (dispersal habitat), and areas surrounding the trails will be left to mature into older-forest. These impacts to nesting, roosting, and foraging habitat will be more spread out and often sited to occur adjacent to existing open roads. The increased vehicle traffic on existing roads in the area created by increased visitation may create noise. As stated in the 2017-2018 NLAA LOC (OIEOFWOO-2017-l-0105), it is anticipated that owls that select nest sites in proximity to regularly used open roads are less disturbed by sounds associated with those roads. Additionally, USFWS (2006) determined that pedestrian human presence along trails is not an adverse effect for northern spotted owls. Effects from recreational use *may affect but are not likely to adversely affect* NSO species or critical habitat.

9.3.6 Effects Due to Disruption

Adverse effects due to significant noise, smoke, line-of-sight and similar disruptions of breeding or territorial/resident spotted owl may affect and are not likely to adversely affect spotted owls because of adherence to all PDC in Section 2.4 including PDCs in subsection 2.4.2, particularly PDCs 1, 3, and 6-7) are designed to ensure that appropriate seasonal and distance restrictions are followed so that disruption and associated incidental take of spotted owls due to harm would not occur. See the Definitions Section 2.4 for distinctions between disturbance and disruptions as defined in this Opinion. Because spotted owl nesting, roosting and foraging activities are not expected within the distance limitations (PDC-based) of treatments (i.e., Heavy Thinning Project) and recreation use (i.e., Sand Lake Recreation Project), these projects ***may affect and are not likely to adversely affect*** spotted owls due to disruption and disturbance.

9.3.7 Effects of Habitat Modification by Project Category.

Heavy Thinning Project

Heavy Thinning and 2-5 Acre Gap/Opening Treatments

This section discusses effects outside of spotted owl critical habitat.

The BA and this Opinion use the terms Project Category and Activity Type interchangeably to denote components of the Sand Lake proposed action which are described in Section 2 of this Opinion. The below discussion is organized by Project Category(s). This Opinion reiterates BA language that establishes and defines terminology used to denote spotted owl habitat types and habitat alternation definitions in this Opinion (e.g., habitat removal, downgrade and maintenance or degradation).

All activities could generate above-ambient noise levels. This could occur due to chainsaws, heavy equipment for hauling and logging (e.g., trucks). All activities would be subject to PDC that define disturbance and disruption to spotted owls, and PDC that prevent disruption to spotted owls (which is not allowed in this Opinion).

Heavy thinning below 40% canopy cover will remove dispersal habitat. These activities also generate above-ambient noise levels due to activities such as road construction, renovation or maintenance, and the use of chainsaws and heavy equipment. All of the proposed habitat removal of dispersal habitat will be from heavy thinning and early seral harvest with long-term negative impacts until habitat redevelops. Most of the proposed removal of dispersal habitat is from heavy thinning with short-term habitat loss and potential long-term benefits to spotted owl habitat. Some removal of dispersal habitat will occur due to regeneration harvest. Stands treated by regeneration harvest are expected to redevelop to current conditions in periods that roughly coincide with their pre-treatment age.

As nesting/roosting and foraging habitats increase on the landscape, so does the probability of spotted owl occupancy; these habitats are essential for spotted owls to survive and reproduce (Dugger et al., 2016, pp. 96-97). Removal of dispersal habitat in Dispersal-Limited Landscapes (defined in Section 2.5), by heavy thinning, ***may affect and is likely to adversely affect*** spotted owls. Removal of dispersal habitat by heavy thinning in Dispersal-Capable Landscapes (defined in Section 2.5.1) ***may affect and is not likely to adversely affect*** spotted owls.

Sand Lake Recreation Project

Because overstory trees are retained at greater than 40 or 60 percent canopy cover in dispersal and/or nesting, roosting, and foraging only habitats, no habitat modification is expected with the exception of 1 acre of dispersal habitat removal. This project ***may affect and is not likely to adversely affect*** spotted owls. Further detail by each project category is provided below and in the general overview of NSO effects in Section 9.3.1.

Mountain Bike Trail Construction, Mountain Bike Trail Maintenance, and Recreational Operation Use

Activities include cutting trees and other vegetation to construct trails for non-motorized daytime hiking, biking, and equestrian use. Construction will not occur within known or potential nest patches per PDC. If trails are not constructed in nest patches, habitat functionality is maintained, and all PDC are implemented to prevent disruption to spotted owls, spotted owl occupancy, survival and reproduction will not be adversely affected by trail construction, maintenance and use—including within known or potential site territories.

PDC will ensure that activities in this project category will not change the function of spotted owl habitat, or adversely affect PBFs, at the habitat stand and project area scales. Trail construction/reconstruction implemented consistent with all PDC including those for trails with non-motorized use, may affect, but is not likely to adversely affect spotted owls.

Trail construction that would exceed the PDC in the BA—such as removing overstory trees (especially large diameter, potential nest trees) or creating a wider trail/total width (e.g., widths often needed for motorized bikes or vehicles)—could affect the functionality of the habitat at the stand level or remove spotted owl nesting habitat. If the activities would downgrade the function of suitable habitat, it may affect, and is likely to adversely affect spotted owls. Any loss or downgrade of habitat that impairs the functionality of an occupied owl site would not be covered in this Opinion.

Trail construction for motorized vehicles, especially those larger than a motorcycle, typically require larger trail widths, greater amounts or sizes of tree removal, and typically generate high volumes of noise far above ambient pre-project levels. This could introduce chronic disturbance/disruption to spotted owls. Such activities may result in greater habitat modification effects (including a potential change in habitat function) and would render areas less hospitable for spotted owls and their prey (Larson et al., 2016). Therefore, motorized/OHV trail construction, or trail construction inconsistent with the action descriptions and PDC in the BA, may affect, and would likely adversely affect spotted owls due to a reduction in habitat quality or introduction of episodic or chronic noise levels. All trail construction/reconstruction, and any subsequent use, is subject to PDC that prevent disruption to spotted owls (which is not covered in this Opinion).

Individual Tree Removal

As defined in the project category, individual tree removal will retain sufficient cover and deadwood at the stand level to maintain the surrounding spotted owl habitat type, including insignificant effects to spotted owl prey. ITR activities generate above-ambient noise levels due to the use of chainsaws and heavy equipment for yarding and possible road maintenance. The duration of any disturbance from individual tree removal typically is less than one day with respect to any site affected. This duration typically is not likely to adversely affect the reproductive success or survival of spotted owls as the duration of the exposure to excessive noise is of a short duration. However, see discussion of disturbance and disruption in Section 2.

Thus, individual tree removal in current habitat generally may affect, and is not likely to adversely affect spotted owls, including when consistent with all considerations and specifications found in Section 2. In habitat-capable lands, individual tree removal would have lesser effect to spotted owl habitat, including no effect in some situations.

ITR in habitat-capable lands would have no/insignificant direct or indirect effect on spotted owls or their habitat. Disruption of spotted owls potentially present in adjacent current habitat during the breeding period, will be avoided by various PDC.

Nest tree removal will not be covered by this consultation and in the event a nest tree needs removed for human safety; this will trigger emergency consultation.

Trailhead Parking Lot Construction and Skills Park Construction

For purposes of this analysis, a worst-case assumption is applied for the direct habitat modification effects of permanent parking lot construction, including because they are effectively permanent. This includes activities that are independent of the timber harvest activities because they are not in or adjacent to the contiguous timber harvest footprint.

Parking lot construction will maintain the dispersal habitat functionality that exists in the four, less than one-acre areas with bare ground from previous disturbance that will be converted into parking lots. Skills park construction will maintain 2.25 acres of dispersal habitat within NSO CH as dispersal habitat, but will prevent it from developing into suitable habitat. Skills park constructions will remove one acre of dispersal habitat that occurs in NSO CH and will prevent it from developing into dispersal or suitable habitat. These actions will likely generate above-ambient noise levels due to use of chainsaws, and heavy equipment. The one acre of dispersal habitat removal and prevention of approximately 2.25 acres from developing into suitable habitat will effectively be permanent for non-native (dirt) road surfaces. For this Opinion, parking lot construction would use four existing bare spots less than an acre each, adjacent to the road.

Depending on use, permanent parking lots could introduce episodic or chronic disturbance/disruption that could directly or indirectly affect spotted owls due to human use activities.

Small removal footprints, including smaller relative portions of intersecting habitat stands (e.g., generally less than one acre), under this activity may affect, but are not likely to adversely affect, spotted owls if current and future spotted owl habitats will be maintained at the stand scale, and the action will not directly cause disruption to spotted owls due to road construction or use due to implementation of PDC. This relative stand-scale effect must be validated by the project biologist to determine a NLAA outcome.

9.3.8 Effects to Territorial and Non-Territorial/Dispersing Individuals

No disruption of breeding spotted owls will occur, as Section 2.4.2 PDC are designed to ensure that disruption is not part of actions covered under this Opinion. Dispersing and non-breeding territorial spotted owl are able to move away from the proposed disturbances causing only a discountable or insignificant change to the roosting or foraging behavior, due to the large areas of undisturbed lands available for spotted owls to move to within a territory or on the landscape for dispersing spotted owls.

The proposed action including PDC allow adverse effects from habitat modification at a stand scale to dispersal habitat. There is no suitable/NRF habitat removal or downgrade as part of the project. There are no known activity centers or spotted owl sites in the action area. The SNF identified areas that could be potential owl sites based on habitat modeling, however there is no removal or downgrade of suitable/NRF habitat as part of the project action and therefore there will be no impairment of sites or potential sites. No spotted owls are expected to be harmed, injured or killed from the proposed action either directly or by indirect effects due to the limited scope of the project action and its effects, and implementation of the PDC.

9.3.5 Effects Due to Habitat Change and Barred Owls

Generalized effects of barred owls can be referenced in Section 4.4 Barred Owls and Appendix D Status of the Species for Northern Spotted Owls and its Critical Habitat.

9.3.6 Recovery Plan Actions

Recovery Action 6

Recovery Action 6 states that 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 (USFWS 2011, p. III-19). All of the thinning treatments in LSR moist forests are designed to accelerate the development of late successional forest or to improve the quality of the habitat, including measures to not significantly delay the development of spotted owl suitable habitat.

The action does not include removal or downgrade of any existing NRF or suitable habitat (Table 14). All treatments in suitable/NRF habitat will maintain the functionality of that habitat (Table 14). The treatments in dispersal habitat will

Where 236 acres of dispersal habitat will be removed in the heavy thinning portion of the project area, the proposed action will maintain at least 40% average canopy cover across the 1,095-acre contiguous AMA area (northern area of the Sand Lake EA project area), to minimize the effects of treatments to dispersal habitat. The purpose of the proposed action includes benefits for northern spotted owls in the long-term (10-years or more) through forest restoration actions such as thinning and prescribed fire that accelerate the development of more complex forest habitat including NSO suitable habitat, and increase the resistance and resilience of the forested landscape to withstand uncharacteristic disturbance such as large wildfires, thereby reducing the probability of large-scale and long-term NSO habitat removal.

From the BA Effects Analysis Methodology section, page 64:

"Long-term, these treatments are expected to increase nesting, roosting, and foraging habitat by accelerating the rate of late-successional forest development within the plantation which is beneficial to the spotted owl. This future habitat would link existing habitat at Cape Lookout State Park and the Sand Lake Research Natural Area potentially creating enough suitable habitat to support nesting owls." Additionally, "the project's intent is to expedite the development of late-successional habitat and, over time, improve habitat conditions for NSO."

Thinning young stands may increase long-term structural complexity, but the Heavy Thinning Project treatments are expected to set back the development of dispersal and/or suitable habitat, at least short-term with the initial removal of up to 236 acres of dispersal habitat in a dispersal limited area. The effects pertain specifically to PBF 1 in critical habitat.

Recovery Action 10

Recovery Action 10 of the Revised Recovery Plan for the Spotted Owl (USFWS 2011, pp. 111-43-47)) states: "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population." The intent of this action is to protect, enhance, and develop habitat in the quantity and distribution necessary to provide for the long-term recovery of spotted owls. Prioritization factors to consider are provided in the Recovery Plan (USFWS 2011, p. III-44) and are repeated below.

The generalized RA10 conservation priorities for sites are as follows:

- Known sites with reproductive pairs;
- Known sites with pairs;
- Known sites with resident singles; and
- Historic sites with reproductive pairs, pairs, and resident singles, respectively.

No historic or known sites reside within the Sand Lake action area. No occupied sites discovered during the project's duration will be impaired due to the scope of the action not including removal or downgrade of any existing NRF/suitable habitat (Table 14) and implementation of PDC in Section 2.4.2.

Recovery Action 32

Recovery Action 32 of the Revised Recovery Plan for the Spotted Owl (USFWS 2011, p III-67) states: "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 USFWS 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. Maintaining or restoring forests with high-quality habitat will provide additional support for reducing key threats faced by spotted owls. Protecting these forests should provide spotted owls high-quality refugia habitat from the negative competitive interactions with barred owls that are likely occurring where the two species' home ranges overlap. Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures. Forest stands or patches meeting the described conditions are a subset of suitable habitat and actual stand conditions vary across the range. These stands or patches may be relatively small but important in a local area, may not be easily discernible using remote sensing techniques, and likely require project-level analysis and field verification to identify.".

This recovery action contains the components that make up the definition of nesting and roosting habitat (Section 2.5). The USFS identified the nesting and roosting habitat within the action area. No nesting or roosting habitat or foraging habitat will be removed or downgraded within the action area (Table 14).

9.5 Cumulative Effects to Spotted Owls

Cumulative effects are those effects of future State, Tribal, local or private activities (not involving Federal activities) that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR § 402.02 Definitions). A Memorandum to the Director of Fish and

Wildlife Service, August 27, 1982, *Cumulative Effects to be Considered Under Section 7 of the Endangered Species Act* set forth the legal requirements for consideration by federal agencies of the cumulative effects. "A non-federal action is *reasonably certain* to occur if the action requires approval of a state or local resource or land use control agency and such agencies have approved the action, and the project is ready to proceed...these indicators must show *more than the possibility* that the non-federal project will occur; they must demonstrate with *reasonable certainty that it will occur*." 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. See also "Activities reasonably certain to occur" within 50 CFR § 402.19(a).

We anticipate that non-federal land management actions in western Oregon would continue at current levels. We have no knowledge or expectation of any change in future State, Tribal, local or private actions that are reasonably certain to occur or would be related to implementation of the NCO RMP or the NWFP.

State and private lands within the action area support mostly marginal habitats for the spotted owl and do not notably contribute to the viability of these species. Most assessments of the functionality of spotted owl territories that overlap on State tribal and private lands use a worst-case assumption that the non-federal lands do not provide owl habitat. If lands are surveyed and spotted owls are not detected, then private land managers often cut most of the trees on the land, rendering it unsuitable for spotted owls. Habitat conditions on these lands are expected to decrease within the foreseeable future and, as a result, delay the recovery of the species.

Cumulative effects to spotted owls are an ongoing concern and would likely continue in the future within the action area and the State of Oregon. The Oregon Forest Practice Rules require protection of a 70-acre nest patch area around active nest sites only, and do not provide any protection or conservation of other surrounding habitat. For a species that requires up to several thousand acres of habitat to persist, these rules allow for the progressive elimination of active spotted owl sites. Removal of large amounts of habitat around 70-acre nest patch areas will eventually render the nest patch areas non-functional and displacement of spotted owls is the likely outcome. Non-federal timber lands, however, support some dispersal habitat for spotted owls and may contribute, at least temporarily (e.g., until the next harvest rotation) to the reproduction, health, and condition of spotted owls on adjacent Federal land. Habitat conditions on non-federal lands are not expected to improve significantly within the foreseeable future and, as a result, are not expected to contribute to the survival and recovery of the spotted owl.

The Oregon Department of Forestry is developing a Habitat Conservation Plan (HCP) for Western Oregon State Forests. The Oregon Department of State Lands is developing a Habitat Conservation Planning for the Elliott State Forest, located east of Coos Bay, Oregon and outside of the action area of this Opinion. Under the draft plan, the Elliott State Forest, an area of approximately 83,000 acres will be managed as a research forest by Oregon State University. The HCP and the associated National Environmental Policy Act processes are ongoing and we have not yet completed ESA section 7 consultations. Any effects of implementing Santiam State Forest management under the new HCP will be addressed when the proposed action sufficiently developed. On August 22, 2023, the Confederated Tribes of Grand Ronde submitted Natural Resources Management Plan for Reservation and Tribal Trust Timber Lands: 2024-2033 Biological Assessment for section 7 consultation. This includes the Reservation, 10,211 acres and the Coal Creek Property, 884 acres, and trust lands around Grand Ronde that are managed for forestry. The Grand Ronde Reservation comprises approximately 10,212 acres on the east side of the Coast Range. The Reservation is located in Yamhill County, approximately 3 miles north of the town of Grand Ronde and outside of but adjacent to the action area of this Opinion. In the action area, the Service and action agency are unaware of any proposed future State actions within the action area that would affect critical habitat. The projects in this Opinion will occur on 100% federal lands.

Summary of Effects to the Northern Spotted Owl

We expect significant indirect effects to NSO from removal of 236 acres of dispersal habitat in the heavy thinning portion of the project area and insignificant effects to NSO from maintain treatments in NSO NRF and dispersal habitat, and 1 acre of dispersal habitat removal in the recreation portion of the project area. We do not expect the small amount of dispersal habitat removal at the scale of the project and landscape area to result in harm or take of NSO due to although canopy cover in the heavy thinning units will be reduced to, but maintained at >30%, average canopy cover for the entire North Block AMA will be maintained at 40%, which will minimize the effects of the dispersal removal to NSO.

Therefore, the determination of the USFWS is that the proposed action *may affect but is likely to adversely affect* northern spotted owl.

9.6 Marbled Murrelet

9.6.1 Effects of the Action - General

Effects of the action are all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

Note that effects of the action must be both caused by the proposed action AND reasonably certain to occur. The new section 7 regulations published in 2019 provide definitions of these terms at 50 CFR 402.17:

(a) Activities that are reasonably certain to occur. A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to:

(1) Past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;

(2) Existing plans for the activity; and

(3) Any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

(b) Consequences caused by the proposed action. To be considered an effect of a proposed action, a consequence must be caused by the proposed action (i.e., the consequence would not occur but for the proposed action and is reasonably certain to occur). A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Considerations for determining that a consequence to the species or critical habitat is not caused by the proposed action include, but are not limited to:

(1) The consequence is so remote in time from the action under consultation that it is not reasonably certain to occur; or

(2) The consequence is so geographically remote from the immediate area involved in the action that it is not reasonably certain to occur; or

(3) The consequence is only reached through a lengthy causal chain that involves so many steps as to make the consequence not reasonably certain to occur.

The following Effects of the Action are adapted from the "Marbled Murrelet and Critical Habitat" section in the BA effects determinations. See pages 60-64 of the BA. See also Table 17: Action Description and Deconstruction with Exposure and Effects Matrix for the Marbled Murrelet.

Heavy Thinning and Early Successional Habitat Treatments (North Block):

The proposed early-successional and heavy thinning treatments are designed to create forest openings like those that occur naturally in mature stands. They also help accelerate the development of marbled murrelet nest structure by giving trees room to develop large canopies and branches that, specifically for MAMU, provide areas for moss mat development, which is critical for nesting. In addition to developing larger diameter trees, these openings benefit a variety of other bird species, bats, herbivores, and pollinators. In contrast, forest openings and/or low canopy cover adjacent to suitable marbled murrelet nesting habitat can have negative impacts and modify the overall function of a stand if openings are within 300 ft. of suitable habitat and larger than ¼ acre (USFWS 1997). Forest openings create fragmentation, increase fruiting bodies which may increase predator (corvid) levels within a stand, modify microclimate, and increase potential windthrow of nest trees and/or remove trees containing nesting structure.

Although openings can increase botanical fruiting bodies, greater increase in corvid predation is most associated with anthropogenic food sources such as campgrounds and settlements (Marzluff and Neatherlin 2006). The Cape Lookout trailhead and parking area are in proximity to the suitable habitat adjacent to the heavy thinning unit in the northern portion of the project area (Figure 9). This recreational site is most likely contributing to baseline corvid presence and predation pressure. Because of this proximity of this site to the project area, we feel that the potential increase in botanical fruiting bodies from the heavy thinning treatments will have minimal effects, if any, to the increase in corvid presence (Figure 9). Increased corvid predation to the suitable habitat from the early successional treatments to the south are also thought to have minimal impacts and will maintain 40% residual canopy cover. Malt and Lank (2009) also found that negative edge effects will occur at initial harvest, but then decline to baseline or sub-baseline levels as the forest regenerates.

To reduce negative impacts from edge effects, the murrelet recovery plan suggests a buffer of 300-600 ft. around suitable habitat to maintain successful nesting (USFWS 1997). To reduce disturbance, operational periods will be restricted to occur outside of the critical breeding and follow daily timing restrictions as outlined in Tables 8 and 9. Currently, suitable murrelet and critical habitat are not present or being modified within the treatment units and are over 300 ft from any suitable habitat containing murrelet nesting structure (Figure 11). Overall, the proposed early-successional treatments and heavy thinning are expected to have long-term benefits for marbled murrelets with no significant impact to the species in the short-term. With the project design criteria in place, the proposed early-successional and heavy thinning treatments *may affect but are not likely to adversely affect* the marbled murrelet. These treatments occur outside of designated Marbled Murrelet critical habitat, therefore, will have *no effect* on designated critical habitat (Figure 13).

Recreational Improvements (South Block)

Mountain Bike Trail Construction:

A total of 30 miles of mountain bike trails are proposed and of those, 22.5 miles will consist of new trail construction with the remaining 7.5 miles proposed on existing road templates (open, closed, and temporary). Portions of the trail system occur within suitable nesting (6 acres) and critical habitat (8.7 acres). The rest of the trail system is located within a regenerating plantation that while capable of developing into suitable habitat in the future, does not currently have suitable nesting structure present. Half of the trails within designated critical habitat are in stands supporting PBF 1 (trees with nesting structure) while the rest of the stands are PBF 2 (forested lands providing buffer habitat to suitable nesting structure).

The trail project is not expected to remove overstory trees though it will remove understory vegetation and potentially inhibit future vegetation growth in the trail footprint. Given the narrow width of these trails (trail width of 24 to 60 inches with a vegetation clearance width of 72 inches and vegetation clearance height of 10 feet) and their linear design across the landscape, impacts to understory vegetation are expected to be minimal at the stand level. Overall, this activity does not affect existing trees with potential nest structure or buffer habitat and therefore will not directly modify marbled murrelet habitat. Trail construction involves the use of chainsaws and some machinery such as weed-eaters and has the potential to disturb or disrupt nesting pairs if operated during the breeding season. To reduce disturbance, trail construction will occur outside of the critical breeding season (April 1 to August 5) and daily timing restrictions will apply during the late breeding season (Table 8 and 9). With PDC's in place, the proposed trail construction *may affect but is not likely to adversely affect* marbled murrelet and suitable habitat. Given that PBFs will not be removed from the landscape, the proposed mountain bike trail construction *may affect, but is not likely to adversely affect* Marbled Murrelet critical and suitable habitat. Effects associated with use of the trails is discussed below in the Recreational Use section.

Parking Areas:

The proposed action includes the development of 4 designated parking areas for access to trails and the Skills Park areas. The size of the parking areas ranges from approximately 0.13-0.9 acre in size. These parking areas would utilize wide road shoulders, existing landings, and junctions between roads in previously disturbed terrain and are not expected to remove groups of trees. Approximately 0.83 acres of the proposed parking areas occur in designated Marbled Murrelet critical habitat and have the potential to develop into suitable marbled murrelet habitat (Table 7).

The Middle Crest (0.23 acres) and Buzzard Butte (0.6 acres) parking areas are within 110 yards of suitable marbled murrelet habitat and occur within critical habitat: 15 acres of suitable habitat within 110 yards at the Middle Crest Parking Area and 8.7 acres at the Buzzard Butte Parking Area. Openings larger than ¼ acre within 110 yds. of suitable murrelet habitat reduce the overall function of the forest stand by modifying microclimate, increasing potential windthrow of nest trees, and/or removes trees containing nesting structure. These parking areas are sited along the key FS-1004 RD in existing disturbed pullouts and will maintain a canopy cover of ≥40%. Since the proposed parking area footprint contains suitable MAMU habitat, this will downgrade this habitat to buffer habitat and further prevent future nest sites within 110 yds of the parking lot footprint. Because of this habitat downgrade, the two parking areas within critical habitat that contain suitable habitat are *likely to adversely affect* marbled murrelet and critical habitat.

Mountain Bike Skills Park Construction:

Critical habitat and suitable habitat are not present within the footprint of the skills park. Habitat will not be downgraded or removed. Suitable habitat with suitable nesting structure is greater than 200 yds from the skills park area. The action *may affect but is not likely to adversely affect the species* and with the absence of critical habitat, there is *no effect* to CH. Discussions regarding effects from skills park operations are discussed in the Recreational Use section.

Individual Tree Removal:

The zone within the action area slated for individual tree removal for hazard/danger trees will occur in the footprint of previously harvested thinning units associated with the Whalen Knob Timber Restoration Thinning Project. Because hazard/danger trees are removed during timber sale operations, we anticipate a low number of additional hazard trees will be removed during the construction phases of the parking lots, trail system, and skills park. ITR for hazard trees during construction phases will occur with timing restrictions consistent in Table 8 to minimize effects to MAMU and NSO. However, the need to remove such trees for human safety will continue in perpetuity after construction.

The proposed action includes the development of 4 designated parking areas for access to trails and the Skills Park areas. The size of the parking areas ranges from approximately 0.13-0.9 acre in size with a total footprint of up to 2.25 acres. These parking areas will utilize wide road shoulders, existing landings, and junctions between roads in previously disturbed terrain and are not expected to remove groups of trees. Approximately 0.83 acres of the proposed parking areas occur in designated Marbled Murrelet critical habitat and have the potential to develop into suitable marbled murrelet habitat The area around the parking lots and skills park will have the highest volume of human traffic and ITR will occur year-round as needed. The Middle Crest (0.23 acres) and Buzzard Butte (0.6 acres) parking areas are within 110 yards of suitable marbled murrelet habitat and occur within critical habitat: 15 acres of suitable habitat within 110 yards at the Middle Crest Parking Area and 8.7 acres at the Buzzard Butte Parking Area.

With PDC's in place, individual tree removal will not directly modify existing suitable murrelet habitat within the tree removal zone. Disturbance from removal along the trail corridor will be minimized with chainsaw use restricted to outside of the critical breeding season (April 1-August 5) and daily timing restrictions applied during the late breeding season (Table 8 and 9). However, there will be a need to perform hazardous tree removal during the critical breeding season around the parking lots which will result in disruption to unsurveyed suitable MAMU habitat within 110 yds of the hazardous tree removal zone. We do not expect hazard tree removal for an area already cleared of hazard trees during the past thinning project and parking lot construction phases, for such a small area (The Middle Crest parking area of .23 acres and Buzzard Butte parking area of .6 acres) to take longer than 1 day at any location within disruption distance to unsurveyed or occupied suitable habitat. It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply) (Table 8). Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation. This consultation does not cover the removal of MAMU nest trees during the breeding season. In the event a nest tree must be removed, it will be after the breeding season and covered under a separate emergency consultation. The potential disruption of suitable habitat surrounding the parking areas, trails and skills park areas *may affect, but is not likely to adversely affect* the species and *may affect but is not likely to adversely affect* CH.

Recreational Use:

Recreational activities in the action area have the potential to change the composition of wildlife species present. Certain species are attracted to human presence and/or the potential food sources created by humans including corvids. The degree to which predators like corvids will be attracted to mountain bike trails is not fully known, however corvids are attracted to areas of human development, congregation, and loitering especially when those areas include potential human food sources such as campgrounds and picnic areas (Marzluff and Neatherlin 2006). Corvid densities and their effects on native species are typically greater in areas heavily used by humans because of the availability of food subsidies (Marzluff and Neatherlin 2006, West and Jones 2022). Typically, mountain biking is a fast-paced sport in which recreationist continually move at speed through the trail system from the trailhead to the end point; group congregation and snacking are more likely to occur at trailheads, parking areas, and at the skills park rather than along the trails themselves. It is expected that while predators like corvids may initially be attracted to riders on the trail system out of association and curiosity, this attraction will fade as predators focus more on parking areas and the skills park.

The mountain bike trail system is intended to become a well utilized recreation site with the potential to draw visitors from out of the area. Given the proximity to the metro-hub of Portland and vacation destination of Pacific City, the trail system will likely get significant use. Several recreation sites currently exist in the watershed but are all located on the beach and/or estuary front. Travel along the FS-1004 Rd. is currently moderate; this road is a short cut from the town of Beaver over to the Sand Lake Rd. Current use of the area is small and dispersed i.e., hunters, dispersed campers, and off trail hikers and this will be the first designated recreation site located in this area of the watershed.

Recreational use at the trailheads, parking lots, and skills park have the potential to attract corvids and generate human food subsides. Two parking areas and portions of the trail system will increase human presence within critical and suitable habitat; the Skills Park is not within either critical or suitable habitat, however, trash accumulation is possible within this area (Figure 12). The suitable habitat surrounding the parking areas is close to the ocean, has high quality murrelet nest structure confirmed by ground surveys, and is in proximity to historical murrelet detections. Wildlife proof trashcans may reduce the accumulation of trash but will not fully prevent the increase in corvid presence in the area. Installation of wildlife-proof trashcans and interpretive signs has resulted in reduced impacts from corvid predation by lowering corvid densities, but the initial increases in corvid abundance is an adverse effect (Brunk et al. 2021). Murrelet PBF's 1 and 2 will not be modified or altered, but corvid predation increase may have a 1 km impact (Marzluff and Neatherlin 2006). Raphael et. al (2002, p. 230) concluded that nest predation was highest within the first 50 m of a trash source; the Middle Crest and Buzzard Butte parking areas will impact a total of 5 acres of suitable unsurveyed MAMU habitat within 50 m of the parking lots. The amount of suitable unsurveyed habitat within the 1 km zone totaled 500 acres. We analyzed the corvid increase affects from the skills park to suitable habitat in conjunction with the parking areas and is included in the total 500 acres of impacted suitable habitat within the 1 km buffers.

Potential take caused by these impacts is hard to quantify but is expected. Nelson (2005) estimated murrelet densities at 0.07 nests/ha. When considering this density estimate, roughly 14 pairs of murrelets would occupy the 500 acres of suitable habitat in the project area if simply summing the number of suitable acres (500 acres = 202.34 ha x 0.07), but this approach does not consider the complexities of murrelet nest site selection and therefore does not accurately represent the true number of nesting pairs within the project area. Nelson and Wilson (2002) found that the distribution of suitable nesting habitat for murrelets is not uniform and important characteristics for nest tree selection included trees located in areas of the forest that included an abundance of grouped, large trees with numerous platforms and generally more than two canopy layers. Interior, core patches of forest provide suitable microclimates for the development of moss and other nesting platform substrates (Nelson and Wilson 2002). Using the Nelson (2005) density estimate in conjunction with the suitable murrelet nest tree stand characteristics identified by Nelson and Wilson (2002), plus current population numbers, we estimate the realized potential occupancy of suitable habitat in the project area is much less than 14 pairs (Figure 12).

Disturbance from human presence along the trails is also a concern and may cause disruption within the 110 yds of the suitable unsurveyed habitat (Marzluff et al. 2002). Disruption can lead to missed feedings which result in detrimental effects to successful reproduction such as starvation, malnutrition, and death of murrelet nestlings (Nelson and Fitzgerald 2023). Disturbance to nesting murrelets by human presence within proximity of nesting trees at the ground level is not fully understood and studies show mixed results regarding negative behavioral impacts to murrelets

(Long and Ralph 1998, Hamer and Nelson 1998). The USFWS (2006) deduced that noise disturbance from human foot traffic along trails within suitable habitat should not have a detrimental effect on marbled murrelets, however, the area is within a National Park unit and heavily trafficked; birds may have habituated to human presence (Long and Ralph 1998). As stated in Long and Ralph (1998), murrelet behavior did not appear influenced by the presence of hikers and park personnel near nesting trees in the Oregon Coast, and successful nesting occurred within 90 m of a moderately used trail within the Cascade Mountains of Washington, however, they did document disruption to feeding activities in response to tree climbing activities positioned adjacent to nest trees in the canopy. Data suggests that murrelet response to human presence near the nesting tree varies and depends on several factors such as proximity, time of day, duration, and baseline habituation to humans (Long and Ralph 1998, Hamer and Nelson 1998, USFWS 2006). Sections of the proposed mountain bike trail system will occur within the 110 yd. disturbance distance of suitable nesting habitat (Figure 11). Two areas with historical murrelet detections fall right on the edge outside of the 110 yd. buffer distance with an additional site within the buffer zone (Figure 11). Considering tree height, modeled suitable habitat, and results from the surveyed murrelet habitat, the total suitable habitat within the buffer zone of the trails is roughly 138 acres; 66 acres overlap with the 500 acres of best suitable habitat identified within the 1 km predation effects buffers (Figure 11). Although study results summarize recreational activities such as hiking near nest sites as minimal disturbance to murrelets and chicks, the proximity of the trails to historic detection sites, the introduction of humans to an area currently devoid of human traffic may initially disrupt murrelet nesting behavior. Disruption from human presence and increases in corvid predation will result in take of the species. The Recreational use associated with this project ***is likely to adversely affect*** the species, but since there is no direct habitat modification ***may affect but is not likely to adversely affect*** critical habitat.

9.6.2 Effects of Disturbance, Predation and Disruption by Project Category

Murrelet breeding behavior can be difficult to detect. We usually do not know the nest location within occupied stands due to the small size and cryptic behavior of the species within large, forested areas and nests located in the upper canopy. Without knowledge of nest locations, we are typically unable to determine more precisely certain manners of effects, including egg predation or a failure of a chick to fledge. Finding a dead or impaired specimen is also unlikely due to the small body size of an egg or young. Therefore, we use a habitat surrogate to evaluate how the proposed action would adversely affect murrelets, including effects that could rise to incidental take due to habitat modification or disruption that affects breeding behavior and reproductive success.

During the critical murrelet breeding period (April 1 to August 5), noise and visual disturbance may disturb adult or juvenile murrelets and could cause them to flush from their nest site, cause a juvenile to prematurely fledge, or could interrupt feeding attempts by the adult, particularly during the critical nesting period. While the effects of such disturbance are not always clear, any of these impacts could result in the reduced fitness or even death of an individual bird due to missed feedings, or reduced protection of the young if adults are disturbed.

Proposed activities include habitat modification and associated road construction, yarding, loading, hauling, site preparation, burning, brushing, piling, scarification and coarse woody debris and snag creation—all that generate noise above local ambient levels may disturb murrelets and interfere with essential nesting behaviors.

Many details on 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 affect murrelets in a similar manner. For these reasons disturbance is considered a threat to the species (McShane et al. 2004). 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).

Murrelet reactions to noise, smoke and/or temporary increases in predation due to human presence at or in the immediate vicinity of murrelets are expected to 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 their 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 substantial disruption of its behavior. Murrelets feed at sea and only rely on forest habitat for nesting. Therefore, forest management or other forest activities during the murrelet breeding season (April 1 – September 15) may affect murrelets that are nesting. Current disturbance distances by common sources have been summarized in the BA. Disruption is a subset of disturbance, to indicate the subset of disturbance that may adversely affect nesting murrelets due to the greater impacts when an action occurs closer to the nesting murrelets.

In the late breeding period (August 6 – September 15), potential effects from disturbance decline because all breeding murrelets have established a nest, most are finished incubating and either have completed nesting (about half of the chicks have fledged) (Hamer and Nelson. 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 are defined as two hours after sunrise and two hours before sunset, when most food deliveries to the young are made. When disruption events occur only during the day and outside the crepuscular periods (which will be referred to as daily timing restrictions), the likelihood of nest abandonment or substantial alteration of breeding success in the late breeding period is minimized. With daily timing restrictions, disruption will not occur during the majority of food deliveries to the chick and the percent of young that have fledged increases every day. Therefore, the likelihood of adversely affecting murrelets by annoying the adult murrelets to such an extent as to substantially 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).

Although disruption distances in the BA are based on the interpretation of the best available information, the exact distance where different types of noise, 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-producing activities to cause adverse effects 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 probably less susceptible to small increases in disturbances because they are accustomed to such activities. Murrelets do occur in areas near human activities and may habituate to certain levels of noise.

Heavy Thinning Project

Heavy Thinning and 2-5 Acre Gap/Opening Treatments

Suitable habitat is not present with the heavy thinning portion of the action area, and no treatments are expected within 110 yards of suitable habitat. The action ***may affect but is not likely to adversely affect*** marbled murrelets due to disruption, disturbance or predation.

Sand Lake Recreation Project

Mountain Bike Trail Construction, Trailhead Parking Lot Construction, Skills Park Construction, and Mountain Bike Trail Maintenance

Adverse effects to murrelet reproduction may occur when there is occupied habitat or unsurveyed habitat occurring within disruption distances. Use of small and heavy equipment outside of the breeding season or two hours after sunrise and at least two hours before sunset during the late breeding season between sunset and sunrise will avoid murrelets' dawn and dusk feeding schedule. The action ***may affect but is not likely to adversely affect*** marbled murrelets due to disruption, disturbance or predation.

Recreational Operation Use

The relationship between human activities and predators, and their potential impact on murrelet nesting success, has been identified as a significant threat to murrelets (75 FR 3424:3432 [Jan. 21, 2010], Peery and Henry 2010, p. 2414). Research in the Pacific Northwest has identified up to 15 mammalian and avian species that potentially prey on murrelet nests (Marzluff and Neatherlin 2006, p. 308). The risk of predation on murrelet nests by avian predators (especially corvids) appears to be highest in close proximity to forest edges (including roads), campgrounds, and settlements (Raphael et al. 2002; Marzluff and Neatherlin 2006). Corvid populations are elevated within 1 km of campgrounds and settlements, in comparison with populations of the same species more than 5 km from the same human developments, and sources of human food may attract individual corvids from more than 30 km away (Marzluff and Neatherlin 2006, p. 312). The most significant increase in nest predation occurs within 50 m (55 yards) of the campground edge (Raphael et al. 2002, p. 230). Even small campgrounds bolster corvid fledging success (Neatherlin and Marzluff 2004, pp. 715-716).

