Saddle Lakes Project

Wildlife and Subsistence Report

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for:

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The greatest impact to wildlife habitat has occurred at the cumulative effects level. Table ES- 1 displays the cumulative reduction in historic habitat for management indicator species (MIS) and R10 sensitive species. Since most of these species are associated with productive old growth habitat (POG), conversion to young growth through even-age silvicultural prescriptions (clearcutting) represents a long-term (150 years or longer) to permanent habitat loss under the current 100 year timber rotation. Under the current Forest Plan scenario, the gradual decline in old-growth habitat from timber harvest and road construction may be considered an irreversible commitment of resources (USDA 2008b p. 3-2). Alaback et al. (2013) state that 100-year timber harvest has the potential to permanently change temperate coastal rainforest disturbance patterns from long-term gap dynamics with 300 to 500 year old dominant trees to more frequent stand replacing disturbance. Loss of habitat capability can reduce wildlife populations which, in turn, can affect subsistence and sport hunter success and/or create gaps in species distribution.

Management Indicator Species

Table ES-1 displays cumulative effects to MIS for the most limiting habitat. Effects for some species would be immediate upon completion of the Saddle Lakes project. Other MIS, such as deer, would be affected initially, then reduced again as regenerating stands transition into the stem exclusion phase. See individual species section for details.

Table ES- 1. Cumulative Reduction in Wildlife Habitat after Implementing Saddle Lakes[1].

Management Indicator Species	Historic Habitat Acres/Density	% reduction Current/ Alt 1	% reduction Alt 2	% reduction Alt 3	% reduction Alt 4	% reduction Alt 5	% reduction Alt 6
WAAs 406 and 407 Combined							
Deer (deep snow winter)	6,131	-35.3%	-36.6%	-35.6%	-37.0%	-37.7%	-37.0%
Wolf (deer density)[2]	20	11.8	11.6	11.7	11.6	11.5	11.6
Wolf (total road density)[3]	0	1.7	1.8	1.7	1.8	1.8	1.8
Black bear (riparian forage)	15,188	-28.4%	-29.7%	-28.9%	-29.7%	-30.1%	-29.7%
Mountain goat	71,880	-21.2%	-22.6%	-21.8%	-22.8%	-23.2%	-22.5%
VCUs 7460, 7470, and 7530 Combined							
Marten (winter)	30,822	-41.1%	-43.8%	-42.1%	-44.2%	-45.1%	-43.8%
Bald eagle	7,047	-33.6%	-33.6%	-33.6%	-33.6%	-33.6%	-33.6%
Brown creeper	25,594	-65.9%	-68.3%	-67.0%	-68.5%	-69.1%	-68.3%
Hairy woodpecker	33,728	-38.0%	-40.6%	-39.0%	-44.4%	-45.3%	-40.6%
Red-breasted sapsucker	16,917	-4.1%	-6.8%	-3.8%	-7.3%	-8.9%	-6.5%
Red squirrel	50,646	-25.6%	-29.3%	-27.2%	-29.7%	-30.8%	-29.2%
River otter	27,884	-31.3%	-33.8%	-32.4%	-34.0%	-34.7%	-33.7%
Vancouver Canada goose	35,357	-0%	-2.5%	-1.4%	-2.7%	-3.5%	-2.6%

Based upon the most limiting habitat for the species at stem exclusion.

1.Shown for either combined WAAs 406/407 or combined VCUs 7460/7470/7530. See individual accounts for specific information.

2. FP S&G = 18 deer/mi^2

3. . FP S&G - 0.7 to 1.0 mi/mi2 total road density may be needed if mortality concerns have been identified.

Threatened, Endangered, and Sensitive Species

Threatened and Endangered Species for the Saddle Lakes project area occur solely within the adjacent marine environment. R10 Sensitive wildlife species use forested or aquatic habitats. Determinations from the Biological Assessment/Biological Evaluation are summarized in ***Error! Not a valid bookmark self-reference.***. As with MIS, impacts to goshawk nesting and foraging habitat would be long-term and irreversible. Current high levels of fragmentation and impacts on nesting habitat (up to 45% reduction from historic levels) could be affecting goshawk use of the area and limiting nesting (see Biological Evaluation). Research in British Columbia suggests that landscapes that should be managed for at least 40 to 50 percent mature and old forest to provide adequate nesting and foraging habitat for Queen Charlotte goshawks (Doyle 2005, NGRT 2008). This research is also cited by the U.S. Fish and Wildlife Service (USFWS) in their Saddle Lakes scoping comments (see project record).

Table ES- 2. Summary of Species Determinations for Saddle Lakes

Federally Listed Species	No Effect	Beneficial Effect	Not Likely to Adversely Affect	May Adversely Affect
Humpback whale	Alt 1		Alts 2-6	
R10 Sensitive Species	**No Impact**	**Beneficial Impact**	**May Impact Individuals[1]**	**Likely to Result in Loss of Viability[2]**
Steller sea lion[3]	Alt 1		Alts 2-6	
Queen Charlotte goshawk	Alt 1		Alts 2-6	
Yellow-billed loon	All Alts.			

1 May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.

2. Likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing.

3. Steller sea lion eastern distinct population segment (DPS) delisted December 4, 2013, but automatically added to R10 Sensitive Species list due to monitoring requirements. Occurrence of Western DPS in the project area is unlikely.

Fragmentation/Connectivity

Fragmentation is the element of biological diversity that describes the natural condition of habitats in terms of old-growth patch size and distribution and the effects of management on these natural conditions. Fragmentation occurs when large blocks of habitat are broken into smaller parcels by natural (e.g., wind throw, landslides, erosion, and avalanches) or human induced (e.g., roads or timber harvest operations) forces.

The natural distribution of POG forest is patchy across the Saddle Lakes landscape, with fragmentation created by muskeg, forested wetlands, and alpine areas. Timber harvest operations, including road-building, add to the level of fragmentation or edge that occurs naturally. Within the Revilla Island/Cleveland Peninsula biogeographic province, relatively high concentrations of past harvest have occurred at a number of areas along Behm Canal, George Inlet, Carroll Inlet, and near Ketchikan on Revillagigedo Island. In many of these areas (including the Saddle Lakes area), biodiversity has been affected due to the intensity of past harvest and the higher reductions in larger tree POG types (USDA 2008c). Providing spatial connectivity may help maintain wildlife populations large enough to prevent negative effects of inbreeding and local extirpations from natural fluctuations and catastrophic environmental events (Marcot 2013).

The following areas were identified within the Saddle Lakes project area where additional harvest could reduce natural connectivity and limit the ability of land-based species to disperse or migrate (see Figure 8 for locations):

1. Landscape Corridor between Medium OGRs and other non-development LUDs (WILD1.VI, p. 4-91). Connectivity currently exists between the medium OGR partially within the north end of the project area and Naha LUD II through the North Revilla Inventoried Roadless Area (#526) in

accordance with Forest Plan landscape connectivity direction (USDA 2008b, WILD1.VI, p. 4-91).

2. The Small OGR in VCU 7470 Corridor. Alternatives 2, 3, 4, and 6 would maintain this OGR in its current location and maintain connectivity between Naha LUDII and the George Inlet salt chuck thereby facilitating dispersal and re-colonization of vacant territories. Alternative 5 would move the OGR into 2001 Roadless, clearcut Units 300-308 and 310-312 thus eliminating this connectivity. Alternative 5 would partial cut Unit 309 within the corridor.

3. North Island Point Corridor. - important elevational corridor halfway down the southern arm of project area. This is the only remaining elevational corridor for miles either direction. Alternatives 2, 3, 4, and 6 would maintain this OGR in its current location and maintain connectivity between Naha LUDII and the George Inlet salt chuck. Alternative 5 would move the OGR into 2001 Roadless, clearcut Units 300-308 and 310-312 thus eliminating this connectivity. Alternative 5 would partial cut Unit 309 within the corridor.

4. North Gunsight Corridor. This corridor would be maintained under all alternatives.

5. North Lemon Lake Corridor. This corridor forms the beginning of the north-south corridor between the medium OGR and the Semi-Remote Recreation LUD. Alternative 3 would maintain this corridor. Alternatives 2, 4, 5, and 6 would remove this corridor by clearcutting Units 8 and 9.

6. North Saddle Lakes-Buckhorn Lake Corridor. This is the main connectivity corridor between the north and south halves of the project area.. Alternative 2 would partial cut (UA33) Units 154 and 48 lowering the quality of this corridor. Alternative 3 would maintain this corridor. Alternative 4 would eliminate this corridor by clearcutting Units 48, 53 and 154; it would also partial cut (UA33) Unit 49. Alternative 5 would eliminate the corridor by clearcutting Units 48, 49, 53, 122, and 154. Alternative 6 would eliminate this corridor by clearcutting Units 48 and 154; it would also partial cut (UA33) Unit 49.

7. North Saddle Lakes to George Inlet Corridor. This important corridor starts north of North Saddle Lakes and follows the ridge west to George Inlet. It forms part of the landscape connectivity from Naha LUD II to the Semi-Remote Recreation LUD south of the project area. Alternative 2 would narrow the northeastern end of this corridor by partial cutting (UA33) Units 28 and thus reduce the quality of this corridor. Alternative 3 would maintain this corridor. Alternatives 4 and 5 would eliminate this corridor by clearcutting Units 28, 31, 40, 71, 113, and 114; it would also partial cut UA33) Unit 30 and the remainder of Unit 71. Alternatives 4 and 5 would further fragment the area by constructing a road to access units 28 and 71. Alternative 6 would eliminate the corridor by clearcutting Units 31, 40, 113, and 114; it would also partial cut (UA33) Unit 30.

8. West Saddle Corridor. This is a short, but high use travel corridor around the west end of North Saddle Lakes. It links corridors 6 and 7 providing landscape connectivity from the medium OGR, Naha LUD II, and the Semi-Remote Recreation LUD. Alternative 2 would maintain Unit 115 closest to North Saddle Lake, but partial cut (UA33) Units 46 and 116 narrowing the width and reducing the functionality of this corridor. Alternative 3 would maintain this corridor. Alternative 4 would eliminate the corridor by clearcutting Units 46 and 116. Alternative 5 would eliminate the corridor by clearcutting Units 46, 115, and 116. Alternative 6 would clearcut a portion Unit 46 narrowing the existing corridor and would partial cutting (UA33) Unit 116.

In addition to the specific corridors listed above, all action alternatives would remove leave strips left by the previous timber sales making it harder for deer to move up and down the slopes in the winter, affecting connectivity for species such as red squirrels and red-backed voles, marten, and isolating habitat for small, less mobile species such as salamanders, gastropods, and arthropods.

Subsistence

The proposed project area is located within Wildlife Analysis Areas 406 and 407. The rural communities most impacted by potential changes to subsistence resources are Metlakatla and Saxman. The direct effects from the alternatives in the Saddle Lakes project do not present a significant possibility of a significant restriction of subsistence uses of deer, black bear, marten, wolf, otter, or other terrestrial wildlife species. The cumulative effects from past, proposed, and foreseeable future projects in the project area, do not present a significant possibility of a significant restriction to subsistence uses of black bear, marten, wolf, otter, or other terrestrial wildlife species other than deer. However, past actions, combined with the proposed action alternatives and foreseeable future projects represent a significant possibility of a significant restriction deer. Regardless of the action alternative, projected hunter demand for deer exceeds 20 percent of the habitat capability in WAA 407 and is between 10-20 percent of the habitat capability in WAA 406 (USDA 2008c, pp. 3-428). As a result, declines in hunter success are likely to continue and restrictions may be necessary in the future. If necessary, sport hunting restrictions would occur first, followed by selective subsistence reductions (ANILCA Section 804).

Table ES- 3. Reduction in Patch Size WAAs 406/407 All Ownerships

Patch Size (in acres)	Historic # of patches	Historic acres	Historic Average size (ac)	Existing # of patches	Existing acres	Existing Average size	Alt 2 # of patches	Alt. 2 acres	Alt. 2 Average size	Alt. 3 # of patches	Alt. 3 acres	Alt. 3 Average size	Alt 4 # of patches	Alt. 4 acres	Alt. 4 Average size	Alt. 5 # of patches	Alt. 5 acres	Alt. 5 Average size	Alt. 6 # of patches	Alt. 6 acres	Alt. 6 Average size
0-39	158	2,245	14	274	3,158	12	279	3,279	12	274	3,155	12	278	3,197	12	275	3,181	12	274	3,151	13
40-249	40	3,401	85	61	5,521	91	60	5,373	90	61	5,484	90	61	5,420	89	60	5,409	90	61	5,457	89
250-499	4	1,175	294	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330
500-999	3	1,963	654	9	7,125	792	9	6,817	757	9	7,026	781	9	6,778	753	9	6,709	745	9	6,778	753
1000+	10	85,993	8,599	10	56,687	5,669	10	55,190	5,519	10	56,002	5,600	10	55,034	5,503	10	54,722	5,472	10	55,296	5,530
total	215	94,776	441	367	76,786	209	371	74,901	202	367	75,962	207	371	74,724	201	367	74,316	202	367	74,977	204

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Introduction

The Forest Service is proposing a timber sale involving road construction and timber harvest in the Saddle Lakes area of Revillagigedo Island. The Proposed Action would harvest an estimated 30.5 million board feet (MMBF) of timber from approximately 2,200 acres of National Forest System (NFS) lands and would construct up to 16 miles of road.

All action alternatives include a partial barrier modification to enhance pink salmon runs in lower Salt Creek. Blasting would be used to produce steps and resting pools. Disturbance would be temporary (i.e. limited to the blasts) and limited to the immediate blasting area. Barrier modification is not expected to have measurable effects on wildlife species or habitat. Therefore, it is not discussed further in this report.

All action alternatives also include a 300 foot wide by 1.1 mile long right-of-way (ROW) easement for the Ketchikan to Shelter Cove State road construction on NFS lands. The ROW would equate to 40 acres of NFS land. Within this 40 acres, about 9 acres of ground disturbance would occur (assuming a 66 foot wide clearing width). In actuality, the Ketchikan to Shelter Cove road will follow the same alignment through NFS lands as NFS road 8300280 proposed under the Saddle Lakes Timber Sale. Approximately 0.3 miles of road could be constructed within the small OGR in VCU 7470 if topography precludes alternate location. New road construction is generally inconsistent with Old-growth Habitat LUD objectives, but new roads may be constructed if no feasible alternative is available (USDA 2008b, TRAN.A, p. 3-61). The ROW and additional construction would have minimal effect on wildlife habitat due to the limited acres involved. Disturbance from construction activities would be temporary in nature. Effects of the additional construction on road density are discussed in the Wolf and Marten MIS Sections. Effects of the Ketchikan to Shelter Cove Road on wildlife from increased public access are disclosed by species under cumulative effects in the MIS and Other Species of Concern analyses later in this section.

This report provides an assessment of the current condition of the analysis area and the potential effects of implementing the proposed action and alternatives on wildlife and subsistence resources. The report focuses on the effects associated with old-growth timber harvest and road construction. Impacts to wildlife come from the interaction of the project with climate, vegetation, and past management actions and activities in the area. These functions are introduced in the Affected Environment Section and analyzed by species in the Environmental Effects Section. Field surveys were conducted in 2007, 2011 and 2012; information is available in the project record.

The analysis in this report tiers to the 2008 Tongass National Forest Land and Resource Management Plan Amendment (Forest Plan) Final Environmental Impact Statement (FEIS) and Appendices (USDA 2008c and 2008d), and incorporates by reference the Annual Monitoring and Evaluation Reports , Ketchikan-Misty Fiords Ranger District (KMRD) Access and Travel Management (ATM) Plan (2008), and the KMRD Outfitter/Guide Management Plan EIS (2012). Additional background and supporting information comes from the 1997 Forest Plan FEIS (USDA 1997a and b), the Shelter Cove EIS (USDA 1991), the Sea Level EIS (USDA 1999), and the Salty EA (USDA 2000). Forest Service direction (FSM 2621) requires that the effects of a proposed action on management indicator species (MIS) be assessed and that Forest Plan requirements, goals, and objectives for these species are met at the project level. Forest Plan direction is to use MIS to evaluate the potential effects of proposed management activities affecting wildlife habitat (USDA 2008b,WILD1.II.E p. 4-89). Habitat must be provided for the number and distribution of reproductive individuals to ensure the continued existence of a species generally throughout its current geographic range.