Under the proposed action, the parking lots and trails will continue to be managed for recreational use. Research in other murrelet habitat on the Olympic Peninsula has demonstrated that nest predation risk can increase in close proximity to campground trash sites, even in isolated settings due to the presence of refuse, food scraps, and the deliberate feeding of wildlife by recreationists. Marzluff and Neatherlin (2006, p. 311) state that the quality of nesting habitat adjacent to campgrounds may be compromised because of the increased risk of corvid predation.

These areas will continue to cause an increased level of predation risk for murrelets. Short of closing these areas to public access, there is relatively little that can be done to prevent these effects, other than to manage garbage to reduce wildlife access to human garbage. Under the proposed action, the effects associated with increased predation risk adjacent to parking lots will continue to occur. Continued management of parking lots under the current planned practices creates a likelihood of injury to nesting murrelets due to increased predation risk.

The action agency provided information about the suitable habitat available within 50 meters of a trash source. This equates to approximately 500 acres of suitable habitat.

The action ***may affect and is likely to adversely affect*** marbled murrelets due to disruption, disturbance or predation.

Individual Tree Removal

The zone within the action area slated for individual tree removal for hazard/danger trees will occur in the footprint of previously harvested thinning units associated with the Whalen Knob Timber Restoration Thinning Project. Because hazard/danger trees are removed during timber sale operations, we anticipate a low number of additional hazard trees will be removed during the construction phases of the parking lots, trail system, and skills park. ITR during construction phases will adhere to timing restrictions consistent with avoiding adverse effects in Table 8. However, after construction phases, the need to remove hazard/danger trees for human safety will continue in perpetuity at all times of the year.

The proposed action includes the development of 4 designated parking areas for access to trails and the Skills Park areas. The size of the parking areas ranges from approximately 0.13-0.9 acre in size with a total footprint of up to 2.25 acres. These parking areas will utilize wide road shoulders, existing landings, and junctions between roads in previously disturbed terrain and are not expected to remove groups of trees. Approximately 0.83 acres of the proposed parking areas occur in designated Marbled Murrelet critical habitat and have the potential to develop into suitable marbled murrelet habitat The area around the parking lots and skills park will have the highest volume of human traffic and ITR will occur year-round as needed. The Middle Crest (0.23 acres) and Buzzard Butte (0.6 acres) parking areas are within 110 yards of suitable marbled murrelet habitat and occur within critical habitat: 15 acres of suitable habitat within 110 yards at the Middle Crest Parking Area and 8.7 acres at the Buzzard Butte Parking Area.

With PDC's in place, individual tree removal will not directly modify existing suitable murrelet habitat within the tree removal zone. Disturbance from removal along the trail corridor will be minimized with chainsaw use restricted to outside of the critical breeding season (April 1-August 5) and daily timing restrictions applied during the late breeding season (Table 8 and 9). However, there will be a need to perform hazardous tree removal during the critical breeding season around the parking lots which will result in disruption to unsurveyed suitable MAMU habitat within 110 yds of the hazardous tree removal zone. Hazard and danger trees that will be removed for human safety during the critical breeding season when within 110 yards of unsurveyed suitable habitat will follow daily timing restrictions(Table 8). We do not expect hazard tree removal for an area already cleared of hazard trees during the past thinning project and parking lot construction, for such a small area (The Middle Crest parking area of .23 acres and Buzzard Butte parking area of .6 acres) to take longer than 1 day at any location. It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply) (Table 8). Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation. This consultation does not cover the removal of MAMU nest trees during the breeding season. In the event a nest tree must be removed, it will be after the breeding season and covered under a separate emergency consultation. The potential disruption of suitable habitat surrounding the parking areas, trails and skills park areas may affect, but is not likely to adversely affect the species and may affect but is not likely to adversely affect CH.

9.6.3 Effects of Habitat Modification by Project Category

Heavy Thinning Project

Heavy Thinning and 2-5 Acre Gap/Opening Treatments

Suitable habitat is not present with action area, and no treatments are expected within 110 yards of suitable habitat. The action ***may affect but is not likely to adversely affect*** marbled murrelets due to habitat modification.

Sand Lake Recreation Project

Mountain Bike Trail Construction, Skills Park Construction, Mountain Bike Trail Maintenance, and Recreational Operation Use

Habitat will be maintained with canopy cover in suitable remaining at 60% and 40% in buffer habitat. No removal of any known nest tree or tree with potential marbled murrelet nesting structure. The action ***may affect but is not likely to adversely affect*** marbled murrelets due to habitat modification.

Trailhead Parking Lot Construction

Murrelet responses to forest management are not well understood but are likely most influenced by relative changes in important structural features such as canopy, availability of nesting platforms in larger trees, and quality of those nesting structures such as mistletoe brooms, and large branches with epiphytes. The following discussion focuses on indirect effects to nesting habitat associated with the Sand Lake Recreation Project. The proposed action does not remove nesting habitat but changes in the action area will downgrade suitable habitat to buffer habitat.

The relationships of edge effects, fragmentation, occupancy, and nest success can result in direct or indirect negative impacts to nesting murrelets from increasing the risk to reproduction and occupancy from reduced microsite conditions, habitat fragmentation, and predation (Manley and Nelson 1999, p. 40; Marzluff et al. 2006; Luginbuhl et al. 2001, p. 570; Bradley 2002, p. 44-45; Burger 2002, pp. 91-104, Raphael et al. 2002, p. 228-233; Zharikov et al. 2006, p. 113-117; Malt and Lank 2007, pp. 165-171; Malt and Lank 2009, p. 1278).

The action ***may affect and is likely to adversely affect*** marbled murrelets due to habitat modification.

Individual Tree Removal

The zone within the action area slated for individual tree removal for hazard/danger trees will occur in the footprint of previously harvested thinning units associated with the Whalen Knob Timber Restoration Thinning Project. Because hazard/danger trees are removed during timber sale operations, we anticipate a low number of additional hazard trees will be removed during the construction phases of the parking lots, trail system, and skills park. ITR during construction phases will adhere to timing restrictions consistent with avoiding adverse effects in Table 8. However, after construction phases, the need to remove hazard/danger trees for human safety will continue in perpetuity at all times of the year.

The proposed action includes the development of 4 designated parking areas for access to trails and the Skills Park areas. The size of the parking areas ranges from approximately 0.13-0.9 acre in size with a total footprint of up to 2.25 acres. These parking areas will utilize wide road shoulders, existing landings, and junctions between roads in previously disturbed terrain and are not expected to remove groups of trees. Approximately 0.83 acres of the proposed parking areas occur in designated Marbled Murrelet critical habitat and have the potential to develop into suitable marbled murrelet habitat The area around the parking lots and skills park will have the highest volume of human traffic and ITR will occur year-round as needed. The Middle Crest (0.23 acres) and Buzzard Butte (0.6 acres) parking areas are within 110 yards of suitable marbled murrelet habitat and occur within critical habitat: 15 acres of suitable habitat within 110 yards at the Middle Crest Parking Area and 8.7 acres at the Buzzard Butte Parking Area.

With PDC's in place, individual tree removal will not directly modify existing suitable murrelet habitat within the tree removal zone. Disturbance from removal along the trail corridor will be minimized with chainsaw use restricted to outside of the critical breeding season (April 1-August 5) and daily timing restrictions applied during the late breeding season (Table 8 and 9). However, there will be a need to perform hazardous tree removal during the critical breeding season around the parking lots which will result in disruption to unsurveyed suitable MAMU habitat within 110 yds of the hazardous tree removal zone. Hazard and danger trees that will be removed for human safety during the critical breeding season when within 110 yards of unsurveyed suitable habitat will follow daily timing restrictions(Table 8). We do not expect hazard tree removal for an area already cleared of hazard trees during the past thinning project and parking lot construction, for such a small area (The Middle Crest parking area of .23 acres and Buzzard Butte parking area of .6 acres) to take longer than 1 day at any location. It is the Level 1 Team's Opinion that chainsaw and heavy equipment noise activities that occur with a duration of less than one day during the critical breeding period in a given breeding season at any one location are not likely to cause a reduction in spotted owl or murrelet breeding success (for murrelets, daily timing restrictions would still apply)

(Table 8). Hazard/danger tree removal that needs to occur due to human safety and is within disruption distances to unsurveyed or occupied suitable NSO or MAMU habitat that will take longer than one day in any one area is not covered by this consultation and will be covered under a separate emergency consultation. This consultation does not cover the removal of MAMU nest trees during the breeding season. In the event a nest tree must be removed, it will be after the breeding season and covered under a separate emergency consultation. The potential disruption of suitable habitat surrounding the parking areas, trails and skills park areas may affect, but is not likely to adversely affect the species and may affect but is not likely to adversely affect CH.

9.6.4 Effects of Proposed Action Relative to Available Critical Habitat and Suitable Habitat available to Murrelets

The following Effects of the Action are adapted from the "Marbled Murrelet and Critical Habitat" section in the BA Marbled Murrelet Status section. See pages 43 of the BA. See also Table 7: Acres of MAMU critical and suitable habitat within the project area with summary of effects from project actions.

The Siuslaw contains approximately 270,343 acres of suitable murrelet habitat. Within the analysis area, there are 5,345 acres of designated critical habitat and 6,022 acres of suitable habitat (Figure 13). Suitable habitat is derived from modeled habitat classified as moderate and high suitability which together is referred to as suitable habitat in this report (Falxa and Raphael 2016). No suitable or critical habitat falls within the Heavy Thinning and Early Successional Habitat Creation action area (Figure 13). Portions of the Mountain Bike Trail project overlap with critical and suitable MAMU habitat, with the mountain bike trail system occurring within 8.7 acres of critical habitat and 6 acres of suitable MAMU habitat (Table 7). Additionally, the Middle Crest and Buzzard Butte parking areas overlap with critical and suitable habitat, but the skills park is entirely outside of critical or suitable habitat (Figure 10).

9.6.5 Effects Relative to Recovery Plan Actions

Short Term Actions to Stabilize and Increase the Population

Recovery Action 3.1:

Recovery Action 3.1.1.1-*Maintain Occupied Nesting Habitat; and* Recovery Action 3.1.1.3-*Maintain Buffer Habitat.*

In Section 2.4.2 and 2.4.3, PDC protect active and occupied murrelet sites. The Sand Lake Recreation project will downgrade 1 acre of existing suitable habitat to buffer habitat. To reduce negative impacts from edge effects, the murrelet recovery plan suggests a buffer of 300-600 ft. around suitable habitat to maintain successful nesting (USFWS 1997). To reduce disturbance, operational periods will be restricted to occur outside of the critical breeding and follow daily timing restrictions as outlined in Tables 8 and 9.

Recovery Action 3.1.3*: Minimize Nest Disturbance to Increase Reproduction Success*

In Section 2.4.2 and 2.4.3, PDC protect active and occupied murrelet sites. Any occupied sites will not be disrupted across the majority of the project action area. Use of small and heavy equipment outside of the breeding season or two hours after sunrise and at least two hours before sunset during the late breeding season will avoid murrelets' dawn and dusk feeding schedule. However, the increased human traffic at the Sand Lake recreational project is expected to attract corvids near waste containers and could increase the likelihood of injury to nesting murrelets due to increased predation risk. The action agency provided information about the suitable habitat available within 50 meters of a trash source. This equates to approximately 500 acres of suitable habitat.

Long Term Actions to Stop Population Decline and Increase Population Growth

Recovery Action 3.2.

<u>Recovery Action 3.2.1:</u> *Increase the Amount and Quality of Nesting Habitat.*

Any portion of the heavy thinning project that occur in LSRs within the range of the murrelet would be designed to promote the development of late-successional and old-growth habitat, thereby increasing the amount and quality of nesting habitat for murrelets. The recreation project will have minimal habitat removal (1 acre for the parking lot, Table 7).

<u>Recovery Action 3.2.2:</u> *Improve Distribution of Nesting Habitat.*

Any portion of the heavy thinning project that occur in LSRs within the range of the murrelet would be designed to promote the development of late-successional and old-growth habitat, thereby increasing the amount and quality of nesting habitat for murrelets. The recreation project will have minimal habitat removal (1 acre for the parking lot, Table 7).

9.7 Marbled Murrelet Critical Habitat

See also Table 17: Action Description and Deconstruction with Exposure and Effects Matrix for the Marbled Murrelet.

Project Categories/activities are described in greater detail in Section 2 and Table 7. A more comprehensive description of the changes to forest/vegetation conditions due to habitat modification are found in the marbled murrelet Section 9.6.3. This section does not restate much of that info and focuses on conclusions specific to CH for marbled murrelets.

The discussion below focuses solely on effects to PBFs of marbled murrelet CH. Section 2 of this Opinion contains tables from the BA that describe the expected quantities of Project Categories (activities) to be implemented in CH for the spatial and temporal scales discussed in the BA.

Regardless of any Project Category and the expected effect of an activity, it is the responsibility of the action agency project biologist to ensure effects to CH are considered, applicable PDC are applied and effects to CH are reported in post-implementation monitoring. Any activity that would preclude or significantly delay the further development of PBFs (e.g., increasing the age, and structural complexity of the present PBFs) compared to no-treatment, ***may affect and is likely to adversely affect*** CH due to indirect/long-term effects to habitat and associated PBFs of CH. Significant differences are measured in as little as 10 years when comparing treatment versus no-treatment scenarios. That period could be slightly greater when the benefits of any treatment are demonstrated and pronounced.

Effects to the Primary Constituent Elements of Critical Habitat

PBF 1 – Individual trees with potential nesting platforms
PBF 2 – forested areas within 0.8 kilometer (0.5 mile) of individual trees with potential nesting platforms that have a canopy height of at least one-half the site potential tree height. This includes all such forest, regardless of contiguity (76 FR 61604).

PBF 1 is about forest types that support the nesting habitat. PBF 2 is about maintaining a buffer around the nesting habitat. The projects will treat but maintain 845.7 acres of critical habitat at their current levels and downgrade 0.83 acres for parking lot construction from nesting habitat (PBF 1) to buffer habitat (PBF 2) within the Sand Lake Recreation project. All acres of critical habitat that are treated will be within the Sand Lake Recreation project, and no acres of critical habitat occur or will be treated within the Heavy Thinning project (Table 7).

Summary of Effects to the PBFs of Marbled Murrelet Critical Habitat

We expect insignificant effects to PBFs 1-2 from most of the recreation project action types as 844.9 of the 845.7 acres of treatments to these habitat types in MAMU CH will be largely maintained at their current level at the Sand Lake Recreation Project within the zone of critical habitat. Any modification of critical habitat is a downgrade from PBF 1 (nesting habitat) to PBF 2 (buffer). The amount of area downgraded is significant at 0.83 acres for MAMU because the scale of habitat modification effects considered adverse to MAMU are evaluated at the quarter acre scale. There is no critical habitat within the Heavy Thinning Project area.

9.7.1 Effects of Heavy Thinning by Project Category

Heavy Thinning and 2-5 Acre Gap/Opening Treatments

Because critical habitat is not present within the footprint of the Heavy Thinning Project, the action agency has determined that there is ***no effect*** to marbled murrelet critical habitat.

9.7.2 Effects of Sand Lake Recreation Project by Project Category

Mountain Bike Trail Construction, Mountain Bike Trail Maintenance, and Recreational Operation Use

No critical habitat will be modified by the recreational operation use. Mountain bike trail construction and mountain bike trail maintenance will involve understory vegetation, brush and down log removal, but no removal of known nest tree or any tree with a potential marbled murrelet nesting structure. The trails run through 8.7 acres of critical habitat. These actions ***may affect but are not likely to adversely affect*** marbled murrelet critical habitat.

Trailhead Parking Lot Construction

Critical habitat will be downgraded within the 0.83-acre footprint of the trailhead parking lots. No removal of known nest tree or any tree with a potential marbled murrelet nesting structure will be removed. This action ***may affect and is likely to adversely affect*** marbled murrelet CH.

Skills Park Construction

Because critical habitat is not present within the footprint of the skills park construction, the action agency has determined that there is ***no effect*** to marbled murrelet critical habitat.

Individual Tree Removal

No critical habitat will be modified by the recreational operation use. Hazardous trees will be removed at the skills park construction, along the trails and parking lots. Habitat will be maintained with canopy cover in suitable remaining at 60% and 40% in buffer habitat. No removal of any known nest tree or tree with potential MAMU nesting structure will occur. With implementation of all PDC, these actions ***may affect but are not likely to adversely affect*** marbled murrelet critical habitat.

9.8 Cumulative Effects to Murrelets and Their Critical Habitat

Cumulative effects are those effects of future State or private activities (not involving Federal activities) that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR § 402.02 Definitions). The action area includes lands within the action area associated with the proposed projects and non-federal and Federal lands within approximately 0.5 mile of the Federal lands.

More specific information concerning cumulative effects to marbled murrelets and their CH are available in BA.

The Oregon Department of Forestry is developing a Habitat Conservation Plan (HCP) for Western Oregon State Forests. The Oregon Department of State Lands is developing a Habitat Conservation Planning for the Elliott State Forest, located east of Coos Bay, Oregon and outside of the action area of this Opinion. Under the draft plan, the Elliott State Forest, an area of approximately 83,000 acres will be managed as a research forest by Oregon State University. The HCP and the associated National Environmental Policy Act processes are ongoing and we have not yet completed ESA section 7 consultations. Any effects of implementing Santiam State Forest management under the new HCP will be addressed when the proposed action sufficiently developed. On August 22, 2023, the Confederated Tribes of Grand Ronde submitted Natural Resources Management Plan for Reservation and Tribal Trust Timber Lands: 2024-2033 Biological Assessment for section 7 consultation. This includes the Reservation, 10,211 acres and the Coal Creek Property, 884 acres, and trust lands around Grand Ronde that are managed for forestry. The Grand Ronde Reservation comprises approximately 10,212 acres on the east side of the Coast Range. The Reservation is located in Yamhill County, approximately 3 miles north of the town of Grand Ronde and outside of but adjacent to the action area of this Opinion.

Table 16: Action Description and Deconstruction with Exposure and Effects Matrix for the Northern Spotted Owl
From Appendix C of the BA.

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action/Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects to Critical Habitat with PDC and Minimizing Measures	Effect to Species with PDC and Minimizing Measures	Sum of Affected Area (Acres/Trees)
Mountain Bike Trail Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Use chainsaws to remove hazardous trees within immediate area of trail. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.	Sand Lake Watershed; South Block; along trail system	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate trail footprint 3) Within 100 ft. on either side of trail. 4) Within 6ft trail swath and equipment staging areas 5) Within 6 ft. trail swath and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-6October 4) In perpetuity 5) During Construction; June-October	1) 5 yrs. - short-term 2) In perpetuity - permanent - long-term 3) In perpetuity - permanent removal of trees 4) In perpetuity - permanent 5) 5 yrs. - length of the project	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	Yes	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds. of un-surveyed suitable habitat between March 1-July 7. 2) None 3) No removal of any tree with NSO or nesting structure or live trees > 11 in dbh. Habitat maintained. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA	NLAA	Critical Habitat = 11.5; Suitable NRF = 2.6 acres

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action/Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects to Critical Habitat with PDC and Minimizing Measures	Effect to Species with PDC and Minimizing Measures	Sum of Affected Area (Acres/Trees)
Trailhead Parking Lot Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Use chainsaws to remove hazardous trees within immediate area of parking lots. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator. Hardening with rock/gravel will occur in the parking area footprint.	Skills Park, Gurtis Creek, Middle Crest, and Buzzard Butte Parking Areas within the Recreational Improvements project area in the South Block of the action area.	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate parking lot footprint 3) Within 100 ft. on either side of parking lot boundary. 4) Within parking lot footprint and equipment staging areas 5) Within parking lot footprint and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-October 4) In perpetuity 5) During Construction; June-October	1) 5 yrs. short-term 2) In perpetuity - permanent - long-term 3) In perpetuity - permanent removal of trees 4) In perpetuity - permanent 5) Daily	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	Yes	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 7. 2) None - Not sure how I would minimize this stressor 3) No removal of any tree with NSO or nesting structure or live trees > 11 in dbh. Habitat maintained. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA	NLAA	Critical Habitat = 1.86 acres; Suitable NRF = 0 acres

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action/Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects to Critical Habitat with PDC and Minimizing Measures	Effect to Species with PDC and Minimizing Measures	Sum of Affected Area (Acres/Trees)
Skills Park Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs and any hazardous trees. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.	Skills Park within the Recreational Improvements project area in the South Block of the action area in old landing area.	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1)0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate skills park 3-acre footprint 3) Within 100 ft. on either side of the skills park boundary and within the footprint. 4) Within skills park footprint and equipment staging areas. 5) Within 3-acre skills park footprint and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-October 4) In perpetuity 5) During Construction; June-October	1) 2-5 years 2) Permanent-in Perpetuity 3) In Perpetuity 4) In perpetuity 5) In Perpetuity	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	Yes	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 7. 2) None 3) No removal of any tree with NSO or nesting structure or live trees > 11 in dbh. Habitat maintained. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA	NLAA	Critical Habitat = 3.5 acres; Suitable NRF = 0 acres
Individual Tree Removal	Involves the removal of hazardous trees within 1.5 site potential tree heights (325 ft.). Topography and terrain will reduce the zone of removal in several areas of the project action area. Amounts are expected to be low, and chainsaws will be used.	In skills park, along trail system, and parking lots; South Block	1) Noise 2) Tree Removal	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within 1.5 the site potential tree height on either side of parking lots, trails, and skills park boundary.	1) Year Round 2) Year-Round	1) In Perpetuity 2) In Perpetuity	1) In Perpetuity 2) In Perpetuity	Yes	Yes	1) Action will most likely need to occur during breeding season and therefore could disrupt the species if within 65 yds of suitable habitat. 2) Habitat will be maintained with canopy cover in suitable remaining at 60% and 40% in dispersal. No removal of any known nest tree.	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA - No Habitat Modification	NLAA	Suitable = 446; CH = 1,130

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action/Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects to Critical Habitat with PDC and Minimizing Measures	Effect to Species with PDC and Minimizing Measures	Sum of Affected Area (Acres/Trees)
Mountain Bike Trail Maintenance	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs over trails. Moving of earth with hand tools and small machinery such as a 3,000 lb. excavator as needed.	Along purposed trail system within the Recreational Improvements project is in the South Block of the action area.	1) Noise 2) Brush removal 3) Down log removal (Individual Tree Removal Separate Action)	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate trail system footprint 3) Within the immediate trail system footprint.	1) Dry season; June-October; during daylight hours. 2) Dry season; June-October 3) Dry season; June-October	1) In Perpetuity-Annually 2) In Perpetuity-Annually 3) In Perpetuity-Annually	1) In Perpetuity-Annually-30 days/year 2) In Perpetuity-Annually 3) In Perpetuity-Annually	Yes	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 7. 2) None 3) No removal of any tree with NSO or nesting structure or live trees > 11 in dbh. Habitat maintained. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA	NLAA	Critical Habitat = 11.5 acres; Suitable NRF = 2.6 acres
Recreational Operation-use	Management of human trash, restroom facility maintenance, skills park terrain upkeep. Public travel to and from site.	In skills park, along trail system, and parking lots; South Block	1) Noise 2) Human Intrusion 3) Human Garbage	1) Increased noise from vehicle traffic along main road; human noise within Skills Park, Trails, and Parking Areas 2) Within the immediate trail system footprint and skills park 3) Along trail system, concentrated at Parking Lots and Skills Park areas with potential corvid increase effects up to 1 km (referenced in BA).	1) Year Round 2) Year-Round 3) Year Round	1) In Perpetuity 2) In Perpetuity 3) In Perpetuity	1) In Perpetuity 2) In Perpetuity 3) In Perpetuity	Yes	Yes	1) None 2) None 3) Installation of wildlife proof trash receptacles and leave no trace signage, plus crumb clean educational signage.	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25	NLAA	NLAA	Critical Habitat = 16.6 acres; Suitable Habitat = 2.6 acres

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action/Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects to Critical Habitat with PDC and Minimizing Measures	Effect to Species with PDC and Minimizing Measures	Sum of Affected Area (Acres/Trees)
Creation of 5-acre Gaps	Tree removal, chainsaw use, heavy equipment for logging and hauling. Temporary removal of vegetation and overstory trees with some residual trees within the opening.	Early Seral Units within the North Block of Action area	1) Noise 2) Understory Removal 3) Forest Canopy Removal 4) Soil Compaction 5) Soil Disturbance	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate 5-acre gap 3) Within 5-acre gap 4) along haul roads and equipment staging areas	1) Jan-Dec 2) Jan-Dec 3) Jan-Dec 4) Jan-Dec 5) Jan-Dec	1) 2-5 years 2) 10 years Temporary 3) 20 years - Temporary	1) Daily 2) 10 years Temporary 3) 20 years - Temporary	No	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 7. 2) Restrict clearing to outside of the breeding season; replant gaps; no gaps created in suitable NRF habitat. 3) No removal of any tree with NSO or nesting structure and will leave some residual trees within gap 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Heavy Thinning: 11-18.	NE	LAA	100 acres
Heavy Thinning to 30% CC	Timber hauling, chainsaw use, heavy equipment for logging, temporary removal of vegetation and overstory trees.	Heavy thinning units in the North Block of Action area.	1) Noise 2) Understory Removal 3) Tree Removal 4) Soil Compaction 5) Soil Disturbance	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the units 3) Within the units 4) along haul roads and equipment staging areas 5) within units	1) Jan-Dec 2) Jan-Dec 3) Jan-Dec	1) 2-5 years 2) 10 years Temporary 3) 20 years - Temporary	1) Daily 2) 10 years Temporary 3) 20 years - Temporary	No	Yes	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 7. 2) No heavy thinning in suitable NRF habitat. 3) No removal of any tree with NSO or nesting structure 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Heavy Thinning: 11-18.	NE	LAA	136 acres

Table 17: Action Description and Deconstruction with Exposure and Effects Matrix for the Marbled Murrelet
From Appendix D of the BA.

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action /Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects of Action on Critical Habitat	Effects of Action on Species	Sum of Affected Area (Acres/Trees)
Mountain Bike Trail Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Use chainsaws to remove hazardous trees within immediate area of trail. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.	Sand Lake Watershed; South Block; along trail system	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate trail footprint 3) Within 100 ft. on either side of trail. 4) Within 6ft trail swath and equipment staging areas 5) Within 6 ft. trail swath and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-October 4) In perpetuity 5) During Construction; June-October	1) 5 yrs. - short-term 2) In perpetuity - permeant - long-term 3) In perpetuity - permanent removal of trees 4) In perpetuity - permeant 5) 5 yrs. - length of the project	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	Yes	Yes	1) Restrict action to outside of the critical breeding season and outside of the 300 ft. buffer of un-surveyed suitable habitat between April 1-August 5. Restrict timing on daily operations from August 6-Sept 15, to one hour after sunrise and ceasing one hour before sunset. 2) None 3) No removal of any known nest tree or tree with potential MAMU nesting structure. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	NLAA	NLAA	Critical Habitat = 8.7 acres; Suitable Habitat = 6 acres

Proposed Action	Activity-Tasks-Tools	Action Location	Land, Air, Water Change (Stressor from Action)	Extent of Change	When Action will Occur	Duration of Action/Stressor	Frequency of Action /Stressor	Exposure to Critical Habitat	Exposure to Species	Minimizing/Conservation Measures	PDCs	Effects of Action on Critical Habitat	Effects of Action on Species	Sum of Affected Area (Acres/Trees)
Trailhead Parking Lot Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs. Use chainsaws to remove hazardous trees within immediate area of parking lots. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.	Skills Park, Gurtis Creek, Middle Crest, and Buzzard Butte Parking Areas within the Recreational Improvements project area in the South Block of the action area.	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate parking lot footprint 3) Within 100 ft. on either side of parking lot boundary. 4) Within parking lot footprint and equipment staging areas 5) Within parking lot footprint and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-October 4) In perpetuity 5) During Construction; June-October	1) 5 yrs. - short-term 2) In perpetuity - permanent - long-term 3) In perpetuity - permanent removal of trees 4) In perpetuity - permanent 5) Daily	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	Yes	Yes	1) Restrict action to outside of the critical breeding season and outside of the 300 ft. buffer of un-surveyed suitable habitat between April 1-August 5. Restrict timing on daily operations from August 6-Sept 15, to one hour after sunrise and ceasing one hour before sunset. 2) None 3) No removal of any known nest tree or tree with potential MAMU nesting structure. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	LAA - Downgrade	LAA - habitat downgrade	Critical Habitat = 0.83 acres; Suitable Habitat = 0.83 acres
Skills Park Construction	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs and any hazardous trees within immediate area of skills park and within 1.5 site potential tree height (325 ft.) of the skills park area boundary. Moving of earth with small and heavy machinery such as a 3,000 lb. and 10,000 lb. excavator.	Skills Park within the Recreational Improvements project area in the South Block of the action area in old landing area.	1) Noise 2) Understory Vegetation Removal 3) Individual Tree Removal 4) Soil Compaction 5) Soil Disturbance/moving	1)0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate skills park 3-acre footprint 3) Within 100 ft. on either side of the skills park boundary and within the footprint. 4) Within skills park footprint and equipment staging areas. 5) Within 3-acre skills park footprint and surrounding soil source areas.	1) Dry season; June-October; during daylight hours. 2) In Perpetuity 3) Dry season; June-October 4) In perpetuity 5) During Construction; June-October	1) 2-5 years 2) Permanent-in Perpetuity 3) In Perpetuity 4) In perpetuity 5) In Perpetuity	1) Daily 2) In Perpetuity 3) In Perpetuity 4) In Perpetuity 5) Daily	No	Yes	1) Restrict action to outside of the critical breeding season and outside of the 300 ft. buffer of un-surveyed suitable habitat between April 1-August 5. Restrict timing on daily operations from August 6-Sept 15, to one hour after sunrise and ceasing one hour before sunset. 2) None 3) No removal of any known nest tree or tree with potential MAMU nesting structure. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	NE	NLAA	Critical Habitat = 0 acres; Suitable Habitat = 0

Mountain Bike Trail Maintenance	Use machinery such as weed-eaters, hand saws, chainsaws, hand tools to clear limbs and brush, plus remove down logs over trails. Moving of earth with hand tools and small machinery such as a 3,000 lb. excavator as needed.	Along purposed trail system within the Recreational Improvements project is in the South Block of the action area.	1) Noise 2) Brush removal 3) Down log removal (Individual Tree Removal Separate Action)	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate trail system footprint 3) Within 1.5 the site potential tree height on either side of parking lot boundary.	1) Dry season; June-October; during daylight hours. 2) Dry season; June-October 3) Dry season; June-October	1) In Perpetuity-Annually 2) In Perpetuity-Annually 3) In Perpetuity-Annually	1) In Perpetuity-Annually-30 days/year 2) In Perpetuity-Annually 3) In Perpetuity-Annually	Yes	Yes	1) Restrict action to outside of the critical breeding season and outside of the 300 ft. buffer of un-surveyed suitable habitat between April 1-August 5. Restrict timing on daily operations from August 6-Sept 15, to one hour after sunrise and ceasing one hour before sunset. 2) None 3) No removal of any known nest tree or tree with potential MAMU nesting structure. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	NLAA	NLAA	Critical Habitat = 8.7 acres; Suitable Habitat = 6 acres
Individual Tree Removal	Involves the removal of hazardous trees within 1.5 site potential tree heights (325 ft.)	In skills park, along trail system, and parking lots; South Block	1) Noise 2) Tree Removal	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within 1.5 the site potential tree height on either side of parking lots, trails, and skills park boundary.	1) Year Round 2) Year-Round	1) In Perpetuity 2) In Perpetuity	1) In Perpetuity 2) In Perpetuity	Yes	Yes	1) Action will most likely need to occur during breeding season and therefore could disrupt the species if within 110 yds of suitable habitat. 2) Habitat will be maintained with canopy cover in suitable remaining at 60% and 40% in buffer habitat. No removal of any known nest tree or tree with potential MAMU nesting structure.	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	NLAA - No Habitat Modifica tion	LAA-Disruption at Parking Lots	CH= 837 Suitable = 625

Recreational Operation-use	Management of human trash, restroom facility maintenance, skills park terrain upkeep. Public travel to and from site.	In skills park, along trail system, and parking lots; South Block	1) Noise 2) Human Intrusion 3) Human Garbage	1) Increased noise from vehicle traffic along main road; human noise within Skills Park, Trails, and Parking Areas 2) Within the immediate trail system footprint and skills park 3) Along trail system, concentrated at Parking Lots and Skills Park areas with potential corvid increase effects up to 1 km	1) Year Round 2) Year-Round 3) Year Round	1) In Perpetuity 2) In Perpetuity 3) In Perpetuity	1) In Perpetuity 2) In Perpetuity 3) In Perpetuity	Yes	Yes	1) None 2) None 3) Installation of animal proof trash receptacles at Gurtis Creek and Buzzard Butte and leave no trace signage, plus educational signage	See BA Document: All General Standards 1-9; PDC Specific to NSO: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Recreational Improvements: 19-25.	NLAA - No Habitat Modifica tion	LAA- Disruption Disturbance	*Need to quantify the amount of habitat acres affected in the 300 ft. disturbance/dis ruption zone. Parking lots, Skills Park, and Trails.
Creation of 5-acre Gaps	Tree removal, chainsaw use, heavy equipment for logging and hauling.	Early Seral Units within the North Block of Action area	1) Noise 2) Understory Removal 3) Forest Canopy Removal 4) Soil Compaction 5) Soil Disturbance	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the immediate 5-acre gap 3) Within 5 acre gap 4) along haul roads and equipment staging areas	1) Jan-Dec 2) Jan-Dec 3) Jan-Dec 4) Jan-Dec 5) Jan-Dec	1) 2-5 years 2) 10 years Temporary 3) 20 years - Temporary	1) Daily 2) 10 years Temporary 3) 20 years - Temporary	No	No	1) Restrict action to outside of the critical breeding season and outside of the 300 ft. buffer of unsurveyed suitable habitat between April 1-August 5. Restrict timing on daily operations from August 6-Sept 15, to one hour after sunrise and ceasing one hour before sunset. 2) None 3) No removal of any known nest tree or tree with potential MAMU nesting structure. 4) None 5) None	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Heavy Thinning: 11-18.	NE	NLAA	100
Heavy Thinning to 30% CC	Timber hauling, chainsaw use, heavy equipment for logging,	Heavy thinning units in the North Block of Action area.	1) Noise 2) Understory Removal 3) Tree Removal 4) Soil Compaction 5) Soil Disturbance	1) 0.25 miles from noise source: Heavy machinery/chainsaws 2) Within the units 3) Within the units 4) along haul roads and equipment staging areas 5) within units	1) Jan-Dec 2) Jan-Dec 3) Jan-Dec	1) 2-5 years 2) 10 years Temporary 3) 20 years - Temporary	1) Daily 2) 20 years Temporary 3) 20 years - Temporary	No	No	1) NSO: Restrict action to outside of critical breeding season within 65 yds of un-surveyed suitable habitat between March 1-July 15. 2) No heavy thinning in suitable NRF habitat. 3) No removal of any tree with NSO or nesting structure	See BA Document: All General Standards 1-9; PDC Specific to MAMU: 1, 3, 5, 6, 7, 8, 9, 10; PDC Specific to Heavy Thinning: 11-18.	NE	NLAA	136

										4) None 5) None				

10 Conclusions and Effects

10.1 Spotted Owl and its Critical Habitat

After reviewing the status of the northern spotted owl, the environmental baseline for the action area, and the effects of the proposed action, including all measures proposed to avoid and minimize adverse effects, and the cumulative effects, it is the Service's Biological Opinion that the Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments Project **is not likely to** (1) jeopardize the continued existence of the northern spotted owl by appreciably reducing their likelihood of survival and recovery by reducing their reproduction, numbers, or distribution; and **is not likely to** (2) destroy or adversely modify critical habitat by appreciably diminishing the value of critical habitat as whole for the conservation of the spotted owl.

This jeopardy finding for the northern spotted owl and no destruction or adverse modification of critical habitat is supported by the following:

The Service considered the proposed action, all required specifications found in the management direction of the Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments, and all PDC in this Opinion, including those specific to the northern spotted owl. All PDC in this Opinion are mandatory and their implementation is part of the proposed action.

PDC prohibit injury or mortality to spotted owls caused by any project covered by this Opinion. The PDC restrict activities in such a manner as to avoid take of spotted owls. This avoidance includes requirements to either survey, assume occupancy or apply seasonal operating restrictions to avoid take. PDC also define two methods to assess impairment to an occupied spotted owl territory. There are no known NSO sites in the project area and the two potential sites based on habitat modeling are not expected to be impaired because there is no habitat removal or downgrade planned in NSO NRF/suitable habitat as a part of this project.

As described in Section 9.3.1, the proposed action would be overall beneficial to spotted owls in the mid to long term due to forest restoration actions in the heavy thinning portion of the project area where development of more complex, late successional structure will be accelerated as a result of the treatments. The purpose of the proposed action is to benefit the northern spotted owls in the long-term (10-20 years) as it is expected to accelerate forest restoration and increase the resistance and resilience of the forested landscape to withstand uncharacteristic disturbance such as large wildfires, thereby reducing the probability of large-scale and long-term NSO habitat removal.

10.2 Marbled Murrelet and its Critical Habitat

After reviewing the status of the marbled murrelet, the environmental baseline for the action area, and the effects of the proposed action, including all measures proposed to avoid and minimize adverse effects, and the cumulative effects, it is the Service's Biological Opinion that the Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments Project **is not likely to** (1) jeopardize the continued existence of the marbled murrelet by appreciably reducing their likelihood of survival and recovery by reducing their reproduction, numbers, or distribution; and **is not likely to** (2) destroy or adversely modify critical habitat by appreciably diminishing the value of critical habitat as whole for the conservation of the marbled murrelet.

Marbled Murrelet

This jeopardy finding for the marbled murrelet is supported by the following:

Habitat Modification

Most habitat modification to murrelets is minimized or prohibited by the project design to maintain all but .83 acres of MAMU habitat, and by PDC (*General PDC Specific to NSO and MAMU that apply to all projects, PDC Specific to the Heavy Thinning and Early Seral Habitat Creation Projects, and PDC Specific to the Recreational Improvements Project).* Only .83 acres of adverse effects for MAMU are expected from a downgrade of suitable habitat to buffer habitat for two parking areas. Therefore, no site impairment is expected.

Disruption Effects

Most disruption to murrelets is minimized or prohibited by PDC (*General PDC Specific to NSO and MAMU that apply to all projects, PDC Specific to the Heavy Thinning and Early Seral Habitat Creation Projects, and PDC Specific to the Recreational Improvements Project)*, and impairment of any site (regardless of occupation status) resulting from activities in suitable habitat is not expected due to most MAMU habitat being maintained by treatments with the exception of .83 acres being downgraded from suitable to buffer habitat for two parking areas.

However, predator disruption to murrelet breeding behavior in the Sand Lake Recreational Area during interrupted chick feedings is likely to adversely affect reproduction and numbers. New garbage cans and increased human presence would attract corvids around the new recreational trails and parking lots and have adverse effects to the individuals and breeding success within Conservation Zone 3.

The expected harm to adults is due to downgrade of .83 acres of nesting habitat and disruption to breeding behavior; and the amount of young potentially not recruited into the Conservation Zone 3 adult at-sea population over the ten-year period of this project. Overall, the calculated impacts present a worst-case analysis for reasons discussed in Section 9.6. This conservative calculation of impacts is especially applicable to the analysis of young not recruited into the adult population (14 annually, 140 over 10 years of this project and indefinitely while the recreational area continues to attract corvids).

The most recent population estimates for Conservation Zone 3 were:

> 8414 individuals in 2018, 8359 individuals in 2020; and 8249 individuals in 2022 (McIver et al. 2023).

<u>The number of young not recruited into the adult breeding population:</u> Implementing the proposed action would result in 14 young per year (14 nests potentially inhabiting the Sand Lake recreational project area [as discussed in 9.6.1] with 1 nestling per nest [Nelson 2020]) not recruited into the adult breeding population, thereby reducing the murrelet Conservation Zone 3 breeding population by 140 young over 10 years (if theoretically, all of this affect occurred at once). *These annual and 10-year impacts to breeding would insignificantly affect the number of individuals or reproductive success within the at-sea population of murrelets in Conservation Zone 3.*

<u>The number of adults harmed due to impacted breeding behavior</u>: Implementing the proposed action would impact 14 breeding pairs per year inhabiting the Sand Lake recreational project area [as discussed in 9.6.1]), thereby affecting breeding of approximately 0.34 % of the annual murrelet breeding population in Conservation Zone 3. In this context, impacts to breeding would not adversely affect breeding within population of murrelets in Conservation Zone 3 (if theoretically, all of this affect occurred at once). *These annual and 10-year impacts to breeding would insignificantly affect breeding success within the at-sea population of murrelets in Conservation Zone 3.*

Furthermore, these impacts would occur to the Conservation Zone 3 at-sea population which now has a positive average annual rate of change of 1.6%, including confidence intervals that no longer overlap zero (McIver et al. 2023, Table 5).

Marbled Murrelet Critical Habitat

This finding of no destruction or adverse modification of marbled murrelet critical habitat is supported by the following:

The Service considered the proposed action, all required specifications found in the management direction of the Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments, and all PDC in this Opinion, including those specific to the marbled murrelet critical habitat. All PDC in this Opinion are mandatory and their implementation is part of the proposed action.

PDC prohibit destruction or adverse modification to marbled murrelet critical habitat caused by any project covered by this Opinion.

General PDC Specific to NSO and MAMU that apply to all projects, PDC Specific to the Heavy Thinning and Early Seral Habitat Creation Projects, and PDC Specific to the Recreational Improvements Project would prevent impairment of any site (regardless of occupation status) resulting from activities in critical habitat.

As described in Section 9.6.1, the proposed action would be overall beneficial to marbled murrelet habitat. The purpose of the proposed action is to accelerate the development of complex, late successional forest structure in the heavy thinning portion of the project area, which would have long term benefits for MAMU. The project in the heavy thinning portion of the project area is also expected to increase the resistance and resilience of the forested landscape to withstand uncharacteristic disturbance such as large wildfires, thereby reducing the probability of large-scale and long-term MAMU habitat removal.

11 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened animal species, respectively. 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 defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of 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 prohibited taking under the Act provided that such taking is compliant with the terms and conditions of this Incidental Take Statement.

The project design criteria (PDC), and any further pre-implementation reviews, negotiated in cooperation with the Service and included as part of the proposed action constitute all of the reasonable measures necessary to minimize the impacts of incidental take including monitoring and reporting requirements. On that basis, no Reasonable and Prudent Measures are included in this Incidental Take Statement.

11.1 Spotted Owl

Based on the above analysis of the effects of the action on the spotted owl, and assuming all requisite PDC are adhered to, including but not limited to *General PDC Specific to NSO and MAMU that apply to all projects, PDC Specific to the Heavy Thinning and Early Seral Habitat Creation Projects, and PDC Specific to the Recreational Improvements Project 1, 3, 5-8, 11-19, 23-25* which eliminate or limit potential adverse effects to northern spotted owls, the Service concludes that no take of spotted owls is reasonably certain to occur from the proposed action. **As no incidental take is anticipated, there are no reasonable and prudent measures, and no terms and conditions are provided.**

The Service does not anticipate the proposed action will incidentally take any listed species. The Service must provide a reasoned basis for a likelihood of take in order to anticipate and exempt it. Since no take is anticipated or exempted, no reasonable and prudent measures and terms and conditions are provided below. If take is detected during implementation of the proposed action, reinitiation of formal consultation should be requested immediately.

The Service Level 1 Team representative is to be notified within three working days upon locating a dead, injured or sick spotted owl specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed.

11.2 Marbled Murrelet

11.2.1 Amount or Extent of Take

The Service anticipates incidental take of murrelets will be difficult to detect for the following reasons: The species occurs in habitat that makes detection difficult. We usually do not know the nest location within occupied stands due to the small size and cryptic behavior of the species within large, forested areas. Without knowledge of nest locations, we are typically unable to determine more precisely certain manners of effects, including egg predation or a failure of a chick to fledge. Finding a dead or impaired specimen is also unlikely due to the small body size of an egg or young. Therefore, we use a project type-habitat surrogate to evaluate how the entirety of the proposed action would take murrelet pairs disrupted during breeding, and potential young not recruited into the adult breeding population due to disruptions that cause breeding failure. Knowingly taking murrelets is prohibited under the proposed action and its PDC. Take is assessed for situations where it would unknowingly occur in the course of implementing the proposed action. The take analysis includes assumptions of potential murrelet breeding in areas not surveyed, estimates for how many protocol surveys do not detect breeding behavior or nest locations, and estimates for the amount of young not expected to survive to adulthood after breeding is disrupted. Under all effect pathways, disrupted adult murrelets would survive to breed the following year. As explained in Section 9.6 of the Opinion, the analysis estimating potential take is conservative due to likely overstating the number of impact situations.

The proposed action includes the development of 4 designated parking areas for access to trails and the Skills Park areas. The size of the parking areas ranges from approximately 0.13-0.9 acre in size with a total footprint of up to 2.25 acres (Section 2.3). These parking areas would utilize wide road shoulders, existing landings, and junctions between roads in previously disturbed terrain and are not expected to remove groups of trees. Approximately 0.83 acres of the proposed parking areas occur in designated Marbled Murrelet critical habitat and have the potential to develop into suitable marbled murrelet habitat (Section 2.3).

The Middle Crest (0.23 acres) and Buzzard Butte (0.6 acres) parking areas are within 110 yards of suitable marbled murrelet habitat and occur within critical habitat: 15 acres of suitable habitat within 110 yards at the Middle Crest Parking Area and 8.7 acres at the Buzzard Butte Parking Area. Openings larger than 0.25 acre within 110 yds. of suitable murrelet habitat reduce the overall function of the forest stand by modifying microclimate, increasing potential windthrow of nest trees, and/or removes trees containing nesting structure. Since these parking areas are sited along the key FS-1004 RD in existing disturbed pullouts, do not involve tree removal, and canopy cover will remain above 40%, the impact from the parking lots footprint is deemed insignificant and actions will not remove existing habitat. Since the proposed parking areas within critical habitat are not removing trees and canopy cover at both sites is maintained at ≥ 40%, the parking areas *may affect, and are not likely to adversely affect* marbled murrelet critical habitat.

However, these areas will become permanent features on the landscape and have the potential to increase disturbance and presence of corvids. As stated above, the proposed parking areas have the potential to increase anthropogenic food subsidies which is known to increase corvid densities at those sites and may increase predation on nesting murrelets in adjacent suitable habitat for up to 1 km from the parking areas. From our analysis, we identified 1 historic murrelet detection site within the 1 km buffer around the Middle Crest parking area and impacts to approximately 500 acres of suitable habitat from all 4 parking areas (Figure 12). The suitable habitat surrounding the parking areas is close to the ocean, has high quality murrelet nest structure confirmed by ground surveys, and is in proximity to historical murrelet detections. Due to increased human recreation potentially increasing the presence of predators, the proposed parking areas *may affect and are likely to adversely affect* marbled murrelets.

Potential take caused by these impacts is hard to quantify. Nelson (2005) estimated murrelet densities at 0.07 nests/ha. When considering this density estimate, roughly 14 pairs of murrelets would occupy the 500 acres of suitable habitat in the project area if simply summing the number of suitable acres (500 acres = 202.34 ha x 0.07), but this approach does not consider the complexities of murrelet nest site selection and therefore does not accurately represent the true number of nesting pairs within the project area. Nelson and Wilson (2002) found that the distribution of suitable nesting habitat for murrelets is not uniform and important characteristics for nest tree selection included trees located in areas of the forest that included an abundance of grouped, large trees with numerous platforms and generally more than two canopy layers. Interior, core patches of forest provide suitable microclimates for the development of moss and other nesting platform substrates (Nelson and Wilson 2002). Using the Nelson (2005) density estimate in conjunction with the suitable murrelet nest tree stand characteristics identified by Nelson and Wilson (2002), plus current population numbers, we estimate the realized potential occupancy of suitable habitat in the project area is most likely half of the estimated 14 pairs (Figure 12). The installation of wildlife-proof trashcans and interpretive signs has resulted in reduced impacts from corvid predation by lowering corvid densities, but the initial increases in corvid abundance is an adverse effect (Brunk et al. 2021).

In the accompanying Opinion, the Service determined the following levels of impact:

<u>The number of young not recruited into the adult breeding population</u>: Implementing the proposed action is expected to result in up to 14 young per year not recruited into the adult breeding population; and would result in up to 140 young over 10 years of the project (2024-2033) not recruited into the adult population. *We do not have any indication that MAMU can practice avoidance of this disturbance. Therefore, we estimate the amount of take to be the same each year. These annual and 10-year impacts to breeding would insignificantly affect the number of individuals in the breeding population, and breeding success within the at-sea population of murrelets in Conservation Zone 3.*

<u>The number of adults harmed due to impacted breeding behavior</u>: Implementing the proposed action is expected to impact up to 14 breeding pairs per year, thereby affecting breeding of up to 3.3 % of

the at-sea murrelet breeding population in Conservation Zone 3 over 10 years of the project; and would impact up to 140 breeding pairs over 10 years (2024-2033). In this context, impacts to breeding would not adversely affect breeding within the at-sea population of murrelets in Conservation Zone 3 (if theoretically, all of this affect occurred at once). *These annual and 10-year impacts to breeding would insignificantly affect the number of individuals and the breeding success within the at-sea population of murrelets in Conservation Zone 3*.

These impacts would affect the number of individuals and the reproductive success of the Conservation Zone 3 at-sea population, which now has a positive average annual rate of change of 1.6%, including confidence intervals that no longer overlap zero (McIver 2023 Table 5). This population was last estimated be 8,249 individuals in 2022.

Although these effects are expressed in numbers of individuals, they are derived from the types, locations, and amounts of habitat affected when implementing the proposed action. Therefore, the total amounts of each affecting proposed action Project Category will be the units of measure for reporting and monitoring of take. Project Categories that result in take of murrelets due to habitat removal and disruption are summarized in Section 9.6 of the biological Opinion. As stated in Section 9.6 and elsewhere in the Opinion, all actions were conservatively analyzed for potential habitat modification and/or disruption effects to breeding that could take murrelets.

11.2.2 Effect of Take

The aforementioned amounts of take to breeding adults and young not recruited into the adult breeding population, are not likely to jeopardize the continued existence of the species by appreciably reducing the number of murrelets or their reproduction in Conservation Zone 3, last estimated to be 8,249 individuals in 2022 (McIver et al. 2023).

11.2.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPMs) are measures necessary or appropriate to minimize the impacts, i.e., amount or extent of incidental take (50 CFR 402.02).

The Service has not identified any reasonable and prudent measures necessary or appropriate to minimize the impact of incidental take. The conservation measures included as part of the proposed action, including the project design criteria (PDC) negotiated in cooperation with the Service constitute all of the measures necessary to minimize incidental take, as well as to report on the progress of the action and its impact on the species pursuant to 50 CFR 402.14(i)(3). On that basis, no RPMs or additional monitoring and reporting requirements are included in this Incidental Take Statement for the marbled murrelet.

Within the biological Opinion, the marbled murrelet PDC (*General PDC Specific to NSO and MAMU that apply to all projects, PDC Specific to the Heavy Thinning and Early Seral Habitat Creation Projects, and PDC Specific to the Recreational Improvements Project 1-5-8, 11-15, 17-25)*, are found in Section 2.4. *The General Standards PDC 1-9* describe specific reporting, monitoring and information requirements—including *General Standards PDC 6*-Annual Reporting (includes annual pre- and post-action reporting and monitoring), and *General Standards PDC 7*-Annual Project Compliance. All PDC serve to minimize or avoid adverse effects to murrelets and to describe all necessary reporting and monitoring of activities that could result in take of murrelets. For murrelets, annual monitoring and reporting requirements include the entire proposed action.

If, during the course of the action, the aforementioned amount of take is exceeded, such incidental take requires that USFS must immediately contact the Service to reinitiate consultation. The USFS must immediately provide an explanation of the causes of the taking and promptly review with the Service any need for possible modification of reasonable and prudent measures.

The Service is to be notified within three working days upon locating a dead, injured or sick murrelet specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (503) 682-6131, or the Service's Oregon Fish and Wildlife Office at (503) 231-6179.

12 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 USFS' proactive and early coordination with the Service resulted in numerous conservation measures being incorporated into the project design.

Northern Spotted Owl

The Service has no conservation recommendations to offer.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Marbled Murrelet

The Service additionally recommends consideration and application of animal-proof trash cans at all parking lots and trash to be removed daily to prevent attracting corvids as potential predators.

13 Reinitiation Notice

This concludes formal consultation on the Siuslaw National Forest Hebo Ranger District's Sand Lake Recreation Improvements and Heavy Thinning Treatments project. As provided in 50 CFR 402.16, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) 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 (4) If a new species is listed or critical habitat designated that may be affected by the identified action.

Reinitiation will be needed for ongoing effects of recreation and corvid presence on marbled murrelets disruption every 10 years after the completion of the project. This consultation only accounts for the effects of the first 10 years during the life of this project.

Failure to adequately monitor and report constitutes a change in the proposed action that may facilitate effects to listed species or critical habitat that were not considered in the Opinion. If monitoring and reporting are not done in accordance with the description of the proposed action, including the PDC, the USFS would need to immediately contact the Service to review the cause and any needs to reinitiate formal consultation in accordance with the requirements of 402.16(c).

If you have any questions about this consultation,
please contact Gretchen Newberry at (503) 758-7632 or Gretchen_Newberry@fws.gov or
Mike Blow at (503) 807-6196 or John_Blow@fws.gov.

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Wiens, J.D., Dugger, K.M., Higley, J.M., Lesmeister, D.B., Franklin, A.B., Hamm, K.A., White, G.C., Dilione, K.E., Simon, D.C., Bown, R.R. and Carlson, P.C., 2021. Invader removal triggers competitive release in a threatened avian predator. Proceedings of the National Academy of Sciences, 118(31), p.e2102859118.

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NSO_CTS_CLASS_YYYY: Classified nesting/roosting forest cover type

Appendix A: NSO Habitat Model Output Explanations

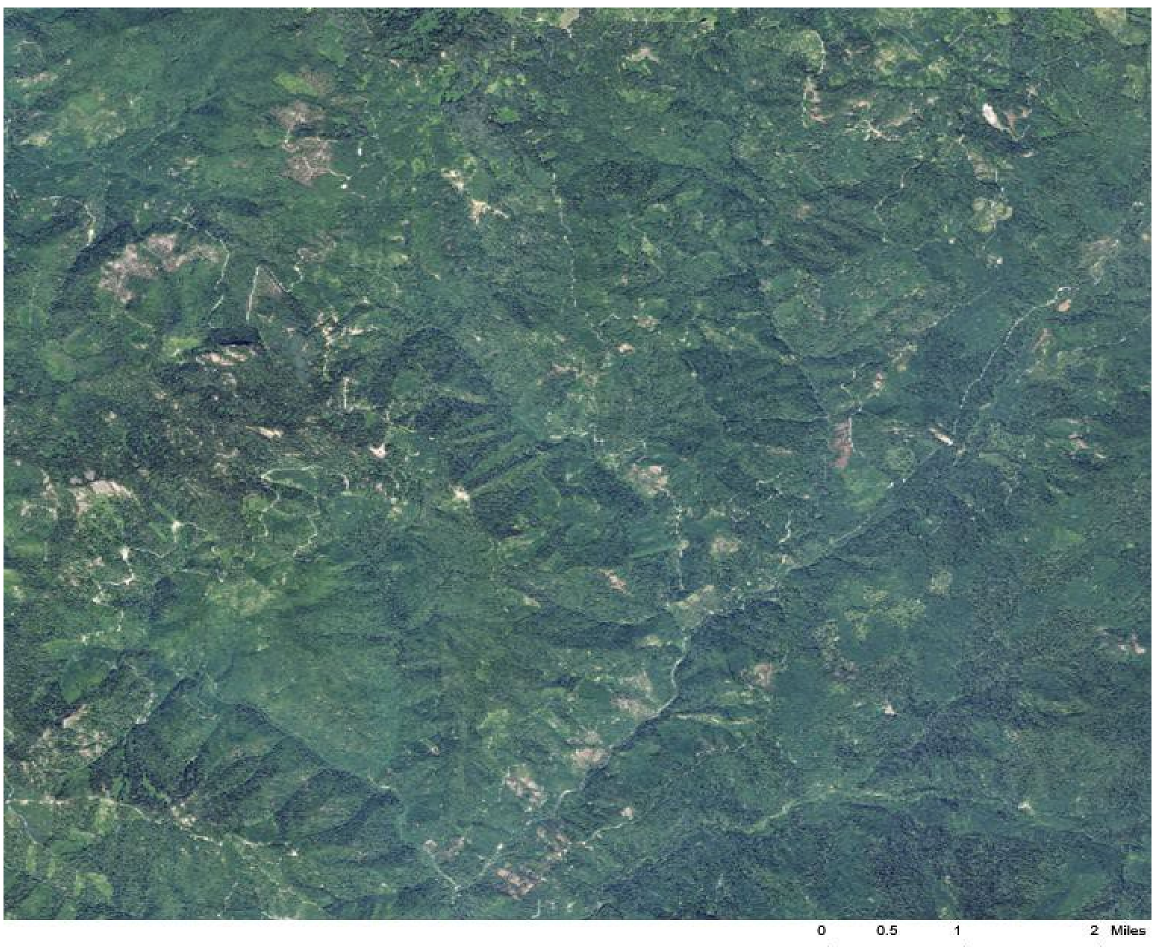
From Appendix F of the BA.

Northwest Forest Plan Interagency Monitoring Program

Northern Spotted Owl Habitat Monitoring Products

This document provides metadata for the Northwest Forest Plan Interagency Monitoring Program's 25yr monitoring products from the northern spotted owl (NSO) monitoring module. In-depth information on the data sources, methods, and accuracy assessments can be found in Davis et al. (in press). Further background information can be found in previous monitoring reports at the following links:

- **NSO 15yr monitoring report (see chapter 3)** - https://www.fs.fed.us/pnw/pubs/pnw_gtr850.pdf
- **NSO 20yr monitoring report** - https://www.fs.fed.us/pnw/pubs/pnw_gtr929.pdf



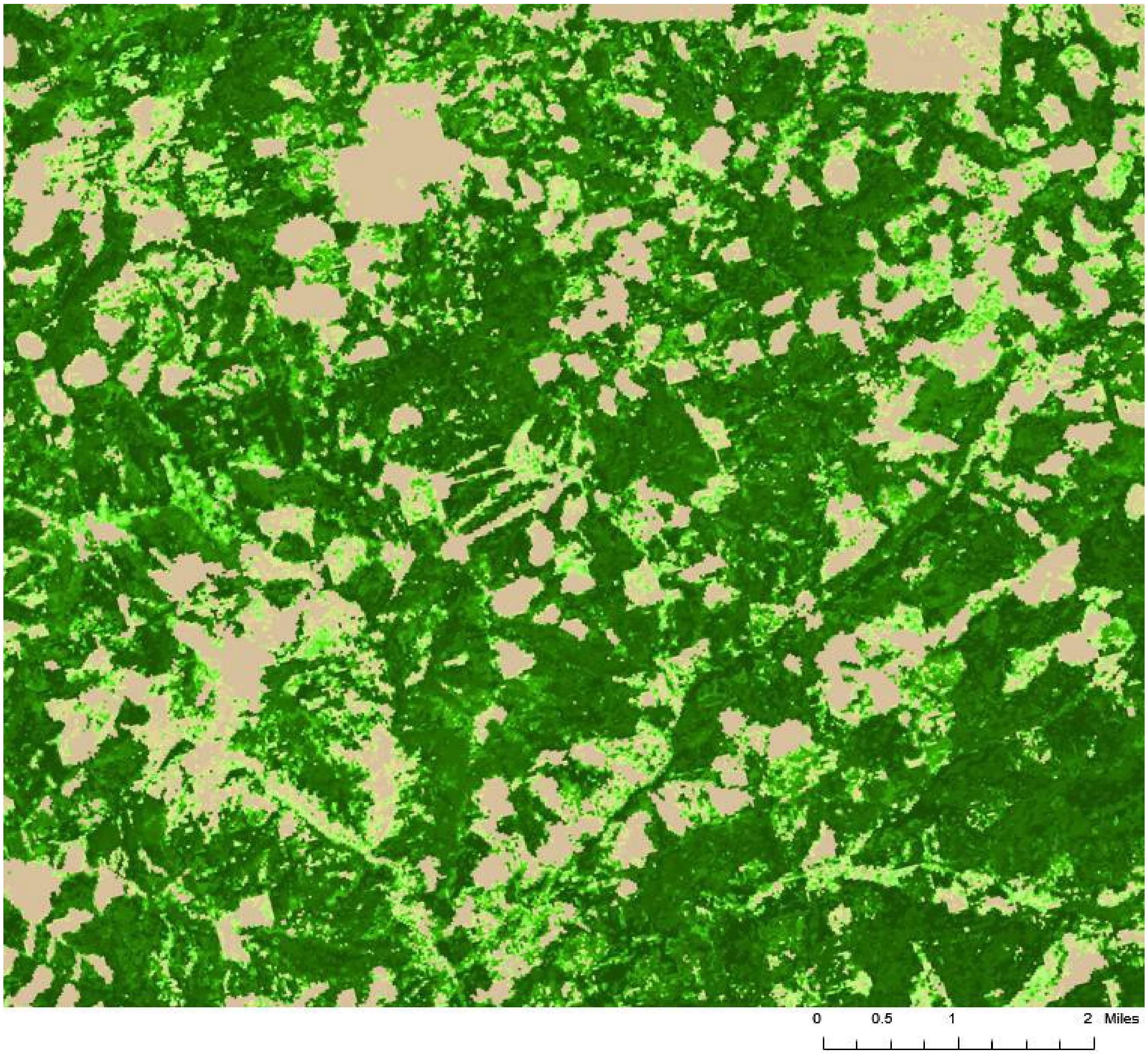
Citation for maps described in this document:

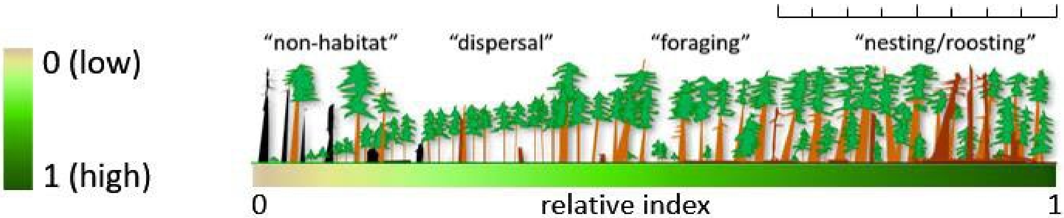
Davis, R.J.; Lesmeister, D.B.; Yang, Z.; Hollen, B.; Tuerler, B.; Hobson, J.; Guetterman, J.; Stratton, A. *In press.* Northwest Forest Plan—the first 25 years (1994–2017): status and trends of northern spotted owl habitats. Gen. Tech. Rep. PNW-GTR-1003. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. xx p.

NSO_CTS_CLASS_YYYY: Classified nesting/roosting forest cover type

A relative index (0-1) of suitability (or similarity) of forest structure and composition for NSO nesting/roosting. Produced using machine learning software Maxent and trained/tested with nesting/roosting pair locations (1993). As illustrated in the diagram below, an index near zero indicates forest structure/composition dissimilar to where NSO pairs nest/roost. An index nearer to one indicates similar conditions. Raster values are as follows:

- -1 = no data (non-forested)
- 0−10000 = relative suitability index from 0 to 1 (with a x10000 scalar applied)



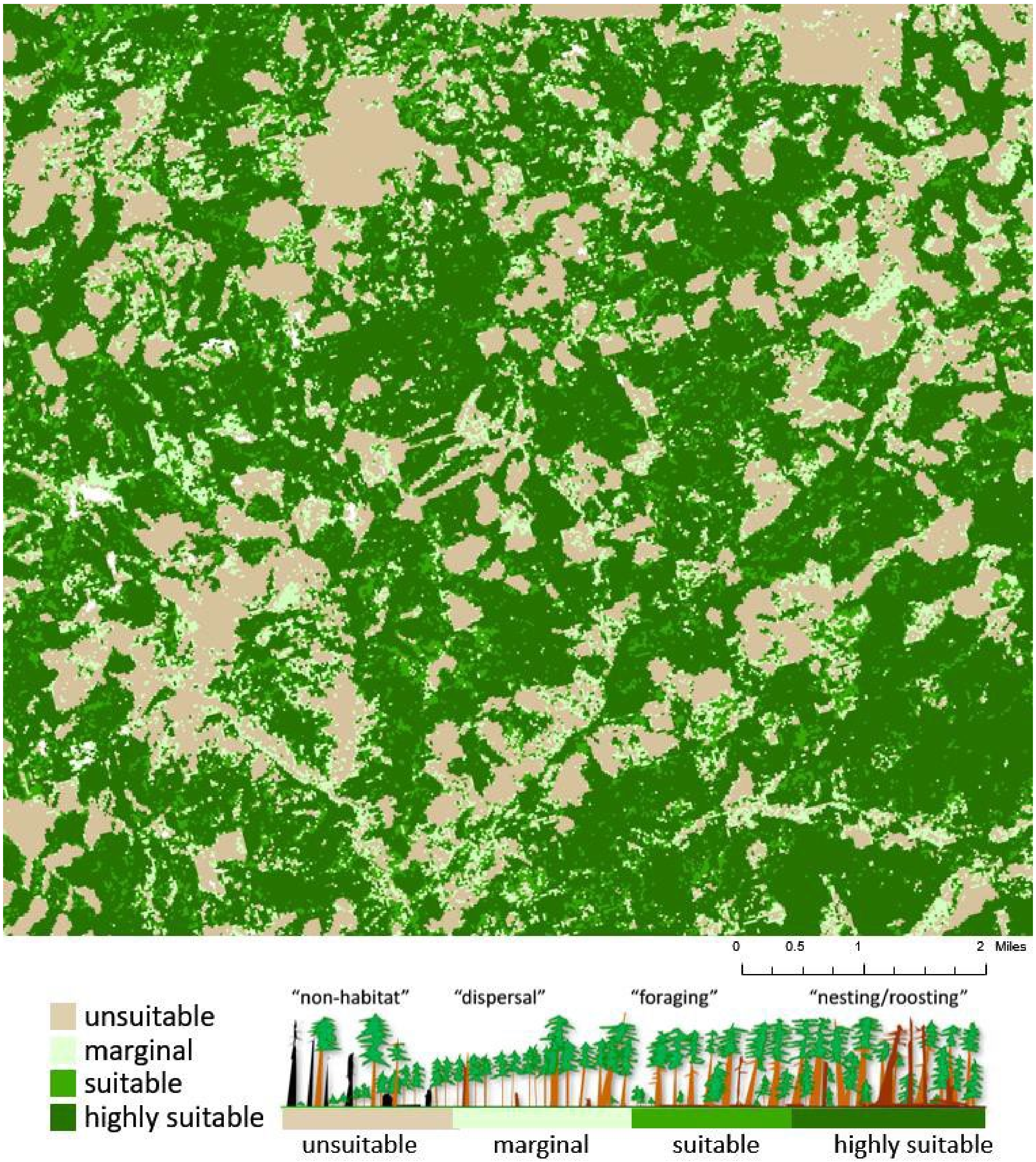


The index of relative suitability is classified into 4 map classes relating to statistical similarity to nesting/roosting forest that can be interpreted in the figure at the bottom of this page. Raster values are as follows:

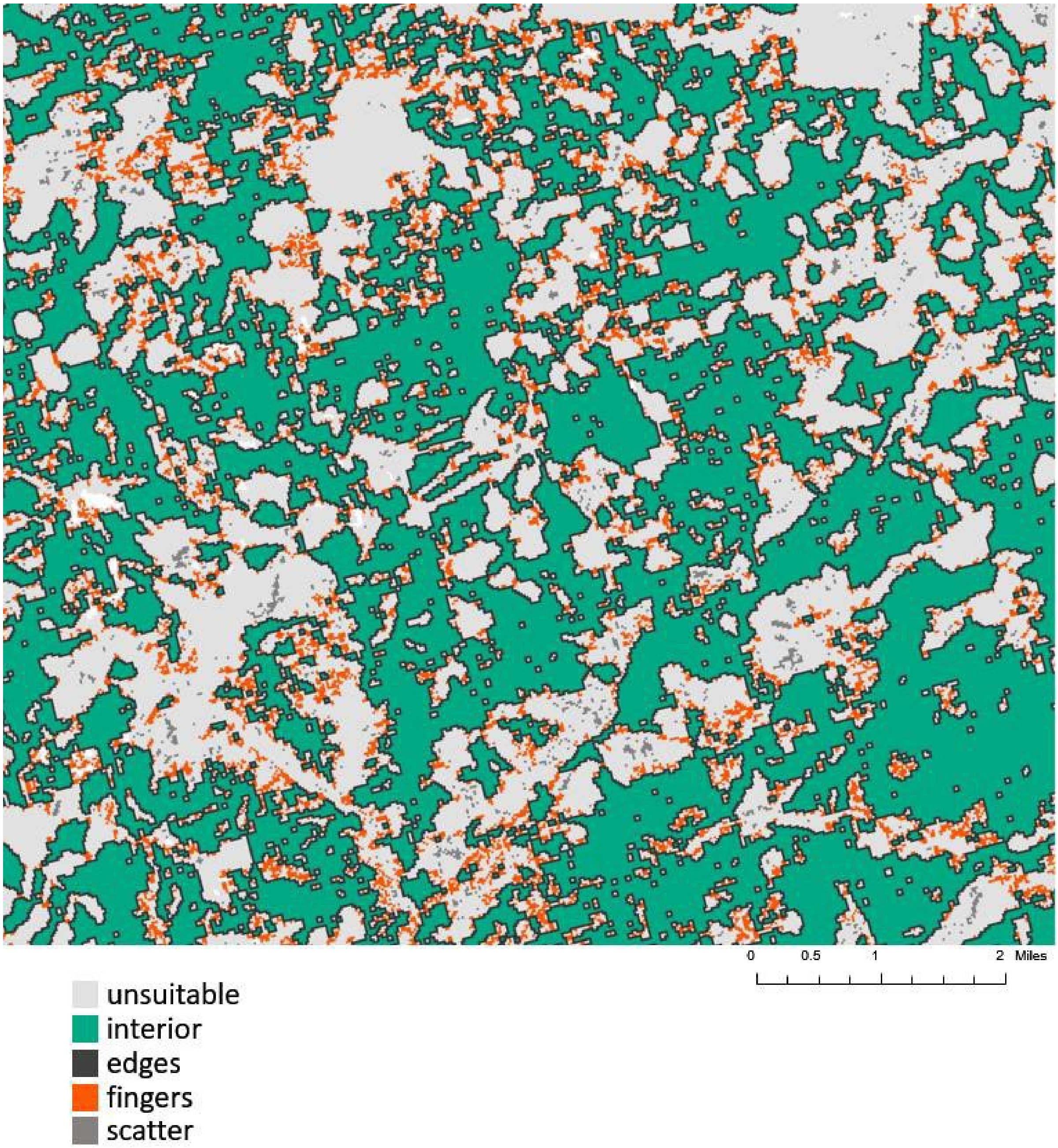
- -1 = no data (non-forested)
- 0 = background (not nesting/roosting forest)
- 1 = unsuitable

NSO_CTS_CLASS_YYYY: Classified nesting/roosting forest cover type

- 2 = marginal
- 3 = suitable
- 4 = highly suitable



NSO_Habitat_YYYY: Suitable NSO habitat map that can potentially harbor NSO pair territory



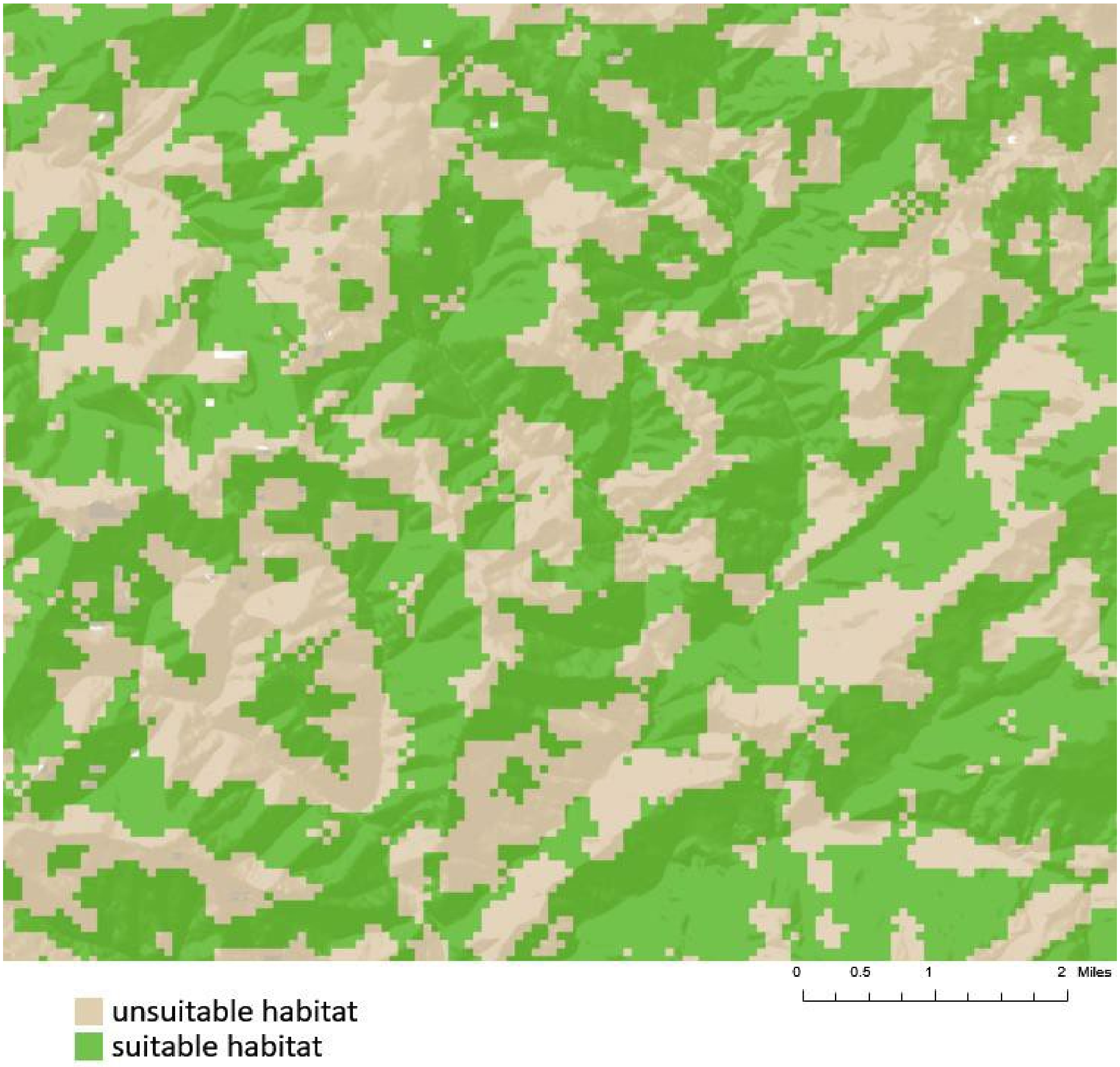
The "suitable" nesting/roosting forest (NRF) classes are mapped according to their morphological spatial patterns (MSPA), to identify interior "NRF" forest, edges of interior patches, fingers connected to those patches, and scattered pixels of "NRF" forest. Interior and edge pixels constitute "patches" that are ≥2 ac in size. Raster values are as follows:

- -1 = no data (non-forested)
- 0 = unsuitable for nesting/roosting forest
- 1 = interior (core of a patch)
- 2 = edge (edges of patches, either outer or interior gaps)
- 3 = finger (always attached to a patch but not large enough to contain interior)
- 4 = scatter (isolated pixels not connected to a patch, sometimes satellite imagery "noise")

NSO_Habitat_YYYY: Suitable NSO habitat map that can potentially harbor NSO pair territory

Produced using machine learning software Maxent and trained/tested with nesting/roosting NSO pair locations (1993). Habitat maps are based on multi-spatial scale (patch to territory) arrangement and amounts of nesting/roosting forest cover types, topography, and climate following methods described in Glenn et al. (2017). The purpose of this map is to produce estimations of NSO pair territory density (# pairs per unit area) based on nearest neighbor distances and local NSO occupancy rates. This map informs estimates of population size and distribution. Raster values are as follows:

- 0 = unsuitable habitat
- 1 = suitable habitat

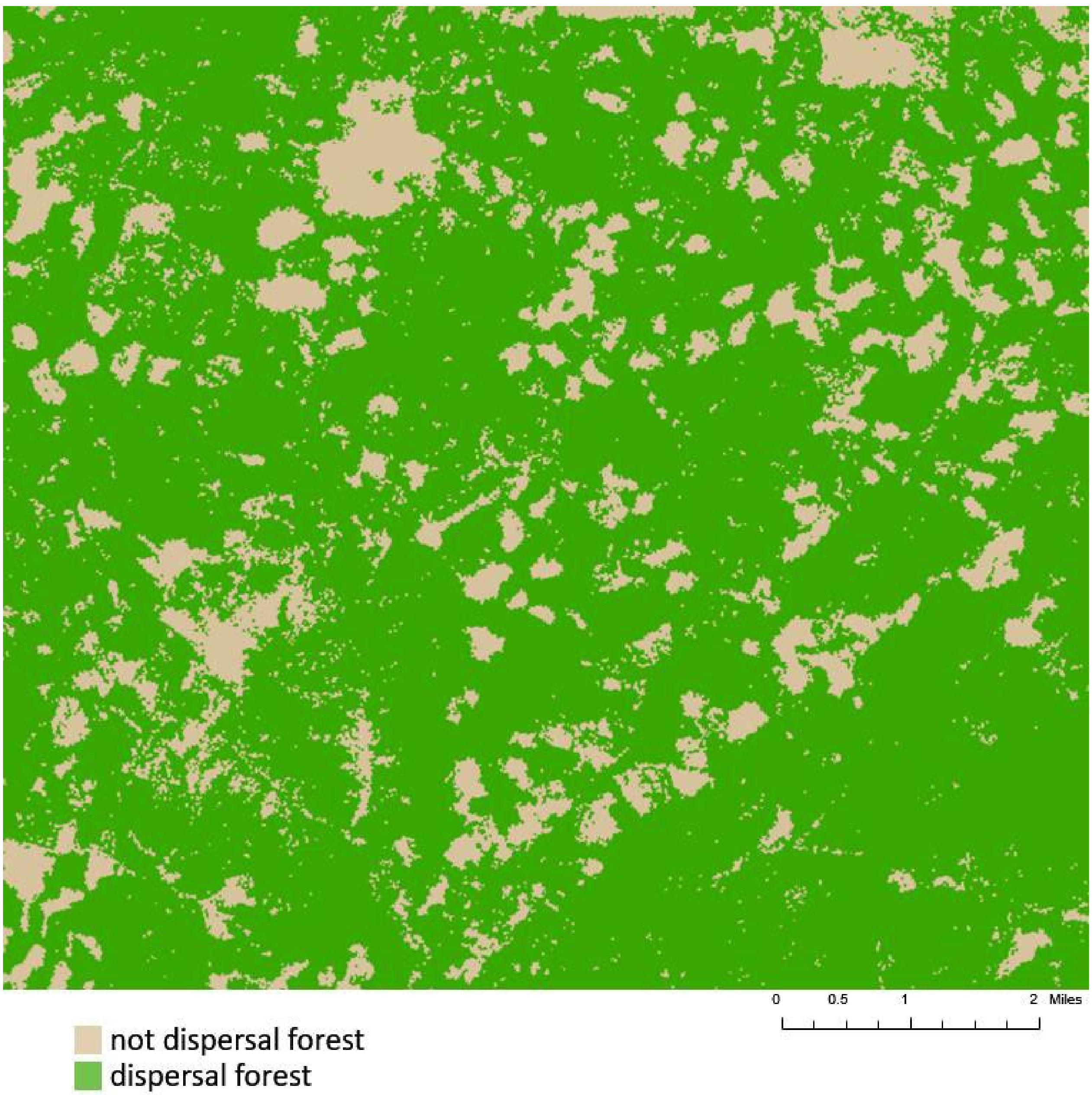


Citation:

Glenn, E.M.; Lesmeister, D.B.; Davis, R.J.; Hollen, B.; Poopatanapong, A. 2017. Estimating density of a territorial species in a dynamic landscape. Landscape Ecology. 32: 563–579.

Includes suitable NRF but also forest cover with mean dbh. ≥11 inches and canopy cover ≥40 percent (Thomas et al. 1990). Raster values are as follows:

- -1 = no data (non-forested)
- 0 = not dispersal forest
- 1 = dispersal forest

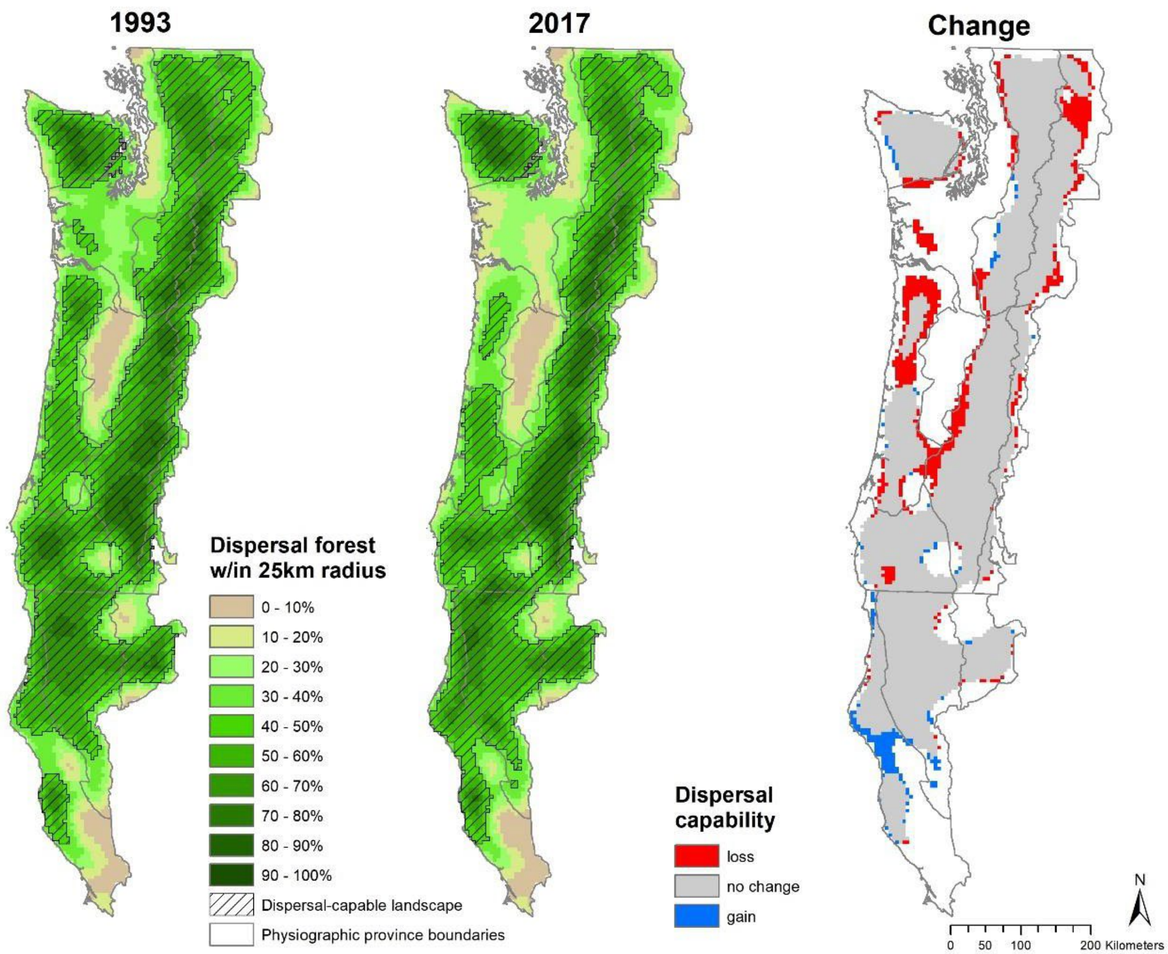


Citation:

Thomas, J.W.; Forsman, E.D.; Lint, J.B.; Meslow, E.C.; Noon, B.R.; Verner, J. 1990. A conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, National Park Service. 427 p.

The percentage of a 25-km (15.5-mi) radius roving circular window that contained dispersal forest. Ninety percent of natal NSO movements (Forsman et al. 2002) occurred within 15.5-mi of the natal site, when the surrounding landscape was covered with ≥40 percent dispersal forest (Davis et al. 2011). Pixels with ≥40 percent dispersal forest within this window are considered "dispersal-capable landscape". Raster values are as follows:

- -1 = no data (non-forested)
- 0−1.0 = proportion (multiply by 100 to get percent) of landscape (25km or 15.5mi radius) covered by dispersal forest.



Citations:

Davis, R.J.; Dugger, K.M.; Mohoric, S.; Evers, L.; Aney,W.C. 2011. Northwest Forest Plan—the first 15 years (1994–2008): status and trends of northern spotted owl populations and habitats. Gen. Tech. Rep. PNW-GTR-850. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 147 p.

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Appendix B: Level 2 Policy for the Management of Marbled Murrelet Nesting Structure with Younger Stands

From Appendix A of the BA.

Revised Policy for the Management of
Marbled Murrelet Nesting Structure within Younger Stands

Issued by the Level 2 Team for the North Coast Planning Province, Oregon
October 13, 2011

This policy revises the policy of March 26, 2004, for the management of *marbled murrelet nesting structure within younger stands*, herein referred to as *nesting structure.* This revised policy applies to thinning prescriptions in all land use allocations in the North Coast Province. It supplants the "guidance on the management of potential habitat in younger coniferous forests for marbled murrelets," issued on June 25, 1999, by the Level 2 Team for the North Coast Province.

This policy allows thinning operations without protocol surveys when effects to murrelets are discountable, insignificant or entirely beneficial (Options 2 or 3).

This policy does not modify definitions of "suitable habitat," "potential habitat" or "recruitment habitat" by the Pacific Seabird Group (PSG), Northwest Forest Plan or the Interagency Memo (2670 FS/ 6840 BLM (OR931) P; Subject: Marbled Murrelet Inland Survey Protocol Update). If a younger stand does not contain nesting structure, there still may be adjacent nest trees or suitable habitat that requires design criteria through this policy or "normal" consultation design criteria to avoid adverse effects to murrelets.

I. Characteristics of Nesting Structure

A tree with nesting structure has the following characteristics:

It occurs within 50 miles (81 km) of the coast (U.S. Fish & Wildlife Service 1997:32)
It is a conifer tree (U.S. Fish & Wildlife Service 1997:18);
It is ≥ 19.1 in. (49 cm) (dbh) in diameter, > 107 ft. (33 m) in height, has at least one **platform** ≥ 4 in. (10-cm) in diameter, nesting substrate (e.g., moss, epiphytes, duff) on that platform, and an access route through the canopy that a murrelet could use to approach and land on the platform (Burger 2002, Nelson & Wilson 2002:24, 27, 42, 97, 100);
It has a nest platform ≥ 32.5 ft. (9.9 m) above the ground (Nelson & Wilson 2002, 28);
And it has a tree branch or foliage, either on the tree with nesting structure or on an adjacent tree, that provides protective cover over the platform (Nelson & Wilson 2002:98 & 99);

Any tree that does not meet all of these characteristics is unlikely to support nesting murrelets. However, we recognize that not all of these characteristics are visible from the ground in all situations. Therefore, the unit wildlife biologist shall make site-specific determinations on the presence of nesting structure.

II. Options for the Management and Protection of Nesting Structure

The administrative units shall follow the steps in Figure 1 to determine which of the following three options is available for any given proposed action, and when additional seasonal or time-of-day restrictions must be applied to avoid adverse effects to the murrelet. Compliance with these steps and restrictions is necessary to ensure that actions implemented without current protocol surveys under Option 2 or Option 3 would have discountable, insignificant or entirely beneficial effects on the murrelet.

Option 1 (normal procedure): Follow current practices as provided by the provisions of USDA & USDI 1994:C-10(3) (Occupied Marbled Murrelet Sites).

Prior to implementing a project in suitable or potential murrelet habitat as defined by protocol, the Standards and Guidelines (USDA & USDI 1994:C-10[3]) require survey to protocol and, if nesting occupancy is determined, the identification of an unmapped LSR and the protection of habitat. This is the only option available to an administrative unit if a proposed action may affect and is likely to adversely affect the murrelet.

Option 2: Exclude nesting structure from the project area and apply protection measures to ensure that the effects of the proposed action on the murrelet would be discountable, insignificant or entirely beneficial.

To comply with Option 2, the administrative unit must do all of the following:

1. Prohibit the removal or damage of nesting structure. This includes the removal or damage of trees with nesting structure and the removal or damage of adjacent trees with branches that interlock the branches of any tree with nesting structure.
2. Prohibit timber harvest and associated ground disturbances during the murrelet nesting period (April 1 – September 15) unless otherwise authorized by a biological Opinion.
3. Maintain a 150-foot un-thinned buffer around all trees with nesting structure. That is, within 150 feet of any tree(s) exhibiting nesting structure, no trees shall be removed for any reason associated with the timber harvest, including the placement of roads, landings or yarding corridors.
4. Maintain an average canopy closure of at least 60 percent post-treatment (averaged over each 40-acre area) in the zone between 150 feet and 300 feet of all trees exhibiting nesting structure.
5. Consider additional, site-specific prescriptive measures to maintain or enhance habitat conditions, as deemed necessary, in the zone between 150- and 300-feet from all trees exhibiting nesting structure.

6. Maintain an average canopy closure of at least 40 percent post-treatment (averaged over each 40-acre area) within the proposed thinning unit beyond 300 feet from all trees exhibiting nesting structure.

Option 3: Protect nesting structure within the project area and apply protection measures to ensure that the effects of the proposed action on the murrelet would be discountable, insignificant or entirely beneficial . Option 3 may be used only when timing restrictions are implemented, if within 20 miles of the coast, and where nesting structure occurs at low densities (see flow chart at end for definition of low density and specific timing restrictions).

To comply with Option 3, the administrative unit must do the following:

1. Design the project in accordance with LSR management standards (USDA & USDI 1994:C-9 – C-20) or REO Working Group direction.

2. Prohibit the removal or damage of nesting structure as identified in Section I.

3. Design habitat modifications that occur within a distance equal to one site-potential tree height of nesting structure to protect and improve future habitat conditions. Examples include protecting the roots of trees with nesting structure, and removing suppressed trees, trees that might damage nesting structure during windstorms, and trees that compete with key adjacent trees that are, or will be, providing cover to potential nest platforms. The administrative units must consider management actions that aid limb development and maintenance, and the development of adjacent cover.

4. In accordance with U.S. Fish and Wildlife Service 1997:21, prohibit the creation of any opening *(i.e.*, a gap ≥ 0.25 acre [0.10 ha] in size) within a distance equal to one site-potential tree height of nesting structure.

5. Verify that proposed habitat modifications comply with the intent of this policy through normal streamline consultation procedures. The administrative units are encouraged to involve the U.S. Fish and Wildlife Service during prescription development. The Level 1 Team will verify that the proposed habitat modification complies with the intent of this policy. Any issues concerning this policy are to be elevated by the Level 1 Team to Level 2 for clarification.

Additional guidance on LSR prescription thinning is contained in USDA & USDI 1997:42-46 and 1998:86-90, and REO direction.

Citations for Appendix B

Anderson, Gayle M. 2003. Personal communication of 10 years field survey data of marbled murrelet remnant habitat on Boise Cascade forestland in western Oregon.

Burger, Alan E. 1997. Behavior and numbers of marbled murrelets measured with radar. *Journal of Field Ornithology* 68(2):208-223.

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Humes, Marcia. 2003. Personal communication of 10 years of field survey and nest location data Of marbled murrelets on state forestlands in western Oregon.

Nelson, S. Kim, and Amanda K. Wilson. 2002. Marbled murrelet habitat characteristics on state lands in western Oregon. Corvallis, OR: Oregon Cooperative Fish and Wildlife Research Unit, OSU, Department of Fisheries and Wildlife. 151 pages.

Pacific Seabird Group. 2002. Using tree climbing for marbled murrelet habitat management. Guidance Memorandum dated May 22. 2 pp.

Raphael, Martin G., Diane Evans-Mack, and Brian A. Cooper. 2002. Landscape-scale relationships between abundance of marbled murrelets and distribution of nesting habitat. *Condor* 104(2):331-342

U.S. Bureau of Land Management. 2003. Remnant habitat survey data from the Tillamook, Salem, Eugene, Coos Bay and Roseburg Districts.

U.S. Department of Agriculture & U.S. Department of the Interior. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service, USDI Bureau of Land Management. Portland, Oregon.

________________. 1997. Late-Successional Reserve Assessment, Oregon Coast Province, Southern Portion. 160 pages.

________________. 1998. Late-Successional Reserve Assessment for Northern Oregon Coast Range Adaptive Management Area. 117 pages.

U.S. Fish and Wildlife Service. 1997. Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. U.S. Fish and Wildlife Service, Portland, Oregon. 203pp.

________________. 1998. West Fork Smith River Riparian and Instream Restoration Project (1- 7-98-F-330).

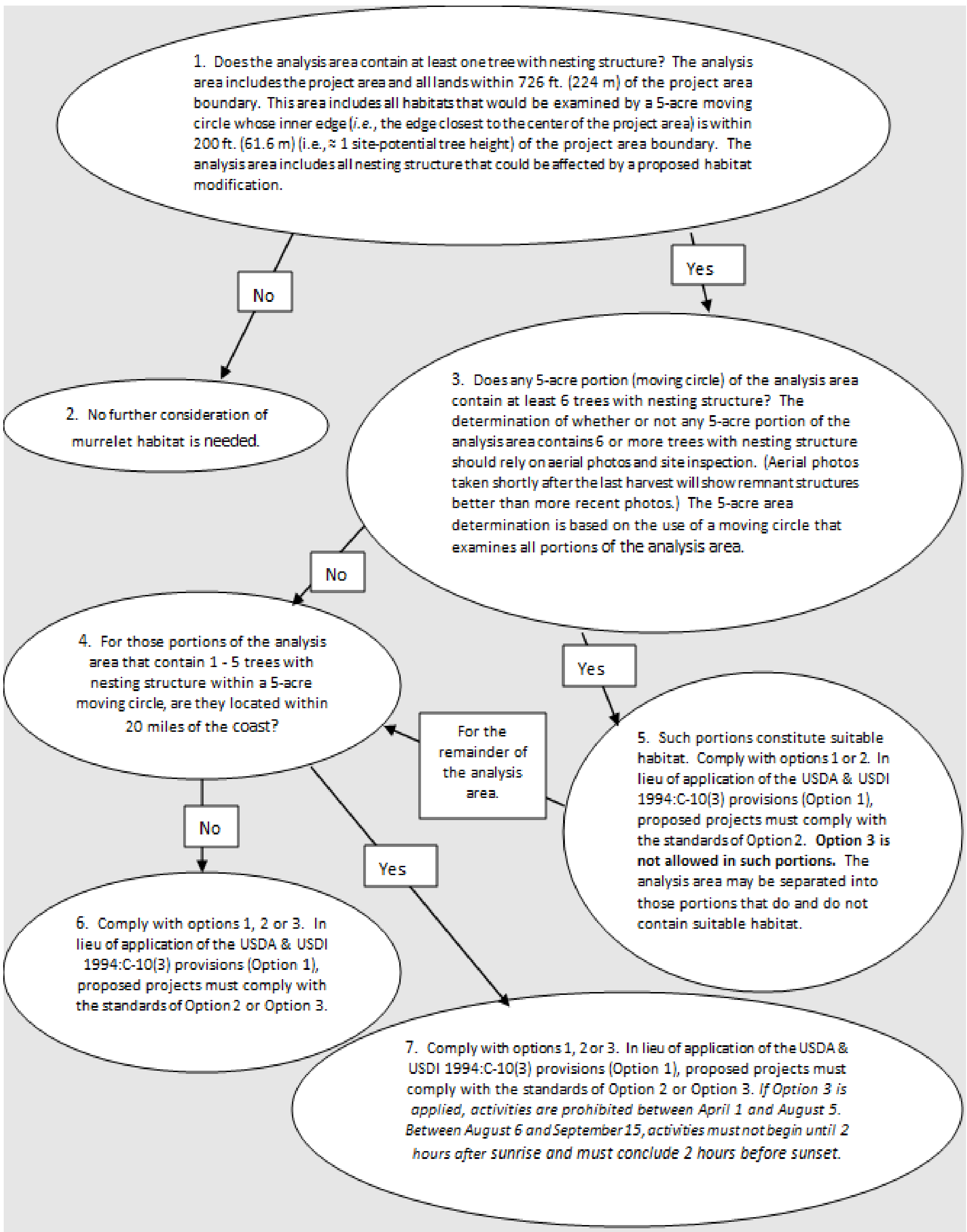
________________. 2001. Formal and informal consultation on the Upper Nestucca Restoration and Enhancement Projects (1-7-01-F-315).

________________. 2002. Formal and informal consultation on FY 2003-2004 projects within the North Coast Province which may modify the habitat of bald eagles, northern spotted owls, and marbled murrelets (1-7-02-F-958).

Webb, Lee, Jim Alegria, Lee Folliard, Joseph Lint, Sarah Madsen & Tim Max. 2002. Southwest Oregon Inland Survey Assessment for Marbled Murrelets (unpublished). Rogue River and Siskiyou National Forest, 333 W. 8th St., Medford OR 97501.

Willamette Industries, Inc. 2003. Five years of marbled murrelet survey data in western Oregon. Wilson, Mike. 2002. Marbled murrelet surveying on state lands: biogeographic and stand-level characteristics required for protocol surveys on state-managed forests. General file number 3-2-1-330.1; mamusurveyrevisions1102.doc

Figure 1. Steps to determine which options for the management and protection of nesting structure are permitted for any given proposed thinning project. Management options are explained in Section II. Step 7 contains additional requirements for the application of Option 3.



Appendix C: Status of the Species For Marbled Murrelet and its Critical Habitat

Produced by

U.S. Fish and Wildlife Service,

December 18, 2023

Status of the Species

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 (USDI FWS 1992). Since the species' listing, the U.S. Fish and Wildlife Service (Service) has completed two 5-yr status reviews of the species: September 1, 2004 (USDI FWS 2004) and June 12, 2009 (USDI FWS 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 (USDI FWS and NOAA 1996, USDI FWS 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 (USDI FWS 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. The most recent five-year status review was completed in May 2019. This review did not propose changes to the listing status but noted that a change in listing status could be warranted if continued trends of manmade and natural threats continue at current or increased levels (USDI FWS 2019). 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 semi-precocial, 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 offshore 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; USDI FWS 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 (*Sebastas 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 (Fountain et al. 2023, pp. 148-149). 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 1995). 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 (USDI FWS 1997, p. 32);
2. It is a conifer tree (USDI FWS 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 ≥ 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 (how about right after noon., 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) suggest 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 (USDI FWS 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 (USDI FWS 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 and the correlation of occupancy 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. (2016a, p. 115, in Falxa and Raphael 2016) 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. Recently, Betts and others (2020, pp. 5-7) found occupancy was correlated with amounts of mature forest, ocean conditions, and distance to the coast. Elevation had a negative association in some studies with murrelet habitat occupancy (Burger 2002). Hamer and Nelson (1995) 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 do 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

Current population and distribution of the listed species

Since 2014, the at-sea-surveys moved to an annual every-other zone survey effort, with Conservation Zones 1 and 3 surveyed in even years and zones 2, 4, and 5 surveyed in odd years (Figure MAMU 1). Due to the staggered surveys, the At-sea Monitoring-2022 Summary Report (McIver et al. 2023, entire) reported the range-wide population estimate to be 18,000 in 2021 (Table MAMU 1). The 2022 surveys estimated approximately 3,800 murrelets in Conservation Zone 1 and 8,200 murrelets in Conservation Zone 3 (McIver et al. 2023, p. 4). Conservation Zone 1 continues to show a declining population (-4.6 annual rate of change) while Conservation Zone 3 continues to show a stable to increasing population (1.6 annual rate of change) (Table MAMU 2). Recovery zones are the functional equivalent of recovery units as defined by Service policy (USDI FWS 1997, p. 115). The 2022 surveys of Conservation Zones 2, 4 and 5 indicate the population in Conservation Zone 2 continues to decline, with a -3.3 annual rate of change, while Conservation Zone 4 remains the strongest zone with a 2.8 annual rate of change, with 95 percent confidence intervals that do not overlap zero (McIver et al. 2022, Table 5, p. 20).

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 MAMU 2). This lack of a demonstrated NWFP-wide decline may be due to sample size or statistical power of the sampling design (see Table MAMU 1 for confidence intervals). Conservation Zones 3 and 4 support 47 percent of the murrelet population within the U.S. (Table MAMU 3), and consistently have the highest – at-sea densities during the nesting season and have recently continued to have positive annual rates of change. 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 2018, marbled murrelet population for Conservation Zone 6 is estimated at about 397 birds (95 percent confidence limit [CL]: 277-568; Felis et al. 2023, p. 5 Table 2, see Table MAMU 4).

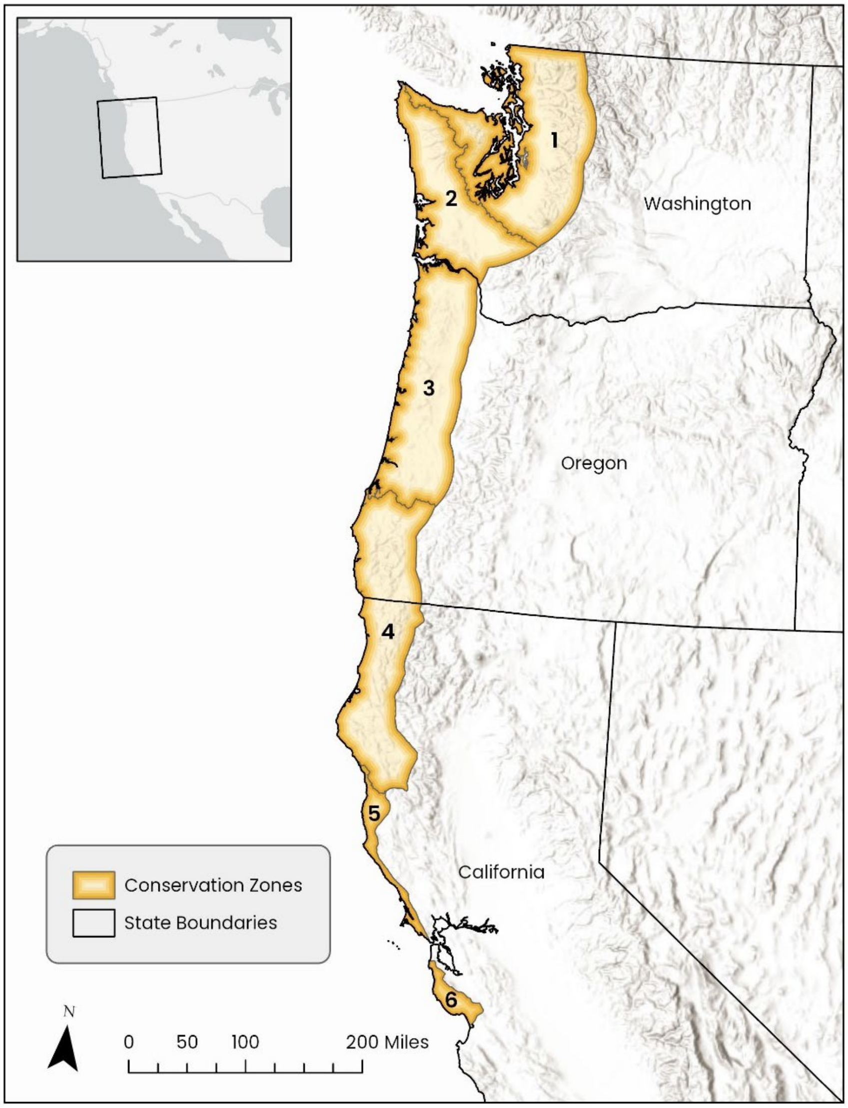


Figure MAMU 1. The six geographic areas identified as Conservation Zones in the recovery plan for the murrelet (USDI FWS 1997, p. 114). Critical habitat beyond these mapped areas is considered part of the conservation zone (USDI FWS 1997, p. 127).

Table C- 1. **Summary of 2001-2021 marbled murrelet density and abundance estimates (rounded to nearest 100 birds) for Conservation Zones 1-5 combined. Numbers in some years may differ slightly from those in previous summary reports (as indicated by an asterisk [*], as a result of additional data quality reviews performed in 2019. Note that the most recent rangewide estimate is always one year behind the current sampling year because it takes two years to derive estimates when sampling units every other year. (McIver et al. 2023, p. 10, Table 2).**

Year	Density (birds/km²)	Bootstrap Standard Error (birds/km²)	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	2.09	0.17	8.2	18,300	15,400	21,300
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	17,200	13,600	20,800
2010	1.89	0.21	11.1	16,600	13,000	20,200
2011	2.50	0.31	12.6	22,000	16,600	27,400
2012	2.40	0.27	11.3	21,100	16,400	25,800
2013	2.24	0.25	11.1	19,700	15,400	23,900
2014*	2.43	0.22	9.1	21,300	17,500	25,100
2015	2.75	0.26	9.5	24,100	19,700	28,600
2016	2.58	0.26	10.0	22,600	18,200	27,100
2017	2.62	0.26	10.1	23,000	18,500	27,600
2018	2.56	0.29	11.4	22,500	17,500	27,600
2019	2.42	0.28	11.5	21,200	16,400	26,000
2020	2.24	0.24	10.9	19,700	15,500	23,900
2021	2.05	0.23	11.3	18,000	14,000	21,900

*Numbers in some years may differ slightly from those in previous summary reports (as indicated by an asterisk (*), as a result of additional data quality reviews performed in 2019 (see McIver et al. 2019 [2018 Annual Summary Report]).

Table C- 2. Estimates of average annual rate of marbled murrelet population change based on at-sea population surveys. Confidence limits are for the estimates of percent annual change. The P-value is based on a 2-tailed test for whether the annual rate of change is less than zero, significant values are shaded in gray. Please note that the period of analysis varies by sampling unit, depending on which year sampling units were last surveyed. (McIver et al. 2023, p. 20 Table 5).

Year	State	Density (murrelets per km^2)	Murrelets		Murrelets 95% CL Lower	Murrelets 95% CL Upper
			Year	State		
Zone 1[1]	2001-2022	-4.6	-6.4	-2.7	0.585	<0.001
Zone 2[2]	2001-2021	-3.3	-6.1	0.4	0.226	0.027
Zone 3[1]	2000-2022	1.6	0.3	2.9	0.228	0.022
Zone 4[2]	2000-2021	2.8	0.9	4.6	0.361	0.005
Zone 5	2000-2021	1.5	−7.7	11.7	0.000	0.726
WA	2001-2020	-4.2	-5.5	-3.0	0.709	<0.001
OR	2000-2020	1.8	0.8	2.9	0.371	0.002
CA	2000-2021	3.8	2.2	5.6	0.515	<0.001
All Zones	2001-2020	0.1	−0.8	0.9	0.000	0.832

Table C- 3. Summary of 2000 to 2019 marbled murrelet density and population size estimates within the NWFP area at the State scale (Periods of analysis: 2001-2021 for Washington, 2000-2020 for Oregon and 2000-2020 for California 2000-2021 (From McIver et al. 2023, pp. 18 - 19, Table 4).

Year	State	Density (murrelets per km^2)	Murrelets	Murrelets 95% CL Lower	Murrelets 95% CL Upper	Area (km2)
2001	WA	2.01	10,453	7,057	13,849	5,188
2002	WA	2.29	11,789	7,507	16,071	5,151
2003	WA	2.42	12,467	8,906	16,028	5,149
2004	WA	1.65	8,474	5,625	11,322	5,149
2005	WA	2.05	10,533	7,179	13,887	5,148
2006	WA	1.61	8,280	6,024	10,536	5,148
2007	WA	1.85	9,520	5,946	13,095	5,148
2008	WA	1.29	6,628	4,808	8,448	5,148
2009	WA	1.34	6,886	4,486	9,285	5,148
2010	WA	1.10	5,679	3,840	7,518	5,148
2011	WA	1.63	8,376	5,802	10,950	5,148
2012	WA	1.87	9,629	6,116	13,142	5,148

Year	State	Density (murrelets per km^2)	Murrelets	Murrelets 95% CL Lower	Murrelets 95% CL Upper	Area (km2)
2013	WA	1.10	5,665	3,217	8,114	5,148
2014	WA	0.97	4,998	3,311	6,686	5,148
2015	WA	1.46	7,494	4,711	10,276	5,148
2016	WA	1.38	7,095	4,060	10,130	5,148
2017	WA	1.16	5,987	3,209	8,765	5,148
2018	WA	1.08	5,551	2,795	8,307	5,148
2019	WA	1.00	5,151	2,958	7,344	5,148
2020	WA	0.87	4,481	2,997	5,965	5,148
2021	WA	0.87	4,488	3,240	5,736	5,148
2000	OR	3.85	7,983	4,992	10,974	2,071
2001	OR	4.43	9,168	6,537	11,800	2,071
2002	OR	3.64	7,530	4,727	10,332	2,071
2003	OR	3.56	7,380	5,370	9,390	2,075
2004	OR	4.40	9,112	6,833	11,391	2,071
2005	OR	3.36	6,966	4,812	9,121	2,071
2006	OR	3.68	7,617	5,916	9,318	2,071
2007	OR	2.59	5,357	3,332	7,381	2,071
2008	OR	3.64	7,541	5,682	9,400	2,071
2009	OR	3.58	7,423	5,208	9,638	2,071
2010	OR	3.95	8,182	5,743	10,622	2,071
2011	OR	4.05	8,379	5,943	10,816	2,071
2012	OR	3.76	7,780	5,605	9,956	2,071
2013	OR	4.74	9,819	7,195	12,443	2,071
2014	OR	5.50	11,384	8,839	13,930	2,071
2015	OR	5.30	10,975	8,188	13,762	2,071
2016	OR	4.86	10,060	7,541	12,579	2,071
2017	OR	5.29	10,959	8,044	13,874	2,071
2018	OR	5.34	11,063	7,610	14,515	2,071
2019	OR	4.99	10,339	7,070	13,607	2,017
2020	OR	4.69	10,742	7,565	13,919	2,071
2021	OR	4.64	9,607	6,511	12,704	2,071
2000	CA	2.28	3,571	1,884	5,258	1,566
2001	CA	1.31	2,051	608	3,495	1,566
2002	CA	2.04	3,202	2,181	4,224	1,566
2003	CA	1.9	2,985	1,753	4,217	1,567
2004	CA	2.55	3,986	2,197	5,775	1,566
2005	CA	1.73	2,710	1,896	3,523	1,566
2006	CA	1.56	2,438	1,727	3,149	1,566
2007	CA	1.56	2,440	1,465	3,415	1,566
2008	CA	2.53	3,964	2,802	5,126	1,566
2009	CA	1.87	2,928	1,589	4,268	1,566
2010	CA	1.69	2,644	1,098	4,191	1,566
2011	CA	3.33	5,217	1,962	8,472	1,566

Year	State	Density (murrelets per km^2)	Murrelets	Murrelets 95% CL Lower	Murrelets 95% CL Upper	Area (km2)
2012	CA	2.24	3,514	1,812	5,216	1,566
2013	CA	2.67	4,178	2,662	5,694	1,566
2014	CA	3.14	4,922	3,410	6,433	1,566
2015	CA	3.62	5,666	3,970	7,361	1,566
2016	CA	3.49	5,469	3,963	6,974	1,566
2017	CA	3.88	6,073	4,415	7,730	1,566
2018	CA	3.77	5,907	4,164	7,650	1,566
2019	CA	3.67	5,741	3,894	7,588	1,566
2020	CA	3.33	5,217	3,669	6,765	1,566
2021	CA	2.47	3,870	2,727	5,014	1,566

Table C- 4. Annual after-hatch-year (AHY) and hatch-year (HY) marbled murrelet abundance estimates and HY:AHY ratios, including log-normal 95% confidence intervals (CI), standard errors (SE), coefficients of variation (CV), and sample sizes (k; number of surveys), for all surveys conducted June 1–August 24 (AHY abundance) and July 10–August 24 (HY abundance and HY:AHY ratio [R])., U.S. Fish and Wildlife Service Conservation Zone 6, central California, 1999–2022. (Felis et al. 2023, p. 5 Table 2).