Project Location and Analysis Areas

The Saddle Lakes project area is located in the center of Revillagigedo Island, between George and Carroll Inlets, 14 miles northeast of Ketchikan, Alaska (see Figure 1). The project area contains approximately 35,000 acres of National Forest System (NFS) lands and 3,500 acres of State or private (non-NFS) lands. Non-NFS lands are owned by Cape Fox Corporation, State of Alaska Department of Natural Resources (ADNR), Alaska Mental Health Trust Authority (AMHT) and other private landowners. Much of the area is roaded due to previous timber harvest.

The Saddle Lakes project area occurs within Game Management Unit (GMU) 1A. GMU 1A encompasses all drainages south of the latitude of Lemesurier Point including all drainages into Behm Canal and excluding all drainages of Ernest Sound. It includes Revillagigedo, Gravina, Annette, and smaller Islands as well as portions of the Cleveland Peninsula and mainland.

The Saddle Lakes project area falls within portions of Wildlife Analysis Areas (WAAs) 406 and 407. A small sliver of WAA 509 is present within the Saddle Lakes project area due to mapping inconsistencies. Saddle Lakes contains portions of three value comparison units (VCUs): 7460, 7470, and 7530. There is a small portion of VCU 7480 within the project boundary. No activities are proposed within WAA 509 or VCU 7480; therefore, I concluded that excluding these small areas would not measurably affect analysis results. WAA 406 and VCUs 7460 and 7530 are bisected by Carroll Inlet.

Spatial and Temporal Context for Effects Analysis

Only National Forest System (NFS) lands were used for direct effects analysis. WAAs 406 and 407 are used to assess direct and indirect effects on deer, wolves, bear, and mountain goat due to their larger home range sizes. WAAs were specifically delineated to encompass areas that are used by larger, wide-ranging wildlife species, especially large mammals that have large home ranges. VCUs are used in this report to address direct and indirect effects on other species with smaller home ranges. See individual species assessments for rationale.

All ownerships were used for cumulative effects analysis in accordance with 40 C.F.R. § 1508.7. WAAs 406 and 407 form the broader landscape boundary of the wildlife effects analysis. Cumulative effects analysis at the WAA scale shows the influence of adjacent lands on overall wildlife habitat capability, and incorporates relevant past and future activities. Cumulative effects for species with smaller home ranges were analyzed at both the VCU scale, to show effects of other ownerships, and at the WAA scale. Wolves will also be analyzed at the Revillagigedo Island/Cleveland Peninsula biogeographic province level to address long-term sustainability. The Saddle Lakes area is not part of the State of Alaska's wolf eradication intensive management proposal, but fall within the same Revilla/Cleveland biogeographic province.

Most wildlife species on the Tongass inhabit old-growth forest or prey on species that inhabit old growth forests (USDA 2008c, p. 3-220). Old growth stands on the Tongass are generally greater than 150 years old (USDA 2008b, p. 3-137, Capp et al. 1992). The greatest variation in stand structure, including multi-storied canopies important to many wildlife species, occurs in stands greater than 200 years old (Alaback 1982). Following complete removal of the overstory, it may take 300 years or more for a stands in Southeast Alaska and Northern coastal British Columbia to develop old growth ecological characteristics (Orians and Schoen 2013, discussion under photo 12).

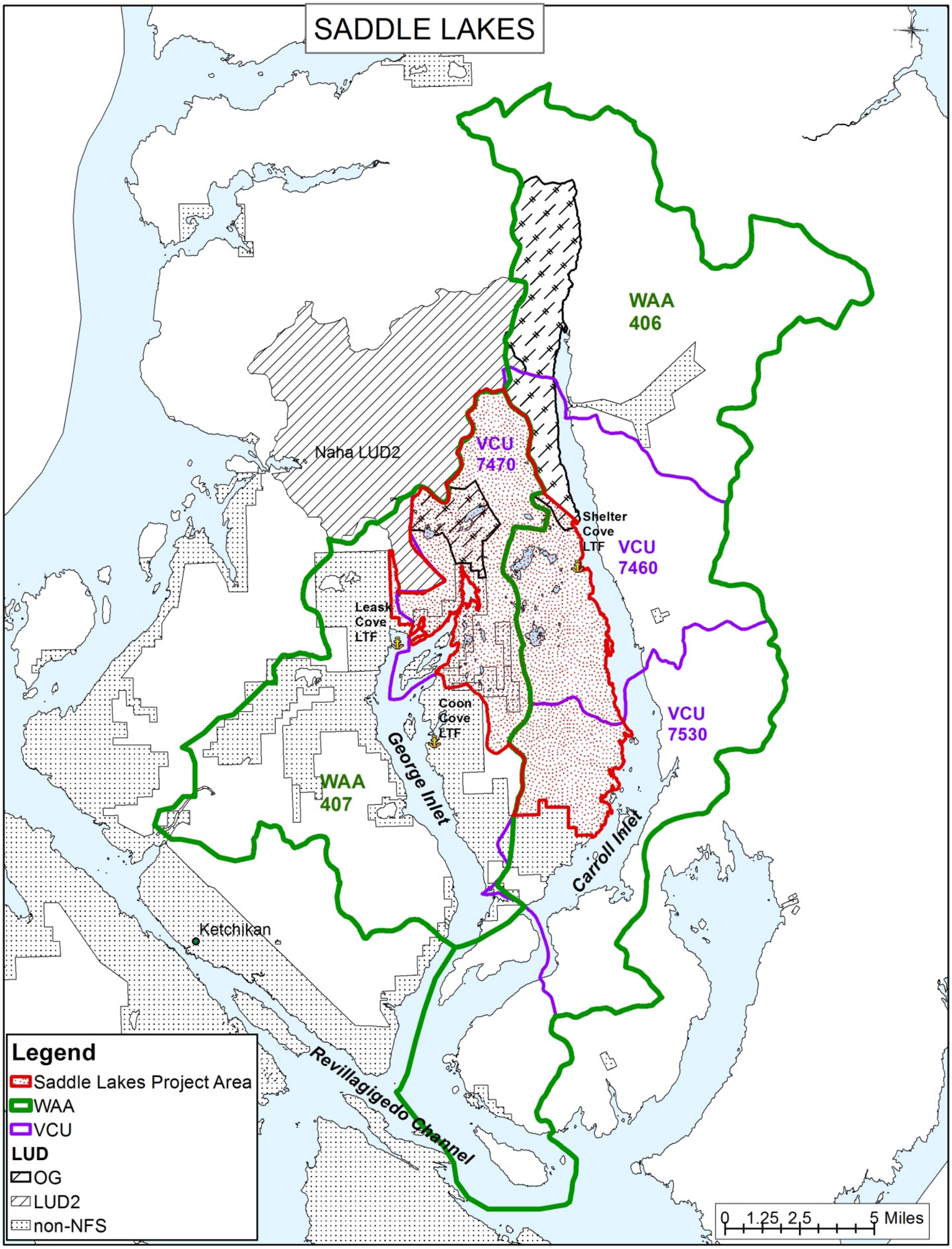


Figure 1. Saddle Lakes Project VCUs and WAAs

Impacts to preferred old-growth habitat occur immediately during project implementation since harvest activities alter stand structure and diversity. Additional short-term changes occur as harvested stands begin to regenerate (stand initiation phase, 0-25 years). Effects continue and intensify long-term as harvested stands enter into the stem exclusion phase (26-150+ years) where dense regeneration tends to shade out all understory habitat. Silvicultural thinning may enhance understory productivity in young growth short term, but no data exists that suggest that silvicultural thinnings or timber rotations less than 200 years will measurably increase either the diversity or productivity of understory vegetation long term over that present in old-growth forests (Alaback 1984, Alaback 2010). Therefore, reductions in POG habitat and resultant effects on many Tongass wildlife species persist for over 200 years and represent a permanent habitat loss.

Under current Forest Plan scenarios, the gradual decline in old-growth habitat from timber harvest and road construction may be considered an irreversible commitment of resources (USDA 2008b p. 3-2) or a non-renewable resource (Cotter 2007). Timber harvest on a 100-year rotation would result in stands being re-harvested before they return to fully functioning old growth condition.

Regulatory Framework

The wildlife resource analysis is guided by applicable laws, acts, executive orders, and memorandums of understanding (MOUs) and as well as Forest Service management direction as detailed in the Forest Plan and applicable manuals and handbooks. Pertinent laws, acts, and Forest Service management direction are listed below.

- The National Environmental Policy Act of 1969, (NEPA) as amended (42 U.S.C. §§ 4321-4347)
- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 C.F.R. §§ 1500-1508)
- Endangered Species Act of 1973 as amended (16 U.S.C. §§ 1531 et seq.)
- Marine Mammal Protection Act of 1972 (16 U.S.C. § 1361 et seq.)
- Regulations Governing the Approach to Humpback Whales in Alaska (50 C.F.R. § 224.103)
- Marine Mammal Viewing Guidelines and Regulations. Internet: http://www.fakr.noaa.gov/protectedresources/mmv/guide.htm
- Bald and Golden Eagle Protection Act of 1940 as amended (16 U.S.C. §§ 668-668d)
- Measures to Avoid Disturbing Nesting Bald Eagles During Timber Operation and Forestry Practices (50 C.F.R. § 22.26). Internet: http://alaska.fws.gov/eaglepermit/guidelines/disturbnestingbaea1.htm
- Alaska National Interest Lands Conservation Act (ANILCA) Public Law 96-487, 94 STAT. 2371; 16 U.S.C. §§ 3101 et seq.
- Fish and Wildlife Conservation Act (16 U.S.C. §§ 2901 et seq.)
- Migratory Bird Treaty Act of 1918 as amended (16 U.S.C. §§ 703 et seq.)
- National Forest System Land and Resource Management Planning, Fish and wildlife resource (36 C.F R. § 219.19 [2000])
- National Forest Management Act (NFMA) (16 U.S.C. §§ 1600 et seq.)
- Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186)
- Hunting Heritage and Wildlife Conservation (Executive Order 13443)
- Forest Service Manual (FSM) 2600 Wildlife, Fish, and Sensitive Plant Habitat Management
- FSM 2670 Threatened, Endangered, and Sensitive Plants and Animals.
- FSM, Region 10 Supplement (R-10 2600-2005-1) Threatened, Endangered, and Sensitive Plants and Animals.

Forest-wide multiple-use goals for wildlife listed in the Forest Plan (USDA 2008b, p. 2-9) are to: 1) Maintain the abundance and distribution of habitats, especially old-growth forests, to sustain viable populations in the planning area and 2) Maintain the abundance and distribution of habitats, especially old-growth forests, to sustain viable populations in the planning area.

The Saddle Lakes project area contains three Forest Plan land use designations (LUDs): Old-growth Habitat, Modified Landscape, and Timber Production. Old-growth Habitat found within the project area include the small Old-growth Reserve (OGR) in VCU 7470, and a sliver of Medium OGR in VCUs 7440 and 7460 (official ID #1311). Forest land within the Old-growth Habitat LUD is classified as unsuitable for timber production, whereas suitable timber is available for harvest in the other two LUDs.

Old-growth Habitat LUD Standards and Guidelines for wildlife (USDA 2008b, p. 3-62):

> Maintain contiguous blocks of old-growth forest habitat in a forest-wide system of old-growth reserves to support viable and well-distributed populations of old-growth associated species and subspecies. A system of large, medium, and small old-growth habitat reserves has been identified and mapped in the Forest Plan as part of a Forest-wide Old-growth Habitat reserve strategy. … During project-level environmental analysis, for projects areas that include or are adjacent to mapped old-growth habitat reserves, the size, spacing, and habitat composition of mapped reserves may be further evaluated. (See Appendix K for mapping criteria.). 1. Adjust reserves not meeting the minimum criteria to meet or exceed the minimum criteria. 2). Reserve location, composition, and size may otherwise also be adjusted. Alternative reserves must provide comparable achievement of the Old-growth Habitat LUD goals and objectives. Determination as to comparability must consider the criteria listed in Appendix K. 3. Adjustments to individual reserves described in 1. and 2. above are not expected to require a significant plan amendment. Adjustments Forest-wide shall be monitored yearly to assess whether a significant plan amendment is warranted on the basis of cumulative changes. ….

Modified Landscape LUD Standards and Guidelines for wildlife (USDA 2008b, p. 3-115 WILD1):

> Use existing inventories and evaluate the need for further project-specific inventories of wildlife habitat conditions during project analysis. Select Management Indicator Species (MIS) appropriate to the project area for project analysis. Consider wildlife habitat needs during project planning and implementation. Use the habitat needs of MIS to evaluate opportunities for, and consequences on, wildlife. In project planning, consider opportunities to allow for the elevational migration of wildlife. Coordinate road management with the needs of wildlife.

The Timber Production LUD Standards and Guidelines for wildlife (USDA 2008b, p. 3-121 WILD1):

> Use existing inventories and evaluate the need for further project-specific inventories of wildlife habitat conditions during project analysis. Select Management Indicator Species (MIS) appropriate to the project area for project analysis. Consider wildlife habitat needs during project planning and implementation. Use the habitat needs of MIS to evaluate opportunities for, and consequences on, wildlife.

Forest-wide Standards and Guidelines for wildlife are found in the Forest Plan (USDA2008b) on pages 4-89 through 4-100 (see individual species accounts for further information).

Available Information

Best Available Science

I spent considerable time locating what information I could using existing district files and databases, standard electronic search engines, electronic journal links, and interlibrary services. Local information from studies conducted within Saddle Lakes or on Revillagigedo Island was sought in all cases, but local studies have not yet been conducted for many of the species or species groups addressed in this report.

The Saddle Lakes project area does not have breeding bird survey (BBS) routes or Christmas bird count information; localized trend information is not available or readily attainable; general trends for Southeast Alaska are included where available. Peer reviewed, published literature from Southeast Alaska is limited for many of the MIS species. Much of the available information for Southeast Alaska is USDA Forest Service general technical reports and monitoring reports, and Alaska Department of Fish and Game (ADF&G) internal publications and harvest reports. For some species, the published literature is decades old, but the only local information available. In other cases, the only local information comes from MS or PhD theses.

Collection of population trend information for MIS and/or habitat relationships specific to the Saddle Lakes project area is cost prohibitive and would require years of data collection to establish trends. 40 C.F.R. § 1502.22(b)(1)-(4) [2009]states:

> If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement: (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

36 C.F.R. § 219.22(a) [2010] states:

> The responsible official must ensure that the best available science is considered in planning. The responsible official, when appropriate, should acknowledge incomplete or unavailable information, scientific uncertainty, and the variability inherent in complex systems.

Since data is lacking, peer reviewed information from other areas was used to support conclusions and correlation with non-peer reviewed publications disclosed. I used information from Alaska first, followed by British Columbia and the Pacific Northwest. Other research was used to document similar findings across a species range. Key reference citations are included throughout this report; many other research publications provided basic information, but seemed less relevant to Saddle Lakes field observations, issues and/or Southeast Alaska.

The Tongass Forest Plan was developed under the 1982 planning rule, which employs the concept of management indicator species. MIS are vertebrate or invertebrate species whose response to land management is thought to predict the response of other species with similar habitat requirements. This concept is no longer supported by the best available scientific information (see National Forest System Land Management Planning 2012). Even though the process of assessing and selecting MIS has evolved, the ability of a species or species group, on its own, to adequately represent all associated species that rely on similar habitat conditions is now largely unsupported in the scientific literature. However, All MIS for the Tongass were selected based on their dependence (direct or indirect; whole or in part) on POG and thus are good choices for measuring effects of timber projects.

Assumptions

This report was prepared based upon presently available information. A new or revised report will be required if: 1) the proposed action is modified in a manner that it causes effects not considered, 2) new information becomes available that reveals that the action may affect endangered, threatened, candidate, proposed or sensitive species in a manner or to an extent not previously considered, or 3) a new species is listed or critical habitat identified.

I used the Size Density Model (SDM) GIS layer to classify wildlife habitat (Table 1). This model has been tested and found to be 70 percent accurate. As a result of field reconnaissance, several inconsistencies in the database were noted, but data is anticipated to fall within the accuracy range and errors are consistent throughout the analysis. To re-create historic conditions (1954) for cumulative effects analysis, harvested stands were assumed to originally be high-POG if on non-hydric soils or medium-POG if on hydric soils. Historic information was generated in GIS using silvicultural data, slope, and soil input.

Likewise, information for non-NFS lands are based upon the best information available, but data is lacking for some areas or activities. As a result, data for non-NFS lands may fall outside the SDM accuracy range. Available non-NFS GIS information was used, with limitations, in cumulative effects analysis. Alaska DNR, Division of Forestry does not track acres harvested by land ownership (Clark 2013). Therefore, recent Alaska Mental Health Trust (AMHT) harvest at Leask Lakes was not available in GIS. I assumed that all harvest was within POG, but the Forest Service does not have specific information on specific POG classifications within harvest units.

Foreseeable future projects have not been entered into corporate GIS layers since most designs have not been finalized. Therefore, they are not included in GIS data results. I used available information from study plans, preliminary proposals, or reconnaissance reports to estimate affected acres, and discuss the information qualitatively under relevant cumulative effects sections.

I found minimal research on the impacts of partial cutting on Tongass wildlife species. Therefore, I took a conservative approach and all tables include total acres of habitat affected by the proposed alternatives. Potential effects of partial cutting are discussed qualitatively in the narratives.

Definitions of open and closed roads used in this report may vary from those used by Engineering since I considered access from a hunting standpoint. For example, some roads have been decommissioned, but still provide hunter and trapper access. All proposed roads constructed for the Saddle Lakes timber sale would be closed to motorized traffic post sale except where alignment overlaps the State of Alaska Ketchikan to Shelter Cove Road.

The terms “impacts” and “effects” are used synonymously (40 C.F.R. §1508.8).

Percentages in this resource report may include decimal places for reference purposes.

Methodology

The Wildlife effects analysis focuses on the impacts of proposed activities on old-growth habitat and the effect of its loss on MIS, other wildlife species of interest, and habitat connectivity. While other habitat components can be important, they are generally not impacted by harvest activities. This quantitative approach incorporates relevant research literature, analyzes the reduction in old-growth habitat, and provides a comparison of alternatives.

The Forest Plan (USDA 2008b, WILD1, pp. 3-115 & 3-121) directs that existing inventories be used during project analysis and the need for further project-specific inventories of wildlife habitat conditions be evaluated. During the project planning process, I assessed wildlife habitat within the entire unit pool and visited representative samples of units and the surrounding area. My analysis is based on past surveys, aerial photo interpretation, existing databases, field reconnaissance by myself, trained wildlife technicians, and other knowledgeable field crews, local knowledge, and interagency input. Field recon focused on walk through surveys and incidental observations, but included vocalized call station protocol to update existing goshawk information. As a result of initial field recon, some potential units were dropped or modified. Browse utilization hedging classes (light, moderate, severe) from Region 4 FSH 2209.21 and the Interagency "Utilization Studies and Residual Measurements" technical reference guide (USDA et al. 1996, p. 46 and Appendix D) were to describe deer use on *Vaccinium*.

Analysis conclusions are based on professional judgment using information provided by forest staff, knowledgeable scientists and ecologists, and relevant references and technical literature citations. Local ADF&G biologists were contacted for information regarding the status of species, habitats, and special habitat features in the Saddle Lakes vicinity.

Limitations of the Analysis

The terms "habitat capability" and "population" are not interchangeable. Habitat capability is synonymous with carrying capacity or the maximum number of animals the habitat can support during a typical year, whereas the population is the number of animals actually present at a given time. Populations may temporarily exceed (e.g., due to a series of mild winters) or be below (e.g., due to predation, winter mortality, or other ecological factors) habitat capability.

When old-growth habitat is harvested, the habitat capability for old-growth associated species declines. If the population is near carrying capacity, the population will also decline. If the population is below carrying capacity, habitat modification through timber harvest may not have immediate effects on the population. However, the potential for the population to recover following a decline (e.g., caused by severe winters, predation, or disease) will usually be reduced where timber harvest has occurred.

As stated above, there is limited information specific to southeast Alaska species and their habitat requirements and interactions. Given the data limitations, actual populations may vary from those predicted by this analysis. However, the procedures provide the best available estimate of general population response to habitat change that is available at the present time.

Overview of Issues Addressed

Internal and external scoping generated resource issues pertinent to the proposed Saddle Lakes Timber Sale. Many commenters were concerned about the cumulative impact on wildlife habitat and species.

Issue Indicators

Issue 3 – Wildlife Habitat and Subsistence Use.
Timber harvest and road construction, combined with past management activities, would affect wildlife habitat and could affect subsistence use.

Issue 3 relates to impacts within the matrix (i.e., areas outside reserves that are subject to timber harvest) for MIS, TES, and other wildlife species of interest and associated Forest Plan Standards and Guidelines. It also relates to the proposed adjustment/relocation of the Old-growth Reserve in VCU 7470 and associated biological components listed in USDA 2008d Appendix D and USDA 2008b Appendix K.

There are various wildlife impact indicators that apply to the selected species. Impact indicator categories include 1) *habitat loss/alteration*: the number of acres of suitable habitats expected to be altered or lost by project implementation and the change from existing and historic habitat levels; 2) *habitat fragmentation*: the number, sizes, and distribution of forest habitat patches expected to be affected (for species that are sensitive to fragmentation); and 3) *road density*: the status and density of roads (for species that are sensitive to roads).

The comparison of alternatives for this issue focuses on the following units of measure:

- Percent reduction from historic and existing acres of habitat by wildlife species (using SDM habitat classifications) at the Value Comparison Unit (VCU), and/or Wildlife Analysis Area (WAA) scale;
- Connectivity / Fragmentation within the project area by alternative (corridor analysis, reduction of POG acres, change in patch size);
- Open and total road density (miles per square mile) at analysis scales specific to wolf and marten;
- Deer model habitat capability and deer density;
- Conservation Strategy Old Growth Reserve goals and objectives (from FP Appendix K and FP FEIS Appendix D); and
- ANILCA 810 analysis: deer abundance and distribution, change in access, and competition between subsistence and sport hunters

Existing Condition

The existing condition for the Saddle Lakes project is comprised of or influenced by topography, climate, the biodiversity of the area, and past management actions.

Topography

The Saddle Lakes project area is located in the central portion of Revillagigedo Island on the western shore of Carroll Inlet. Topography is characterized by high, generally steep mountains interspersed with lowland muskeg and scrub. Elevations range from sea level to over 3,100 feet in elevation. The highest peaks occur in the northern portion of the project area where numerous peaks over 2,000 feet in elevation form the east, west, and north boundary. Peaks on the southern portion of the project area are lower; the dominant ridge running north/south between North Saddle and Buckhorn Lakes rises to 2,300 feet in elevation, but most other peaks are less than 2,000 feet. Proposed units in the Saddle Lakes timber sale are at low elevation; only six units extend above 1,500 feet elevation.

Peaks up to 3,100 feet in elevation are present in WAA 407 west of George Inlet in the Silvis Lakes/Mahoney Lakes area and multiple peaks up to 3,900 feet elevation are present on the east side of Carroll Inlet in WAA 406. Slopes are generally covered with old-growth forest or with regenerating young growth in previously harvested stands. Carroll Inlet coastal areas are comprised of low elevation old-growth timber and regenerating young growth interspersed with numerous muskegs.

High gradient streams drain from steeper mountain slopes into low elevation valleys containing both anadromous and resident fish streams. There are 48 lakes greater than 1 acre within the project area including several large ones: North Saddle Lakes (296 ac), Buckhorn Lake (154 ac), two large unnamed lakes (167 and 125 ac, respectively) and South Saddle Lake (26 ac). Natural and human-induced landslides occur throughout the project area. There are 325 lakes within WAAs 406 and 407; the largest is Swan Lake at 1,445 acres.

Climatic Influence

The warm Japanese current and resulting maritime climate has had a substantial influence upon the landscape ecology. Climate is generally characterized as mild winters with snow, cool summers, and year-round rainfall. Southeast Alaska is located almost directly in the path of easterly-moving storms crossing the Gulf of Alaska, resulting in a variety of wind problems. Wind is a common form of natural disturbance creating openings or gaps in the forest canopy. Direct exposure results in the frequent occurrence of winds in excess of 50 mph during all but the summer months. Wind velocities approaching 100 mph are uncommon but do occur, usually associated with mountainous terrain and narrow passes. Topography and altitude above sea level also have a pronounced influence on the climate of a given area.

Locations that are under the predominant influence of the sea are characterized by relatively small seasonal temperature variability with high humidity. Locations only a few hundred feet above sea level can be significantly warmer than locations at high elevations. The latter generally receives much higher precipitation and temperatures are generally cooler (Alaska Climate Research Center 2013, Western Regional Climate Center 2013). Because of the wet climate, nutrients in the coastal rainforest are quickly leached out of the mineral soil. Many of the nutrients are, and in the vegetation itself (B.C. Ministry of Forests 1999).

The greatest percentage of precipitation occurs in the form of rain with October generally being the wettest month (Figure 2). Snow, or snow mixed with rain, may occur as early as October. The closest long-term weather data is available from the weather stations at the Ketchikan Airport (Western Regional Climate Center) and on Annette Island (Alaska Regional Climate Center). However, winter conditions in the Saddle Lakes area are generally more severe with higher and more persistent snowfall. The average year-round temperature in Ketchikan is 51.6 °F; typical summer temperatures average 60 – 65°F with average winter temperatures ranging from 39 - 44 °F (Western Regional Climate Center 2013).

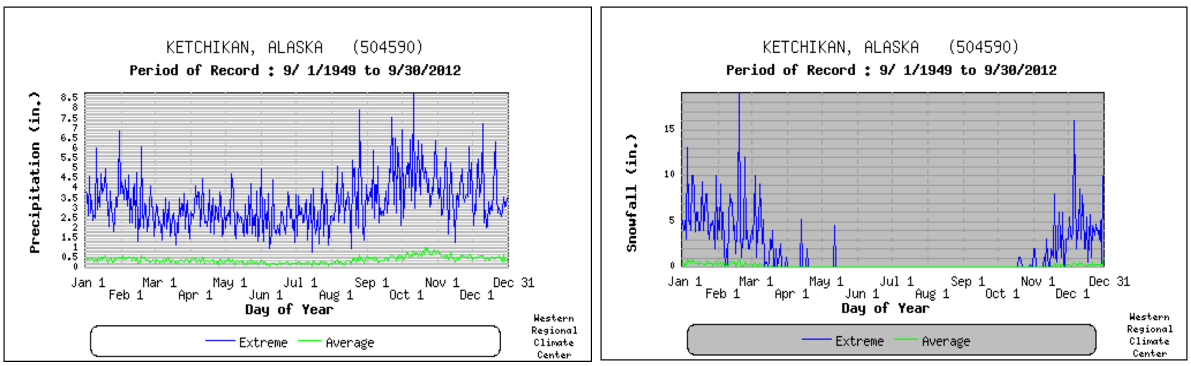


Figure 2. Long-term Average and Extreme Precipitation and Snow Depth, Ketchikan Airport

For example, low elevations around Ketchikan have been relatively snow-free, whereas snow depth at the Shelter Cove log transfer facility (LTF) ranged from several inches to several feet. Based upon long-term yearly averages, Albert and Schoen (2007) classified northern Saddle Lakes as intermediate snow accumulation with low snow in the south and around George Inlet. However, the Tongass snow layer maps the entire area as intermediate snow. Based upon the amount of snowfall documented by KMRD personnel (Figure 3), I believe the intermediate snow classification is more accurate. Specific habitat use within the project area depends upon the severity of the winter and type of habitat.

Figure 3. Snow Levels Above Shelter Cove LTF

Biodiversity

National Forest Management Act (NFMA) regulations define diversity as the distribution and abundance of different plant and animal communities and species within the area covered by a Forest Plan. Under NFMA, the Tongass National Forest must provide for diversity based on the suitability and capability of specific land areas (see Conservation Strategy section above). Biological diversity encompasses the variety of genetic stocks, plant and animal species and subspecies, ecosystems, and the ecological processes through which individual organisms interact with one another and their environments. Biological diversity on an ecosystem or landscape scale can be described in terms of three components: composition (the numbers and types of species, plant communities, and smaller ecosystems within an area), structure (the vertical and horizontal spatial arrangement of communities and ecosystems across a landscape), and function (the interactions and influences between plant and animal species within an area. See USDA (2008c, p. 3-128) for additional discussion. Temperate rainforests are characterized by their high annual rainfall and cool growing season. As a result, species that inhabit temperate rainforests have adapted to a low-energy, nutrient poor environment (Alaback et al. 2013).

Old growth stands on the Tongass are greater than 150 years old (USDA 2008b, p. 3-137, Capp et al. 1992) with old-growth characteristics beginning at approximately 250 years old (USDA 1997a, p. 3-18). The greatest variation in stand structure, including multi-storied canopies important to many wildlife species, occurs in stands greater than 200 years old (Alaback 1982). Banner and LePage (2008) report that understory species richness and cover were statistically higher in old-growth forests than in young growth in Central and Northern Coastal British Columbia. In their study, young-growth forests (41-100 years old) averaged 68 percent similarity of species richness compared to old growth and 56 percent similarity of understory cover. Citing Banner and LePage, Alaback et al. (2013, pp. 83-84)) state that “with commercial rotation lengths of between 80 and 120 years, these forests will not maintain, at either stand or landscape level, the full complement of species characteristic of their old-growth (>250 years) seral and structural stage”.

Old-growth ecosystems [in Northern Coastal British Columbia and Southeast Alaska] are distinguished by uneven-aged stands that contain seedlings, saplings, pole-sized trees, and large diameter dominant trees 300 to 1,000 years old; these stands have broken, multi-layered canopies that allow sunlight to reach the forest floor enabling the growth of diverse and abundant understories (Orians and Schoen 2013, photo 12). In Southeast Alaska, old-growth forests are primarily comprised of western hemlock and Sitka spruce and are distinctively heterogeneous. Snags (standing dead trees) and large woody debris (fallen trees) and arboreal lichens are common. Sporadic, low- to moderate-severity disturbances are an integral part of the internal dynamics of these old-growth forests. Large trees die and fall to the forest floor creating openings that allow light to penetrate to the forest floor and release understory vegetation. These openings give rise to patches of small trees, shrubs, and herbs in the understory (USDA 1997a, p. 3-18).

Old-growth forested habitat on the Tongass is divided into two major classifications: 1) productive old growth (POG) or commercial timber capable of supporting at least 20 cubic feet of industrial wood per acre per year or having greater than 8,000 board feet per acre of standing volume and 2) un-productive old growth (herein NPOG) or areas with at least 10 percent tree cover that otherwise meet old growth definitions, but which generally contain smaller, more open canopy trees that are not capable of producing 20 cubic feet per acre per year. See USDA (2008c p. 3-137) for further discussion of old growth forest classifications.

The biological diversity associated with old-growth forests has long been recognized as important within the Tongass National Forest, and the old-growth forest is the ecosystem most affected by timber management activities on the Tongass. (USDA 2008c, p. 3-137). As old-growth forest is harvested, it transitions through several ecological changes. Rainforests dominated by hemlock or hemlock/spruce have multi-layered dense canopies can intercept as much as 99 percent of the incoming sunlight (Alaback 1982, Tappeiner and Alaback 1989). Within 5 years of being clearcut, plants respond to the unrestricted sunlight producing an abundance of forage that reaches maximum biomass at approximately 12 to 19 post-logging (Alaback 1982). By the time these regenerating stands reach 20 to 30 years, naturally regenerating conifers have become large enough to create interlocking canopies that shade out understory plants. As the canopy becomes denser, these young even-aged conifers almost completely eliminate understory plants creating a "stem exclusion" phase that may last for more than 150 years (Deal and Tappeiner 2002, Person and Brinkman 2013). Young-growth thinning can delay the onset of stem exclusion or temporarily improve low light conditions (Cole 2010, Hanley et al. 2013), but the benefit of thinning is often short lived (Alaback 2010, Cole 2010, McClellan et al. 2014).

Alaback et al. (2013) state that the current management practice of re-harvesting timber within 100 years of the first harvest:

> has the potential to permanently change the disturbance regime of these forests from long-term gap dynamics (with dominant trees persisting an average of 300 to 500 years or more) to more frequent stand replacing disturbance. A key ecological consequence of these short-duration disturbance cycles is the elimination of late-successional habitats. Because large trees never regrow, the legacy of coarse woody debris from previous stands is greatly reduced, degrading habitat for many species associated with these structures.