	AHY Abundance (June 1 – August 24)				Reproductive output (July 10 – August 24)						
						HY Abundance			HY:AHY Ratio		
Year	k	N (95%CI)	SE	CV	k	N (95%CI)	SE	CV	R (95%CI)	SE	CV
1999	5	391 (290–527)	55.1	0.14	4	18 (4–97)	11.2	0.60	0.057 (0.024–0.137)	0.027	0.47
2000	8	340 (227–509)	62.7	0.18	4	7 (1–38)	4.3	0.61	0.024 (0.010–0.061)	0.012	0.50
2001	15	540 (442–660)	53.5	0.10	8	23 (12–43)	6.9	0.30	0.070 (0.039–0.126)	0.021	0.31
2002	15	569 (466–696)	56.3	0.10	11	20 (12–34)	5.1	0.25	0.051 (0.036–0.073)	0.009	0.18
2003	12	585 (480–714)	57.5	0.10	8	19 (11–35)	5.6	0.29	0.049 (0.032–0.075)	0.011	0.22
2007	4	330 (191–572)	82.0	0.25	3	8 (0–247)	7.9	0.97	0.049 (0.009–0.268)	0.052	1.06
2008	4	163 (88–305)	48.0	0.29	4	0	NA	NA	0	NA	NA
2009	8	444 (334–591)	59.6	0.13	4	9 (1–54)	5.7	0.64	0.028 (0.009–0.087)	0.018	0.62
2010	7	256 (173–377)	44.8	0.18	3	16 (2–116)	8.5	0.53	0.081 (0.034–0.197)	0.039	0.47
2011	6	303 (240–384)	36.2	0.12	3	19 (4–83)	7.9	0.41	0.080 (0.052–0.124)	0.018	0.22
2012	6	381 (291–498)	49.5	0.13	3	5 (0–136)	4.6	0.94	0.029 (0.007–0.111)	0.022	0.78
2013	6	388 (236–640)	84.3	0.22	3	31 (6–175)	14.7	0.47	0.122 (0.048–0.312)	0.062	0.51
2014	9	330 (226–483)	58.5	0.18	6	24 (7–84)	12.7	0.54	0.081 (0.036–0.182)	0.035	0.43
2015	9	211 (148–302)	35.8	0.17	6	8 (3–17)	2.6	0.34	0.059 (0.030–0.114)	0.020	0.35
2016	7	531 (335–842)	108.5	0.20	5	26 (8–81)	11.7	0.45	0.108 (0.045–0.260)	0.051	0.47
2017	9	462 (342–623)	67.8	0.15	6	6 (1–28)	4.0	0.69	0.022 (0.007–0.074)	0.015	0.68
2018	9	266 (181–391)	48.5	0.18	6	8 (2–35)	5.1	0.65	0.047 (0.014–0.158)	0.032	0.68
2019	8	321 (213–482)	63.9	0.20	6	6 (1–29)	4.1	0.69	0.025 (0.007–0.097)	0.020	0.77
2020	9	408 (279–596)	72.6	0.18	6	4 (0–32)	3.9	1.00	0.019 (0.006–0.056)	0.011	0.61
2021	9	350 (184–664)	104.1	0.30	6	8 (2–25)	3.9	0.50	0.041 (0.014–0.120)	0.024	0.60
2022	9	397 (277–568)	68.7	0.17	6	0	NA	NA	0	NA	NA

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

The most recent nesting habitat evaluation was published in 2021 for the NWFP's series of 25-year monitoring reviews. Lorenz et al. (2021) assessed habitat changes between 1993 and 2017 through an updated habitat assessment process that re-evaluated the assumptions, methods and reporting as compared to past reviews. The authors applied the current assessment parameters to the data from 1993, so while the results of the 25-year review are not directly comparable to the past years' reports; the changes reported between 1993 and 2017 are accurate. As the interim data is not directly comparable, we retained the information from both the 15-year and 20-year reports in this Status of the Species. A comprehensive discussion of how the 25-year monitoring differed from the 20-year modeling is found on pages 11-17 of the 25-year monitoring report (Lorenz et al. 2021).

Early habitat assessments include McShane et al. (2004, p. 4-2), in which authors 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). At that time, Washington State contained 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) were 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.

Falxa and Raphael (2016) 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 2016, p. 85– see Table 46). The habitat analysis output for the 20-year NWFP review divided habitat in to one of four classes, with class 3 and 4 representing “higher suitability” habitat (Falxa and Raphael 2016, p. 54). Lorenz et al. (2021, in entirety), followed a similar approach in the recent NWFP habitat update, with updated GNN and forest disturbance data from the U.S. Forest Service’s Laboratory for Applications of Remote Sensing in Ecology. This 25-year monitoring report applied updated parameters for training the models and a slightly reduced edge width for identifying core habitat (Lorenz et al. 2021, pp. 12-13). This report does not describe habitat in the classes used in the previous reports, but instead uses the terminology; “higher probability”, “moderate probability”, and “lower probability”, referring to the likelihood of murrelet occupancy. While the terminology has been updated, the 25-year report classes still correspond with the habitat classifications from previous NWFP monitoring reports, with “higher probability” corresponding with Class 4, “moderate probability” corresponding with Class 3, and “lower probability” corresponding with Classes 1 and 2 (Lorenz et al. 2021, p. 12-13)

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 (USDI FWS 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.

Falxa and Raphael (2016, p. 72) 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. (2016b, p. 72, in Falxa and Raphael 2016) 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. (2016b, p. 37, in Falxa and Raphael 2016) 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.

Lorenz et al. (2021) completed the NWFP 25-year review including only three habitat classes based on presence and nesting probabilities, compared to the four classes from previous years (as described above), and thus the authors recalculated the 1993 habitat values based on the updated assumptions. They estimated in 1993 approximately 1.51 million acres of higher probability nesting habitat were available across all lands in NWFP portion of the murrelet's range (p. 28). A majority (approximately 75 percent) of this habitat was on Federally managed lands in reserve land use allocations, but tended to be scattered fragments on the landscape rather than blocks of core habitat (p. 29). Over the 25 years of the plan, the authors note a loss of more than 20,000 acres of high quality habitat across the range (p. 29). This net loss of 1.4 percent of high probability nesting habitat from 1993 to 2017 includes a net loss of 1.8 percent of core habitat (Table MAMU 5 and Table MAMU 6). When reviewed by ownership, acres of high probability nesting habitat on federal and state lands increased by almost 3 percent from 1993 through 2017 but decreased on privately managed lands (p. 30-31). While habitat gains were reported on federal lands, modeling indicates core habitat was lost in Washington and California, and a majority of the increases in high probability habitat occurred in scattered parcels. Modeling indicates an increase in high probability habitat on Oregon's federal lands, primarily in identified reserve LUAs (p. 48). When reviewing changes across the three states in the NWFP, Washington experienced the greatest losses, including on federal lands, while Oregon dominantly indicated gains in the high probability nesting habitat on federal lands (Table MAMU 6). Authors were able to identify the cause of habitat loss in approximately 74 percent of the landscape, with 96 percent attributed to timber harvest (p. 31). On non-federal lands, 99 percent of high probability habitat loss was due to timber harvest (p. 48). Although, authors note that 66 percent of the loss of high probability core habitat was not attributed (p. 31).

Lorenz et al. (2021) caution comparing absolute habitat estimates of this report to previous versions, as modeling parameters change from report to report. Readers are encouraged review the habitat trends reported in each iteration. Trends in the 25-year report indicate an increase in higher probably core habitat in Oregon, which contrasts with the results of previous reports (Raphael et al. 2016). The authors reviewed this trend change and determined it is entirely attributable to the GNN data, which were determined to be more accurate than GNN data used in previous iterations (Lorenz et al. 2021, pp. 50-51).

Table C- 5. Distribution of murrelet nesting habitat on all lands, by habitat suitability class, for the baseline period (1993) and final year of analysis (2017). Table from Lorenz et al. (2021 p. 28, Table 7).

State/landowner	1993			2017		
	Lower probability	Moderate probability	Higher probability	Lower probability	Moderate probability	Higher probability
Washington						
Federal reserved	1,327,727	1,016,831	709,216	1,287,155	1,064,228	702,392
Federal nonreserved	306,865	101,086	38,268	275,401	131,177	39,641
Federal total	1,634,592	1,117,917	747,484	1,562,556	1,195,405	742,033
State	1,246,994	290,022	109,907	1,277,591	274,532	94,800
Other landowners	4,995,937	563,834	142,627	5,231,260	371,990	99,147
Total	7,877,523	1,971,773	1,000,018	8,071,407	1,841,927	935,980
Oregon						
Federal reserved	1,572,290	169,986	248,182	1,472,982	243,721	273,755
Federal nonreserved	403,251	27,630	27,859	365,324	55,144	38,272
Federal total	1,975,541	197,616	276,041	1,838,306	298,865	312,027
State	537,229	101,217	56,539	449,922	163,971	81,092
Other landowners	3,116,361	210,315	138,640	3,114,679	226,070	124,567
Total	5,629,131	509,148	471,220	5,402,907	688,906	517,686
California						
Federal reserved	764,231	7,841	11,377	765,883	6,367	11,200
Federal nonreserved	217,260	234	461	217,222	260	473
Federal total	981,491	8,075	11,838	983,105	6,627	11,673
State	164,909	7,346	20,295	166,055	6,253	20,242
Other landowners	2,015,236	31,145	9,707	2,026,379	23,059	6,649
Total	3,161,636	46,566	41,840	3,175,539	35,939	38,564
Plan area total						
Federal reserved	3,664,248	1,194,658	968,775	3,526,020	1,314,316	987,347
Federal nonreserved	927,376	128,950	66,588	857,947	186,581	78,386
Federal total	4,591,624	1,323,608	1,035,363	4,383,967	1,500,897	1,065,733
State	1,949,132	398,585	186,741	1,893,568	444,756	196,144
Other landowners	10,127,534	805,294	290,974	10,372,318	621,119	230,353
Total	16,668,290	2,527,487	1,513,078	16,649,853	2,566,772	1,492,230

Table C 6. Net changes in acres of higher probability nesting habitat and core, edge, and scatter between 1993 and 2017 by State and landowner (Lorenz et al. 2021, p. 32, Table 10).

State/landowner	Higher probability nesting habitat	Core	Edge	Scatter
Washington				
Federal reserved	-6,824	-2,585	-3,683	-556
Federal nonreserved	1,373	0	37	1,336
Federal total	-5,451	-2,585	-3,646	780
State	-15,107	-128	-762	-14,217
Other landowners	-43,480	-437	-1,725	-41,318
Total	-64,038	-3,150	-6,133	-54,755
Oregon				
Federal reserved	25,573	656	2,251	22,665
Federal nonreserved	10,413	254	848	9,310
Federal total	35,986	910	3,099	31,975
State	24,553	830	1,857	21,866
Other landowners	-14,073	-1,072	-3,651	-9,347
Total	46,466	668	1,305	44,494
California				
Federal reserved	-177	-6	2	-174
Federal nonreserved	12	0	-6	18
Federal total	-165	-6	-4	-156
State	-53	-18	31	-66
Other landowners	-3,058	-16	-122	-2,920
Total	-3,276	-40	-95	-3,142
Plan area total				
Federal reserved	18,572	-1,935	-1,430	21,935
Federal nonreserved	11,798	254	879	10,664
Federal total	30,370	-1,681	-551	32,599
State	9,403	684	1,126	7,583
Other landowners	-60,621	-1,525	-5,498	-53,585
Total	-20,848	-2,522	-4,923	-13,403

Note: Color gradient indicates the percentile rank among all values in the analysis area and is bounded by the maximum (green) and minimum (red).

Consulted on effects from October 1, 2003, to February 1, 2023, are summarized in Table MAMU 7, with impacts associated with the NWFP reported in Table MAMU 8. Across all lands, the Service has consulted on, or "authorized" the removal of 123,929 acres of nesting habitat acres with 20,275 of those acres associated with NWFP federal lands. Caution is warranted in reviewing these consulted on impacts and applying them directly to habitat baselines in the monitoring reports. Habitat removal may not be realized to the extent of the consultations, particularly with large scale consultations where implementation will be distributed over decades and impacts may be offset by habitat development. “Reported” habitat effects include acres reported by action agencies as implemented by actions.

Table C- 7. Aggregate results of all suitable habitat (acres) removed as determined by section 7 consultation for the marbled murrelet; summary of effects by Conservation Zone and habitat type from October 1, 2003, to February 2023 (from USDI FWS database).

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Conservation Zone[1]	Authorized Habitat Effects[2]		Reported Habitat Effects[2]	
	Stands[3]	Remnants[4]	Stands[3]	Remnants[4]
Puget Sound	-24,356	0	-1	0
Western Washington	-17,583	0	-12	0
Outside CZ Area in WA	0	0	0	0
Oregon Coast Range	-65,761	-2,671	-2,924	-1,608
Siskiyou Coast Range	-16,193	-271	-5,184	-187
Outside CZ Area in OR	-36	-3	0	0
Mendocino	0	0	0	0
Santa Cruz Mountains	0	0	0	0
Outside CZ Area in CA	0	0	0	0
Total	**-123,929**	**-2,945**	**-8,121**	**-1,795**

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 Marbled 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 Marbled 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. (Condor 104:331-342).
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 marbled murrelet nesting.

Table C- 8. **Aggregate results of all suitable habitat (acres) removed on federal lands within the NWFP planning area; summary of effects by Conservation Zone and habitat type from October 1, 2003, to February 2023 (from USDI FWS database).**

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Conservation Zone[1]	Authorized Habitat Effects[2]		Reported Habitat Effects[2]	
	Stands[3]	Remnants[4]	Stands[3]	Remnants[4]
Puget Sound	-105	0	-1	0
Western Washington	-13	0	-12	0
Outside CZ Area in WA	0	0	0	0
Oregon Coast Range	-5,119	-2,551	-2,717	-1,608
Siskiyou Coast Range	-15,003	-187	-4,957	-187
Outside CZ Area in OR	-35	-3	0	0
Mendocino	0	0	0	0
Santa Cruz Mountains	0	0	0	0
Outside CZ Area in CA	0	0	0	0
Total	**-20,275**	**-2,741**	**-7,687**	**-1,795**

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 Marbled 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 Marbled 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. (Condor 104:331-342).
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 marbled murrelet nesting.

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 (USDI FWS 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).

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 (USDI FWS 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 (USDI FWS 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 (Ŕ), 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 (Bloxton and Raphael 2006). In northwestern Washington, Bloxton 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 Ŕ (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 Ŕ 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; USDI FWS 1997, p. B-35; Beissinger 1995, p. 390). The estimates for Ŕ discussed above from individual studies, as well as Ŕ estimates for the listed range (0.02 to 0.13) are all below the lowest estimated Ŕ value (0.2) identified as required for population stability (Beissinger and Peery 2007, p. 302).

The current estimates for Ŕ 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 Ŕ 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

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Rangewide Trend, Population

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 for all NWFP zones between 2000 and 2019 was 0.5 percent, based on at-sea surveys (McIver et al. 2021a, p. 20 and Table MAMU 2). 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 et al. (2016, p. 29, in Falxa and Raphael 2016) the increase in the murrelet population between 2011 and 2018 is too rapid, particularly in Conservation Zone 4, 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 et al. 2016, p. 26, in Falxa and Raphael 2016). However, Lorenz et al. (2021, p. 48) found a positive relationship between habitat gains and population estimates in Oregon and California, but included that these relationships may be altered by at-sea changes and are not necessarily habitat driven. McIver et al. (2021b, p. 28), suggested that factors; local recruitment, abnormal adult presence on the water or a combination of factors, may be influencing the increase in the at-sea survey numbers for Conservation Zone 4. Authors describe how abnormal adult presence may be influenced by altered timing of nesting, increased numbers of non-breeding adults, or an influx of non-breeding adults from neighboring conservation zones. Additional research is necessary to decern the magnitude to which these variations in at-sea movements may influence the bi-annual survey results (p. 30).

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; USDI FWS 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 MAMU 9) 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 (USDI FWS 1997, p. 5).

Table C- 9. 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 et al. 2004
Juvenile Ratio (Ŕ)	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 USDI FWS (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).

Reason for Listing-Threats

When the murrelet was listed under the Endangered Species Act (USDI FWS 1992) and threats summarized in the Recovery Plan (USDI FWS 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 (USDI FWS 2004, pp. 11-12; USDI FWS 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 (USDI FWS 2004, pp. 11-12). The levels for the other threats identified in 1992 listing (USDI FWS 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, rangewide status review for the murrelet (USDI FWS 2004, pp. 11-12). However, the continued downward population trends found Washington, combined with the species' continued vulnerability from a broad range of threats across its entire listed range are recognized as a serious concern for the species (USDI FWS 2019, p. 64-65).

New Threats

New threats identified in the FWS's 2009, 5-year review for the murrelet (USDI FWS 2009, pp. 27-67) 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).

The 2019 5-year review did not describe new threats from this list but did reference new information on increasing at risk of mortality in trawling gear, but that the scope and severity of the threat to murrelets of entanglement in derelict fishing gear has not changed (USDI FWS 2019, p. 64).

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. See TableMAMU 10 for causes of habitat loss based on analysis in the most recent NWFP review (Lorenz et al. 2021, p. 33, Table 11). While Oregon, and the

NWFP analysis area, has had an increase in higher suitability habitat overall, it is primarily in scattered patches.

The 2019 5-year review concluded that climate change could exacerbate the impacts of continued nesting habitat loss and fragmentation (USDI FWS 2019, p. 64) and will affect the environmental baseline for murrelets and other listed species. 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 (USDI FWS 2009, p. 34). In addition, recent reviews of the annual at-sea population monitoring and inland survey protocol data highlight the negative impact of "poor" ocean years on marbled murrelet reproduction and hatchling survival (Betts et al. 2020, p. 6, Strong and Duarte 2023, p. 191). "Poor" ocean years occur during warm current patterns off the Pacific coast, resulting in low prey availability (Betts et al. 2020, p. 4). The threats present in both the marine and terrestrial environments collectively comprise a suite of environmental stressors that, individually or through interaction, have likely 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 (USDI FWS 1992); the Recovery Plan, Ecology and Conservation of the Murrelet (Ralph et al. 1995); the final rule designating murrelet critical habitat (USDI FWS 1996); the Evaluation Report in the 5-Year Status Review of the Murrelet in Washington, Oregon, and California (McShane et al. 2004); the 2004,2009, and 2019 5-year Reviews for the Murrelet (USDI FWS 2004; USDI FWS 2009; USDI FWS 2019), and the final rule revising critical habitat for the murrelet (USDI FWS 2011]).

Table C- 10. Attribution of gross loss (acres) of higher probability nest and core habitat from 1993 to 2017 by state and landowner (Lorenz et al. 2021, p. 33, Table 11).

	Higher probability nesting habitat					Core habitat				
State/landowner	Timber harvest	Wildfire	Insect damage	Other	Unattributable loss	Timber harvest	Wildfire	Insect damage	Other	Unattributable loss
Washington										
Federal reserved	2,417	2,895	113	2,787	20,447	339	537	2	407	4,889
Federal nonreserved	687	27	1	1	1,556	7	0	0	0	115
Federal total	3,103	2,923	114	2,788	22,003	346	537	2	407	5,005
State	21,383	2	137	2	5,518	180	0	0	0	201
Other landowners	49,857	92	415	17	5,916	525	0	3	2	117
Total	74,343	3,017	666	2,807	33,436	1,051	537	6	409	5,323
Oregon										
Federal reserved	1,774	38	2	30	12,788	111	0	0	3	1,098
Federal nonreserved	1,052	0	0	1	1,760	13	0	0	0	54
Federal total	2,826	38	2	31	14,548	124	0	0	3	1,152
State	10,331		10		3,034	121	0	0	0	115
Other landowners	65,492	39	137	0	5,023	1,310	0	2	0	178
Total	78,650	77	149	31	22,606	1,554	0	2	3	1,445
California										
Federal reserved	14	238	1	14	193	1	12	0	0	34
Federal nonreserved	0	0	0	0	4	0	0	0	0	0
Federal total	14	238	1	14	197	1	12	0	0	34
State	147	1	0	0	274	5	0	0	0	49
Other landowners	2,683	5	3	0	767	6	0	0	0	11
Total	2,844	244	4	14	1,238	12	12	0	0	94
Plan area total										
Federal reserved	4,205	3,172	116	2,831	33,429	451	549	2	410	6,022
Federal nonreserved	1,739	28	2	2	3,319	20	0	0	0	170
Federal total	5,944	3,199	117	2,833	36,748	471	549	2	410	6,191
State	31,860	3	148	2	8,825	306	0	0	0	365
Other landowners	118,032	136	555	17	11,707	1,841	0	5	2	306
Total	155,836	3,338	820	2,852	57,280	2,618	549	8	412	6,862

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 (USDI FWS 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 (USDI FWS 1997, pp. vi and 10). The recent 5-year review determined that if reproductive success continues to be too low to sustain the population, the observed population trends continue to decline significantly, and manmade and natural threats continue at current or increased levels, then a change in listing status to endangered may be warranted in the future (USDI FWS 2019, p. 65).

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 (USDI FWS 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 (USDI FWS 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 visitor 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 (USDI FWS 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.

Western Oregon RMP Protections

The Bureau of Land Management's (BLM) Wildlife Resource Program's Management Direction for murrelets provides some 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). As described in its biological Opinion for the RMP, the Service found that overall, the plan would provide for the survival and recovery of the murrelet. There was an expected immediate net gain of 79,500 acres to the reserve system including a gain of 48,182 acres of murrelet nesting habitat, about half of which was considered high-quality murrelet nesting habitat that would be added to the BLM's reserve system. An important provision required the incorporation of all occupied murrelet sites known at the time of implementation within the Late-successional Reserves (LSRs). Additionally, 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. Proposed actions would significantly minimize habitat modification by applying protective measures to activities in all land allocations (LUAs) in inland zone 1 and to activities in the late-successional and riparian LUAs in inland zone 2. Nest disturbance will be minimized 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 murrelets nesting. Future activities are expected to 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), but the overall protections and management of murrelet habitat and sites are expected to result in an increase in the murrelet population within BLM lands and within the action area over time (USDI FWS 2016a, p. 284).

Tree Removal

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 are large contiguous blocks of late-successional or old growth habitat on the landscape (Falxa and Raphael 2016, pp. 113-114). 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 (USDI FWS 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 (Perisores 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."

Disturbance

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 MAMU 11), 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 C- 11. 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 MAMU 9. 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 fledge 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 MAMU 12).

Although disruption distances in Table MAMU 12 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 MAMU 12).

Table C- 12. 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)	Disruption Distances During the Breeding Period (Apr 1 – Sep 15)	Disruption Distances with daily timing restrictions *, unless noted otherwise. (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
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 MAMU 11 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, USDI FWS 2012, p. 10).
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 is 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 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 are 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, USDI FWS 2012, p. 10).
10. Based on recommendations presented in Smoke Effects to Northern Spotted Owls (USDI FWS 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.

Status of the Critical Habitat

Description

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 as a whole for the conservation of the listed species." (USDI FWS and USDC NOAA 2019, p. 45016).

Legal Status

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 (USDI FWS 1996, p. 26271).

On October 5, 2011, the final rule revising critical habitat for the murrelet was published (USDI FWS 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 (USDI FWS 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 final rule (USDI FWS 2016b) determined that all of the designated areas meet the statutory definition of critical habitat. Because the determination was that all areas currently designated as critical habitat meet the statutory definition, the Service did not change the boundaries of the specific areas identified as critical habitat.

Physical and Biological Features (PBF)

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 (USDI FWS 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 was 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 (USDI FWS 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 rangewide network of murrelet critical habitat has experienced little modification of habitat since designation. Consultation data from October 1, 2003 – March 9, 2022, is displayed in Table MAMU 13.

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). 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.

Current Condition of Rangewide 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 FWS/USDC NMFS 1998, pp. 4-19). The database facilitates the tracking of impacts to habitat within designated critical habitat by conservation zone (Table MAMU 13 and 14). As of February 1, 2023, approximately 65,608 acres of suitable habitat across all ands (Fed/non-federal). have been consulted on as removed with 5,471 acres reported on NWFP lands only. As with the overall habitat affects, caution is warranted in reviewing these consulted on impacts and applying them directly to habitat baselines in the monitoring reports. Habitat removal may not be realized to the extent of the consultations, particularly with large scale consultations where implementation will be distributed over decades and impacts may be offset by habitat development. “Reported” habitat effects include acres reported by action agencies as implemented by actions.

Table C- 13. **Aggregate Results of All Critical Habitat Removed by Section 7 Consultation for the Murrelet; Baseline and Summary of Effects by Conservation Zone and Habitat Type From October 1, 2003, to February 2023 (USFWS Database).**

Wednesday, February 1, 2023 5:21:02 PM

Conservation Zone[1]	Designated Acres[2]	Authorized Habitat Effects[3]			Reported Habitat Effects[3]		
	Total CHU Acres	STAND[4]	REMNT[5]	PCE2[6]	STAND[4]	REMNT[5]	PCE2[6]
Puget Sound	1,271,782	-16	0	-45	0	-1	0
Western Washington	414,050	-1	0	-1	0	0	0
Outside CZ Area in WA	0	0	0	0	0	0	0
Oregon Coast Range	1,024,122	-60,651	-4	-2,497	0	-1,186	0
Siskiyou Coast Range	1,055,788	-4,940	0	-3,195	0	-97	0
Outside CZ Area in OR	0	0	0	0	0	0	0
Mendocino	122,882	0	0	0	0	0	0
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**	**-65,608**	**-4**	**-5,738**	**0**	**-1,284**	**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 Marbled Murrelet. Marbled Murrelet Recovery Plan, September 1997
2. Critical Habitat Unit acres divided by Conservation zones, as presented in the Marbled Murrelet Recovery Plan Figure 8, page 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 Marbled 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. (Condor 104:331-342).
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 marbled murrelet nesting.
6. PCE2: trees with a ½ site-potential tree height within .5 mile of a potential nest tree.

Table C- 14. **Aggregate Results of Critical Habitat Removed on NWFP lands by Section 7 Consultation for the Murrelet; Baseline and Summary of Effects by Conservation Zone and Habitat Type From October 1, 2003, to February 2023 (USFWS Database)**

Wednesday, February 1, 2023 5:20:22 PM

Conservation Zone[1]	Designated Acres[2]	Authorized Habitat Effects[3]			Reported Habitat Effects[3]		
	Total CHU Acres	STAND[4]	REMNT[5]	PCE2[6]	STAND[4]	REMNT[5]	PCE2[6]
Puget Sound	1,271,782	-16	0	-45	0	-1	0
Western Washington	414,050	-1	0	-1	0	0	0
Outside CZ Area in WA	0	0	0	0	0	0	0
Oregon Coast Range	1,024,122	-651	-4	-2,497	0	-1,186	0
Siskiyou Coast Range	1,055,788	-4,803	0	-2,961	0	0	0
Outside CZ Area in OR	0	0	0	0	0	0	0
Mendocino	122,882	0	0	0	0	0	0
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**	**-5,471**	**-4**	**-5,504**	**0**	**-1,187**	**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 Marbled Murrelet. Marbled Murrelet Recovery Plan, September 1997
2. Critical Habitat Unit acres divided by Conservation zones, as presented in the Marbled Murrelet Recovery Plan Figure 8, page 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 Marbled 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. (Condor 104:331-342).
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 marbled murrelet nesting.
6. PCE2: trees with a ½ site-potential tree height within .5 mile of a potential nest tree.

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Appendix D: Status of the Species For Northern Spotted Owl and its Critical Habitat

STATUS OF THE SPECIES
FOR
NORTHERN SPOTTED OWL
AND ITS
CRITICAL HABITAT

Produced by

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Executive Summary

The northern spotted owl has declined across large portions of its range since the time of listing in 1990. The biggest threats are 1) loss of habitat due to timber harvest or severe wildfire 2) and competition with non-native barred owls (*Strix varia*). The most severe population declines are occurring in the northern portion of the species range where barred owls have been established for the longest period of time. The current rate of decline raises concerns about the long-term persistence of the northern spotted owl throughout the Pacific Northwest.

Northern spotted owls rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. The northern spotted owl was listed as threatened throughout its range "due to loss and adverse modification of northern spotted owl habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and windstorms" (Service 1990a, p. 26114). Loss of northern spotted owl habitat on Federal lands since the 1990s due to timber harvest has been reduced on Federal lands over the past two decades under the Northwest Forest Plan (NWFP or the Plan). Wildfire is currently the primary cause of habitat loss on Federal lands, and the rate and severity of wildfire in portions of the range of the northern spotted owl are expected to increase in the future under projected climate change scenarios. Northern spotted owl habitat on private lands has continued to decline since the time of listing and has declined at a higher rate than on Federal lands; thus, Federal and State lands will continue to provide the majority of habitat for northern spotted owls for the foreseeable future. With the exception of some areas in northern California, northern spotted owls are unlikely to persist in areas without Federal lands.

The most recent observed 5.3 percent annual rate of decline of the northern spotted owl (Franklin et al., 2021 p. 13) indicates that this species is in severe decline and the extinction risk for this species has increased since the time of listing. Spotted owl populations in long-term study areas have declined 32 to over 80 percent since the early 1990s. If this rate continues into the future, the species will likely decline to extirpation in the northern portion of its range in the near future where population declines have been greatest (over 60 percent). Additionally, northern spotted owl population simulations indicated that without a reduction in barred owl impacts on northern spotted owls, northern spotted owl populations had a greater than 50 percent probability of extirpation in Washington and the Oregon Coast Ranges. The most recent range wide northern spotted owl demographic study indicated that barred owls are currently the factor with the largest negative impact on northern spotted owls (Franklin et al 2021, entire).

Critical habitat for the northern spotted owl includes approximately 9,373,676 acres in 11 units and 60 subunits in California, Oregon, and Washington (Service 2021b, p. 62641). This acreage resulted from the November 10, 2021, final rule's exclusion of approximately 204,294 acres within the Harvest Land Base for BLM and some tribal lands in Oregon (Service 2021b, entire) from the 2012 critical habitat designation (Service 2012a, entire).

Legal Status

The northern spotted owl (*Strix occidentalis caurina*) was listed as threatened on June 26, 1990, due to widespread loss and adverse modification of suitable habitat across the species' entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (Service 1990a, p. 26114). Recovery priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). The number reflects the severity of threats and the potential for recovery, and "C" reflects conflict with development, construction, or other economic activity (Service 1983, p. 43104). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number has been changed several times over the years and is now 6C. This number reflects a high degree of threat, a low potential for recovery, and conflicts with economic activity (Service 1983, p. 51895). In 2012, the U.S. Fish and Wildlife Service (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 (Service 2015, pp. 19259-19263). An assessment of the species status in the most recent 5-year review documented the declining status of the northern spotted owl (Service 2019, entire). After this review, the Service concluded on December 15, 2020, that changing the status of the northern spotted owl from threatened to endangered was warranted but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants (Service 2020, pp. 81144-81152).

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; Funk et al. 2008, pp. 1-11), morphological (Gutiérrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). 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., unpubl. 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), although bi-directional hybridization and dispersal between the subspecies occurs (Funk et al. 2008, pp. 1-11) 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). However, Funk et al. (2008, pp. 1-11) discovered intro-regression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington, indicating some long-distance dispersal of Mexican spotted owls into the northern spotted owl range. Hybridization of northern spotted owls with barred owls (*Strix varia*) has been recorded (Hamer et al. 1994, pp. 487-491; Dark et al. 1998, pp. 50-56; Kelly 2001, pp. 33-34, 38; Kelly and Forsman 2004, pp. 807-809; Funk et al. 2008, pp. 161-171; Wiens 2012, p. 1).

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) (Loschl, P. and E. Forsman pers. comm. 2006 cited in Service 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 [1]

The current range of the northern 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 (Service 1990a, p. 26115). The range of the northern spotted owl is partitioned into 12 physiographic provinces (see Figure A-1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Service 2011b, p. III-1; Thomas et al. 1993). 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

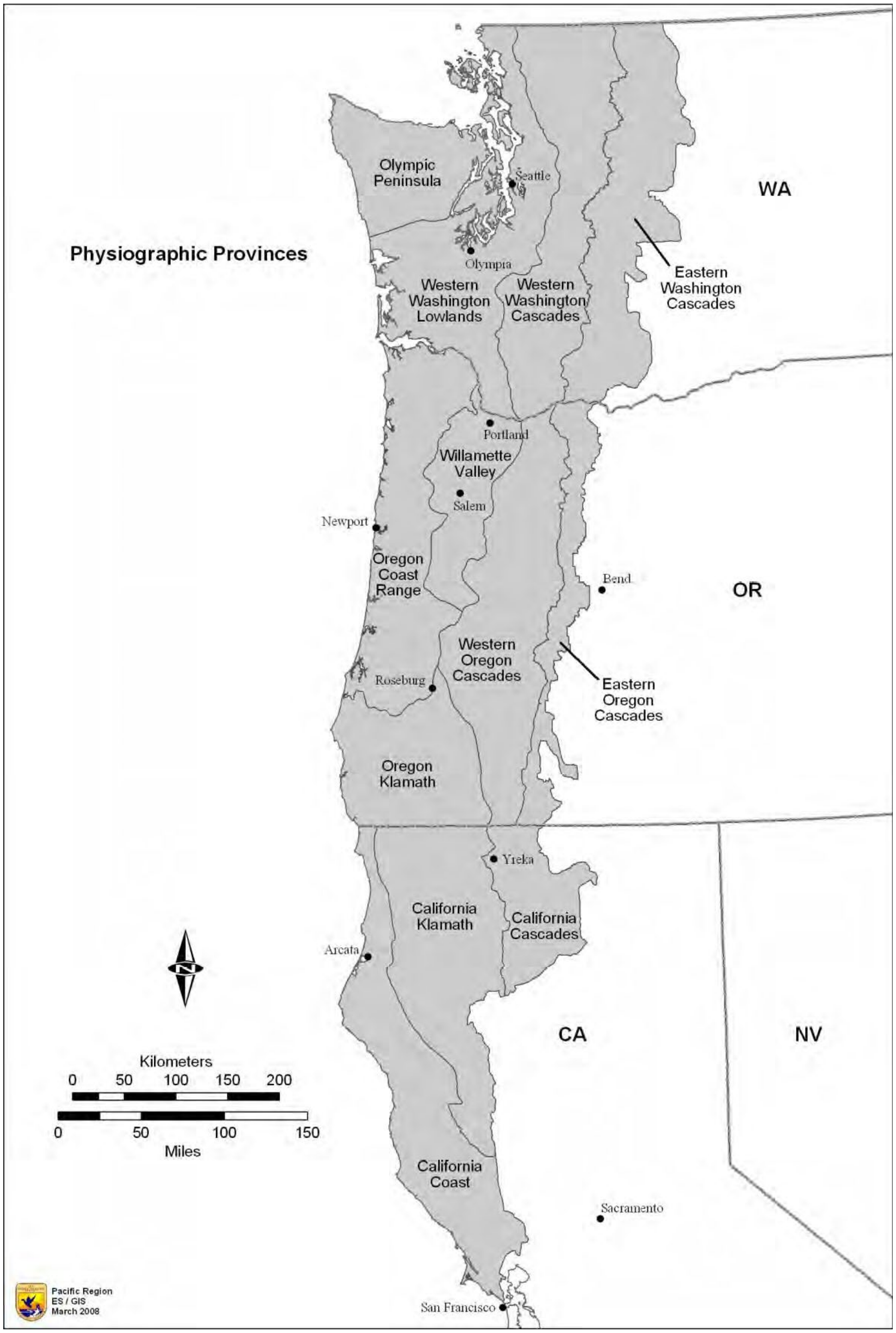
The northern spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented northern spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Service 2011b, pp. B-1 to B-4; Thomas and Raphael 1993).

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.

1

Figure A-1. Physiographic Provinces within the range of the northern spotted owl in the United States (from Service 2011b, A-3)



(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, northern 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).

Northern 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 carried out by hooting, barking and whistle type calls. Some northern 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 northern 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).

Northern 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 and Core Areas

Northern spotted owls are territorial raptors that range widely in search of prey but are 'anchored' during the breeding season to a nest site (central-place forager). Evaluations of northern spotted owl habitat are usually conducted at two spatial scales; the home range and core areas. The home range is the "area traversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943:351, cited in Service 2009).

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (Service 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 (Service 1994, 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 home ranges, areas receiving concentrated use, typically surrounding the nest site and favored foraging areas, are called core areas. Results from Bingham and Noon (1997) showed that northern spotted owls typically used 20-21 percent of their home range as core use area habitat, which generally included 60-70 percent of the sites within their home range used during the breeding season. As central place foragers, nesting northern spotted owls are likely very sensitive to activities that occur within their core use areas and especially their nest patches (Swindle et al. 1997, Miller 1989, and Meyer et al. 1998). Zabel et al. (2003, abstract, p. 1033) found the best-fitting model for northern spotted owl occupancy predictions in northwest California was at the 200-ha (500 acre) scale.

Some studies have found that northern 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). In Southern Oregon, one study found that home range and core areas remained essentially the same between seasons, concluding that perhaps this was due to the quality of available habitat (Schilling et al. 2013).