In general, major landscape disturbance poses an increased risk of local extirpation of resident species, and the greater the disturbance process deviates from natural disturbance processes, the greater the risk, particularly in highly fragmented archipelago ecosystems (Everest et al. 1997, Orians et al. 2013). Everest et al. (1997) further state that numerous factors contribute to population viability including the quality, quantity, and distribution of habitat, and that habitat quality influences susceptibility to severe climate and predation and ultimately determines reproductive success.

In population studies, source habitat is generally considered to be high-quality habitat (based upon local characteristics of forage, vegetation structure, etc.) where births exceed deaths, whereas sink habitat is considered to be low-quality habitat deaths exceed births (Forman 1995). Source and sink dynamics consider the spatial linkage of population dynamics where high-quality habitat provides excess individuals that maintain population densities, through migration, within low-quality habitats (Congdon and Dunham 1997, Wikipedia).

Vegetation

WAAs 406 and 407 contain typical Southeast Alaska coastal rain forest vegetation. Forested areas are primarily old growth with inclusions of past harvest. POG comprised almost half (49%) of the historic (1954) vegetation on NFS lands within WAAs 406 and 407, followed by unproductive old growth (NPOG; 28%), lower elevation non-forested openings or muskegs (18%), high elevation (>2000') non-forested muskeg or alpine habitat (3%), and lastly pre-1954 harvest or natural disturbance (<1%).

POG is comprised of western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), western redcedar (*Thuja plicata*), and Alaska yellow cedar (*Callitropsis nootkatensis*). Pacific silver fir (*Abies amabilis*) is scattered in the project area as a minor stand component. Red alder (*Alnus rubra*) is common along streams and on soils disturbed by past management activities and landslides. Trees range from tiny seedlings to over 50 inches in diameter and snags are common. NPOG is generally found on poorly drained soils or at higher elevations and is generally comprised of shore pine (*Pinus contorta*), western redcedar, Alaska yellow cedar and mountain hemlock (*Tsuga mertensiana*). Blueberry (*Vaccinium spp.*), red huckleberry (*Vaccinium parvifolium*), salmonberry (*Rubus spectabilis*), menziesia (*Menziesia ferruginea*), Devil's club (*Oplopanax horridus*), and salal (*Gaultheria shallon*) are common understory shrubs and range from a few inches to approximately eight feet in height depending upon how heavily they have been browsed. The forest floor is composed of species such as bunchberry (*Cornus canadensis*), five-leaf bramble (*Rubus pedatus*), single delight (*Moneses uniflora*), foamflower (*Tiarella trifoliata*), ferns, and skunk cabbage (*Lysichiton americanum*). Mosses are commonly found on the ground, on fallen logs, on the lower branches of trees, and in forest openings. Sphagnum mosses, sedges (*Carex spp*.), sundew (*Drosera spp*.), Labrador tea (*Rhododendron groenlandicum*), deer cabbage (*Nephrophyllidium crista-galli*), western bog laurel (*Kalmia polifolia*.), blueberries, marsh marigold (*Caltha leptosepala*), and many other species are common in the numerous muskegs. See USDA 2008c (pp. 3-134 thru 3-142) for additional information on project area vegetation. Carstensen (2007) contains detailed discussions of common southeast Alaska terrestrial ecosystems; many of those are similar to what is found within Saddle Lakes and the surrounding area.

A representation of wildlife habitats within Saddle Lakes was generated from the mapping of forest stands using the size-density model (SDM). SDM classifications are described in detail in the Forest Plan FEIS (USDA 2008c, pp. 3-139 through 3-142 and 3-231, Caouette and DeGayner 2008, Krosse and O'Connor 2009). Habitat definitions derived from size density classes are shown in Table 1. Habitat groupings were used to analyze effects (see MIS Section below).

Table 1 SDM Habitat Classifications

Habitat	SDM VegCode
POG	SD4H, SD4N, SD4S, SD5H, SD5N, SD5S, SD67
High-POG	SD5N, SD5S, SD67
Medium-POG	SD4N, SD4S, SD5H
Low-POG	SD4H
Large Tree POG	SD67
NPOG	UF
Forested muskeg	FM
Non-forested	NF
Young (<26 year old) second growth	HS1, HS2, S1, S2
Older second growth (stem exclusion)	HS3, S3

The mosaic of old-growth forest, muskeg, and alpine provides diverse habitat for area wildlife (Figure 4). POG provides important cover and forage habitat for wildlife due to the dense, multistoried canopy, which reduces snow accumulation in the understory during the winter but is open enough to provide understory vegetation during the spring, summer, and fall. The combination of a dense canopy with scattered small openings that is characteristic of POG allows forage to grow under the openings, while the large limbs within the canopy provide thermal insulation and intercept enough snowfall to allow access to forage during the winter. Large dead or defective trees provide denning, nesting, or feeding sites for marten, eagles, squirrels, woodpeckers, sapsuckers, brown creepers, and others. Woody debris provides wildlife habitat and provides micro-sites on which seedlings may grow.

Figure 4. Saddle Lakes Vegetation Mosaic

Low elevation POG (≤800 feet), within the Saddle Lakes project area and near the beach, supports many wildlife species during high snow winters or as year-round habitat. During field reconnaissance, wildlife use of the project area was evidenced by trails, light to moderate hedging on huckleberry and menziesia, and scat. Deer beds were observed under large cedars and on small rises where predators could be easily detected. Wolf and bear scat was observed in openings and along roads. Old-growth forest at intermediate elevations provides transitional range for migratory deer, additional year-round range for resident deer during low snow winters, and year-round habitat for other species. Higher elevation habitat (>1500 feet) provides summer habitat.

Species

Roughly 150 bird species are thought to occur annually on Revillagigedo Island, in the Ketchikan area (Heinl and Piston 2009). Seventy of the 150 regularly occurring species in the Ketchikan area have been confirmed as breeders. Of the migratory bird species of management concern listed in the Forest Plan FEIS (USDA 2008c, p.3-244) or listed in the FWS Region 7 [Alaska] Birds of Conservation Concern (2008), 43 were reported by Heinl and Piston (2009) as occurring in the Ketchikan area. Many use forested habitat; other important habitats include shrub thickets, marshes, cliffs, beach and tidal flats, rocky and shores and reefs, and inshore and offshore waters.

Based on specimen collection records presented in MacDonald and Cook (2007, 2009), 24 mammalian species are known to occur on Revillagigedo Island. Habitats range from POG to muskeg and sedge meadows. Because of the geographic isolation of the islands in the Alexander Archipelago and their possible role as refugia for terrestrial mammals during previous glaciations, the study of mammalian endemism in the Alexander Archipelago continues to attract research attention (ISLES 2009, MacDonald and Cook 2007). Additional endemic small mammal work was completed in 2013 on KMRD as part of the ISLES project including portions of the Saddle Lakes project area. Red squirrel, long-tailed vole, southern red-backed vole, northwestern deermouse, and dusky shrew specimens were collected. Southern red-backed voles (*Clethrionomys gapperi solus*) are the only small endemic mammal specific to Revillagigedo Island which includes the Saddle Lakes project area (MacDonald and Cook 2007, Smith 2005). This species is utilizes POG and is discussed in detail under the Other Species of Interest Section.

The Forest Plan identified 13 species as management indicator species (MIS). MIS and other species of interest (OSI) selected for detailed project analysis and the rationale for their selection are displayed in Table 2. All wildlife management indicator species are associated with productive old-growth forest and are consequently affected by timber harvest. Impacts to their preferred habitat(s) would occur during project implementation since harvest activities in POG alter stand structure and diversity. Specific patch size and structural requirements vary by species (see Past Activities and MIS sections). Effects for many species continue and/or intensify long-term as harvested stands enter into the stem exclusion phase. Brown bear (*Ursus arctos*) do not occur on Revillagigedo Island.

Federally listed threatened and endangered species, candidate species, and Forest Service Alaska Region (R10) sensitive species and their habitats are analyzed in a separate Biological Assessment/Biological Evaluation.

Table 2. Selected Saddle Lakes MIS[1] and Other Species of Interest

Species	Species Class	Basis for Selection, habitat preference	Associated POG Habitat Project Level Indicator/Measurement[1]
Sitka Black-tailed deer (*Odocoileus hemionus sitkensis*)	MIS	Important subsistence and game species; represents variety of habitat at all elevations	Deep snow winter habitat - acres of high-POG ≤800'; average snow winter habitat - acres of POG ≤1500'; summer habitat - all habitats except stem exclusion.
Alexander Archipelago wolf (*Canis lupus ligoni*)	MIS	Population concerns, major predator of deer	Deer Model deer density; Deer/wolf Interactions, fragmentation.
Black bear (*Ursus americanus*)	MIS	Species of local interest; important game species; early (<26 year old) habitat and all types of old growth	Denning habitat - acres of POG. Foraging - POG within 500' of anadromous fish streams and all habitats except stem exclusion.
Mountain goat (*Oreamnos americanus*)	MIS	Important game species;	Acres of POG near cliffs
American marten (*Martes americana)*	MIS	Important furbearer. Represents POG and fragmentation.	Winter - acres of high-POG ≤1500'; year-round - POG; fragmentation
Bald eagle (*Haliaeetus leucocephalus*)	MIS	Represents coastal habitats with large trees	Acres of POG within beach/estuary buffer; disturbance
Brown creeper (*Certhia americana*)	MIS	Snag dependent species affected by edge.	Acres of interior POG
Hairy woodpecker (*Picoides villosus*)	MIS	Snag dependent species representing high volume POG.	Acres of high-POG at all elevations, patch size

Species	Species Class	Basis for Selection, habitat preference	Associated POG Habitat Project Level Indicator/Measurement[1]
Red-breasted sapsucker (*Sphyrapicus ruber*)	MIS	Snag dependent species representing low-medium POG.	Acres of low- and medium-POG at all elevations, patch size
Red squirrel (*Tamiasciurus hudsonicus*)	MIS	Small mammal & key goshawk prey; POG; mature, cone bearing trees provide limited foraging habitat	Acres of POG
River Otter (*Lontra canadensis*)	MIS	Important furbearer; riparian and coastal habitat	Acres of POG within 500' of fish streams and within beach buffers
Vancouver Canada goose (*Branta canadensis fulva*)	MIS	Represents hydric and unproductive old growth; nests in trees	Acres of muskeg, NPOG, and hydric POG (SD4H, SD5H)
Southern red-backed vole (*Myodes gapperi solus)*	OSI	Endemic mammal; important prey species for mammal and avian predators	Acres of POG
Great Blue Heron (*Ardea herodias*)	OSI	FP requirements	Acres of POG within beach/estuary or lake buffers
Forest Raptors	OSI	FP requirements	Acres of POG
Marbled murrelet (*Brachyramphus marmoratus*)	OSI	FP requirement; sensitive to forest management activities	Acres of large tree SD67 POG
Migratory Birds	OSI	MBTA requirements	

1. No brown bear populations occur on Revillagigedo Island. Documented occurrence has been rare and generally limited to infrequent single males.

Relevant Past and Present Actions

I considered the complete list of cumulative actions for the project (see DEIS, Appendix B). Past and proposed projects such as timber harvest, road construction or closure, hydropower transmission line clearing and facility construction or expansion, and land exchanges have a measureable impact on wildlife habitat and are analyzed in the cumulative effects under individual species.

Outfitter-Guide and other recreational activities can disturb and/or displace wildlife in a small localized area but are not quantifiable; impacts from these activities were qualitatively disclosed in the Ketchikan-Misty Fiords Outfitter and Guide EIS (2012). I deemed that other hydropower operations, aquaculture, trail maintenance, mine closures, private residences, private greenhouse operations, and communication site operations did not have a measurable impact on wildlife even though there could be infrequent, temporary disturbance. These projects are not analyzed further.

Timber Harvest and Related Activities

Past timber harvest activities on NFS lands within WAAs 406 and 407 include Long-term sale era timber harvest and units from Shelter Cove EIS (1991), Salty EA (2000), and Sea Level (1999), Upper Carroll EIS (1996), Brand X EA (1997), Mop Point/91 Knot EA (2001), Harriet Hunt Firewood EA (2001), Licking Creek EIS (2003), Boundary EA (2004), Revilla Road Salvage CE (2011), 2012 Ketchikan-Misty Fiords Ranger District Timber Stand Improvement CE, 2013 Cedar Planting CE, 2013 Music wood micro sale (Boundary EA), Spit Point Wildlife Restoration CE (2010). Since the effects to wildlife habitat from timber harvest can extend for 150 to 300 years or longer, loss of old-growth habitat to stem exclusion represents an irreversible commitment of resources (USDA 2008c, p. 3-2). Past harvest is shown in Table 3.

Table 3. Past Commercial Timber Harvest WAAs 406/407, All Ownerships

Harvest Period	Acres Harvested
Pre-1954	291
1954-1963	1,540
1964-1973	4,694
1974-1983	2,652
1984-1993[a]	2,625
1994-2003	5,012
2004-2013[b]	4,743
Unknown date	7,406
TOTAL Harvest	28,964

a. Stands harvested prior to 1987 are assumed to have entered the stem exclusion phase.
b. Includes 3,726 acres of timber harvest at Leask Lakes not in GIS.

Even-aged management via clearcutting has been the dominant (96%) timber management regime since the 1950s (McClellan 2004, Tongass Young Growth Report 2013). Most early stands were clearcut using cable or shovel yarding methods, but helicopter yarding also occurred in more recent years.

Between 1990 and 2012, about 1,094 acres of young-growth were thinned in the project area. See Silviculture Resource Report for more details on precommercial thinning.

Past timber harvest activities on non-NFS lands within WAAs 406 and 407 include historic and recent harvest on Cape Fox Corporation lands (including some young growth harvest in George Inlet) and 3,726 acres of recent harvest activity and associated 25.5 miles of road construction on Alaska Mental Health Trust (AMHT) lands at Leask Lakes. Most of the Leask Lakes parcel is below 800 feet elevation; less than 10 acres were estimated to be above 1,500 feet elevation so harvest affected winter range in WAA 407 and VCU 7470.

Figure 5. AMHT Leask Lakes Timber Harvest

Extensive road systems occur in both WAAs due to previous timber harvest, but most roads can only be accessed via boat or barge. A portion of WAA 407 is accessible from Ketchikan via Revilla and Brown Mountain roads. A portion of Revilla Highway has been upgraded and paved. The White Mountain road system is also connected to Ketchikan, but this road is gated and managed by the Cape Fox Corporation. The remainder of roads in WAA 407, including the Leask Lake roads on AMHT lands, are currently isolated from Ketchikan. All of the roads in WAA 406 are isolated from Ketchikan. Additional NFS road actions include the Ketchikan-Misty Fiords Ranger District Access and Travel Management (ATM) Plan (2008) and associated road closures.

There are two existing log transfer facilities (LTFs) in or near the project area: Shelter Cove and Leask Cove. LTFs must be permitted through the Alaska Department of Environmental Conservation's (DEC) Alaska Pollutant Discharge Elimination System (APDES) General Permit AKG-70-0000. The Permit authorizes discharge of bark and wood debris into the coastal water with stipulations. Shelter Cove is currently under permit, but needs to be reconstructed (see connected actions below). Coon Cove LTF was removed in 2012 and the shoreline restored. It would be up to the purchaser to obtain necessary permits and reconstruct the LTF. The privately owned LTF at Leask Lakes could be accessed with the completion of the Ketchikan to Shelter Cove Road or logs could be trucked directly to Ketchikan. Selection of individual LTFs would depend upon purchaser, agreements and permits in place at the time, export authority, road status, and sale economics.

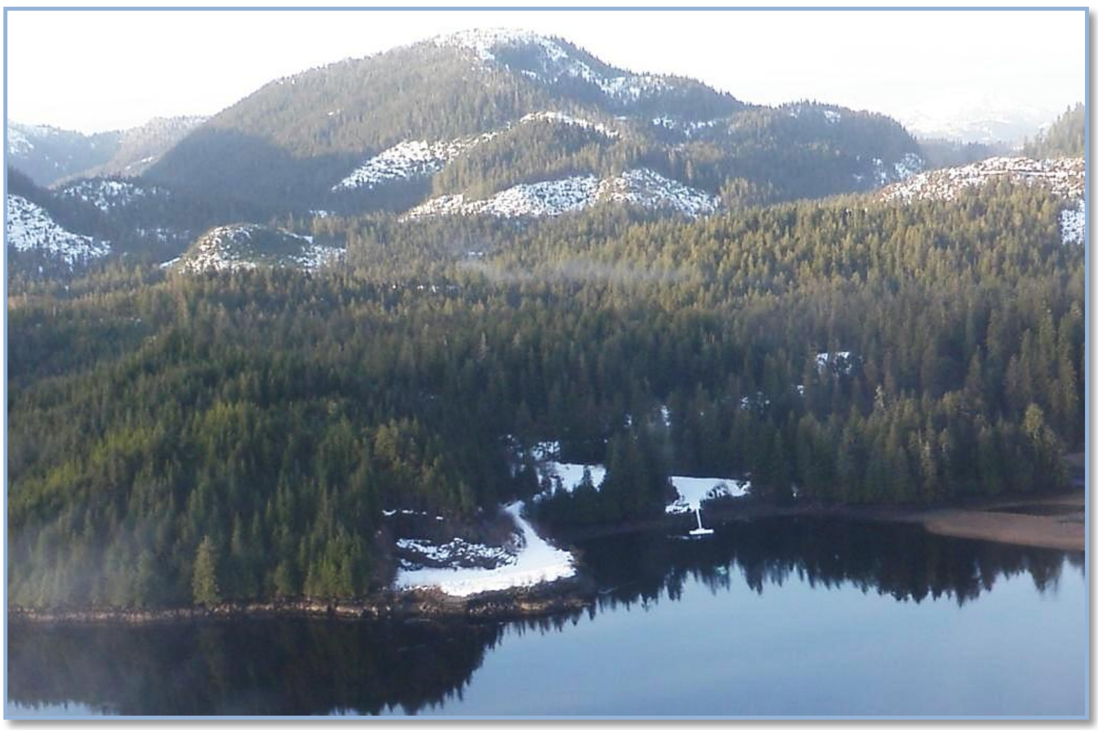


Figure 6. Shelter Cove LTF

Other Activities

The Swan Lake hydropower facility began operation in 1984. It consists of a 174 foot high concrete arch dam. Water passes through a 2,217 foot long, 11 foot diameter tunnel to the powerhouse. The initial dam flooded an estimated 500 acres of existing forest to create a 1,373 surface acre lake. An access road was constructed from Carroll Inlet to the powerhouse facility along with camp and staging areas for the construction (Tetra Tech and McMillen 2013).

The Swan Lake 115 kV transmission line extends 30.5 miles from hydroelectric powerhouse on the east side of Carroll Inlet to the existing S.W. Bailey substation in Ketchikan. The transmission line bisects the medium OGR and project area. Old-growth timber was removed from the transmission line corridor during construction and periodic brushing occurs to keep the line clear. This transmission line has been tracked in corporate GIS activity layers.

The Swan-Tyee 138-kV electric transmission line extends 57 miles north and west from the Swan Lake powerhouse to the Tyee Lake hydroelectric project near Wrangell.

Beaver Falls hydropower plan is owned and operated by Ketchikan Public Utilities (KPU). This project consists of two dams with reservoirs and two powerhouses. Upper and Lower Silvis Lakes are formed behind a concrete-faced rockfill dams which has a separate spillway weir and channel. Tunnels and penstocks connect Upper Silvis Lake to the powerhouse located on Lower Silvis Lake and from Lower Silvis Lake to the Beaver Falls powerhouse located on George Inlet at tidewater. The total capacity is 5,000 kW.

Past and current activities have altered the amount of available old growth habitat for wildlife in project area VCUs and WAAs. Changes (from available GIS information) are shown for NFS lands in Table 4.

Table 4. Historic POG Saddle Lakes VCUs and WAAs, NFS Lands Only.

	Historic NFS Acres VCUs 7460/7470/7530	Current NFS Acres VCUs	% Change	Historic NFS Acres WAA 406/407	Current NFS Acres WAAs	% Change
High-POG ≤800' elev.	18,366	9,904	-46%	26,984	17,193	-36%
High-POG ≤1500' elev.	28,340	17,018	-40%	45,655	32,032	-30%
POG ≤1500' elevation	41,529	30,207	-27%	69,974	56,351	-19%
High-POG	31,213	19,711	-37%	52,033	37,851	-27%
Moderate-POG	11,407	11,407	0%	22,464	22,463	<1%
Low-POG	3,711	3,711	0%	6,613	6,613	0%
POG	46,331	34,829	-18%	81,110	66,928	-17%
Interior POG[1]	23,186	7,960	-66%	36,858	18,824	-49%
Large Tree POG-SD67	unknown	1,927	??	unknown	5,998	
Unproductive Old Growth (UF,F99)	17,500	17,500	0%	46,215	46,215	0%
Forested muskeg	7,995	7,995	0%	17,197	17,197	0%
Non-forested (NF, X99)	3,202	3,202	0%	18,979	18,979	0%
Young (<26 year old) second growth	69	5,719		177	7,486	%
Older (26+ year old) second growth	235	6,088		484	7,357	%

1. Based upon vegetative and climatic edge effect distances for Southeast AK (Concannon 1995)

Relevant Foreseeable Future Activities

Shelter Cove LTF

Connected actions include rebuilding the LTF at Shelter Cove. High winds and storm damage have destroyed the bulkhead at Shelter Cove. Based upon engineering estimates, replacement of the bulkhead would take approximately six to eight weeks and work is expected to occur during the normal timber operating season, May through October. Reconstruction would involve excavating and removing the existing rock and bulkhead. A new log crib would be assembled, geotextile placed, backfilled with rock, and compacted; any unsuitable material would be backhauled away from the marine environment. Rock would be hauled from existing pits if additional material was required. Work would be limited to previously disturbed areas; approximately two acres of marine habitat could be temporarily disturbed.

Ketchikan to Shelter Cove Road

Alaska Department of Transportation and Public Facilities (ADOT&PF) is in the design phase of the Ketchikan to Shelter Cove Road and funding has been secured for construction. This project will connect the currently isolated Shelter Cove road system to the community of Ketchikan via Revilla Road and White River and Leask Lake road systems. Alternative II, (the LOW-LOW route) was chosen as the preferred road location. Road estimates include 6 miles of new road construction, and upgrading 18 miles of existing logging roads. The proposed road would be a 14 foot wide single lane gravel road with turnouts. Ditching and resurfacing of the White River road segment through Cape Fox Corporation lands is scheduled to occur this fall (2013). The existing gate would be moved to the AMHT boundary making the White River Road accessible by the general public. Construction on the six miles of new road is scheduled to occur Fall 2014.

This road connection is expected to expand recreational opportunities for Ketchikan residents and visitors and increase hunting pressure within the project area. For purposes of cumulative effects analysis, I assumed an average 66 foot right-of-way clearing recognizing that it could be wider on steeper slopes and turnouts and narrower on flatter ground and through muskegs. Therefore, the 6 miles of new construction could affect 48 acres of habitat. From preliminary road location, I estimated that roughly 3.5 miles (28 acres) is through young growth, 2 miles (16 acres) is through POG, and 0.5 mile (4 acres) is through NPOG or muskeg. I assumed that no additional clearing would be needed on the 17.6 miles of existing road.

Alaska Mental Health Trust Land Exchange

AMHT has proposed a land exchange with the Forest Service that includes an 8,170 acre Shelter Cove parcel. If approved, the land exchange would affect the small Old Growth Reserve in VCU 7470 by transferring the connectivity corridor linking Naha LUD II through George Inlet Salt Chuck into non-federal ownership/ The parcel also includes over 4,000 acres of POG habitat. The AMHT Trust Land Office (TLO) has recently released a land management plan which states: “TLO’s pursuit of a land exchange with the U.S. Forest Service (USFS), if successful, will provide The Trust with a timber basket that under current conditions can provide a continuous rotation and cycle of timber harvest revenues and opportunities. TLO will be better positioned to fulfill its mandate of maximizing Trust timber assets after the exchange is complete.” (AMHT 2014, Forest Resource Management Plan, pp. 1 and 2). AMHT also states “The public is often unaware that Trust land is not managed for public use, but managed for the best interest of The Trust and its beneficiaries. Limiting parcel development opportunities from the full market potential is inconsistent with AS 38.05.801 and 11 AAC 99” (AMHT 2014, Land Resource Management Plan, p. 3). Therefore, timber would be harvested using the most appropriate cost beneficial and highest revenue generating method and prescription. AMHT has a goal of re-harvesting timber on a 70 year rotation schedule. This rotation would preclude stands from returning to an old growth condition.

US Coast Guard Shoal Cove Loran Station Decommissioning

The US Coast Guard has closed the Shoal Cove loran station and will decommission the site in the foreseeable future. This site was previously harvested with additional ground disturbance over the years of operation. There could be temporary noise disturbance from removing the facilities, but no additional loss of old growth habitat is anticipated. The facilities are located within WAA 406 on the eastern side of Carroll Inlet.

Swan Lake Hydroelectric Project (FERC P-2911)

Southeast Alaska Power Agency (SEAPA) is in the process of amending their FERC license. The non-capacity amendment would increase the storage capacity at the Swan Lake Hydroelectric Project (FERC P-2911) by increasing the dam's height and establishing a new maximum operating pool. The increase in dam height would flood a total of 140 acres including approximately 26 acres of NFS land and increase the lake surface area to 1,513 acres. Total habitat loss (all ownerships) is approximately 64 acres high-POG, 34 acres medium-POG, 7 acres low-POG, 18 acres NPOG, 11 acres muskeg, and 5 acres naturally occurring young growth (Tetra Tech and McMillen 2013). The existing access road, camp, and staging areas would be utilized during the expansion. Swan Lake is located within WAA 406 on the eastern side of Carroll Inlet.

Mahoney Lakes Hydropower Project

The Mahoney Lakes hydropower project (City of Saxman) includes a lake tap near the natural outlet of Upper Mahoney Lake, a 1,700 foot long upper tunnel with an incorporated a valve house, a 36 inch diameter bypass pipe from the valve house to Upper Mahoney Creek, a 39 inch diameter 4,000 foot long lower tunnel, a 40x57 foot metal powerhouse and 3.1 miles of 34.5 kV overhead transmission line. The access road is already in place from Cape Fox Corporation logging operations. Tunnels would be on NFS lands with a portion of the lower tunnel, the powerhouse, and transmission line on Cape Fox Corporation lands. The project is located within WAA 407 on the western side of George Inlet.

Conservation Strategy

An integrated science-based old-growth forest habitat conservation strategy was developed and adopted for the 1997 Forest Plan and carried forward in the 2008 Forest Plan Amendment. This old-growth strategy has two basic components. The first is a forest-wide reserve network (Old-growth Reserves) that protects the integrity of the old-growth forest by retaining blocks of intact, largely undisturbed habitat. The second component of the old-growth habitat conservation strategy is management of "the matrix", e.g., the lands with LUD allocations where commercial timber harvest may occur. Within the matrix, components of the old-growth ecosystem are maintained by standards and guidelines to protect important areas and provide old-growth forest habitat connectivity (USDA 2008d, Appendix D, p. D-3). See USDA 1997b Appendix N, USDA 2008b, pp. 3-57 through 3-62, and USDA 2008d, Appendix D, pp. D-5 through D-8 for in-depth details on OGR criteria.

Old-growth Reserve System (OGRs)

The 1997 Forest Plan Interagency Viable Population Committee (VPOP) systematically screened all wildlife species and identified those old-growth associated species they considered to be most sensitive to habitat loss and fragmentation of the old-growth ecosystem. These species were then used to determine the size and spacing requirements of Old-Growth Reserves. The approach was reviewed and carried forward in the 2008 Forest Plan:

> This coarse-filter old-growth reserve approach was designed to maintain a functional and interconnected old-growth ecosystem, which in turn would maintain the composition, structure,

> and functional processes of that ecosystem. In general, the home range and dispersal capabilities of old-growth associated species of concern were considered in determining the size, spacing, and number of reserves. However, the reserve location was adjusted to achieve multiple-use objectives such as timber harvest (USDA 2008d, Appendix D, p. D-8).
>
> VPOP identified two objectives for small HCAs [OGRs] ((Suring et al. 1993, pg.28.): “to provide temporary functional habitat for animals dispersing between large and medium HCAs and to ensure that species of concern have a relatively high likelihood of occurring in each 10,000+ acre watershed” … These reserves represent an important component of the Forest-wide old-growth habitat conservation strategy (USDA 2008d, Appendix D, p. D-9).

OGR Criteria

Primary habitat criteria for OGRs are described in the Forest Plan, Appendix K and the Forest Plan FEIS, Appendix D (pp. D-6 thru D-8). OGR calculations are based on the acres of National Forest Service lands within the VCU. Small OGRs should encompass a contiguous landscape representing at least 16 percent of each VCU with at least 50 percent of that area in productive old growth (POG). In VCUs that are separated by saltwater channels, reserves may be separated, but attempt to retain 800 acres of productive old growth in each.

The Forest Plan designated one medium old growth reserve (OGRs) and one small OGR within the Saddle Lakes project area. The small OGRs in VCUs 7460 and 7530 are on the east side of Carroll Inlet disjunct from the project area. These OGRs meet Forest Plan Appendix K criteria and were not reviewed further. The Interagency preferred OGR (IOGR) was selected under the Forest Plan for VCU 7530; the IOGR was modified slightly in VCU 7460 to follow definable boundaries. The medium reserve is located along Carroll Inlet at the northern extent of the project. No modifications are proposed to the medium OGR. The remaining small OGR is located within VCU 7470.

VCU 7470 OGR History

The purpose/rationale for small OGR in VCU 7470 is to provide connectivity and population exchange between Naha LUD II through the low elevation beach fringe POG in George Inlet Salt Chuck State Marine Park to the Saddle Lakes area between George and Carroll Inlets.

As stated in the 1991 Shelter Cove EIS, (p. 4-59):

> The Naha area LUD II acts as a regional center (habitat refugia) [source habitat] for old-growth dependent populations, while the nearby Old-Growth Retention [i.e., Old-Growth Reserve] produces old-growth wildlife and provides a biological corridor to vacant, suitable habitats. Consequently, the landscape of old-growth retention, located north of Salt Lagoon, [facilitates] the recolonization of neighboring populations as the habitat becomes suitable in the future. With this connection to the Naha area, the [OGR] located north of Salt Lagoon would be able to provide wildlife for future utilization in George and Carroll Inlets. Without this connection, wildlife would end up being isolated in the Naha area and less able to disperse to areas where they could be utilized. …
>
> Habitat blocks are a key component … to assure the long-term persistence of a given species that is subject to widespread, systematic reduction in the amount of its suitable habitat. The [OGR], proposed between the Naha and George Inlet and Carroll Inlet, will also help to insure adequate wildlife resources for subsistence and recreation.

Conversely, the 1997 Forest Plan deleted the connection to the Salt Lagoon when it replaced the more extensive old growth retention area with small OGR north of George Inlet.

However, the 2000 Salty EA Decision Notice modified the 1997 Forest Plan OGR to re-establish a portion of this important high quality travel corridor between Naha and George Inlet, but did not select the biologically preferred IOGR. The 1999 Interagency Salty site visit notes (Gustafson 1999) identified that the selected configuration was better than mapped in the 1997 Forest Plan, but that it is "biologically inferior" to the [Salty] interagency proposal. Concern was expressed by the resource agencies during the Salty review that a precedent would be set to modify OGR proposals based upon timber harvest unit maps.

Likewise, the 2008 Forest Plan strengthened this connectivity by adopting the Salty biologically preferred IOGR. In the implementation notes on the 2008 Forest Plan Small Old Growth Reserve Data Sheet it was acknowledged that "existing [Forest Road] 8300000 occurs in the IOGR and that this road may be improved for passenger vehicles and become a major route" (i.e., part of the Ketchikan to Shelter Cove Road). The Tongass National Forest Land and Resource Management Plan Errata: Mapping Correction in VCU 7470 Small Old Growth Reserve (OGR) dated February 6, 2012 corrected the mapping error to follow the IOGR boundary adopted in the 2008 decision.