The habitat composition, specifically sufficient amounts of nesting, roosting and foraging habitat (N, R, and F), within cores and annual home ranges has been found to be directly correlated with demographic responses such as occupancy, reproductive success, survival, and fitness. For example, Franklin et al. (2000) found that the proportion of good habitat was around 60 percent to lesser quality habitat for owl core use areas in northwest California. Bart (1995) found that core areas should contain 30-50 percent mature and old growth forest. When northern spotted owl home ranges have less than 40 to 60 percent nesting/roosting/foraging (NRF), they were more likely to have lower occupancy and fitness (Thomas et al.,1990; Bart and Forsman 1992; Bart 1995; Dugger et al. 2005; and Olson et al. 2005). Northern spotted owl survival has been found to be negatively correlated with forest fragmentation (Schilling et al. 2013).

The probability of occupancy is increased when core areas contain a range of habitat conditions suitable for use by northern spotted owls, and the survival and fitness of northern spotted owls is positively correlated with larger patch sizes or proportion of older forests (Franklin et al. 2000, Dugger et al. 2005, Service 2009). The Service notes that "the strongest type of information relevant to the evaluation of take relates the fitness of [northern spotted owls] to characteristics of their habitat" (Service 2009). 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 northern spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which northern 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).

Northern 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 closure (60 to 80 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 northern spotted owls to fly (Thomas et al. 1990, p. 19). Weathers et al. 2001, (p. 686) found the northern spotted owl association with structurally complex habitats containing high canopy closure was in part due to their intolerance of high temperatures. Complex vertically structured habitat such as mature and old-growth forests habitats contain sufficient cover to provides protection from predators (Franklin et al. 2000, p. 578-579).

Northern spotted owls nest almost exclusively in trees. Nest sites are found in forests having complex structure dominated by large diameter trees and high canopy closure (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402, LaHaye et al. 1997, p. 46-48). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, p. 40; Buchanan et al. 1995, p. 304-305; Hershey et al. 1998, p. 1406-1407). Similarly, roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 2-3; Forsman et al. 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743, 747).

Foraging habitat, which provides a food supply for northern spotted owl survival and reproduction, is the most variable of all habitats used by territorial northern spotted owls (Thomas et al. 1990; Service 2011b, p. G-2). Northern 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). Glenn et al. (2004, p. 48) found that northern spotted owls had larger home ranges in areas with less old-growth and mature forest, although the population was not self-sustaining during the study period (Franklin et al. 1999 in Glenn et al. 2004, p. 46).

Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure and woody debris (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). Habitat use is influenced by prey availability. Ward (1990, p. 62) found that spotted owls foraged in areas where the occurrence of prey was more predictable within older forests and near ecotones of old forest and brush seral stages. The availability or abundance of prey can in turn influence reproductive success (Rosenburg et al. 2003, pp. 1720-1723).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. While dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, at a minimum it consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal roosting and foraging opportunities (Service 2011b, p. G-1). Northern spotted owls have been found to disperse through highly fragmented forest landscapes (Forsman et al., 2002; p. 22). However, in a study of the natal dispersal of northern spotted owls, Sovern and others (2015, pp. 257-260) found the majority of roosts were in forested habitats with at least some large (>50 cm or about 19 inches 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.

Geographic Variability

In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, spotted owls occur in both old growth forests and 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 the southern portion of their range, where woodrats are a major component of their diet, northern 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).

In the Coast Ranges, Western Oregon and Washington Cascades, and the Olympic Peninsula, radio-marked spotted owls selected for 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; Irwin et al. 2000, p. 41; Herter et al. 2002, p. 441; Forsman et al. 2005, pp. 372-373).

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 eastern Washington, spotted owl nest sites were found to have canopies of dominant and/or codominant and intermediate trees that were farther aboveground, more 35-60-cm (14-24 in)-dbh Douglas-fir, greater basal area of Douglas-fir trees, more 61-84-cm (24-33.5 in) dbh ponderosa pine trees, more live tree basal and more basal area of Class IV snags (broken snags with no branches and little bark).

The availability and distribution of habitats are important considerations. 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). Olson et al. (2004, pp. 1049-1050) infer that while mid-seral and late-seral forests are important to spotted owls, in the central Oregon Coast Range 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. The most recent rangewide population meta-analysis (Franklin et al. 2021, pp. 13, 18) found that increased amounts of northern spotted owl habitat decreased site extirpation, and in most areas increased site colonization, even when barred owls were present. Yackulic and others (2019, pp. 4-6) found that the influence of habitat availability on population extirpation was similar in magnitude to the influence of barred owls.

Reproductive Biology

The northern 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). Northern 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 northern spotted owl pairs do not nest every year, nor are nesting pairs successful every year (Service 1990b; Forsman et al. 1984, pp. 32-34; Anthony et al. 2006, p. 28), and re-nesting 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 northern spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (Service 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 northern 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 northern 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 northern spotted owls experience high mortality rates, exceeding 70 percent in some studies (Service 1990a; Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; Service 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 northern 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 northern 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 northern spotted owls move around large water bodies rather than cross them (Forsman et al. 2002, p. 22). Analysis of the genetic structure of northern 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 in the late 1990s (Haig et al. 2001, p. 35).

Breeding dispersal occurs among a small proportion of adult northern 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). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (Service 2012a, p. 14086). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting and foraging habitats used by breeding birds (Miller et al 1997, p. 144; Courtney et al 2004, p. 5-13; Service 2012a, p. 14086).

Food Habits

Northern 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 northern spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for northern spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) 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 includes 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 northern 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 northern 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, northern 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 northern spotted owl diet should not be underestimated (Forsman et al. 2001, p. 148; 2004, pp. 218-219).

Population Dynamics

The northern 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 northern 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).

Annual variation in population parameters for northern spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000, p. 581). In coniferous forests, mean fledgling production of the California spotted owl, 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 regulate northern 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 northern 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, Yackulic et al. 2019, pp. 4-6).

Competition with barred owls is an important stressor of northern spotted owl populations. The presence of barred owls decreases northern spotted owl fecundity, survival, and recruitment, as well as occupancy, colonization, and extirpation of territories (Franklin et al. 2021, pp. 9-13). Older research also established barred owl influences on site occupancy, site extirpation, and colonization (Olson et al. 2005, pp. 930-931). In the older research, northern spotted owl site occupancy was mostly stable through time, but in more recent research, site occupancy has declined at all study areas (Franklin et al. 2021, p. 17; Olson et al. 2005, pp. 930-931). The older research also found that per-visit detection probabilities were lower than expected and were highly variable among years and study areas (Olson et al. 2005, pp. 930-931). The most recent analysis of occupancy, colonization, and extirpation of northern spotted owl territories also accounts for varying detection probabilities (Franklin et al. 2021, p. 7).

Even while accounting for the effects of competition with barred owls, habitat availability and climatic patterns also appear to influence survival, occupancy, recruitment, and, to a lesser extent, fecundity (Dugger et al. 2016, entire). Occupancy, colonization, and extirpation of northern spotted owl territories are all influenced by the amount of habitat present, and territory extinction is also related to climate factors (Franklin et al. 2021, pp. 13, 16, 18). Habitat availability also influences the likelihood of northern spotted owl population persistence, and this effect is similar in magnitude to the effect of competition with barred owls (Yackulic et al. 2019, p. 4).

Northern spotted owl populations are declining across the range. Between 1995 and 2016, the Northwest California study area showed the lowest rate of decline, around two percent per year; the Hoopa study area, also in northwestern California, showed a similar rate of decline from 1995 through 2012, prior to the implementation of barred owl control there (Franklin et al. 2021, pp. 11-13). The highest rates of decline, around 9 percent per year from 1995 through 2016, have been observed in Washington at the Cle Elum and Olympic study areas (Franklin et al. 2021, pp. 11-13). Considering only study areas without barred owl removal, the rangewide mean rate of population change was -5.3 percent per year from 1995 through 2016 (Franklin et al. 2021, p. 12). By 2016, northern spotted owl populations in study areas without barred owl removal were, at best, 50 percent of their size in 1995 (for the Northwest California study area), and at worse, more than 80 percent smaller than in 1995, for the Cle Elum and Olympic study areas (Franklin et al. 2021, p. 13). For more details on current status, see section on Population Trends below.

Threats

The northern 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 windstorms" (Service 1990a, p. 26114). More specifically, threats to the northern 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 (Service 1992a, pp. 33-41). Of these threats, declining habitat was recognized as a severe or moderate threat to the northern 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 (Service 1992a, pp. 33-41). Together, these three factors represented the greatest concerns about rangewide conservation of the northern 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 northern spotted owl's range. At the time of listing, vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the northern 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 northern spotted owls (Courtney et al. 2004, pp. 11-8 to 11-9). However, great horned owls (*Bubo virginianus*), an effective predator on northern 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 northern spotted owl vulnerability to predation.

The Service conducted a 5-year review of the northern spotted owl in 2004 (Service 2004), for which the Service prepared a scientific evaluation of the status of the northern spotted owl (Courtney et al. 2004). Some of the key threats identified in 2004 were catastrophic wildfire, barred owls, and the legacy of past harvest (Courtney and Gutiérrez 2004, pp.11.7-8). The 2011 Revised Recovery Plan for the Northern Spotted Owl emphasizes that habitat loss and barred owls the main threats to northern spotted owl recovery (Service 2011b, Appendix A), and that effects of high severity wildfires pose concern for habitat conservation in some portions of the range (Davis et al. 2016, p. 38).

The most recent 5-year review, completed in 2019, concludes that competition with barred owls is likely now driving population declines across the range, that habitat loss has slowed but remains a threat, and that climate change is expected to drive increases in habitat loss due to fire (Service 2019, pp. 3-4). Even more recent scientific information, published since 2019, continues to confirm the severity of the threats from barred owls, lack of habitat, and the effects of increasingly severe fire (e.g., Franklin et al. 2021, pp. 9-19; Jones et al. 2021, pp. 5-6).

Barred Owls (*Strix varia*)

Barred owls currently appear to be the primary threat to northern spotted owls. Having expanded along the coast as far south as Marin County, California and in the Sierra Nevada, as far south as the Greenhorn Mountains in northern Kern County, California (Gutiérrez et al. 2004, pp. 7-12 to 7-13; Steger et al. 2006, p. 226, Long and Wolf 2019, p. 1283), the barred owl's range now completely overlaps that of the northern spotted owl. Evidence that barred owls are occurring in higher densities than northern spotted owls in many parts of the range (3 to 8 barred owl territories/northern spotted owl; Hamer et al. 2007; Singleton et al. 2010; Wiens et al. 2011, 2014), now including the portion of the northern spotted owl range within California (Diller et al. 2016, Dugger et al. 2016). In a recent study, the highest densities found were in the Oregon Coast Range, with up to 20 barred owls per northern spotted owl territory reported (Wiens et al. 2017, p. 12).

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, Holm et al. 2016, Long and Wolf 2019, Irwin et al. 2020). 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 northern 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 may be taking northern spotted owls' primary prey only as a generalist, northern spotted owls may be affected by a sufficient reduction in the density of these prey items due to barred owls, leading to a depletion of prey to the extent that the northern 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). These impacts are likely to have direct and indirect effects on ecosystem processes (Holm et al. 2016, p. 618)

In addition to competition for prey, barred owls are competing for habitats (Hamer et al. 1989, p. 55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274; Wiens et al., 2014, pp. 24 and 33). Barred owls were initially thought to be more closely associated with early successional forests than northern 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, more 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 the fire prone forests of eastern Washington, a telemetry study conducted on barred and northern spotted owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while northern 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). Several other studies in western Washington have similarly shown that when barred owls are present, northern spotted owl habitat use shifts upslope and into areas with steeper slopes and more marginal habitat (Gremel et al. 2005, p. 17; Mangan et al. 2019, p. 10; Pearson and Livezey 2003, p. 274, Irwin et al. 2020). The most recent rangewide meta-analysis indicated that barred owl colonization of northern spotted owl territories was more likely in lower-elevation territories in most study areas (Franklin et al. 2021, pp. 13, 18).

In addition to resource competition, barred owls have been documented to physically attack northern spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a northern spotted owl (Leskiw and Gutiérrez 1998, p. 226).

A consensus in the literature documents the negative influence barred owls are having on northern spotted owl site occupancy, fecundity, reproduction, apparent survival, and detectability, and that data indicates that over the last 26 years, they are contributing to declines in northern spotted owl populations (Olson et al. 2005, p. 924; Forsman et al. 2011, pp. 69-70), Dugger et al. 2011, pp. 2463-2467; Dugger et al. 2016, pp. 70-96); Franklin et al. 2021, entire). As barred owls have expanded, the occupancy of historical northern spotted owl territories is declining (Franklin et al. 2021, p. 17). Even 20 years ago, site occupancy of northern spotted owls in Washington and Oregon was 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 northern 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 northern spotted owl circles than occupied northern spotted owl circles (centered on historical northern 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 northern spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at northern spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a northern spotted owl territory would be occupied by a pair of northern 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 northern spotted owls from territories in Oregon.

More recently, results from a barred owl and northern spotted owl radio-telemetry study in Washington reported two northern spotted owls fleeing their territories and traveling six and 15 miles, believed to be as a result of frequent direct encounters with barred owls; both northern spotted owls were subsequently found dead (Irwin et al. 2010, p. 3-4). In study areas for a recently completed experimental barred owl removal study, northern spotted owl pair occupancy was low, and continued to decline in control sites; while the occupancy by barred owls generally increased (Wiens et al. 2017, tables 1 and 2). The probability of use by barred owls within 500-acre hexagons (1,235 acres) in the Oregon Coast Ranges study area was high in the first two years of the study in the control area (>0.920) (p. 16). In the 2021 meta-analysis associated with the completed barred owl removal experiment Wiens and others (2021, entire) demonstrated that in each of the five study areas across the range, the removal of invasive barred owls had a strong, positive effect on survival of native northern spotted owls. This subsequently reduced long-term population declines from a mean annual decline of 12.1% without barred owl removal to a 0.2% decline in areas with removal (Wiens et al. 2021, p. 1).

Numerous studies suggest that barred owls are negatively affecting northern spotted owl survival and reproduction. Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of northern 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) described synergistic effects associated with territory composition and presence of barred owls; some northern 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 northern 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 northern spotted owls, both through its immediate effects on local extinction and by indirectly lowering colonization (Yackulic et al., 2014, pp. 271-273).

Most recently, apparent survival, recruitment, and territory colonization and extinction rates were the key vital rates associated with barred owl presence in northern spotted owl populations (Franklin et al. 2021, pp. 9-18). Franklin et al. (2021, p. 19) suggested that without barred owl management, near-term extirpation of northern spotted owls is likely in portions of the range, and the small populations that may remain in other parts of the range will be highly vulnerable to extirpation due to wildfire or other stressors, resulting in eventual extinction. Dugger et al. (2016) found that the removal of barred owls in the Green Diamond study area in northern California had rapid, positive effects on northern spotted owl survival and rates of population change. The meta-analysis of the larger, multi-year barred owl removal experiment (Wiens et al. 2021, entire) in 5 study areas across the range demonstrated that removal of invasive barred owls had a strong, positive effect on survival of native northern spotted owls, and subsequently reduced long-term population declines. Barred owl removal had a positive, but weaker, effect on recruitment of northern spotted owls, which was likely a consequence of consistently depressed reproduction of northern spotted owls (and diminished availability of new recruits) during the later years of the study. Removal of barred owls also influenced the dispersal dynamics of resident northern spotted owls in at least two study areas where NSO from territories without barred owl removal had an increased estimated probability of movement to territories in treatment areas where barred owls had been removed. Both studies suggest that, along with habitat conservation and management, barred owl removal may be able to slow or reverse northern spotted owl population declines on at least a localized scale (Diller et al. 2016, Wiens et al. 2021).

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of northern 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 northern 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 northern spotted owls because northern spotted owls often cannot be relocated after they are displaced by barred owls (Forsman, E. pers. comm. 2006, cited in Service 2011b, p. B-11). Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of northern 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 extirpation and colonization rates of territories by northern spotted owls. Extirpation rates of northern spotted owl territories nearly tripled when barred owls were detected (Dugger et al. 2011, p. 2464).

Monitoring and management of northern 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). Evidence that northern spotted owls were responding less frequently during surveys led the Service and its many research partners to update the northern spotted owl survey protocol (Service 2012b) and develop a survey protocol using autonomous recording units (Service 2021a, entire). The recent changes to the northern spotted owl survey protocol were based on the probability of detecting northern spotted owls when barred owls are present (See Service Memorandum, revised January 9, 2012, “Northern Spotted Owl Survey Protocol” and attached “Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls” for guidance and methodology).

In an analysis of more than 9,000 banded northern 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).

There is no evidence that the increasing trend in barred owls has stabilized in any portion of the northern spotted owl’s range in the western United States, and “there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized” (Gutiérrez et al. 2004, pp. 7-38). To date, this situation does not appear to have changed.

The most recent meta-analysis of 26 years of survey and capture-recapture data at 11 study areas across the range of the northern spotted owl (Franklin et al. 2021, entire) indicated barred owl presence on northern spotted owl territories was the primary factor negatively affecting apparent survival, fecundity and recruitment, increasing territorial extirpation, decreasing territorial colonization of northern spotted owls, and ultimately, continued rates of population decline. In addition to lowering northern spotted owl survival and reproduction, competition with barred owl appears to impair the ability of younger northern spotted owls to acquire breeding territories (Franklin et al. 2021, p. 18).

The rate of decline of northern spotted owl populations in control areas where barred owl removal did not occur by the end of the barred owl removal experiment was severe (approximately 12 percent per year), indicating an increasingly high risk of northern spotted owl populations to local extirpations without barred owl control (Wiens et al. 2021 p. 7). Results of the barred owl control experiments across the range indicated that persistence and recovery of northern spotted owl populations are possible with active control of the barred owl threat, at least over the short term, in managed areas (Wiens et al. 2021, p. 7). However, recovery of northern spotted owls will also require short and long-term availability of older forests and suitable northern spotted owl habitat on the landscape (Wiens et al. 2021, p. 7, Franklin et al. 2021, p.18).

Wildfire

At the time of listing there was recognition that large-scale wildfire posed a threat to the northern spotted owl and its habitat (Service 1990a, p. 26183). Large scale wildfire is now recognized as the primary source of habitat loss on federal lands; there have been significant losses of nesting/roosting habitats since 2005, particularly in the reserved land allocations of the Klamath Province and parts of the Oregon Cascades (Davis et al. 2011, pp. 43-48; Davis et al. 2016, tables 5 and 7). Table A-2 below also summarizes habitat lost from natural disturbances, the majority of which has resulted from high severity fires. The NWFP recognized wildfire as an inherent part of managing northern spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77).

Wildfire 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; Davis et al. 2011, pp. 43-48; Davis et al. 2016, tables 5 and 7). A recent systematic review and meta-analysis of 21 studies, including studies of all three spotted owl subspecies, concluded that most demographic effects of mixed-severity fire are insignificant (Lee 2018, p. 15), but the authors of several of the included studies have outlined problems with the ecological foundations, statistical methods, and conclusions of the analysis, and counter that stand-replacing fire can threaten spotted owls (Jones et al. 2020a, entire).

In some parts of the range, nesting/roosting habitat is associated with a lower likelihood of high-severity fire, as compared with unsuitable forest cover types (Lesmeister et al. 2019, pp. 12-15). Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity, and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities (Eyes et al. 2017, p. 384). However, current indications are that hotter, drier summers due to climate change will likely result in larger, more intense fires than historically occurred (Service 2011, pp. III-6).

Mixed and lower severity fires may have little or even beneficial effects to spotted owls (Bond et al. 2002, p. 1025-1026; Jones et al. 2016, 304); but large, high severity fires have been found to cause reduced survival and occupancy (Jones et al. 2016). Site fidelity can influence spotted owl use of burned areas that were previously suitable (Clark 2007; Bond et al. 2009; Lee et al. 2012), and high severity fires can result in population sinks when northern spotted owls return to burned territories (Rockweit et al. 2017, p. 1574). In two telemetry studies, California spotted owls avoided large high-severity burned patches, especially those larger than 115 ha (284 ac), a size similar to the maximum historical high-severity patch size of that region (Jones et al. 2020b, pp. 1208; Kramer et al. 2021, p. 7).

One year following the extensive King Fire in the Sierra Nevada Mountains, Jones and others (2016) documented strong negative California spotted owl population impacts, with declines in occupancy and reproduction associated with severely burned sites; the probability of site extirpation in that study was seven times higher one year after the fire where more than 50 percent of the site (approximately 0.7 mile radius area) burned at high severity (75–100 percent canopy mortality) (p. 303-304). In southwest Oregon, lower occupancy and survival rates of northern spotted owl were found in burned areas compared to unburned, but the results were confounded by prior management and post-fire harvest (Clark 2007, Clark et al. 2011, Clark et al. 2013).

Available data on the direct mortality of spotted owls from fire is limited. In one study, mortality was assumed to have occurred at one site, and northern spotted owls were present at only one of the six sites 1 year after a fire (Gaines et al. 1997, p. 126). In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, northern spotted owls were observed using areas that burned at low and medium intensities, although the amount of home ranges burned was not quantified (King et al. 1998, pp. 2-3). No direct mortality of northern spotted owls was observed, even though thick smoke covered several northern spotted owl site-centers for a week.

Additional impacts to northern spotted owls related to wildfire include forest management that occurs after fires. Post-fire salvage logging typically occurs on the majority of private timberlands, but also occurs on Federal lands to a smaller degree. This type of harvest can directly impact habitat potentially occupied by northern spotted owls and can negatively influence ecological processes, which can impair the long-term development of northern spotted owl habitat (reviewed in Service 2011b, p. III-48). Action agencies, working with the Service, are attempting to influence fire severity by designing projects to reduce fire-suppressed vegetation and mimic the effects of historical fire regimes. The effects of this type of management are uncertain and highly 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. 2006 p. 359-361; Hanson et al. 2009, pp. 1316-1319; Spies et al. 2009, pp. 331-332; Ager et al. 2012, p. 282; Odion et al. 2014a pp. 10-12, Spies et al. 2012, pp. 10-12; Odion et al. 2014b, pp. 46-49; Gaines et al. 2010, Baker 2015, entire; Baker 2017, entire; Gallagher et al. 2018, pp. 10-13).

West Nile Virus

At this time, no avian diseases, including West Nile virus (WNV) or Highly Pathogenic Avian Influenza (HPAI), are known to be significantly affecting northern spotted owls; Recovery Action 17 recommends monitoring for such diseases as needed (Service 2011, p. III-5).

Sudden Oak Death

Sudden oak death was not listed as particular threat at the time of listing but was recognized as a potential threat to the northern spotted owl after it was discovered in Oregon (Courtney et al. 2004, USDI Fish and Wildlife 2011). Because of the coastal influence on his pathogen, sudden oak death is not likely to be of consequence rangewide but could compound existing stressors in coastal provinces of the northern spotted owl range.

This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading as it is capable of infecting over 100 species of trees and shrubs (APHIS 2011, in Peterson et al. 2015, p. 937). The disease has been found in several different forest types and at elevations from sea level to over 800 m and is now known to extend over 650 km from south of Big Sur, California to Curry County, Oregon (Rizzo and Garbelotto 2003, p. 198). In some areas it has reached epidemic proportions in oak (Quercus spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 kilometers (186 miles) of the central and northern California coast (Rizzo et al. 2002, p. 733). Near Brookings, Oregon it has killed tanoak and caused dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002, p. 441), common components of northern spotted owl habitat. Despite treatments of infected sites that remove all infected trees and shrubs as well as those occurring within a 300-foot buffer, occurrences of infected sites have increased since 2001 (Peterson et al. 2015, p. 937). The majority of infected sites in Oregon are concentrated in the Chetco River drainage, but it has been located as far north as Cape Sebastian (Peterson et al. 2015, p. 238). The spores from this pathogen are transmitted through the coastal fog and rain or through contaminated surfaces. During a study completed between 2001 and 2003 in California, one-third to one-half of the hikers 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 northern spotted owl habitat components (e.g., hardwood trees, forest structure and nest tree mortality); especially in the southern portion of the northern spotted owl's range (Courtney et al. 2004, pp. 6-26 through 6-27, 11-8). Eradication treatments themselves have the potential to remove habitat at the stand level as all hardwoods and shrubs identified as carriers are removed.

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 northern spotted owl at the time of listing. Earlier studies showed 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). A more recent study however, reported a significant bottleneck influence in the Washington Cascades, an area known to be experiencing a significant population decline, and that other areas with significant population bottlenecks were correlated with declines in population growth rate (Funk et al. 2010, as reviewed in Haig et al. 2016, p. 187). Recently, evidence has emerged that inbreeding depression (reduced fitness resulting from mating of close relatives) in is affecting northern spotted owls, though it is not clear whether or to what extent inbreeding depression may be exacerbating current population declines (Miller et al. 2018, pp. 827, 829, 831). Northern spotted owls known to have closely-related parents, such as full-sibling pairs, were much less likely to be observed producing offspring themselves (6.8 percent), as compared with owls without closely-related parents (27.2 percent of which were observed to produce offspring), indicating a large reduction in fitness. Rates of inbreeding were highest in the Washington Cascades (12.3 percent), intermediate on the Olympic Peninsula (5.3 percent), and low in Oregon (0.6 percent) and California (1.2 percent) (Miller et al. 2018, p. 826).

The circumstantial case for increasing risk of inbreeding depression, genetic isolation, and reduced genetic diversity also has become stronger in the northern portion of the range. In Washington demography study areas, current effective population sizes are on average fewer than 20 individuals (Gremel 2015, pp. 4–5; Herter 2016, p. 8; Lesmeister et al. 2017, pp. 3 and 12; Lesmeister and Pruett 2017, pp. 3, 7-8). Populations of this size are highly susceptible to loss of genetic variation and fitness due to genetic drift and other factors (Frankham 1996, entire; Frankham et al. 2014, entire). Canadian populations may be even 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 northern spotted owls from the wild in British Columbia (Service 2012a, p. 14078). This recommendation resulted in the eventual capture of the remaining 16 wild northern spotted owls in British Columbia for a captive breeding program (Service 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 northern 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

Global climate change has the potential to produce entirely new environmental conditions, making predictions about future ecological consequences a more daunting challenge. Recent forecasts 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. Frey et al. (2016, pp. 1, 6) concluded that old-growth will provide some buffer from impacts of regional warming and/or slow the rate at which some species relying on old-growth must adapt, based on their modeling of the fine-scale spatial distribution, under-canopy air temperatures in mountainous terrain of central Oregon. Similarly, Lesmeister et al. (2019, p. 16) concluded that older forest can serve as a buffer to climate change and associated increases in wildfire, as these areas have the highest probability of persisting through fire events even in weather conditions associated with high fire activity. 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, but they will also likely alter or interrupt forest growth and development processes (Karl et al. 2008, pp. 15 and 18; Dale et al. 2001, entire; Yospin et al. 2015, entire) 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. 2014, entire).

Glenn et al. (2010, p.2551) noted that the potential consequences of global climate change on Pacific Northwest forests remain somewhat unclear, though there is potential for changes in forest composition and disturbance patterns that could affect northern spotted owl populations. Most models predict warmer, wetter winters and hotter, drier summers for the Pacific Northwest in the first half of the 21st century (Mote et al., 2008, Mote et al. 2014, p. 489). This may result in a change in species composition or reduction in the acreage of existing low-elevation forests. The general predicted trend in North American forests is declining occupancy by conifers and displacement by hardwoods. 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 northern spotted owl habitat loss on Federal lands, with about 505,800 acres of nesting/roosting habitat loss attributed to wildfires from 1993 to 2012 (Davis et al. 2016, table 7, p. 22).

In its review of the status of the northern spotted owl in California (CDFW 2016, p. 153-155), the California Department of Fish and Wildlife (CDFW) evaluated the possible effects of climate change upon northern spotted owl and the forested habitats on which it depends. In general, CDFW (2016, p. 153-155) determined that climate change is occurring within the northern spotted owl's entire range, including California, with many climate projections forecasting steady changes in the future. They reported that climate change studies predict future conditions that may negatively impact northern spotted owls, such as wet and cold springs, more frequent and severe summer heat waves, decreased fog along the coast, shifts in forest species composition, and increased frequency of severe wildfire events. However, CDFW (2016, p. 153-155) also reported that in some instances predicted future conditions, such as increased frequency of low to moderate severity fires and expansion of suitable owl habitat forest types, may be favorable to the northern spotted owl in the long-term. They further reported that in California, current rates of temperature and precipitation change predict hotter and drier conditions in some areas of the northern spotted owl's range, and wetter colder conditions in other areas of the range. They looked at past precipitation and temperature trends and reported that drying trends across most of the northern spotted owl's range in California, coupled with warmer winters and cooler summers in the interior and cooler winters and warmer summers along the coast, may play a role in both owl and prey population dynamics. CDFW (2016, p. 153-155) recommended that further research is necessary to understand how climate change may be affecting northern spotted owls in California and throughout its range.

Potential changes in temperature and precipitation have important implications for northern 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 northern 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. 2011, 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. 2011, 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. 2011, p. 1286). Most recently, the relationships between northern spotted owl populations and climate were complex and variable, but rangewide, Dugger and others (2016, page 98) suggested that survival increased when winters were warmer and 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 northern 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 northern spotted owls prey upon (Glenn et al. 2010, p. 2549).

Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19).

While a change in forest composition or extent is likely as a result of climate change, the rate of that change is uncertain. In forests with long-lived dominant tree species, mature individuals may be able to survive these stresses, so direct effects of climate on forest composition and structure would most likely occur over a longer time scale (100 to 500 years) in some areas than in areas with disturbances such as wildfire or insect outbreaks (25 to 100 years) (McKenzie et al. 2009). The presence of high-quality habitat may buffer the negative effects of cold, wet, springs and winters on survival of northern spotted owls as well as ameliorate the effects of heat. This habitat might help maintain a stable prey base, thereby reducing the cost of foraging during the breeding season when energetic needs are high (Franklin et al. 2000).

Although the scientific literature has explored the link between climate change and the invasion by barred owls, changing climate alone is unlikely to have caused the invasion (Livezey 2009). In general, climate change can increase the success of introduced or invasive species in colonizing new territory. Invasive animal species are more likely to be generalists, such as the barred owl, than specialists, such as the northern spotted owl, and adapt more successfully to a new climate than natives.

In summary, effects of climate change may vary across the range, but is likely to exacerbate some existing threats to the northern 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.

Exposure to Toxicants

Toxicants were not identified as a threat when the northern spotted owl was listed, but a growing body of information suggests exposure to anti-coagulant rodenticides, fertilizers, other contaminants, as well as other factors associated with marijuana cultivation represent a growing concern for northern spotted owls. Recent accounts show that the scope and scale of exposure from illegal cultivation is increasing on federal and non-federal ownerships; these threats extend northern spotted owls and many other wildlife species and the resources they depend upon (Thompson et al. 2013, entire, Gabriel et al. 2013, entire; Wengert et al. 2015, p. 8; CDFW 2016 pp. 176-177, CEPA 2017b, p.1; Gabriel et al. 2018, entire; Higley et al. 2017 (abstracts). Known grow sites have been found to intersect with both subspecies of spotted owl ranges throughout California. On Forest Service lands in 2014, more than 620,000 marijuana plants on about 1,500 ac (607 ha) were removed from 167 different sites; about 90 percent of which were in California (US Senate press release 2015). Over 600 trespass grow sites were reported on mixed California ownerships in 2010 (Wengert et al. 2015, p. 8). Increases in mortalities from and exposure to pesticides in fishers in the Sierras and Northern California indicate that toxicants from marijuana cultivation suggest increasing trends (Gabriel et al. 2015, pp. 5-8, 14).

Illegal cultivation is a serious issue in the Klamath Physiographic Province, an area recognized as an important area for northern spotted owl populations (Schumaker et al. 2014). In Southwestern Oregon in Jackson and Josephine Counties alone, a multi-agency Drug Task force reported a total of 100 illegal marijuana cultivation sites containing approximately 294,090 plants between 2005-2014 (Caruthers, R. pers. comm. 2017). Many of these sites were located within known northern spotted owl home ranges, cores, or nest stands (Clayton, D. pers. comm. 2017).

Known exposure and recent data on impacts to barred owls suggest serious implications for northern spotted owls. In Hoopa Tribal lands in northwestern California, of 176 barred owls tested for exposure to anticoagulant rodenticides, 65 percent tested positive for one or more second generation ARs; many of these were collected from known northern spotted owl home ranges (Higley et al. 2017). In a separate study in northwestern California, seven out of ten northern spotted owls (70 percent) and 34 of 80 barred owls (40 percent) tested positive for ARs (Gabriel et al. 2018, pp. 5-6). At experimental barred owl removal areas in Oregon and Washington, 19 of 40 (48 percent) of tested barred owl carcasses, as well as one of two opportunistically-obtained northern spotted owl carcasses, showed evidence of exposure to ARs (Wiens et al. 2019, p. 4). Most exposures in Oregon and Washington were at trace levels, and AR toxicosis could not be confirmed in any of the tested owls. These exposures in Oregon and Washington could not be definitively attributed to legal rodenticide applications or to illicit marijuana cultivation (Wiens et al. 2019, p. 6).

Disturbance

Northern 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 northern 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 northern spotted owl core areas (Wasser et al. 1997, p.1021; Tempel and Gutiérrez 2004, p. 544).

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 1988, 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.

nformation 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 Northern Spotted Owl

Based on the above assessment of threats, the northern 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 northern spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;

2. Suitable habitat conditions and spacing between local northern 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 northern 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, which now include the entire range, 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 northern spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in northern spotted owl populations.

Conservation Strategy to Address Habitat Loss and Fragmentation

Since 1990, various efforts have addressed the conservation needs of the northern spotted owl and attempted to formulate conservation 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 (Service 1992b), the Draft Recovery Plan (Service 1992a), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USFS and

BLM 1994a). Recently, the management strategy for portions of Bureau of Land Management lands in Oregon (2.5 million acres) was modified and is no longer following all measures described in the NWFP (BLM 2016a, entire and BLM 2016b, entire). In comparison to the NWFP land use allocations, the Late-Successional Reserve (LSR) designs of the revised Resource Management Plans (RMPs) make similar contributions to the development and spacing of the large habitat blocks needed for northern spotted owl conservation. The RMPs includes approximately 177,000 more acres (71,629 ha) of LSR and Riparian Reserves than in the NWFP. These land use allocations represent 36 and 27 percent of the RMP lands, respectively, and will be managed for the retention and development of large trees and complex forests across the RMP landscape (Service 2016, Table 1, p. 9). Two additional key provisions differ from previous strategies, including a mitigation that the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30 when the Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl. Also, timber sales that would cause the incidental take of northern spotted owls from timber harvest would not be authorized until implementation of a barred owl management program has begun (BLM 2016a, p 19 and BLM 2016b, p. 19). Overall fundamentals of these large-scale conservation strategies have been 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.
- 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 northern spotted owl (USFS and BLM 1994a, 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 northern spotted owl, as well as to produce a predictable and sustainable level of timber sales. The NWFP included land use allocations which would provide for population clusters of northern spotted owls (i.e., demographic support) and maintain connectivity between population clusters. 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. Matrix areas were to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. [USFS and BLM 1994a, Service 1994]) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic

Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993).

The Forest Ecosystem Management Assessment Team and the NWFP predicted, based on expert Opinion, that the northern spotted owl population would decline in the Matrix land use allocation over time, 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). The results of the first decade of monitoring, Lint (2005, p. 18) did not yield conclusions whether implementation of the NWFP would reverse the northern spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring did not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, p. 18; Noon and Blakesley 2006, p. 288). Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection with WNV (which may or may not occur) may complicate the conservation of the northern spotted owl. Recent reports about the status of the northern spotted owl offer few management recommendations to deal with these emerging threats. However, Franklin and others (2021, p. 18) suggest that maintaining northern spotted owl habitat, even where it is currently unoccupied, will be helpful in allowing for recolonization by northern spotted owls if barred owl populations can be reduced, and in allowing for connectivity among areas still occupied by northern spotted owls.

Recovery Plan

On June 28, 2011, the Service published the Revised Recovery Plan for the Northern Spotted Owl (Service 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of northern spotted owl habitat as a result of timber harvest, loss or modification of northern spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of northern spotted owl habitat as a result of past activities and disturbances (Service 2011b, p. II-2 and Appendix A). To address these threats, the current recovery strategy identifies five main steps: 1) development of a rangewide habitat modeling framework; 2) barred owl management; 3) monitoring and research; 4) adaptive management; and 5) habitat conservation and active forest restoration (Service 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 (Service 2008). 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 rangewide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (Service 2011b, Appendix C).

The Revised Recovery Plan recommended implementing a robust monitoring and research program for the northern spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring northern spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of northern spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (Service 2011b, p. II-5). The Revised Recovery Plan also strongly encourages land managers to be aggressive in the implementation of recovery actions, including strategies that include active forest management. 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 northern spotted owl. But they should also not be so aggressive that they subject northern 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 northern spotted owl conservation (Service 2011b, p. II-12). The Revised Recovery Plan estimates that recovery of the northern spotted owl could be achieved in approximately 30 years (Service 2011b, p. II-3). The Revised Recovery Plan and the critical habitat designation build on the NWFP and recommends continued implementation of the NWFP and its standards and guides (Service 2011b, p. I-1).

Northern Spotted Owl Recovery Units

The 2011 Final Revised Recovery Plan for the Northern Spotted Owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (Service 2011b, p. III 1-2). Each recovery unit is essential for the conservation of the northern spotted owl. The suite of recovery units is intended to further the re-establishment or maintenance of 1) genetic flow between northern spotted owl populations; 2) population and habitat distribution; and 3) northern spotted owl meta-population dynamics. Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to result through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will take time and are 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 criterion are: 1) stable population trend, 2) adequate population distribution in all recovery units except for the Willamette Province, 3) continued maintenance and recruitment of northern spotted owl habitat, and 4) post-delisting monitoring (Service 2011b, p III-3).

The 2011 Revised Recovery Plan for the Northern Spotted Owl (Service 2011b) contains 14 recovery actions that specifically address northern spotted owl habitat loss and degradation. Two actions of primary importance are recovery actions 10 and 32:

Recovery Action 10: Conserve northern spotted owl sites and high value northern spotted owl habitat to provide additional demographic support to the northern spotted owl population. This action addresses both nesting/roosting and foraging habitat.