Project Level Review 2013

In response to comments received during the Saddle Lakes scoping process, the Responsible Official, Forrest Cole, requested a project-level review of the VCU 7470 small old-growth reserve. The Forest Plan states "Under limited circumstances, a line officer may decide to modify the size and location of an OGR. Modifications of OGRs, other than minor as described will require the completion of a project level review (USDA 2008b, Appendix K-1).

This review was conducted on March 12, 2013, by an interagency team comprised of USFWS, ADF&G, and Forest Service biologists. The Interagency Team had the following objectives:

- Identify and evaluate the Interagency biologically preferred (IOGR) location. Since the 2008 Forest Plan adopted the previously recommended IOGR location, the objective of the 2013 Interagency Team was to evaluate whether the rationale for placement has changed, and to confirm the current location or recommend adjustments;
- Evaluate the potential for moving the OGR completely within the North Revilla Inventoried Roadless Area (herein Roadless OGR) while meeting Forest Plan OGR objectives (USDA 2008b Standard and Guideline WILD1.B.1, p. 3-62; USDA 2008c, Appendix K, USDA 2008d, Appendix D, p. D-7).
- Evaluate the need for a "hybrid" OGR containing Roadless and additional adjacent lands to meet Forest Plan OGR objectives.

Alternative reserve locations must provide comparable achievement of the Old-growth Habitat LUD goals and objectives; determination as to comparability must consider the criteria listed in Appendix K (FP, pg. 3-62). Appendix K "describes criteria for changing the boundaries of old-growth reserves (OGRs) at the project level as described in the Old-growth Habitat Land Use Designation (LUD) Standards and Guidelines (Wildlife section). For a complete review of the Conservation Strategy, including assumptions for the design of the OGR system, refer to Appendix D of the 2008 Final EIS" (Forest Plan, Appendix K, p. K-1).

The Interagency Team reviewed the existing IOGR and developed one Roadless and two Hybrid OGRs with varying success at meeting comparable achievement of OGR goals and objectives and design criteria (FP Appendix K and FP FEIS Appendix D, pp. D-7 & D-8). See Table 5 and the 2013 Saddle Lakes OGR Report for detailed analysis.

Existing OGR

The Interagency Team determined that the existing OGR was in the biologically preferred location and that the rationale for the OGR has not changed. No boundary adjustments were made to the existing OGR (see Appendix A for OGR maps).

Roadless OGR

The Interagency Team developed an OGR entirely within the North Revilla Inventoried Roadless Area (IRA 526). This OGR retained the portion of the existing OGR currently within the IRA and included additional roadless acres to the northeast. The Roadless OGR is in roughly the same vicinity as the 1997 Forest Plan OGR, but includes the south facing slope northeast of the lake instead of the north facing slope. This OGR eliminates early seral habitat and roads, but protects fewer acres of habitat by reducing overall size (compared to the existing OGR) and by moving additional acres into the IRA. The Roadless OGR fails to meet several other biological criteria: 1) it removes the important connection between Naha and George Inlet that provides connectivity into the Saddle Lakes project area, 2) it reduces the large POG block within the VCU, 3) it reduces the amount of low elevation high-POG winter/nesting habitat, particularly on more gentle slopes, 4) it reduces the amount of low elevation Class I riparian habitat, 5) it excludes rare features such as known R10 sensitive and rare plant populations, 6) it reduces the protection of under-represented large tree SD67 habitat. *Based upon the criteria, the Interagency Team concurred that the Roadless OGR would not provide comparable achievement of the Old-growth Habitat LUD goals and objectives and failed to meet key biological design criteria.*

Hybrid OGRs

Benefits of the Hybrid OGRs include retention of habitat along Class I (anadromous) George Inlet Creek, retention of some low elevation deer winter habitat at the mouth of George Inlet, and retention of some rare plant and rare features habitat. Some additional south facing large tree POG would be added to the OGR on the north side of the lake, including high-POG adjacent to Class I streams. However, this area is steeper, at higher elevation, and further up the drainage, so it provides less quality winter habitat than stands near the salt lagoon. Both hybrids eliminate the existing harvest stands and reduce the amount of road within the OGR. Identified concerns of the hybrid OGRs include reduced connectivity. Since both Hybrid OGRs add replacement acreage within the North Revilla Inventoried Roadless Area, they represent a net loss of protected habitat.

Hybrid Option1

This option provided a slightly reduced connectivity corridor between Naha and the head of George Inlet, but maintained a high percentage of the large block POG and low elevation, high-POG, added high-POG habitat along Class I streams, and contained some sensitive plant locations. *The Interagency Team concurred that Hybrid Option1 OGR could provide comparable achievement of the Old-growth Habitat LUD goals and objectives since it maintains a functional connection between Naha to George Inlet and maintains important biological design criteria.*

Hybrid Option2

This option further reduced the corridor between Naha and George Inlet by removing substantially more habitat at the head of George Inlet salt chuck. It retained a fairly high percentage of the large block POG, added high-POG habitat along Class I streams, and some sensitive plant locations, but reduced the amount of high-POG, low elevation habitat near the beach. *The Interagency Team concurred that Hybrid Option2 did not provide comparable achievement of the Old-growth Habitat LUD goals and objectives. It weakens the important connectivity between Naha and George Inlet and fails to meet important biological design criteria.*

The Responsible Official decided on April 8, 2013, to carry the Roadless option forward for analysis in Alternative 5. Impacts of moving the OGR are discussed under individual MIS Alternative 5 effects. Table 5 provides a comparison of the OGRs.

Table 5. Comparison of VCU Small OGR Options using Forest Plan OGR Criteria

	VCU 7470			
OGR purpose/rationale for VCU	Connectivity between Naha LUD II and low elevation beach fringe POG in George Inlet Salt Chuck State Marine Park.			
Forest Plan Appendix K Criteria	**Existing OGR**	**Roadless OGR**	**Hybrid Option1 OGR.**	**Hybrid Option2 OGR**
Minimum Required OGR acres[1]	**2,534**			
Minimum Required POG acres[2]	**1,267**			
OGR acres	3,225	2,852	3,261	3,200
POG acres	2,182	1,941	2,291	2.253
Acreage requirements met?	Yes	Yes	Yes	Yes
2008 Forest Plan FEIS Appendix D Design Criteria				
Circular rather than linear to maximize interior habitat/minimize fragmentation	Yes	Yes	Yes	No
Minimizes roads (total miles)[3]	2.6	0	1.8	1.8
Minimizes early seral habitat (acres)	80	0	12	12
Riparian/beach/estuary habitats (Class I stream miles)	5.6 mi	4.9 mi	6.8	6.8 mi
Includes largest remaining block of POG in VCU?	Yes	Yes	Yes	Yes
Rare/Underrepresented features (# rare or sensitive plant locations)[4]	4	0	2	2
Important deer winter habitat (acres)[5]	864	657	918	895
Important marten habitat (acres)[6]	1,248	1,086	1,348	1,324
Goshawk nesting habitat (acres)[7]	989	794	1,041	1,032
Murrelet nesting habitat SD67 (acres)	174	149	173	173
Other Considerations				
Connectivity	Yes	No	Yes	No
Low elevation POG <800’ (acres)	1,360	1,059	1,430	1,397
Comparable achievement of Old-growth LUD Goals & Objectives?	**N/A**	**No**	**Yes**	**No**
Meets Objective for VCU	**Yes**	**No**	**Yes**	**No**

1. Small OGRs are a contiguous landscape of at least 16 percent of the National Forest System land area of each VCU.
2. At least 50 percent of the small OGR should be productive old growth.
3. 1.8 miles of current mainline and planned State ADOT Ketchikan Shelter Cove Road system within or adjacent to OGR.
4. See Marbled Murrelet nesting habitat (SD67) for large tree component.
5. High-volume Productive Old Growth (High-POG) <800 feet elevation.
6. High-POG <1,500 feet elevation.
7. High-POG <1,000 feet elevation.

Matrix Management

The second component of the old-growth forest habitat conservation strategy is management of the area outside reserves that is subject to timber harvest (i.e., the “matrix”) (see USDA 1997b Appendix N and

USDA 2008d Appendix D-10). This topic was of notable concern to the Pacific Northwest Research Station Review scientists for the who suggested that more attention be directed to this component of landscape conservation planning. They particularly noted the need to provide enhanced landscape connectivity and to manage human disturbance of the land similar to natural disturbance regimes (Kiester and Eckhardt 1994). Person and Brinkman (2013) state that the matrix will likely play a critical role in sustaining wildlife habitat and subsistence uses.

Matrix management can serve at least three important roles: 1) providing habitat at smaller spatial scales, 2) increasing the effectiveness of the reserves, and 3) improving landscape connectivity (USDA 2008d, Appendix D, p. D-3). It was noted that the allocation of forest stands and landscapes to some form of timber harvest within the matrix “did not mean that all trees and stands would be harvested leaving only a continuous sea of second growth.” (USDA 2008d, Appendix D, p. D-14).

Beach and estuary fringe, and riparian habitats, if intact, have special importance as components of old-growth forests, serving as horizontal or low-elevation wildlife travel corridors, providing unique wildlife habitats, and providing a forest interface with marine or riverine influences that may distinguish them as separate ecosystems within the larger old-growth ecosystem. The beach fringe provides horizontal or low-elevation connectivity between watersheds, many of which otherwise have very steep sides and/or non-forested ridge tops. The beach fringe is thought to be a component of the major travel corridor system used by many resident wildlife species (USDA 2008d, Appendix D-10). However, beach fringes and riparian habitats within Saddle Lakes area VCUs and WAAs have been impacted by past timber harvest and are currently in the stem exclusion phase.

Standards and guidelines applicable to wildlife within the “matrix” are discussed under MIS sections.

Connectivity/Fragmentation

Fragmentation/connectivity is an element of biological diversity that describes the natural condition of habitat in terms of patch size and distribution. Landscape connectivity is defined as the degree to which the structure of a landscape helps or hinders the movement of wildlife species (Taylor et al. 1993). On the Tongass, landscape connectivity between old-growth forest patches or between high and low elevation habitats is important to maintaining well-distributed, viable wildlife populations (USDA 2008c, p. 2-54).

The 1991 Shelter Cove EIS, (p. 4-59) did a good job of explaining the importance of connectivity:

> Most species persist regionally as sets of populations that are linked by dispersing individuals. This dispersing allows for the recolonization of unoccupied habitat patches after local extinction events. A reduction in suitable habitat patches, or a loss of biological corridors, can disrupt the dispersing dynamic and contribute to regional extinction of species. The interconnecting, landscape matrix facilitates the recolonization from surviving neighboring populations.

An intact, undeveloped landscape is assumed to be fully functional, maintaining species, communities, and their supporting ecological processes within their natural ranges of variability (Poiani et al. 2000). The percentage of the original POG forest no longer in an old-growth condition can serve as an indicator of the potential effect on several biodiversity aspects, including structural (within-stand) diversity, connectivity (unfragmented, continuous old-growth blocks), and overstory and understory species composition (USDA 2008c, p. 3-151). Relatively high concentrations of past harvest have occurred at a number of areas along Behm Canal including George Inlet, Carroll Inlet, and near Ketchikan on Revilla Island. In many of these areas, biodiversity has been affected due to the intensity of past harvest and the higher reductions in larger tree POG types (FP FEIS, p.3-163).

See MIS section below for changes in existing and historic POG and how changes in connectivity and fragmentation affect wildlife.

Patch Size

Large, contiguous blocks of old-growth forest are more important to old-growth associated species than individual stands of trees. Large old-growth blocks with interior habitat provide expansive foraging and hunting territories, as well as protection from predators, and promote genetic mixing among populations that would be less likely to interbreed if they were spatially separated by forest fragmentation.

Fragmentation resulting from human-caused actions such as timber harvest and natural causes such as windthrow reduces landscape connectivity by breaking larger contiguous blocks of habitat into smaller patches that are at increasing distances from each other. Timber harvest creates a relatively fine-grained, highly fragmented landscape pattern that includes increased forest-opening edge and decreased patch size (Thomas et al. 1988). Suring and Crocker-Bedford *in* Suring et al. (1993) provide detailed discussion on the effects of fragmentation on extinction/extirpation processes.

As habitat becomes scarce, patches become smaller and more isolated and individuals are required to traverse larger gaps in search of suitable habitat. Past a certain threshold in gap size, the disperser may perish before finding suitable habitat, particularly in heavily fragmented landscapes (With and King 1999). The distribution of a species within a landscape may change from being a single “continuous” population to that of a patchily distributed population with a number of independent subpopulations (Haufler 2007). Populations may become isolated, and therefore at greater risk of local extirpation, if fragmentation hinders movement of individuals between subpopulations (Mladenoff 1997). The degree to which this occurs depends on species-specific dispersal capabilities, the distance between habitat patches, and conditions within the matrix between habitat patches.

Patches at the stand levels (or the smallest size classes) represent scales of influence important to organisms such as lichens, fungi, plants, invertebrates, and small mammals that occur in very specific forest structure or soil conditions or have limited dispersal capabilities (USDA 1997a, p. 3-24, USDA 2008c, p. 3-168). Larger patches represent scales of influence important to wider-ranging species such as deer, marten, and forest-dwelling birds. Existing patch conditions are displayed in Table 6.

Table 6. POG Patch Size for WAAs 406/407 combined, All Ownerships.

Patch Size	Historic All Ownerships			Existing All Ownerships		
	# of patches	acres	Average patch size (acres)	# of patches	acres	Average patch size
0-39 acres	158	2,245	14	274	3,158	12
40-249 acres	40	3,401	85	61	5,521	91
250-499 acres	4	1,175	294	13	4,295	330
500-999 acres	3	1,963	654	9	7,125	792
1000+ ac	10	85,993	8,599	10	56,687	5,669
total	215	94,776	440	316	76,786	243

Source: pog_Patch_1954_071113.xlsx, pog_patches_by_alt_082313.xlsx

All action alternatives would affect the amount of POG within Patch size breakdowns (Table 7). Change in specific patch size requirement is analyzed under Marten, Hairy Woodpecker, and Red-breasted Sapsucker MIS sections.

Table 7. Change in Patch Size, All Ownerships

Patch Size (in acres)	Historic # of patches	Historic acres	Historic Average size (ac)	Existing # of patches	Existing acres	Existing Average size	Alt 2 # of patches	Alt. 2 acres	Alt. 2 Average size	Alt. 3 # of patches	Alt. 3 acres	Alt. 3 Average size	Alt 4 # of patches	Alt. 4 acres	Alt. 4 Average size	Alt. 5 # of patches	Alt. 5 acres	Alt. 5 Average size	Alt. 6 # of patches	Alt. 6 acres	Alt. 6 Average size
0-39	158	2,245	14	274	3,158	12	279	3,279	12	274	3,155	12	278	3,197	12	275	3,181	12	274	3,151	13
40-249	40	3,401	85	61	5,521	91	60	5,373	90	61	5,484	90	61	5,420	89	60	5,409	90	61	5,457	89
250-499	4	1,175	294	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330	13	4,295	330
500-999	3	1,963	654	9	7,125	792	9	6,817	757	9	7,026	781	9	6,778	753	9	6,709	745	9	6,778	753
1000+	10	85,993	8,599	10	56,687	5,669	10	55,190	5,519	10	56,002	5,600	10	55,034	5,503	10	54,722	5,472	10	55,296	5,530
total	215	94,776	441	367	76,786	209	371	74,901	202	367	75,962	207	371	74,724	201	367	74,316	202	367	74,977	204

Interior Habitat

Interior forest habitat is a term used to describe forest that is far enough away from an opening (natural or man-made) to not be affected by light, temperature, moisture, and wind conditions (microclimate) that differ from those deeper within the forest (Harper et al. 2005). When fragmentation occurs, there is an increase in the amount of forest edge habitat and a decrease in the amount of interior forest habitat (Table 8). Edge effects may include changes in vegetation structure, species composition (both plants and animals), predation rates, and disturbance (Murcia 1995, As 1999). Although the number of species may be higher along edges, the number of habitat specialists (i.e., those associated with interior forest conditions or structure) decreases (As 1999, Kissling and Garton 2007).