Recovery Action 32: Because northern 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…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 northern 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. This action addresses nesting/roosting habitat.

Recovery actions 10 and 32 are implemented on reserved areas by the USFS and BLM through the NWFP and the Resource Management Plans (RMPs); these two regulatory actions are discussed in more detail in Section 6. The large reserve network created under the NWFP and RMPs facilitates implementation of recovery actions 10 and 32 by protection of current nesting/roosting and foraging habitat, protection of northern spotted owl nest sites, and allowing for recruitment of new northern spotted owl habitat. Through the section 7 consultation process, the Service reviews the management activities implemented under the NWFP and RMPs and provides technical assistance to the USFS and BLM in making activities within or outside of reserves consistent with recovery actions 10 and 32 to the extent consistent with other land management priorities. Nesting/roosting and foraging habitat associated with both recovery actions 10 and 32 may decrease in local areas, but over the larger area and time, habitat that is associated with these recovery actions is increasing and will continue to increase under both the NWFP and RMPs.

Conservation Efforts on Non-Federal Lands

Non-Federal lands contributed 3,149,700 ac (1,274,638 ha) to the total 12,103,700 ac (4,898,193 ha) of nesting/roosting habitat available for breeding northern spotted owls in 2012 (Davis et al. 2016, pp. 21-22). There are portions of the range where habitat on Federal lands is lacking or of low quality, or where there is little Federal ownership; State and private lands may be important to provide demographic support (pair or cluster protection) and habitat connectivity for northern spotted owl in key areas such as southwestern Washington, northwestern Oregon (potentially including parts of the Tillamook and Clatsop State Forests), and northeastern California (Service 2011b, p. III-51). Timber harvest on State and private lands in Washington, Oregon, and California is regulated by each State's forest practice rules. The level of northern spotted owl conservation included in each State's regulations varies. Furthermore, while recovery efforts for the northern spotted owl are primarily focused on Federal land, Recovery action 14 in the 2011 Revised Recovery Plan centered on seeking partnership with non-Federal landowners to supplement Federal conservation efforts, including voluntary actions like Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs). There are a total of 21 current conservation plans in these states, including 7 HCPs and 3 SHAs located in Washington, 2 HCPs and 5 SHAs in Oregon, and 2 HCPs and one SHA in California, with an additional SHA occurring in both Washington and Oregon.

U.S. Fish and Wildlife Habitat Conservation Plans and Safe Harbor Agreements

The purpose of the HCP and SHA process is to provide for the conservation of endangered and threatened species while at the same time authorizing the incidental take of those species. HCPs are required as part of an application for an incidental take permit. They describe the anticipated effects of the proposed taking; how those impacts will be minimized and mitigated; and how the HCP is to be funded among other things. The Secretary must issue the permit if statutory issuance criteria are met, including that the applicant will minimize and mitigate the effects of the taking to the maximum extent practicable, the taking will not jeopardize the continued existence of the species, and funding to implement the plan is assured. 16 U.S.C. 1539(a)(2)(B). In developing HCPs, people applying for incidental take permits describe measures designed to minimize and mitigate the effects of their actions and receive formal assurances from the Service that if they fulfill the conditions of the HCP, the Service will not require any additional or different management activities by the participants without their consent. SHAs are voluntary agreements between non-Federal property owners and the Service; in exchange for actions that contribute to the recovery of listed species on non-Federal lands, participating property owners may return the enrolled property to the baseline conditions that existed at the beginning of the SHA. Incidental Take Permits that result from both HCPs and SHAs are intended to allow non-Federal entities to undertake actions that incidentally "take" species protected under the Act.

HCPs are not required to have a net benefit and SHAs are designed to have a temporary net gain for northern spotted owls. Under these plans, timber harvest has continued, resulting in the loss of nesting/roosting, foraging, and dispersal habitat. We do not currently have an analysis of habitat loss on lands without conservation plans compared to habitat loss on lands covered by HCPs and SHAs. Although the HCPs do not provide a net conservation benefit to northern spotted owl, they provide mitigation for habitat loss or slow down habitat loss through the required conservation measures. SHAs do provide a net conservation benefit to the northern spotted owl, and both conservation plans eliminate uncertainty with respect to landowners' actions in northern spotted owl habitat and provide the Service an opportunity to provide technical assistance to landowners in the development of conservation measures included in the agreements. Therefore, in this context, both HCPs and SHAs have contributed to the overall conservation of northern spotted owls.

In Washington, there are seven northern spotted owl-related HCPs currently in effect covering 2 million ac (80,9371 ha) of non-Federal lands, one of which covers Washington Department of Natural Resources (DNR) lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. There are four northern spotted owl-related SHAs in Washington, with one including some lands in Oregon. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. In addition, there is a long-term habitat management agreement covering 13,000 ac (5,261 ha) in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (Service 2011b, p. A-15). While timber harvest and habitat loss continue on lands covered by these agreements, the plans retain some nesting/roosting habitat throughout the area or in strategic locations and provide habitat connectivity. Overall, HCPs, and SHAs in Washington provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Washington.

In Oregon, there are two northern spotted owl-related HCPs currently in effect covering 210,400 ac (85,146 ha) of non-Federal lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. There are two northern spotted owl-related SHAs occurring in Oregon. One SHA is a Washington SHA that covered some Oregon lands. The other SHA is a programmatic SHA with the Oregon Department of Forestry with 13 landowners with 3,484 acres enrolled. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. Strategies employed in the programmatic Oregon Department of Forestry SHA include maintaining existing suitable habitat, increasing time between harvests to allow for habitat development, and lightly to moderately thinning younger forest stands that are currently not habitat (to increase tree diameter and stand diversity) (Service 2011b, p. A-16). There are 4 additional SHAs in Oregon related to the Barred Owl Removal Experiment explained below in the barred owl section. While timber harvest and habitat loss continue on lands covered by these HCPs and SHAs in Oregon, the plans retain some nesting/roosting habitat throughout the area or in strategic locations and provide habitat connectivity. Overall, HCPs, and SHAs in Oregon provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Oregon.

In California, there are five northern spotted owl-related HCPs currently in effect covering 2.6 million ac (1 million ha) of non-Federal lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. One HCP, with Sierra Pacific Industries, scientific collection of barred owls for research purposes, as well as studies of barred owl effects on spotted owls. There are two northern spotted owl-related SHAs in California. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. While timber harvest and habitat loss continue on lands covered by these agreements, the plans retain some nesting/roosting habitat throughout the area or in strategic locations and provide habitat connectivity. Overall, HCPs, and SHAs in California provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in California.

State Forest Practice Rules

The majority of northern spotted owl conservation is expected from Federal lands, but 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. Timber harvest on State and private lands in Washington, Oregon, and California is regulated by each State's forest practice rules. The level of northern spotted owl conservation included in each State's regulations varies Each State's rules are described below.

Washington

The northern spotted owl was listed as endangered species in Washington State by the Washington Fish and Wildlife Commission in 1988 to prioritize conservation for the subspecies (WDFW 2017). Timber harvest on State and private lands in Washington is guided by a number of State laws and policies, except for Washington Department of Natural Resources (WDNR) lands that are covered by an HCP. The Washington State Environmental Policy Act (SEPA) requires analysis of environmental impacts and consideration of reasonable alternatives for actions proposed by the State. State timber harvest activities must also comply with the State Forest Practices Act (Chapter 76.09 RCW), which regulates all forest management activities in Washington. The management of

State trust lands, specifically, is guided by the Forest Resource Plan, which was adopted by the Board of Natural Resources in 1992. Among other things, the policies of the Plan require the Washington DNR analyze and potentially modify the impacts of its activities on watersheds, wildlife habitat, special ecological features, wetlands, and other natural resources to maintain healthy forests for future generations.

In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the northern spotted owl and its habitats 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 northern 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). The 1996 rules identified 10 landscapes, or Spotted Owl Special Emphasis Areas (SOSEAs) where owl protections on non-Federal lands would be emphasized. Protections provided under the State Environmental Policy Act for those portions of owl sites located beyond the boundaries of the SOSEAs were largely eliminated (Buchanan and Swedeen 2005, p. 7). The overarching policy goal of the Washington Forest Practices Rules is to complement the conservation strategy on Federal lands, and so the SOSEAs are adjacent to Federal lands. The SOSEAs are designed to provide a larger landscape for demographic and dispersal support for northern spotted owls with the long-term goal of supporting a viable population of northern spotted owls in Washington.

The Forest Practices Rules for northern spotted owls can be described as containing three basic types of provisions: 1) regulations that apply outside SOSEAs, 2) a circle-based protection scheme for northern spotted owl sites inside SOSEAs (retain all suitable habitat within 0.7 mi (1 km) of site center and retain 40 percent of suitable habitat within 1.8 to 2.7 mi (2.9 to 4.3 km) radius of home range), and 3) landscape-level planning options for inside SOSEAs. To avoid disturbance of nesting northern spotted owls inside SOSEAs, the rules also include timing restrictions from March 1 to August 31 within 0.25 miles of a site center for several potentially disruptive activities (e.g., road construction). Forest practices rules outside the SOSEAs are designed to protect the immediate vicinity of northern spotted owl site centers during the nesting season (March 1 to August 31) by restricting harvest within the best 70 ac (28 ha) of habitat around the site center and requiring additional environmental analysis for permitting (of harvesting, road construction, or aerial application of pesticides), but outside the nesting season there are no owl-related protections outside SOSEAs that constrain harvest of suitable northern spotted owl habitat in northern spotted owl management circles (Buchanan and Swedeen 2005, p. 14).

Within SOSEAs, the rules were intended to maintain the viability of each northern spotted owl site center by establishing that enough suitable habitat should be maintained to protect the viability of owls associated with each northern spotted owl site center, or to provide for the goals established in Spotted Owl Special Emphasis Areas. Due to extensive timber harvest activities in the decades leading up to listing of the northern spotted owl, most northern spotted owl management circles centered on non-Federal lands have far less habitat than the viability threshold identified (see below) when the rule went into effect. Because the rules do not include provisions for restoration of habitat to achieve the viability threshold at northern spotted owl sites these circles remain far below those thresholds. For individual site centers, the habitat considered necessary to maintain viability is as follows: (a) all suitable northern spotted owl habitat within 0.7 mi (1.1 km) of each northern spotted owl site center; (b) at least 5,863 ac (2,373 ha) of suitable northern spotted owl habitat within of 2.7 mi (4.3 km) of a site center in the Hoh-Clearwater Spotted Owl Special Emphasis Area on the western Olympic Peninsula, and (c) at least 2,605 ac (1,054 ha) of suitable northern spotted owl habitat within 1.8 mi (2.9 km) of a site center in all other Spotted Owl Special Emphasis Areas. At all sites within SOSEAs, any proposed harvest of suitable northern spotted owl habitat within a territorial owl circle (status 1, 2, or 3 in the Washington Department of Fish and Wildlife database) would be considered a “Class-IV special” and would trigger State Environmental Policy Act review; such activities would require a Class IV special forest practices permit and an environmental impact statement per the State Environmental Policy Act (Buchanan and Swedeen 2005, p. 15-16).

The Forest Practices Board in Washington has a long-standing relationship with the Service and collaborates extensively on owl conservation. The Service provided extensive technical assistance in the development of the Board's existing owl rules. The Board was recognized in the Revised Recovery Plan for the Northern Spotted Owl (Service 2011b) for its ongoing owl conservation efforts in Recovery Action 18 encouraged to continue to use its existing processes "to identify areas on non-Federal lands in Washington that can make strategic contributions to northern spotted owl conservation over time. The Service encourages timely completion of the Board's efforts and will be available to assist as necessary." The Board convened the Northern Spotted Owl Implementation Team (NSOIT) in 2010 to develop incentives for landowners to achieve conservation goals for northern spotted owls and to identify the temporal and spatial allocation of conservation efforts on non-Federal lands. A spatial modeling effort to prioritize private lands for northern spotted owl conservation was completed in late 2021, though the final modeling products are not yet available (Dunk et al. 2021). A programmatic SHA is in development, to be administered by WDNR. The NSOIT also conducted a pilot project testing different thinning prescriptions in northern spotted owl habitat but the project has since been discontinued. These efforts underway have evolved over years of collaboration and are designed to change the dynamic away from fear and resistance to partnership and participation. The Service has provided and is providing funding to support the work of the NSOIT. Overall, State forest practice rules in Washington provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Washington.

Oregon

The northern spotted owl is listed as a threatened species in Oregon (ODFW 2017). The Oregon Fish and Wildlife Commission’s long-term goal for species listed as threatened or endangered under the Oregon Endangered Species Act is to manage the species and their habitats so that the status of the species improves to a point where listing is no longer necessary. Timber harvest on non-Federal lands in Oregon is guided by the Forest Practices Act and Forest Practices Rules (ODF 2014). The Oregon Forest Practices Act restricts timber harvest within 70 ac (28 ha) core areas around sites occupied by an adult pair of northern spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of northern spotted owl habitat beyond these areas (ODF 2014, pp. 61-62). In general, no large-scale northern spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon.

State forests in particular are managed to achieve “greatest permanent value,” considering economics, environmental, and cultural goals. Each State Forest has a Forest Management Plan that seeks to implement these ideals. Ultimately, the State's goal is to produce timber revenue and also provide for a range of habitats across ownerships. Specific policies and procedures have been adopted on State lands to protect and conserve the northern spotted owl and its habitat. The State Forests Division has an extensive survey program across all districts as part of annual harvest planning (approximately $1.4 million spent in 2016) and conducts density surveys on two districts. Division policy directs districts to avoid any harvest activity on State lands which results in less than 40% suitable habitat within the provincial home range of an owl or pair (a 1.2 - 1.5-mi (1.9 - 2.4 km) radius circle centered on a nest site or activity center). Division policy also directs districts to avoid any harvest activity which results in less than 500 ac (202 ha) of suitable habitat within a 0.7-mi (1.1 km) radius (1000 ac (405 ha)) of a nest site or activity center. In addition, 30 percent of Oregon State forests must be managed for the development of "complex forest structure" and late-seral tree species, which could provide some level of conservation benefit for a number of wildlife species of concern, including the northern spotted owl (IEc 2012). The locations of these managed lands are based in part on locations of northern spotted owl nest sites. Within these areas, a variety of treatments are employed to promote complex habitat and species diversity. Overall, State forest practice rules in Oregon provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Oregon.

California

The northern spotted owl was listed as an endangered species under the California Endangered Species Act (CESA) in early 2016 (CDFW 2017). The incidental take of state-listed species is prohibited under the California Code of Regulations (783-783.8 and the California Fish and Game Code 2080 (CDFW 2016), unless permitted by an HCP. Forest management and forest practices on private lands in California, including harvesting for forest products or converting land to another use are regulated by the State under Division 4 of the Public Resources Code, and in accordance with the California Forest Practice Rules (CFPR)(California Code of Regulations, (CCR) Title 14, Sections 895-1115; CFPR)(CFPR 2017). The CFPR require surveys for northern spotted owls in nesting/roosting and foraging habitat and restrict timber harvest within 0.7–1.3 mi (1-2 km) of a northern spotted owl activity center. Under this framework, the California Department of Forestry and Fire Protection (CALFIRE) is the designated authority on forest management and forest practices on private lands in California.

All private land timber harvesting in California must be conducted in accordance with a site-specific Timber Harvest Plan (THP, for industrial timberlands) or Nonindustrial Timber Management Plan (NTMP, for non-industrial private timberland owners) that is submitted by the owner and is subject to administrative approval by the CALFIRE. The THP/NTMP must be prepared by a State-registered professional forester and must contain site-specific details on the quantity of timber involved, where and how it will be harvested, and the steps that will be taken to mitigate potential environmental damage. The THP/NTMP and CALFIRE's review process are recognized as the functional equivalent to the environmental review processes required under the California Environmental Quality Act of 1970 (CEQA). The CFPRs require surveys for northern spotted owls in suitable habitat and to provide protection around activity centers. Under the CFPRs, no THP or NTMP 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.

For private timber lands in California not covered by a HCP or SHA, the policy of the State with regard to the northern spotted owl and timber harvest can be characterized as one of "take avoidance," for which the Service (Arcata and Yreka Fish and Wildlife Offices) has recommended measures to avoid take of northern spotted owls, primarily through recommendations for habitat retention, timing of timber operations and survey procedures for northern spotted owls (described briefly below). The Director of CALFIRE is not authorized to approve any proposed THP or NTMP that would result in take of a federally-listed species, including the northern spotted owl, unless that taking is authorized under a Federal Incidental Take Permit (review process is outlined in 14 CCR 919.9 and 919.10). This latter point creates an incentive for private landowners to enter into HCPs or SHAs, or to implement take avoidance measures recommended by the Service.

Prior to 2000, the California Department of Fish and Wildlife (then, California Department of Fish and Game; CDFW) reviewed THPs and NTMPs to ensure that take of northern spotted owls was not likely to occur. From about 2000 until 2010, the Service assumed this role and reviewed THPs and NTMPs (hundreds per year) for northern spotted owl "take avoidance." From 2010, the Service and CALFIRE shared duties for northern spotted owl take avoidance review of THPs and NTMPs. Beginning in 2014, the northern spotted owl was listed as a candidate species for potential listing under the California Endangered Species Act; consequently, in 2014, CDFW began reviewing a small number of THPs and NTMPs annually for northern spotted owl take avoidance. On August 25, 2016, the California Fish and Game Commission recommended that the northern spotted owl be added to the State list of threatened and endangered animals. Regarding timber harvest on private lands in California after 2016, the Service, CALFIRE and CDFW have not formally discussed how the agencies will share reviewing duties for northern spotted owl take avoidance associated with THPs and NTMPs, but recommended habitat retention standards (i.e., Attachments A and B) and survey recommendations remain in effect. California is currently engaged in discussions with the Service addressing northern spotted owl use of post-fire landscapes currently lacking in the California Forest Practice Rules.

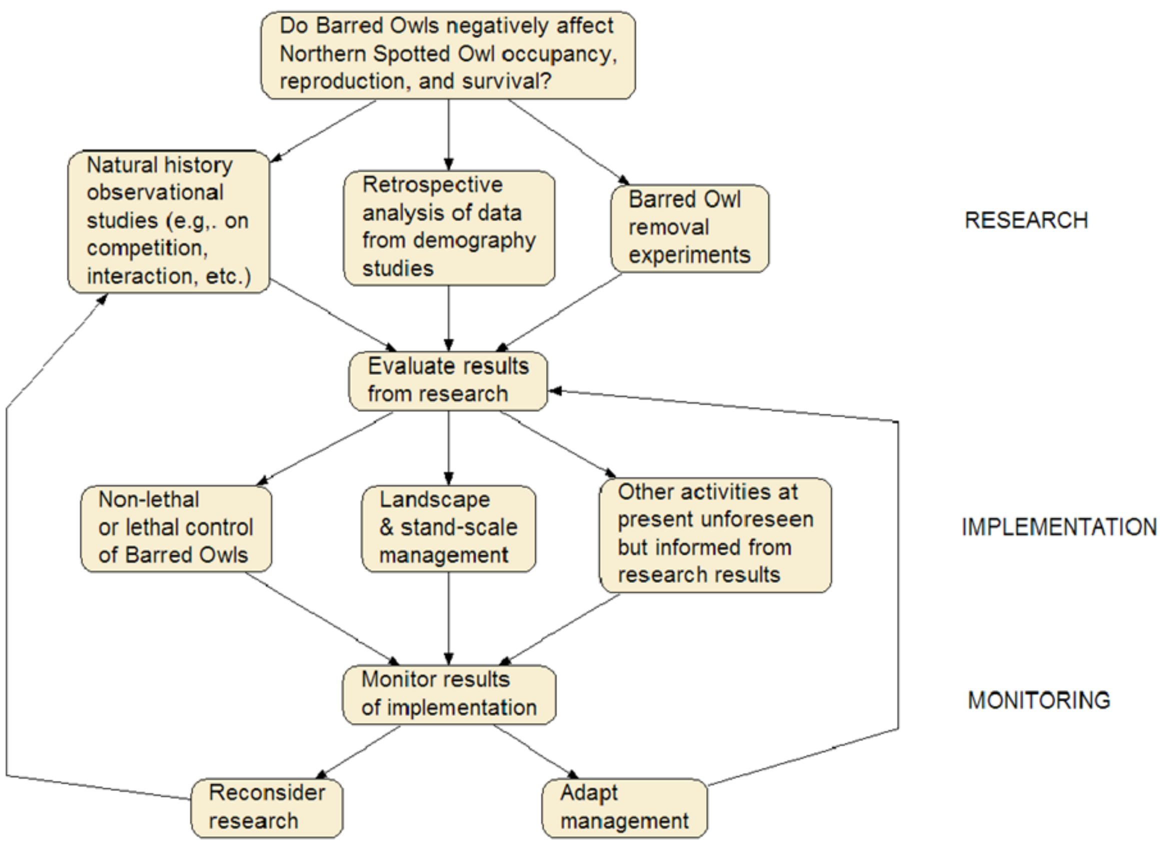
For timber harvest activities that occur on non-Federal lands (excluding California State Parks and lands covered under an HCP) within CAL FIRE's Coast Forest District (generally, within the range of the coast redwood), the Service (Arcata Fish and Wildlife Office) provided to CAL FIRE and foresters a document titled, Northern Spotted Owl Take Avoidance Analysis and Guidance for California Coast Forest District ("Attachment A"), dated March 15, 2011. In general, recommended habitat retention guidelines around known active northern spotted owl activity centers in include: (1) delineation of a 100 ac (40 ha) "Core Area" comprised of "nesting/roosting" habitat (defined in Attachment A), in which timber harvest does not occur; (2) retention of at least an additional 100 ac (40 ha) of "nesting/roosting" habitat within 0.7 mi (1.1 km) of an activity center; and (3) retention of at least 300 ac (121 ha) of "foraging" habitat (defined in Attachment A) within 0.7 mi (1.1 km) of an activity center.

For timber harvest activities that occur on non-Federal lands within CAL FIRE's Interior Forest District, the Service (Arcata and Yreka Fish and Wildlife Offices) provided to CAL FIRE and foresters a document titled, Attachment B: Take Avoidance Analysis-Interior, dated February 27, 2008. In general, recommended habitat retention guidelines around known active northern spotted owl activity centers in include: (1) no harvest within 1,000 ft (305 m) of an activity center; (2) within 0.5 mi (0.8 km) radius (502 ac (203 ha) of an activity center, retention of four habitat types (as defined in Attachment B), including at least 100 ac (40 ha) "high quality nesting/roosting" habitat, 150 ac (61 ha) of “nesting/roosting” habitat, 100 ac (40 ha) of “foraging” habitat and 50 ac (20 ha) “low-quality foraging habitat”; and (3) between 0.5 mi (0.8 km) and 1.3 mi (2 km) radius circles on an activity center (2896 ac (1172 ha)), retention of greater than 935 ac (378 ha) of habitat, including at least 655 ac (265 ha) foraging habitat and at least 280 ac (113 ha) low-quality foraging habitat. Overall, State forest practice rules in California provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in California.

Conservation Measures to Address Barred Owls

The 2011 Revised Recovery Plan for the Northern Spotted Owl contains ten recovery actions specific to addressing the barred owl threat. These include the establishment of protocols to detect barred owls and document barred owl site status and reproduction (Recovery Action 24), the design and implementation of large-scale control experiments to assess effects of barred owl removal on northern spotted owl site occupancy, reproduction, and survival (Recovery Action 29), and the implementation of management strategies to reduce the effects of barred owls on northern spotted owls (Recovery Action 30). The manner in which this set of ten Recovery Actions is expected to contribute to northern spotted owl recovery is presented in Figure A-2.

Figure A-2. Flowchart of barred owl Recovery Actions (Service 2011b, p. III-66, Figure III-1).



Several barred owl recovery actions have been completed, including Recovery Action 29, the Barred Owl Removal Experiment (Service 2013a and Service 2013b). This experiment was developed based on a pilot project at Green Diamond Resources study area that demonstrated barred owl removal had rapid, positive effects on northern spotted owl survival and the rate of population change (Dugger et al. 2016, p. 58). This experiment was implemented under the direction of USGS, the Hoopa Tribe, and APHIS in partnership with the Service. The research program evaluated the effectiveness of barred owl removal as a potential recovery strategy for northern spotted owls on one study area in Washington, two study areas in Oregon, and one study area in northern California. Barred owl removal was implemented on the California study area in fall/winter 2013-2014, and on the Washington and one of the Oregon study areas in fall/winter 2015-2016. Barred owl removal on the final Oregon study area was initiated in fall of 2016. Removal occurred for four consecutive years at each study area, and the experiment is now complete, with removals leading to improvements in northern spotted owl apparent survival, recruitment, and rates of population change, as described above in the section describing threats related to barred owls. Separate barred owl removal experiments remain ongoing in several areas in California, including Hoopa and Yurok Tribal lands, and private lands owned by Sierra Pacific Industries and Green Diamond.

Given the positive outcomes of the removal experiment conducted for Recovery Action 29, the Service is developing a barred owl management strategy, and initiated the public review process in 2022 with a notice of intent to develop an Environmental Impact Statement (87 FR 43886). Under the BLM RMPs, the BLM will support barred owl management on their lands as informed by the outcome of the Barred Owl Removal Experiment. In the interim, the BLM is avoiding incidental take of northern spotted owls resulting from timber harvest on their lands. This support is intended to mitigate for the adverse effects associated with timber harvest and other resource programs, and result in a net positive impact on the recovery of northern spotted owls (Service 2016, p. 701). The BLM and a number of other cooperating agencies are participating in the development of the barred owl management strategy. Once the strategy is developed, implementation of barred owl removal is likely to be a necessary condition for the long-term persistence of the northern spotted owl.

Safe Harbor Agreements in Oregon for Barred Owl Experiment

There are four SHAs related to the Service's Barred Owl Removal Experiment in Oregon. The SHAs were limited to areas managed by landowners that were willing to work with the Service to provide access for survey and removal of barred owls on their lands within the study areas. Agreements were established with Roseburg Resources Company, Oxbow I LLC, Weyerhaeuser Company, and Oregon Department of Forestry to facilitate successful completion of this research project. The Barred Owl Removal Experiment implemented Recovery Action 29 of the 2011 Revised Recovery Plan for the Northern Spotted Owl (Service 2011b, p. III-65). The Barred Owl Removal Experiment was implemented on two study areas in Oregon, one in the Oregon Coast Ranges west of Eugene, Oregon, and one in the forest lands around Canyonville, Oregon. While the experiment focused on Federal lands, the landscapes involved in the study areas included significant interspersed private and state lands. In the Oregon Coast Ranges study area, this included lands owned by Roseburg Resources Company and Oxbow Timber I, LLC (SHA covers 9,400 ac (3,804 ha) of land total, 308 ac (125 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued); Weyerhaeuser Company (SHA covers 1,072 ac (434 ha) total, 817 ac (331 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued), and lands managed by Oregon Department of Forestry (SHA covers 20,000 ac (8,093 ha) total, 3,345 ac (1,354 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued). In the Union/Myrtle (Klamath) study area in southern Oregon, this includes lands owned by Roseburg Resources Company (SHA covers 45,100 ac (18,251 ha) of land total, 7,080 ac (2865 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued). Access to these non-Federal lands enabled the effective and efficient completion of the experiment.

Through these four SHAs, Roseburg Resources Company, Oxbow I LLC, Weyerhaeuser Company, and Oregon Department of Forestry contributed to the conservation of the northern spotted owl by allowing the researchers to survey for barred owls on their lands throughout the Study Area and remove barred owls from their lands within the removal portion of the experiment. The section 10 permit issued to them as part of the SHA provides these landowners with short-term incidental take authorization through habitat modification for northern spotted owls that may return to non-baseline northern spotted owl sites (unoccupied by resident northern spotted owls for the three years prior to the initiation of removal on the area) after the removal of barred owls. However, this information and access was crucial to efficient and effective implementation of this experiment. Information from this experiment is critical to the development of a long-term management strategy to address the barred owl threat to the northern spotted owl.

Rangewide Environmental Baseline

The environmental baseline 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, including all previously consulted on effects (Service and NMFS 1998, pp. 4-19).

Habitat Trends

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 northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USFS and BLM 1994b, Service 2001, Lint 2005, Davis et al. 2011, Davis et al. 2016, Davis et al. 2022). These NWFP monitoring reports assess the status and trends of northern spotted owl habitat across 22.1 million acres of federally administered forest lands in addition to 23.8 million acres of nonfederal forest lands within the range in the United States. The estimate of 7.4 million acres used for the NWFP in 1994 (USFS and BLM 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. These periodic rangewide evaluations of northern spotted owl habitat (Lint 2005, Davis et al. 2011, Davis et al. 2016) are used to determine if the rate of change to northern spotted owl habitat has been consistent with changes in amount of habitat anticipated under the NWFP and described in the Final Supplemental Environmental Impact Statement (FSEIS; USFS and USDI 1994b).

Each analysis has used more up-to-date and higher quality data than the previous analyses and new analytical methods have been incorporated over time. While this improved the overall quality of the information provided, it also means that individual reports should not be compared directly without fully understanding the processes used to develop the results.

Trends for suitable habitat are largely declining rangewide, with rates of loss varying by province and land allocation. Approximately 8,890,500 acres of northern spotted owl nesting/roosting habitat existed on Federal lands and 3,476,500 acres existed on non-federal lands in 1993, prior to the implementation of the NWFP (Davis et al. 2022, pp. 29, 31). Twenty-five years into the NWFP, Davis and others (2022a, p. 32) reported a gross loss of about 2,953,900 acres of nesting/roosting habitat, representing about 23.7 percent of what was present in 1993. Of the total 2.9 million acres gross loss of nesting/roosting habitat between 1993 and 2017 on all Federal and non-Federal lands in the range of the northern spotted owl, 70 percent (2.1 million acres) were lost to timber harvest (Davis et al. 2022, p. 32). In fact, the majority of all losses (2,055,700 acres, or 61 percent) were due to timber harvest on non-Federal lands (Davis et al. 2022, pp. 31, 32). The majority of nesting/roosting habitat loss on non-Federal lands was attributed to timber harvest (95 percent, or about 1.8 million acres), compared to only about 25 percent (or 257,700 acres) of the habitat loss on Federal lands. Losses of nesting/roosting habitat on federal lands made up approximately 36 percent (1,045,100 acres) of all losses and were mostly due to wildfire (703,700 acres across all Federal lands), and mostly in reserved land allocations (726,200 acres across all causes) (Davis et al. 2022, pp. 29-32).

Substantial recruitment of nesting/roosting habitat occurred between 1993 and 2017 (Davis et al. 2022, pp. 29-32). Across all lands, there was a net 2.1 percent increase in nesting/roosting habitat between 1993 and 2017. Gains were steepest on non-reserved Federal lands, but a small net increase also occurred in Federal reserves. Habitat recruitment on non-Federal lands nearly balanced losses. The largest net gains occurred in the Oregon and California Coast Ranges, with smaller net gains in the California and Oregon Klamath provinces (Davis et al. 2022, p. 32). However, large habitat losses have occurred since 2017, most notably during the 2020 fire season. Annual updates of the rangewide nesting/roosting habitat map are now available (Davis et al. 2023). Gross habitat losses have occurred since 2017 in every province except for the Oregon Coast Range, ranging from 1.3 percent in the Olympic province to 26.5 percent in the California Klamath province, with a total loss of 11.9 percent across the range on Federal lands (Table A-4). These losses obliterated the net gains reported between 1993 and 2017, resulting in net losses of 9.3 percent rangewide since 1993. However, net gains since 1993 persisted in the California and Oregon Coast Range, and on the Olympic Peninsula. These maps do not account for habitat recruitment occurring since 2017, and therefore may overestimate net habitat loss. Regardless of the net effect, gross losses of 11.9 percent in only 6 years from 2017 to 2023 undoubtedly represent an acceleration of habitat loss, as compared with gross losses of 11.8 percent on Federal land over 25 years from 1993 to 2017.

Although the spatial resolution of this rangewide habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, the Service has evaluated the map for use in tracking provincial and rangewide habitat trends and now considers these data as the best available information on the distribution and abundance of extant northern spotted owl habitat within its range. The Service also considers habitat effects that are documented through the section 7 consultation process since 1994. The analytical framework of these 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 northern spotted owl habitat within those land-use allocations. In February 2013, the Service adopted the 2006/07 satellite imagery data on northern spotted owl habitat as the new rangewide habitat baseline for Federal lands, effectively resetting the timeframe for establishing changes in the distribution and abundance of northern spotted owl habitat. These data were refreshed in May of 2017 to reflect the 2012 remotely sensed layer utilized in Davis et al., 2016. We are currently developing new methods for combining consultation information with the rangewide habitat map, but at present, we are continuing to use the 2012 baseline along with our documentation of consulted-on acres of habitat modification that have occurred since 2012. We supplement this with information derived from recently updated habitat maps (see Tables A-4 and A-5 below).

Service's Consultation Database

To update information considered in 2001 (Service 2001), the Service designed the Consultation Effects Tracking System database in 2002, which recorded impacts to northern 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. Due to technological difficulties with the existing consultation database, the Service is currently upgrading to a new tracking database, and thus is only reporting consulted on acres through 2021. Individual consultations will capture additional consulted on acres within the Action Areas from 2022 to present.

Rangewide Consultation Effects: 1994 to August 25, 2022

Between 1994 and August 25, 2022, the Service has consulted on the proposed removal/downgrade of approximately 330,865 acres of federal nesting/roosting habitats (Table A-1) or about 3.6 percent of the 9.09 million acres of northern spotted owl nesting/roosting habitat estimated by Davis et al. (2016, p. 21) to have occurred on Federal lands in 1994. These changes in suitable northern 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).

The Service also tracks habitat changes on non-NWFP lands through consultations including long-term Habitat Conservation Plans, Safe Harbor Agreements, or Tribal Forest Management Plans. Consultations conducted since 1994 have documented the eventual combined reduction of about 525,560 acres of habitat on non-NWFP lands (Table A-1). Most of the losses on non-NWFP lands have yet to be realized because they are part of long-term management plans.

In 2017, the Service updated the nesting /roosting habitat baseline, which consultation impacts are evaluated against, based on the 2012 habitat layer documented in Davis et al. (2016, p. 21). The acre values for the Service's 2012 baseline in Table A-2 varies slightly from the acre values in Davis et al. (2016, p. 21), with the total acre variation being 0.09 percent. Davis et al. (2016, p. 21) rounded to the nearest 100 acres, but this does not explain all the variation. In 2016, the BLM in Oregon changed their land use allocations, and which were applied to produce Table A-2. Therefore, we divided our 2012 base habitat layer using different land use allocations representing reserves and non-reserved lands than those used to produce Davis et al. (2016, p. 21). Also, when raster data (2012 habitat layer) overlaid on polygons (land use allocations representing reserves and non-reserved lands) this process can produce error in the identification of acres. The end result is that our calculation and that in Davis et al. (2016, p. 21) resulted in different physiographic province reserves and non-reserved lands habitat acres. The difference is extremely small and does not detract from the usefulness of the information, especially at the rangewide scale as we use it here. This highlights that this data is to be used at a landscape level and may not be appropriate at the finer local scale. Since 2012, the acres reported as removed/downgraded are summarized by origin and by province (Table A-2).

The Service subsequently modified the database input to account for effects to the habitats that could be used as foraging, but that lack the age or structural characteristics of habitats used for nesting and roosting (NR). This distinction may not be made in all consultations. These data represent effects as reported in individual consultations and likely do not represent the entirety of impacts to foraging habitat within critical habitat since 2012. For many projects, affected foraging likely is captured within the "NR" acres as foraging habitat was lumped into "nesting/roosting/foraging habitat" at the time of consultation. Table A-3 summarizes the acres of foraging habitat removed or downgraded.

More recent data are now available regarding the amount of habitat currently present throughout the range. The most recent NWFP effectiveness monitoring review (Davis et al. 2022, entire) summarizes the amount of habitat present in 2017 and describes changes between 1993 and 2017 due to harvest, wildfire, other natural disturbances, and ingrowth. The NWFP effectiveness monitoring program is now able to provide annual updates to the rangewide habitat map (e.g., Davis et al. 2023), which account for habitat losses but not habitat recruitment. These maps do not provide all information needed to describe the habitat baseline for section 7 consultations. Notably, consulted-on effects are a crucial part of the baseline, whether these effects have already occurred or are anticipated to occur in the future. These maps lack information about habitat removals that have already undergone section 7 consultation but have not yet been carried out. These maps also do not include information regarding the effects of fires or other habitat losses that have occurred since the maps were produced. However, they do provide important context to understand the rangewide habitat baseline, especially because these maps measure effects of fire and already-implemented timber harvest in a repeatable, consistent way, unlike the ad hoc methods described above and reflected in tables A-1 through A-3. Tables A-4 and A-5 display information derived from 2017 and 2023 habitat maps, for Federal and non-Federal lands respectively (Davis et al. 2022, pp. 29, 31; Davis et al. 2023). As the annual habitat updates more accurately account for the habitat impacts due to "Other Habitat Changes" originally tracked in the Consultation Tracking Database, these columns should not be considered when reviewing the reported affects in tables A-1 through A-3.

Table A-1: Range-wide summary of effects to northern spotted owl nesting/roosting habitat[1] (acres) documented through ESA section 7 consultations or technical assistance reports from 2012 to August 2022.

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Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
USFS, BLM, and NPS	330,865	687,106	739,191	169,921
Bureau of Indian Affairs / Tribes	116,446	28,893	3,954	0
Habitat Conservation Plans/Safe Harbor Agreements	340,301	14,545	0	0
Other Federal, State, County, Private Lands	68,813	28,447	3,822	0
Total Changes	**856,425**	**758,991**	**746,967**	**169,921**

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat (NRF). Foraging-only habitat is a separate category that can include more open and fragmented forests and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitats. Impacts to foraging-only habitat are tracked separately.