Table 8. Interior POG Habitat, All Ownerships

Area	Historic	Existing	% reduction
VCU 7460	10,983	3,050	(-72.2%)
VCU 7470	6,363	3,070	(-51.8%)
VCU 7530	8,248	2,623	(-68.2%)
WAA 406	30,321	14,193	(-53.2%)
WAA 407	13,949	7,440	(-46.7%)

Interior habitat based upon vegetative & climatic edge effect distances for Southeast AK (Concannon 1995)

Species associated with interior forests are of concern since timber harvest tends to increase the amount of forest edge. Concannon (1995) found that on the Tongass, edge effect influence on the adjacent forest microclimate varied by such factors as forest type, tree density, site aspect, slope, solar insolation, aspect, slope, latitude, season, and edge type. Consistent with the Concannon research, I used the following distances to define edge: 200 meters [656 ft] from hard edges (e.g., roads, past harvest) and 120 meters [394 ft] from soft edges (e.g., muskegs, meadows).

If a stand is circular and surrounded by roads and previous harvest, 31 acres would be needed to provide interior habitat in the very center. If the patch is surrounded by natural openings such as muskegs, alpine, or lakes, 11 acres would be the minimum acreage to provide any interior habitat. However, a more likely scenario is a generally rectangular isolated patch between clearcuts, a road, and a muskeg, which would require a minimum of 45 acres to have 1 acre of interior habitat in the middle (Figure 7).

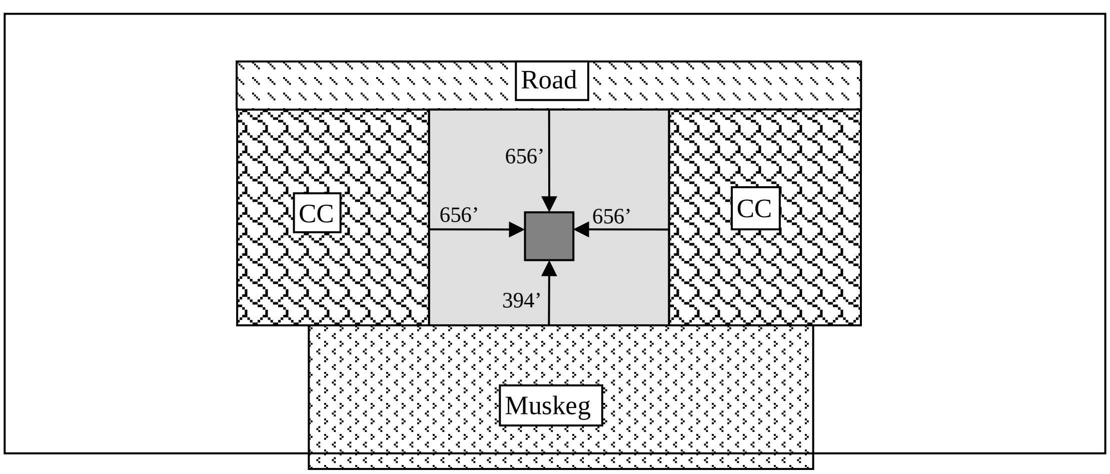


Figure 7. Interior POG Diagram

Species such as the brown creeper are negatively affected by edge and therefore benefit from larger blocks containing interior habitat. Therefore, I selected brown creeper as the indicator for interior habitat. Changes in interior habitat are analyzed under the brown creeper MIS section.

Corridors

The connectivity between old-growth habitat in a landscape may be as important to maintaining diversity as the size of the old-growth patches (Noss 1983). Populations of most species exist in discrete subpopulations that live in distinct habitat patches surrounded by other habitats that they do not inhabit. However, if individuals can frequently move between subpopulations, immigrants may prevent subpopulations from becoming locally extinct (Orians et al. 2013). Maintenance of habitat corridors is important to minimize isolation and potential local extirpation of wildlife species associated with interior old-growth (Hunter 1990). Morrison et al. (1998) listed four types of movement in relation to corridors: 1) dispersal, including movement of young from natal areas, 2) migration between seasonal habitats, 3) home range movement over the space of days to locate resources, and 4) eruption or irregular movements into new areas in response to habitat change.

Corridors may be functional (i.e., non-contiguous patches of old-growth forest and other vegetation with structural characteristics that facilitate movement across the landscape) or structural (i.e., physically connected patches of old-growth forest). Functional connectivity refers to the degree of movement or flow of organisms through broader linkage “zones” which contain an appropriate juxtaposition of habitats and land uses that facilitate movement.

Structural connectivity refers to the physical connections between areas of habitat that facilitate movement of wildlife. Structural corridors can function in different ways, depending on their width and other characteristics. Forman and Godron (1981) identified four types of corridors:

1) line corridors that are narrow and typically contain only edge species;

2) linear habitat patches, that contain interior habitat where species may migrate or live;

3) stream corridors which vary in width according to stream size and may serve as linear habitat;

4) networks formed by intersecting corridors that may overlap any or all of the previous three types.

To be effective, corridors should contain enough forested environment to give animals a sense of security, avoid predation from edge species, and provide plant species and composition similar to interior forest stands. Linear corridors with little or no interior habitat are not as effective as wider ones. Linear habitat patches that network larger habitat patches facilitate re-establishment of species and may provide habitat for species that could not otherwise survive in small isolated patches (Forman and Godron 1981, Hunter 1990, Rosenberg et al. 1995, Rosenberg et al. 1997). Providing spatial connectivity may help maintain wildlife populations large enough to prevent negative effects of inbreeding and local extirpations from natural fluctuations and catastrophic environmental events (Marcot 2013). For example, the small OGR contributes to functioning of habitat in George and Carroll Inlets by connecting the habitat with source populations in Naha LUDII.

Forest Plan landscape connectivity direction (USDA 2008b, WILD1.VI, p. 4-91) states that projects are to be designed to maintain landscape connectivity. Kiester and Eckart stated that overall landscape connectivity was an essential component of the old growth conservation strategy and that wider corridors were necessary, particularly for marten (1997 Forest Plan, Appendix N-19). The objective is to maintain corridors of old-growth forest among large and medium Old-growth Habitat reserves (Appendix K) and other non-development LUDs at the landscape scale.

Connectivity currently exists between the Carroll medium OGR partially within the north end of the project area (VCUs 7460 and 7440) and Naha LUD II through the North Revilla Inventoried Roadless Area (#526) and would be maintained under all alternatives.

Limited connectivity exists between the medium OGR and the Semi-remote Recreation LUD located south of the project area and between Naha LUD II and the Semi-remote Recreation LUD due to past harvest on NFS and private (non-NFS) lands. No connectivity exists through the beach buffer on National Forest Service (NFS) lands due to past timber harvest. These young-growth stands contain predominately small diameter trees in the stem exclusion phase and do not provide suitable habitat for old-growth dependent species. Connectivity exists along the Carroll Inlet shoreline on non-NFS lands, but is limited to roughly 200 feet wide on portions of the beach. Extensive past harvest has also occurred in the beach buffer along the eastern shore of George Inlet. It was determined by the Responsible Official that connectivity between the medium OGG and the Semi-Remote Recreation LUD south of the project area near California Head (VCUs 7580 and 7590) and is not required due to the bisecting private land. Likewise, connectivity between Naha LUD II and the Semi-Remote Recreation LUD is not required for the same reason.

Forest Plan direction (USDA 2008b, WILD1.B.2 p. 3-115) states that projects are to consider opportunities to allow for the elevational migration of wildlife within the Modified Landscape LUD. Based on knowledge of the Saddle Lakes project area, elevational connectivity corridors were identified in the Modified Landscape LUD where additional harvest could reduce natural connectivity and limit the ability of land-based species to disperse or migrate. Connectivity would be reduced further or eliminated under Saddle Lakes alternatives (see Table 9 and Figure 8).

Table 9. Elevational Corridors

Corridor Number	Approximate Location	Connectivity Description/Importance	Potential Units Within Corridor
1	Medium OGR in VCUs 7460 and 7440 and Naha LUD II	Connectivity currently exists between the medium OGR partially within the north end of the project area and Naha LUD II through the North Revilla Inventoried Roadless Area (#526) in accordance with Forest Plan landscape connectivity direction (USDA 2008b, WILD1.VI, p. 4-91). The eastern end of this corridor is between 1,000 and 2,100 feet in elevation.	None
2	Small OGR in VCU 7470 at the head of George Inlet Saltchuck	The objective for the location of this OGR is to maintain connectivity between Naha LUDII and the George Inlet salt chuck thereby facilitating dispersal and re-colonization of vacant territories.	Units 300 through 312.
3	North of Island Point	This is an important elevational corridor because it is the only windfirm POG corridor of sufficient width for roughly four (4) miles either direction that extends from the high elevation ridge near Buckhorn Lake east to saltwater.	Units 203, 204, 207, and 224
4	North of Gunsight Creek	Remaining corridor from high elevation to the beach between Gunsight Creek and Shelter Cove.	None
5	North of Lemon Lake	This corridor joins the medium OGR to North Revilla Roadless Area and the small OGR linking the beach buffer to the higher ridges and is the beginning of connectivity south through the project area (see #1 above).	Units 8 and 9
6	North Saddle Lakes to Buckhorn Lake	This is the main connectivity corridor between the north and south halves of the project area (i.e., no connectivity exists between the medium OGR and the Semi-remote Recreation LUD south of the project area boundary). It begins on the south side of the North Revilla Roadless Area in #5 above, goes between the two North Saddle Lakes, crosses the stream above South Saddle Lake, and continues south connecting to the large ridge in the Carroll Roadless Area that extends north of Buckhorn Lake and south to non-NFS land at the southern project boundary (see #1 above).	Units 48, 49, 53, 122, and 154 and Road 8300330 (that could be left open) would bisect this corridor.
7	North Saddle Lakes to George Inlet	This important travel corridor starts north of North Saddle Lakes and follows the ridge west to George Inlet. Extensive deer use was observed along this corridor.	Units 28, 30, 31, 40, 71, 113, and 114
8	West end of North Saddle Lakes	This is a short, but high use travel corridor around the west end of North Saddle Lakes. It links corridors 6 and 7 to provide connectivity from Naha into the southern portions of the project area.	Units 46, 115, and 116

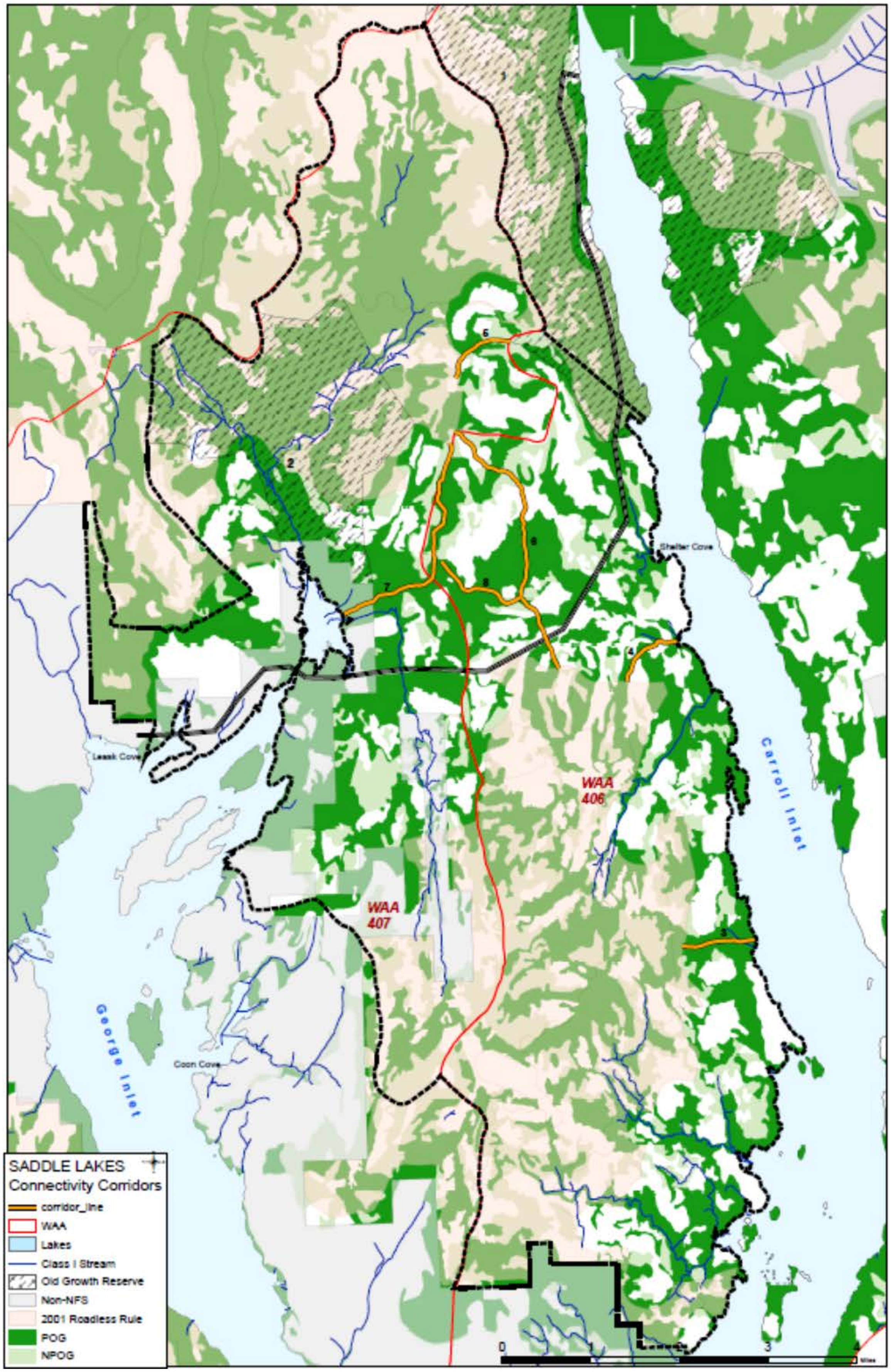


Figure 8. Saddle Lakes Wildlife Connectivity Corridors

All action alternatives would reduce connectivity within the Saddle Lakes project area. Treatment of identified corridors under action alternatives are summarized in Table 10.

Table 10. Treatment of Corridors Under Action Alternatives

Corridor Number	Treatment(s)	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
1	None	Maintains	Maintains	Maintains	Maintains	Maintains
2	Alternative 5 would move the OGR and clearcut Units 300 through 308 and 310 through 312.	Maintains	Maintains	Maintains	Eliminates	Maintains
3	Alternatives 4, 5, and 6 would clearcut Units 204 (east of the road), and 207 and partial cut Units 203 and 204 (west of the road). Alternative 5 would also partial cut Unit 224.	Maintains	Maintains	Eliminates	Eliminates	Eliminates
4	None	Maintains	Maintains	Maintains	Maintains	Maintains
5	Alternatives 2, 4, 5, and 6 would clearcut Units 8 and 9.	Eliminates	Maintains	Eliminates	Eliminates	Eliminates
6	Alternative 2 would partial cut Units 154 and 48. Alternative 4 would clearcut Units 48, 53 and 154 and partial cut Unit 49. Alternative 5 would clearcut Units 48, 49, 53, 122, and 154. Alternative 6 would clearcut Units 48 and 154 and partial cut Unit 49.	Reduces	Maintains	Eliminates	Eliminates	Eliminates
7	Alternative 2 would partial cut Unit 28. Alternatives 4 and 5 would clearcut Units 28, 31, 40, 71, 113, and 114 and partial cut Units 30 and 71. Alternative 6 would clearcut Units 31, 40, 113, and 114 and partial cut Unit 30.	Reduces	Maintains	Eliminates	Eliminates	Eliminates
8	Alternative 2 would partial cut Units 46 and 116. Alternative 4 would clearcut Units 46 and 116. Alternative 5 would clearcut Units 46, 115, and 116. Alternative 6 would clearcut a portion Unit 46 and partial cut Unit 116.	Reduces	Maintains	Eliminates	Eliminates	Reduces

In addition to the specific corridors listed above, all action alternatives would remove leave strips left by the previous timber sales. This would make it harder for deer to move up and down the slopes in the winter, affect connectivity for species such as red squirrels and red-backed voles, marten, and affect habitat for small, less mobile species such as salamanders, gastropods, and arthropods.

Effects related to connectivity corridors are discussed under Deer, Marten, and Red Squirrel MIS sections, and under the Endemic Small Mammal section.