2. Includes effects documented through ESA section 7 consultations for the period from 1994 to 6/26/2001 (USFWS 2001) and all subsequent effects reported in the USFWS Tracking and Integrated Logging System - Northern Spotted Owl Consultation Effects Database (web application and database).

3. Includes effects to spotted owl nesting/roosting habitat documented through technical assistance reports resulting from wildfires and other natural causes, private timber harvest, and/or land exchanges not associated with ESA section 7 consultations.

Table A-2 (ECOSphere Table B). Summary of northern spotted owl nesting/roosting[1] habitat (acres) removed or downgraded as documented through ESA section 7 consultations on Federal lands. Environmental baseline and summary of effects by state, province, and land use function from 2012 to August 2022.

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State	Physiographic Province[2]	Evaluation Baseline (2012)[3]			Nesting/Roosting Habitat Removed/Downgraded[4]							% Provincial Baseline Affected	% Range-wide Effects
					Land Management Effects			Habitat Loss from Natural Events					
		NR Acres in Reserves	NR Acres in Non-Reserves	Total NR Acres	Reserves[5]	Non-Reserves[6]	Total	Reserves	Non-Reserves	Total	Total NR removed/ downgraded		
WA	Eastern Cascades	554,786	224,876	779,662	2,504	55	2,559	123,967	0	123,967	126,526	16.23	21.37
	Olympic Peninsula	714,555	23,084	737,639	1	0	1	0	0	0	1	0.00	0.00
	Western Cascades	957,314	212,325	1,169,639	15	188	203	4,320	0	4,320	4,523	0.39	0.76
	Western Lowlands	12,964	3	12,967	0	0	0	0	0	0	0	0.00	0.00
OR	Cascades East	206,719	133,080	339,799	1,251	8,808	10,059	3,305	1,981	5,286	15,345	4.52	2.59
	Cascades West	1,425,026	949,045	2,374,071	4,569	11,250	15,819	25,804	78,979	104,783	120,602	5.08	20.37
	Coast Range	468,575	38,898	507,473	2,594	2,177	4,771	0	0	0	4,771	0.94	0.81
	Klamath Mountains	706,840	227,726	934,566	9,462	80,958	90,420	47,891	44,880	92,771	183,191	19.60	30.94
	Willamette Valley	3,688	3,938	7,626	0	0	0	0	28,438	28,438	28,438	372.91	4.80
CA	Cascades	120,067	89,316	209,383	0	174	174	0	0	0	174	0.08	0.03
	Coast	113,857	9,999	123,856	0	0	0	0	3,073	3,073	3,073	2.48	0.52
	Klamath	1,143,050	622,027	1,765,077	387	727	1,114	33,333	70,967	104,300	105,414	5.97	17.80
	Total	6,427,441	2,534,317	8,961,758	20,783	104,337	125,120	238,620	228,318	466,938	592,058	6.61	99.99

Notes:

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat (NRF). Foraging-only habitat is a separate category that can include more open and fragmented forests, and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitat. Impacts to foraging-only habitat are tracked separately.

2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.

3. Spotted owl nesting/roosting (NR) habitat on Federal lands (includes USFS, BLM, NPS, DoD, USFWS) based on GIS data developed for the Northwest Forest Plan 20-year monitoring report for northern spotted owl habitat as reported by Davis et al. 2016 (PNW-GTR-929). Nesting/roosting habitat acres are approximate values based on 2012 satellite imagery. Values reported here may vary slightly from values reported in PNW-GTR-929.

4. Estimated nesting/roosting habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.

5. Reserve land use allocations intended to provide spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).

6. Non-reserve lands intended to provide spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Table A-3 (ECOSphere Table B2). Summary of northern spotted owl foraging habitat[1] (acres) removed or downgraded as documented through ESA section 7 consultations on Federal lands. Summary of effects by state, province, and land use function from 2012 to August 2022.

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State	Physiographic Province[2]	Foraging Habitat Removed/Downgraded[3]						
		Land Management Effects			Habitat Loss from Natural Events			Total Foraging Habitat removed/ downgraded
		Reserves[4]	Non-Reserves[5]	Total	Reserves	Non-Reserves	Total	
WA	Eastern Cascades	0	0	0	0	0	0	0
	Olympic Peninsula	0	0	0	0	0	0	0
	Western Cascades	0	10	10	0	0	0	10
	Western Lowlands	0	0	0	0	0	0	0
OR	Cascades East	124	2,738	2,862	0	124	124	2,986
	Cascades West	263	1,746	2,009	0	0	0	2,009
	Coast Range	24	2,050	2,074	0	0	0	2,074
	Klamath Mountains	242	6,867	7,109	0	0	0	7,109
	Willamette Valley	0	0	0	0	0	0	0
CA	Cascades	571	248	819	0	0	0	819
	Coast	0	1	1	0	8,036	8,036	8,037
	Klamath	1,454	655	2,109	15,521	16,122	31,643	33,752
	Total	2,678	14,315	16,993	15,521	24,282	39,803	56,796

Notes:

Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging habitat. Nesting/roosting habitat supports all life-history functions for northern spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat (NRF). Foraging-only habitat is a separate category that can include more open and fragmented forests and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitat. Impacts to foraging-only habitat are tracked separately.

Defined in the Revised Recovery Plan for the Northern Spotted Owl (Service 2011) as Recovery Units as depicted on page A-3.

Northern spotted owl nesting/roosting (NR) habitat on Federal lands (includes USFS, BLM, NPS, DoD, Service) based on GIS data developed for the Northwest Forest Plan 20-year monitoring report for northern spotted owl habitat as reported by Davis et al. 2016 (PNW-GTR-929). Nesting/roosting habitat acres are approximate values based on 2012 satellite imagery. Values reported here may vary slightly from values reported in PNW-GTR-929. Estimated nesting/roosting habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.

Reserve land use allocations intended to provide northern spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other

Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).

Non-reserve lands intended to provide northern spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Table A-4. Changes in northern spotted owl nesting/roosting habitat over time, federal lands

	Nesting/roosting forest area estimates from bookend maps			Explanation for losses, 1993-2017[2]						Total Changes Over Time			
State and physiographic province	**1993**	**2017[3]**	**2023[4]**	**Harvest**	**Wildfire**	**Insect**	**Other**	**Total explained loss. 1993-2017**	**Estimated habitat ingrowth 1993-2017[5]**	**Net area changes 1993-2017**	**Estimated area change 2017-2023**	**Net percent change 1993-2017**	**Estimated percent change 2017-2023**
	Thousand acres											*Percent*	
Washington:													
Olympic Peninsula	719.0	732.3	722.3	3.6	3.4	0.3	6.7	14.1	27.4	13.3	-9.5	1.9	-1.3
Western Lowlands	12.3	10.9	10.2	1.8	0.0	0.0	0.0	1.8	0.4	-1.4	-0.7	-11.1	-6.4
Western Cascades	1,382.4	1,380.2	1,346.9	14.9	5.8	1.8	10.2	32.7	30.5	-2.2	-33.3	-0.2	-2.4
Eastern Cascades	730.4	673.5	542.6	31.3	75.2	22.7	7.4	136.7	79.8	-56.9	-130.9	-7.8	-19.4
Total	*2,844.1*	*2,797.0*	*2,622.5*	*51.6*	*84.4*	*24.9*	*24.2*	*185.2*	*138.1*	*-47.1*	*-174.5*	*-1.7*	*-6.2*
Oregon:													
Coast Range	413.6	559.4	561.7	22.9	0.2	0.0	0.1	23.3	169.1	145.8	2.3	35.3	0.4
Willamette Valley	6.2	8.8	8.7	0.5	0.0	0.0	0.0	0.5	3.1	2.6	-0.1	42.0	-1.3
Western Cascades	2,251.2	2,333.7	2,042.7	68.5	68.0	2.1	3.3	141.8	224.3	82.5	-291.0	3.7	-12.5
Klamath	1,087.6	1,121.6	993.5	40.3	178.6	0.3	1.4	220.6	254.6	34.0	-128.1	3.1	-11.4
Eastern Cascades	283.9	288.9	269.8	19.6	20.0	2.7	1.0	43.4	48.4	5.0	-19.1	1.7	-6.6
Total	*4,042.5*	*4,312.3*	*3,876.5*	*151.9*	*266.8*	*5.1*	*5.8*	*429.6*	*699.4*	*269.8*	*-435.8*	*6.7*	*-10.1*
California:													

[2] Explanations for losses are not available for 2023 habitat estimates.
[3] All 1993 and 2017 figures from Davis et al. 2022, Table A1, except as noted.
[4] All 2023 figures calculated from Davis et al. 2023. These figures do not account for habitat recruitment since 2017.
[5] Calculated by subtracting 1993 bookend estimate from the sum of the 2017 bookend estimate and the total explained loss.

	Nesting/roosting forest area estimates from bookend maps			Explanation for losses, 1993-2017[2]						Total Changes Over Time			
State and physiographic province	1993	2017[3]	2023[4]	Harvest	Wildfire	Insect	Other	Total explained loss. 1993-2017	Estimated habitat ingrowth 1993-2017[5]	Net area changes 1993-2017	Estimated area change 2017-2023	Net percent change 1993-2017	Estimated percent change 2017-2023
Coast Range	106.8	128.5	125.8	2.6	7.7	0.0	0.3	10.6	32.3	21.7	-2.7	20.3	-2.1
Klamath	1,722.9	1,727.2	1,269.7	40.6	329.3	7.5	14.9	392.4	396.7	4.3	-457.5	0.2	-26.5
Cascades	174.2	190.7	169.7	11.0	15.5	0.8	0.1	27.4	43.9	16.5	-21.0	9.4	-11.0
Total	*2,003.9*	*2,046.4*	*1,565.2*	*54.2*	*352.5*	*8.3*	*15.3*	*430.3*	*472.8*	*42.4*	*-481.2*	*2.1*	*-23.5*
NWFP total	**8,890.5**	**9,155.7**	**8,064.2**	**257.7**	**703.7**	**38.3**	**45.3**	**1,045.1**	**1,310.3**	**265.1**	**-1,091.5**	**3.0**	**-11.9**

Table A-5. Changes in northern spotted owl nesting/roosting habitat over time, non-federal lands.

	Nesting/roosting forest area estimates from bookend maps			Explanation for losses, 1993-2017[1]						Total Changes Over Time			
State and physiographic province	**1993**	**2017[2]**	**2023[3]**	**Harvest**	**Wildfire**	**Insect**	**Other**	**Total explained loss. 1993-2017**	**Estimated habitat ingrowth 1993-2017[4]**	**Net area changes 1993-2017**	**Estimated area change 2017-2023**	**Net percent change 1993-2017**	**Estimated percent change 2017-2023**
	Thousand acres											*Percent*	
Washington:													
Olympic Peninsula	151.7	137.7	126.3	74.2	0	0.5	0.1	74.8	60.8	-14.0	-11.4	-9.2	-8.3
Western Lowlands	222.4	135	120.7	152.8	0	0.3	0	153.1	65.7	-87.4	-14.3	-39.3	-10.6
Western Cascades	407.2	272.8	257.0	164.5	0.4	0.3	0	165.2	30.8	-134.4	-15.8	-33.0	-5.8
Eastern Cascades	285.7	219.2	195.5	122.9	13.9	5.5	0.1	142.4	75.9	-66.5	-23.7	-23.3	-10.8
Total	*1,067.0*	*764.7*	*699.5*	*514.4*	*14.4*	*6.5*	*0.2*	*535.5*	*233.2*	*-302.3*	*-65.2*	*-28.3*	*-8.5*
Oregon:													
Coast Range	277.9	325.2	277.7	264.8	0.3	0.4	0	265.5	312.8	47.3	-47.5	17.0	-14.61
Willamette Valley	82.7	76.8	66.8	48.8	0	0.1	0	48.9	43.0	-5.9	-10.0	-7.1	-13.0
Western Cascades	448.7	295.4	205.1	339.4	2.2	0.5	0	342.1	188.8	-153.3	-90.3	-34.2	-30.6
Klamath	340.3	365	312.6	188.7	13.7	0.4	0.1	202.9	227.6	24.7	-52.4	7.3	-14.4
Eastern Cascades	98.4	68.9	54.3	46.9	9.5	0.7	0.1	57.2	27.7	-29.5	-14.6	-30.0	-21.2
Total	*1,248.0*	*1,131.2*	*916.5*	*888.6*	*25.6*	*2*	*0.3*	*916.5*	*799.7*	*-116.8*	*-214.7*	*-9.4*	*-19.0*
California:													
Coast Range	681.6	1050.6	1023.5	232	9	0.1	0	241.1	610.1	369.0	-27.1	54.1	-2.6

[1] Explanations for losses are not available for 2023 habitat estimates.
[2] All 1993 and 2017 figures from Davis et al. 2022, Table A3, except as noted.
[3] All 2022 figures calculated from Davis et al. 2023. These figures do not account for habitat recruitment since 2017.
[4] Calculated by subtracting 1993 bookend estimate from the sum of the 2017 bookend estimate and the total explained loss.

	Nesting/roosting forest area estimates from bookend maps			Explanation for losses, 1993-2017[1]						Total Changes Over Time			
State and physiographic province	**1993**	**2017[2]**	**2023[3]**	**Harvest**	**Wildfire**	**Insect**	**Other**	**Total explained loss. 1993-2017**	**Estimated habitat ingrowth 1993-2017[4]**	**Net area changes 1993-2017**	**Estimated area change 2017-2023**	**Net percent change 1993-2017**	**Estimated percent change 2017-2023**
Klamath	315.6	381.6	335.9	87.5	23.3	0.6	0.1	111.5	177.5	66.0	-45.7	20.9	-12.0
Cascades	164.4	143.6	127.6	75.4	9.8	1	0	86.2	65.4	-20.8	-16.0	-12.7	-11.2
Total	*1,161.5*	*1,575.8*	*1,487.0*	*395*	*42*	*1.8*	*0.1*	*438.9*	*853.2*	*414.3*	*-88.8*	*35.7*	*-5.6*
NWFP total	**3,476.5**	**3,471.8**	**3,103.0**	**1,797.9**	**82**	**10.3**	**0.6**	**1,890.8**	**1,886.1**	**-4.7**	**-368.8**	**-0.1**	**-10.6**

Other Past Habitat Trend Assessments

In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of northern spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2 million acre study area, Pierce et al. (2005) estimated there were 816,000 acres of suitable northern spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce et al. (2005) estimated there were less than 2.8 million acres of northern spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56%) occurred on Federal lands, and lesser amounts were present on state and local lands (21%), private lands (22%) and tribal lands (1%). Most of the harvested northern spotted owl habitat was on private (77%) and state-local (15%) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million acre study area, including harvest of 56,400 acres of suitable northern spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce and others (2005) also evaluated suitable habitat levels in 450 northern spotted owl management circles (based on the provincial annual median northern spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for northern spotted owl territories (Pierce et al. 2005).

Moeur et al. 2005 estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. In the greater than 30-inch dbh size class, the net area increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005). The estimates were based on change-detection layers for losses due to harvest and fire and re-measured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of Forest Service land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with northern spotted owl habitat, the significance of these acres to northern spotted owl conservation remains unknown.

Population Trends

There are no estimates of the historical population size and distribution of northern 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 (Service 1989, pp. 2-17).

The current range of the northern 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 (Service 1990a, p. 26114). The range of the northern spotted owl is partitioned into 12 physiographic provinces (Figure A-1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Service 1992a, p. 31). The northern spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

Because the existing survey coverage and effort are insufficient to produce reliable rangewide estimates of population size, demographic data are used to evaluate trends in northern 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, derived from studies initiated as early as 1985, have been analyzed periodically to estimate trends in the populations of the northern spotted owl (Anderson and Burnham 1992; Burnham et al. 1994; Forsman et al. 1996; Anthony et al. 2006; Forsman et al. 2011; Dugger et al. 2016; Franklin et al. 2021).

The most recent meta-analysis (Franklin et al. 2021) found continued declines in virtually all demographic parameters evaluated (Table A-4). Estimates of annual rates of population change, occupancy rates, and realized population change showed continuing declines across the range, and the annual rate of decline has increased in most areas, including southern Oregon and northern California. Populations in all study areas are declining, including those study areas that had been relatively stable in earlier analyses (Franklin et al. 2021, pp. 12-13). Notably, the rate of realized population change for northern spotted owls in demographic study areas in Washington, as well as the Coast Range and Klamath study areas in Oregon, showed declines of 75 percent or more between 1995 and 2017. Other Oregon study areas showed declines of over 60 percent over the same time period. In California, declines ranged from more than 60 percent over the same time period, to 30 percent at Hoopa between 1995 and 2013, to exclude the period when barred owl removal was conducted at Hoopa (Franklin et al. 2021, p. 13). These findings indicate that these populations are declining over time and the rate of decline is increasing. The probability of occupancy has declined in all three states over the past two decades (Franklin et al. 2021, p. 17). The lowest recent occupancy rates were observed in Washington study areas, as well as the Coast Range and Tyee study areas in Oregon, where 2017 occupancy rates were below 25 percent. The other Oregon study areas had 2017 occupancy rates of approximately 25 percent. In California, 2017 occupancy rates were between 25 and 50 percent; 2017 data were not given for Hoopa, which was between 50 and 75 percent occupied in 2013.

Current estimates of the rangewide northern spotted owl population are not available. Two methods of estimating populations have previously been described - records of known sites and population modeling. There is no central database containing all known site information, but the number of known sites was documented in 1995 in a Federal Register notice (Service 1995, p. 9495). Population modeling was conducted for the 2012 critical habitat designation, and further research has been conducted using the same population modeling framework. We can also combine each of these methods of population estimation with information from the most recent demographic meta-analysis to update these earlier estimates.

As of July 1, 1994, there were 5,431 known site-centers of northern spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites

(31 percent) in California (Service 1995, p. 9495). The actual number of currently occupied northern spotted owl locations across the range is unknown because many areas remain unsurveyed (Service 2011b, p. A-2). In addition, many historical sites are no longer occupied because northern spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The totals above represent the cumulative number of locations recorded in the three states, not population estimates. Even in 1994, it is not likely that all known sites were occupied simultaneously. Furthermore, the number of northern spotted owls associated with each site is likely to vary from year to year, and some northern spotted owls ("floaters") are not associated with a site.

Estimated populations were modeled during the 2012 critical habitat designation which projected a steady-state rangewide population size of roughly 3,000 female northern spotted owls. Note that this steady-state population estimate was not meant to be a measure of actual population size, but rather an estimate of landscape capacity, given the amount of suitable habitat (modelled based on 2006 satellite imagery) and competition with barred owls. Steady-state population estimates varied regionally from low in the north, especially the northwest (e.g., far fewer than 100 female northern spotted owls in the North Coast Olympics and West Cascades North modeling regions), to high in parts of southern Oregon and northern California (e.g., between around 400 and 750 females 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 does not reflect the effects of habitat loss since 2006, or of increasing encounter rates with barred owls in the southern portion of the range.

Additionally, the actual number of currently occupied northern spotted owl locations across the range is unknown because many areas remain un-surveyed (Service 2011a, p. A-2) and many historical sites are no longer occupied because northern spotted owls have been displaced by barred owls, timber harvest, or severe fires. However, displaced northern spotted owls may survive in new territories or as floaters, and so may still be present in the population. Other factors such as impacts of anticoagulant rodenticides have likely negatively affected localized northern spotted owl populations (Gabriel et al. 2018, p. 6). Another unmeasured factor might include the possibility that some new sites have been established due to reduced timber harvest on Federal lands since 1994. At 10 long-term study areas where local northern spotted owl populations have been tracked since 1995 or before, without barred owl management, the average annual rate of population change from 1995 through 2017 was -5.3 percent (Franklin et al. 2021, p. 13). This rate of decline has not been consistent throughout the entire 22-year period, but rather, it was shallower in the earlier years and has become steeper in recent years. In 2016, the annual rate of change for 1985 through 2013 was estimated to be -3.8 percent, and in 2011, the annual rate of change for 1990 through 2006 was estimated to be -2.9 percent (Dugger et al. 2016, p. 70; Forsman et al. 2011, p. 65).

If we simplistically assume that all 5,431 sites known in 1994 were occupied in 1995, and that site occupancy has decreased proportionally to the rate of population change, we expect that approximately 1,318 (calculated as 5,432*0.947^26) of these sites would remain occupied in 2021. More realistically, it is likely that some of these sites were unoccupied in 1995, but also that some number of other sites were occupied in 1995 but remained unknown due to lack of survey. Furthermore, the rate of decline in site occupancy may have outpaced the decline in the population, as barred owls have displaced northern spotted owls, increasing the proportion of floaters in the population. Because these realistic considerations include some sources of overestimation and other sources of underestimation, all of unknown magnitude, it is not clear whether this might be an overestimate or an underestimate of the number of currently occupied sites.

Similarly, if we simplistically assume that 3,074 females were present in the rangewide population in 2006, as estimated for the steady-state population in the critical habitat modeling exercise, and that the number of females has declined by 5.3 percent per year since then, we expect that 1,358 (calculated as 3,074*0.947^15) females would be present in the 2021 rangewide population. More realistically, it is not clear how well the steady-state population estimates approximated the actual 2006 northern spotted owl population, and the rate of population change between 2006 and 2021 has likely been steeper than -5.3.

Based on both of these adjustments to earlier estimates of the number of sites and females in the population, we hypothesize that there are likely 3,000 or fewer individuals present in the rangewide population as of 2021.

Table A-4. Summary of most recent northern spotted owl population trends from in demographic study areas in Washington, Oregon, and California 1985-2017 (Derived from Franklin et al. 2021, pp. 10-18).

Study Area	Apparent Survival	Territory Colonization	Territory Extirpation	Occupancy Rates	Population Trend	Mean Lambda[a]	% 1995 Pop Size in 2017
Washington							
CLE	Declining	Declining	Increasing	Declining	Declining	0.91	<20%
RAI	Declining	Declining	Increasing	Declining	Declining	0.94	25%
OLY	Declining	Declining	Increasing	Declining	Declining	0.91	<20%
Oregon							
COA	Declining	Declining	Increasing	Declining	Declining	0.92	<25%
HJA	Declining	Declining	Increasing	Declining	Declining	0.96	<40%
TYE	Declining	Not significant	Increasing	Declining	Declining	0.96	<40%
KLA	Declining	Declining	Increasing	Declining	Declining	0.93	<25%
CAS	Declining	Declining	Increasing	Declining	Declining	0.96	<40%
California							
NWC	Declining	Not significant	Increasing	Declining	Declining	0.98	50%
HUP[b]	Declining	Not significant	Increasing	Declining	Declining	0.98	70%
GDR	Declining	Not significant	Increasing	Declining	Declining	0.94	<40%

Notes

[a]Approximate estimates from Franklin et al. 2021, pp. 11-12 and Figure 7; lambda estimates not listed by study area.

[b] Trends calculated only through 2012, prior to commencement of barred owl removal

[c] Data used for occupancy modeling in the GDR study area excluded treatment areas after Barred Owl removals began in 2009.

In the northern-most portion of the range in British Columbia, few northern spotted owls are remaining. Chutter et al. (2004, p. v) suggested immediate action was required to improve the likelihood of recovering the northern spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild northern spotted owls (Service 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of northern spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). As of 2016, this program included 17 northern spotted owls, eight of which were born in captivity (British Columbia 2017, p. 1). The program is targeted produce annually up to 20 captive-born owls ready for release back into the wild until the population reaches 200; the first year of release expected to occur in the spring of 2018. The amount of previous interaction between northern spotted owls in Canada and the United States is unknown.

Legal Status

Critical habitat for the northern spotted owl includes approximately 9,373,676 acres in 11 units and 60 subunits in California, Oregon, and Washington (Service 2021b, p. 62641). This acreage resulted from the November 10, 2021, final rule's exclusion of approximately 204,294 acres within the Harvest Land Base for BLM and some tribal lands in Oregon (Service 2021b, entire) from the 2012 critical habitat designation (Service 2012a, entire).

Designation of critical habitat serves to identify those lands that are necessary for the conservation and recovery of the listed species. In this case, the Service's primary objective in designating critical habitat was to identify capable and existing essential northern spotted owl habitat and highlight specific areas where management of the northern spotted owl and its habitat should be given highest priority. The expectation of critical habitat is to ameliorate habitat-based threats. The recovery of the northern 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 (Service 2012a, p. 71879). The conservation role of northern spotted owl critical habitat is to "adequately support the life-history needs of the species to the extent that well-distributed and inter-connected northern spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales" (Service 2012a, p. 71938). The specific conservation roles of the subunits included in the action area are described below in the Environmental Baseline.

Physical or Biological Features and Primary Constituent Elements

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; Service 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" (Service 2012a, p. 71897). The final critical habitat rule states that "for the northern 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" (Service 2012a, p. 71897). The final critical habitat rule for the northern spotted owl provides an in-depth discussion of the PBFs, which may be referenced for further detail (Service 2012a, pp. 71897-71906).

The final rule for critical habitat defines the primary constituent elements (PCEs) as the specific elements of the PBFs that are considered essential to the conservation of the northern spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (Service 2012a, p. 71904). In 2016, the Service returned to the use of statutory reference of PBFs rather than PCEs when evaluating and discussing the availability and function of, as well as the effects to the attributes of critical habitat in the adverse modification analysis (Service and USDC NOAA 2016, p. 2716). References to PCE here are to be consistent with cited critical habitat rule. The PCEs 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 (Service 2012a, p. 71904). Within areas essential for the conservation and recovery of the northern spotted owl, the Service has determined that the PCEs 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;

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 (PCEs 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (Service 2012, pp. 72051-72052).

Some critical habitat subunits may contain all of the PBFs and support multiple life history requirements of the northern 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 PCE 1, forest type. As described in the final rule, PCE 1 always occurs in concert with at least one other PCE (PCE 2, 3, or 4; Service 2012a, p. 72051). Northern spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (Service 2012a, p. 71918).

PBF 1: Forest Types

The primary forest types that support the northern 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 (Service 2012a, p. 72051).

PBF 2: Nesting and Roosting Habitat

Nesting and roosting habitats provide structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. Unlike foraging habitat, structural conditions of nesting roosting habitats do not vary much across the range. The final rule describes characteristics associated with nesting and roosting habitats sufficient 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 (Service 2012a, p. 72051). Nesting and roosting habitats also function as foraging and dispersal habitat (Service 2012a, p. 71884).

PBF 3: Foraging Habitat

Foraging habitat varies across the range, depending upon ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions. Across most of the owl's range, nesting and roosting habitat is also foraging habitat, but in some regions (particularly in the southern portion of the range) northern spotted owls may additionally use other habitat types for foraging as well (differences in foraging habitats between ecological provinces are discussed below).

PBF 4: Dispersal Habitat

Northern 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 (PCE 2 or 3), but which may also be composed of other forest types that occur between larger blocks of northern 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 PCEs are: habitat supporting 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) (Service 2012a, p. 72052).

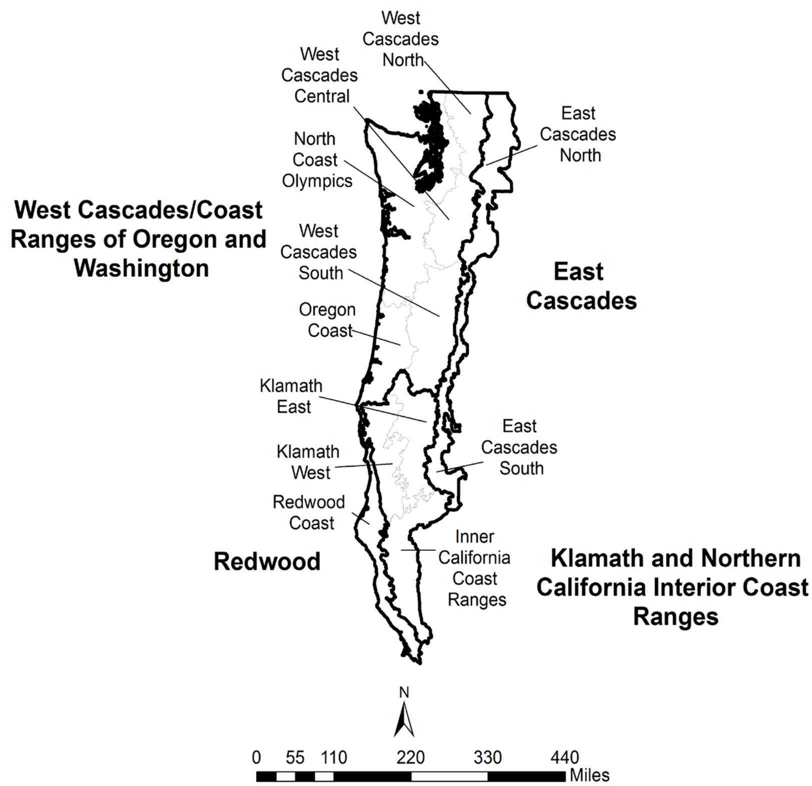
Zones of Habitat Associations used by Northern Spotted Owls

Differences in patterns of habitat associations used by the northern 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 A-3). 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 Service 2012a). These four zones capture the range in variation of some of the PBFs essential to the conservation of the northern spotted owl. 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. 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 northern spotted owl.

West Cascades/ 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; Service 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 northern 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 northern spotted owl's diet.

Figure A-3. Regions and zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.



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 has 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 (Service 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 northern 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 (Service 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 northern 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., Garm et al. 2010, pp. 2048–2050; Loehle et al. 2011, pp. 25–28).

Relative to other portions of the northern 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 northern 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 (Service 2011b, p. C–13). This region in southwestern Oregon and northwestern California is 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. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The eastern portions of this zone have a Mediterranean climate with increased occurrence of ponderosa pine. Douglas-fir/dwarf mistletoe is rarely used for nesting platforms in the western part of the northern spotted owl's range but is commonly used in the east.

The prey base for northern spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Northern 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 northern spotted owl habitat use in the eastern portion and the California Interior Coast Range portion of the 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 (Service 2011b, Appendix C).

Redwood Zone

This zone is confined to the northern California coast, and is represented by the Redwood Coast region (Service 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 northern 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 northern 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 northern 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 Northern 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 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. (See expanded discussion in environmental baseline section above).

Climate change will present unique challenges to the future of northern spotted owl populations and their habitats. Northern spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin et al. 2000, entire; Glenn et al. 2010, entire; Glenn et al. 2011a, 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 Northern Spotted Owl Revised Recovery Plan* provides a detailed discussion of the possible environmental impacts to the habitat of the northern spotted owl from the projected effects of climate change (Service 2011b, pp. III-5 to III-11).

Because both northern 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 northern spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for northern spotted owl conservation.

Current Condition of Range-Wide 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 (Service and NMFS 1998, pg. 4-19). The rangewide condition was “reset” as of December 4, 2012, after the 2012 critical habitat revision. While the quantitative assessment of recent large fires and the 2021 critical habitat exclusions have not been updated in the database, this issue is currently being addressed and updated numbers for the action area should be available for the biological Opinion. Also, the 2021 final critical habitat rule considered the effects of both exclusions and the 2020 (but not 2021) wildfires and concluded that “Although some subunits have experienced a partial and/or temporary reduction in connectivity in places, overall, the critical habitat units and the range wide network designated in 2012 will continue to provide demographic support and connectivity for the northern spotted owl as intended” (Service 2021b, p. 62619). Tables A-7 and A-8 are included below as the last available information for tracking effects within critical habitat; however, these should be used cautiously as they will include effects to acres that are no longer designated as critical habitat.

The tracking database allows for inputs to account for effects to the habitats that could be used as foraging, but that lack the age or structural characteristics of habitats used for nesting and roosting. This distinction may not be made in all consultations. These data represent effects as reported in individual consultations and likely do not represent the entirety of impacts to foraging habitat within critical habitat since 2012. For many projects, affected foraging likely is captured within the NR acres as foraging habitat was lumped into “nesting/roosting/foraging habitat” at the time of consultation. Trends to date show that habitat reductions are disproportionally affecting reserved lands, the California Coast, and the Oregon and California Klamath Provinces (Table A-8).

Table A-7. Northern Spotted Owl Take/Effect Reports Table D - Designated northern spotted owl critical habitat. Summary of northern spotted owl nesting/roosting[1] habitat (acres) removed or downgraded as documented through ESA section 7 consultations. Summary of effects by state, province, and land use function from 2012 to December 2021.

Physiographic Province[2]		Evaluation Baseline		Nesting/Roosting Habitat Removed/Downgraded[5]							% Provincial Baseline Affected	% Range-wide Effects
				Land Management Effects			Habitat Loss from Natural Events					
		Total Designated Critical Habitat Acres[3]	Nesting/ Roosting Acres[4]	Reserves[6]	Non-Reserves[7]	Total	Reserves	Non-Reserves	Total	Total NR Acres Removed		
WA	Eastern Cascades	1,022,960	467,221	1,552	55	1,607	3,895	0	3,895	5,502	1.18	15.03
	Olympic Peninsula	507,165	211,373	1	0	1	0	0	0	1	0.00	0.00
	Western Cascades	1,387,567	606,093	15	185	200	0	0	0	200	0.03	0.55
OR	Cascades East	529,652	187,798	893	4,618	5,511	1,003	195	1,198	6,709	3.57	18.33
	Cascades West	1,965,407	1,255,027	1,830	4,230	6,060	662	617	1,279	7,339	0.58	20.05
	Coast Range	1,151,874	483,846	96	854	950	0	0	0	950	0.20	2.59
	Klamath Mountains	911,681	542,119	2,109	4,068	6,177	2,517	2,727	5,244	11,421	2.11	31.20
CA	Cascades	243,205	97,248	0	114	114	0	0	0	114	0.12	0.31
	Coast	149,044	94,033	0	0	0	0	2,212	2,212	2,212	2.35	6.04
	Klamath	1,708,787	945,505	292	430	722	30	1,411	1,441	2,163	0.23	5.91
	Total	**9,577,342**	**4,890,263**	**6,788**	**14,554**	**21,342**	**8,107**	**7,162**	**15,269**	**36,611**	**0.75**	**100.01**

Notes:

Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging-only habitat. Nesting/roosting habitat supports all life-history functions for northern spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat. Foraging-only habitat is a separate category that can include more open and fragmented forests and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitats. Impacts to foraging-only habitat are tracked separately.

Defined in the Revised Recovery Plan for the Northern Spotted Owl (Service 2011a) as Recovery Units as depicted on page A-3.

Northern spotted owl critical habitat as designated December 4, 2012 (Service 2012a). 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).

Northern spotted owl nesting/roosting (NR) habitat based on GIS data developed for the Northwest Forest Plan 20-year monitoring report by Davis et al. 2016 (PNW-GTR-929). NR habitat acres are approximate values based on 2012 satellite imagery.

Estimated nesting/roosting habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.

Reserve land use allocations intended to provide northern spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).

Non-reserve lands intended to provide northern spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Table A-8: Northern Spotted Owl Take/Effect Reports Table D2 - Designated northern spotted owl critical habitat. Summary of northern spotted owl foraging habitat[1] (acres) removed or downgraded as documented through ESA section 7 consultations. Summary of effects by state, province, and land use function from 2012 to December 2021.

Physiographic Province[2]		Total Designated Critical Habitat Acres[3]	Foraging Habitat Removed/Downgraded[4]						
			Land Management Effects			Habitat Loss from Natural Events			
			Reserves[5]	Non-Reserves[6]	Total	Reserves[5]	Non-Reserves[6]	Total	Total Foraging Habitat removed/ downgraded
WA	Eastern Cascades	1,022,960	0	0	0	0	0	0	0
	Olympic Peninsula	507,165	0	0	0	0	0	0	0
	Western Cascades	1,387,567	0	0	0	0	0	0	0
OR	Cascades East	529,652	0	29	29	0	0	0	29
	Cascades West	1,965,407	263	687	950	0	0	0	950
	Coast Range	1,151,874	12	486	498	0	0	0	498
	Klamath Mountains	911,681	242	1,789	2,031	0	0	0	2,031
CA	Cascades	243,205	98	91	189	0	0	0	189
	Coast	149,044	0	1	1	0	4,688	4,688	4,689
	Klamath	1,708,787	1,449	523	1,972	772	133	905	2,877
	Total	**9,577,342**	**2,064**	**3,606**	**5,670**	**772**	**4,821**	**5,593**	**11,263**

Notes:

Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging-only habitat. Nesting/roosting habitat supports all life-history functions for northern spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat. Foraging-only habitat is a separate category that can include more open and fragmented forests and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to foraging-only habitat. Impacts to nesting/roosting habitat are tracked separately. Environmental baseline information for foraging habitat as a separate habitat category is not available at a provincial scale.

Defined in the Revised Recovery Plan for the Northern Spotted Owl (Service 2011) as Recovery Units as depicted on page A-3.

Northern spotted owl critical habitat as designated December 4, 2012 (Service 2012a). 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).

Estimated foraging-only habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through ESA section 7 consultations or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.

Reserve land use allocations intended to provide northern spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).

Non-reserve lands intended to provide northern spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

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77 FR 71876: Designation of Revised Critical Habitat for the Northern Spotted Owl. Final Rule. Published in the Federal Register on December 4, 2012. 71876-72068.

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80 FR 19259: 90-Day Findings on 10 Petitions. Notice of petition findings and initiation of status reviews. Published in the Federal Register on April 10, 2015. 19259-19263.

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86 FR 62606: Revised Designation of Critical Habitat for the Northern Spotted Owl. Final rule; withdrawal and revision. Published in the Federal Register on November 10, 2021. 62606-62666

87 FR 43886: Barred Owl Management Strategy; Intent to Prepare an Environmental Impact Statement; Washington, Oregon, and California. Notice of availability July 22, 2022.