Management Indicator Species

Sitka Black-tailed Deer (Odocoileus hemionus)

FP Direction (WILD1.VII, p. 4-92):

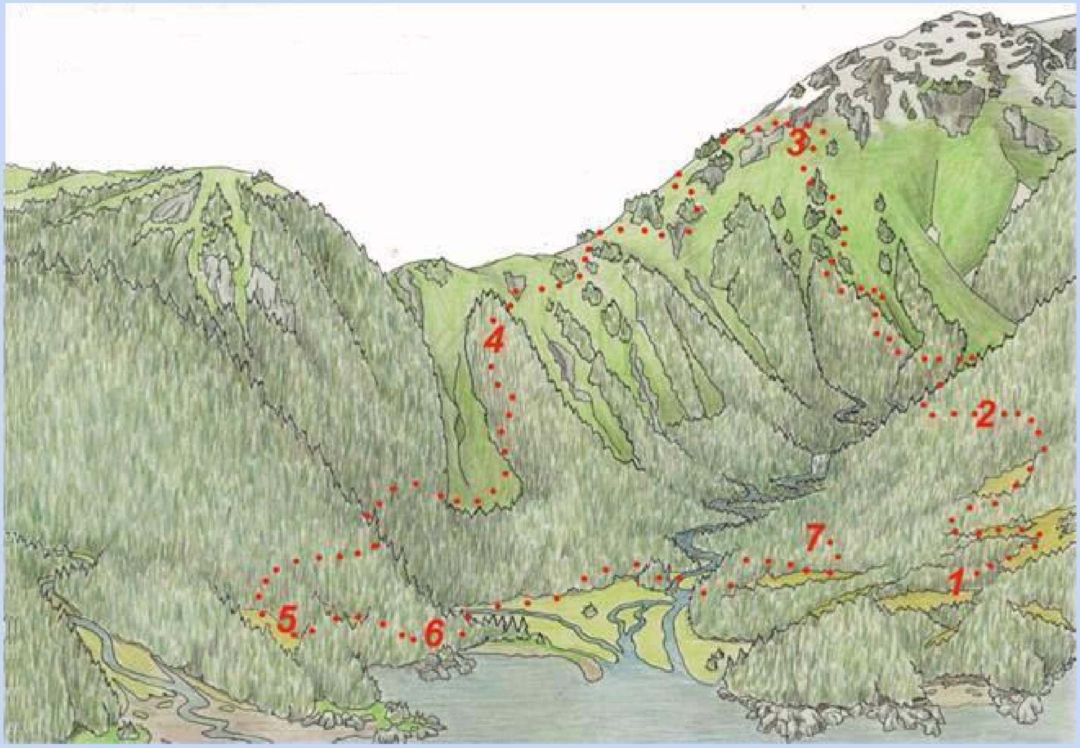
> Consider Sitka black-tailed deer habitat needs before or as part of project analysis. Ensure interdisciplinary involvement and consideration of deer habitat in project planning and in the environmental analysis process.

Introduction and Habitat correlation to the affected environment

The Sitka black-tailed deer is a subspecies of mule deer that is endemic to the coastal areas of Southeast Alaska and northern British Columbia. They were selected as a MIS due to their use of POG, their importance as a game and subsistence species and because they are an important prey species for wolves. Deer/wolf interactions are discussed under the Wolf section.

Deer populations in Southeast Alaska vary with geography and climate. Deer populations are currently highest in the islands north of Frederick Sound, intermediate on the central and southern islands, and lowest on the mainland coast (Schoen and Kirchhoff 2007). Within GMU 1A, deer populations tend to fluctuate seasonally in response to winter weather and wolf and bear predation (Porter 2013a). Annual variability in weather patterns and snowfall can have noticeable impacts on deer distribution, population density, and hunter accessibility (McCoy et al. 2009). Brinkman et al. (2011) using DNA based sampling techniques, identified a 30 percent decline in deer abundance during their 3-year study on nearby Prince of Wales Island. They attributed the decline to the three consecutive severe winters. There are no traditional deer pellet transects or DNA based sampling within the Saddle Lakes area. Similar to conditions described in the 1991 Shelter Cove EIS, abundant deer forage is available within old-growth stands in the project area, but light to moderately browsed indicating that deer numbers are below carrying capacity. Deer numbers are thought to be at very low levels throughout most of GMU 1A and the hunting season was shortened by one month in 2011 (Porter 2013a). Harvest limits have remained at 4 bucks for most of GMU 1A, but harvest limits on the Cleveland Peninsula were decreased to 2 bucks in 2008. ADF&G is currently evaluating population and harvest objectives to see if they are realistic based upon available winter habitat and current deer population levels (Porter 2013a).

Specific habitat for deer varies by season and whether they are resident or migratory deer. Deer distributions within Saddle Lakes area WAAs 406/407 are not known, but roughly two thirds of the deer studied on Admiralty Island near Juneau made distinct migrations between winter and summer ranges; the other one third were year-round residents of their winter ranges (Schoen and Kirchhoff 1985). Given the topography of the area, migration patterns may be similar within WAAs 406/407. Schoen and Kirchhoff (1990) recommended that old growth be retained in large blocks extending from sea level to the subalpine zone so that deer can make elevational movements in response to changing snow conditions. Figure 9 graphically depicts migratory deer movements throughout the year in Southeast Alaska (Schoen and Kirchhoff 2007).



Annual cycle of a Southeast deer

1. FAWNING

In late May and early June, black-tailed does drop their fawns. During late spring, deer are scattered from sea level to 1,500 ft (457 m) in search of new plant growth. Deer use old-growth forests and increase their use of open-canopy stands, fens, tidal meadows, and young clearcuts at this time.

2. UPWARD MIGRATION

Throughout June, migratory deer continue to disperse off their winter ranges following the receding snow line on to upper forest slopes. Resident deer generally remain at lower elevations but use more forest openings for feeding.

3. SUBALPINE SUMMER RANGES

Migratory deer generally reach their ranges by the end of June or early July. On subalpine meadows between 1,800 and 3,000 ft (549-915 m), deer find abundant and nutritious herbaceous forage interspersed among stunted, stands of Sitka spruce and mountain hemlock (*Tsuga mertensiana*).

4. FALL MIGRATION

Following the first high-country frosts in mid to late September, forage plants die and migratory deer move into the upper forests. Throughout the next month, many deer move down to lower elevations as snow accumulates in the high country.

5. THE RUT

The breeding season, or rut, begins in late October and continues through November. Deer are widely dispersed from sea level to 1,500 ft (457 m). Old-growth forests are important foraging habitats but deer also make use of forest openings and muskeg fringes during the rut.

6. WINTER RANGE

From December through March, deer in Southeast are generally confined to old-growth forest winter ranges below 1,000 ft (305 m). Southern exposures generally accumulate less snow and provide greater access to evergreen forbs like bunchberry dogwood and trailing raspberry. Deer move up and down forested slopes following changes in the snow pack throughout the winter. During deep snows, medium- and large-tree old-growth hemlock spruce forests provide the best winter habitat.

7. SPRING SNOWMELT

Spring is a transition period as deer begin to expand their movements beyond the confines of their winter range in search of new plant growth. Wet, open-canopy forests with newly emergent skunk cabbage shoots are important foraging sites for deer in spring. Deer can also been seen foraging along upper beaches and young clearcuts during spring. at this time.

Source: from Schoen and Kirchhoff (2007). Used by permission

Figure 9. Annual Cycle of Southeast Alaska Migratory Deer

The quantity, quality, and distribution of winter habitat is considered the most important limiting factor for deer in Southeast Alaska (USDA 2008c, p. 3-230). Hanley (1984) states that the overall effect of snow restricts the range of suitable habitats and lowers the quality of all habitats. From a deer's perspective, there probably are three thresholds of snow depth. The first is the depth at which evergreen forbs and herb-layer shrubs become buried or approximately 10 cm [~4"] (Hanley 1984, Kirchhoff and Schoen 1987, Parker et al. 1999). The second is when deer sink in the snow beyond front knee height (approximately 25 to 30 cm or 10-12") and energy costs for locomotion increase greatly (Parker et al. 1984, Hanley et al. 1989, Parker et al. 1999). The third threshold is the point at which tall shrubs become buried. When snow is beyond that depth, deer diet consists almost entirely of low quality conifer foliage, and the energy costs for locomotion are extremely high. Crusting of the snowpack reduces sinking depth greatly, but forage remains buried. For management purposes, snow deeper than 25 cm should be considered "deep snow" (Hanley et al. 1986, White et al. 2009). Because snow increases the energy cost of foraging, grazing time required to meet minimum energy needs increases with the depth to which deer sink into the snow particularly at sinking depths near or greater than brisket height. (Hanley et al. 1989).

The Saddle Lakes project area is classified as an intermediate snow area during average winters based upon long-term yearly averages (see Climate section above). Most of WAAs 406/407 are also considered intermediate snow, but portions are classified as high snow and a small area in WAA 406 near Carroll Point is classified as low snow. Since the project area occasionally experiences severe winters with higher than normal snow conditions, I analyzed effects on deep snow and average deer winter habitat and non-winter habitat.

Deep Snow Winter Habitat:

Extensive research conducted in Southeast Alaska indicates that low-elevation (≤ 800 feet) high-POG habitat containing large trees with large branches to intercept snow and containing relatively high amounts of quality forage are important to deer during severe winters with above average snowfall (Person and Brinkman 2013, Schoen and Kirchhoff 2007, Deal 2001, Yeo and Peek 1992, Hanley et al. 1989, Schoen and Kirchhoff 1990, Mankowski and Peek 1989, Hanley and Rose 1987, Kirchhoff and Schoen 1987, Schoen et al. 1985, Alaback 1984b, Hanley 1984, Alaback 1982, Wallmo and Schoen 1980). During severe winters, deer densities in POG are substantially higher than in second-growth (i.e., young-growth) stands (Brinkman et al. 2011, Schoen and Kirchhoff 2007,, Doerr et al. 2005, Deal 2001, Yeo and Peek 1992, Hanley et al. 1989, Schoen and Kirchhoff 1990, Mankowski and Peek 1989, Hanley and Rose 1987, Kirchhoff and Schoen 1987, Schoen et al. 1985, Hanley 1984, Wallmo and Schoen 1980). Winter severity and amount of second growth are key factors in determining the capability of winter range to support deer populations.

In their study on Admiralty Island, Schoen and Kirchhoff (1990) reported that POG was used almost exclusively (99%) with high-volume stands selected significantly more than their abundance (65%). Their deer selected southeast to southwest aspects more than their availability, but Schoen and Kirchhoff contended that this influence is less pronounced in more southerly regions and that elevation and overstory characteristics rather than aspect, were more sensitive variables for identifying deer winter ranges. However, Schoen and Kirchhoff's contention on aspect may not be supported by other research.

Hanley (1984) identified the importance of aspect on snow depth and persistence and available forage on deer winter range: southerly aspects are exposed to more solar radiation than northerly aspects, and radiation increases with steepness of slope on southerly aspects and decreases on northerly aspects. Work by Doerr et al. (2005) found less habitat correlation with timber volume (volume class), but good correlations with timber volume strata (VOLSTRATA) and even better habitat correlations with size density VEGCODE during deep snow winters. Doerr et al. (2005) evaluated habitat selection of deer in Southeast Alaska during a winter with snowfall 43 percent above average on a landscape with extensive clearcutting. They found that deer exhibited significant differences in habitat use during deep snow conditions compared to a low snow winter, and agreed with previous researchers that providing habitats selected by deer during deep snowfall is an important consideration in Sitka black-tailed deer habitat management. Deer in their study used areas >244 m [800 ft] elevation less than expected while selecting areas <153 m [500 ft] elevation; southerly aspects were also used more during deep snow winters. In his deer study on nearby Prince of Wales Island, Brinkman found that snow depths reached 2-3 feet in some old-growth stands above 500-800 feet elevation during heavy snow events in February and March 2007. By mid-April however, snow was mostly gone on SE to SW facing slopes under old growth up to 600 feet elevation or higher in some places; the worst habitat for deer that he encountered was shrub-sapling stage clearcuts. In those stands, the canopy was still open sufficient to allow snow build up but thick enough to retard snow melt. Person et al. (2009) found that deer avoided POG forest on northerly aspects, but selected POG on southerly exposures.

Suring et al. (1992) captured the essence of winter deer habitat: under intermediate and deep snow conditions, deer will select those habitats that provide for snow interception and food availability. Schoen and Kirchhoff (2007) state similar ideas “Productive hillside stands of old-growth hemlock-spruce with large trees provide optimal foraging conditions during winters with deep snow because such stands provide the greatest availability of high-quality forage. The combination of a dense canopy with scattered openings in old growth forests allows forage growth under openings while the canopy modifies snowfall sufficiently to promote forage availability and movement of deer”.

Hanley (1984) found that during winter, both the quantity and quality of forage are low, and deer lose weight. As snow buries forage, the quality of diet decreases along with the amount of forage ingested, and energy intake decreases. At the same time however, deer must spend more energy moving around as they sink deeper into snow. Key forage for meeting energy and protein requirements in the winter include evergreen forbs (most important), arboreal lichens, huckleberry twigs, and western hemlock seedlings (Parker et al. 1999). Within the project area, availability of large cedars also facilitates use by deer. Deer beds were noted at the base of large cedars and were often situated on small knobs or benches where deer could see wolves or other predators approaching.

Average Winter Deer Habitat

During average winters, when habitat selection by deer is not appreciably influenced by snow, deer will select those habitats that provide the best foraging opportunities (Suring et al. 1992). Migratory deer winter as high as snow conditions allow; resident deer also move up and down within their home ranges depending on changing snow levels (Hanley 1984, Schoen and Kirchhoff 1985, McNay and Vollner 1995, B.C. Ministry of Forests 1996, Schoen and Kirchhoff 2007, Colson et al. 2012). Elevations up to 600 m [1,968 ft] may be used during relatively snow free periods (Hanley 1984, Schoen and Kirchhoff 1985) although 1,500 feet has generally been used as the upper elevation (ADF&G 2009, Kirchhoff and Hanley 1992). Hanley (1984) summarized that during snow-free periods, the relative importance of habitats may shift. Herb-layer, evergreen plants (bunchberry and five-leaved bramble) continue to be the forage of highest quality, but may be more available in more open-canopied, lower-volume forests. However, wet sites with an understory dominated by devils club or skunk cabbage received less use during winter than well-drained sites with understories dominated by huckleberry. In contrast, Schoen and Kirchhoff (1990) found that high-volume POG stands were selected greater than availability, whereas mid and low-volume stands received use relative to their availability. Deer used scrub stands more during the low-snow winter, but scrub stands and other habitat types were still used significantly less than their abundance. When supplemental forage is available from open stands during mild winters, deer population may actually increase to levels above normal carrying capacity. As a result, heavy mortality may occur during the next severe winter (McCoy 2008).

Non-Winter (Spring/Summer/Fall) Deer Habitat:

Spring, summer, and fall habitat conditions are important for maintaining the nutritional condition of deer throughout the year to ensure healthy, productive populations (Hanley et al. 1989, Klein 1965). Body reserves accumulated during summer with abundant digestible forage are critical to winter survival and for does to meet the nutritional costs of lactation. Deer in extensively clearcut habitats may have difficulty meeting protein requirements for lactation if they must rely heavily on open clearcuts for feeding areas because of high tannin concentrations in sun-grown leaves (Hanley et al. 1989). Key forages for meeting energy and protein requirements vary seasonally, but include skunk cabbage, early greening forbs, huckleberry, blueberry, and devils club leaves in the spring; forbs and shrub leaves in summer; and shrub leaves and late-growing forbs in the fall (Parker et al. 1999). During the spring, elevations below 1,000 ft [300 m] are used by deer in greater proportion than their abundance (Schoen and Kirchhoff 1990, Hanley 1984, Schoen et al. 1981) and represented 73 percent of deer locations by Schoen and Kirchhoff (1990). As the snowline recedes, deer move around and make greater use of areas with new, green vegetation. By late spring, high quality forage is abundant, and migratory deer move near their summer ranges. Subalpine, alpine, and in scrub forest stands accounted for highest percentage of use by migratory deer; elevations >600 m [1,969 ft] were used statistically more than their abundance (Schoen and Kirchhoff 1990). Resident deer remain within their home ranges, but also make use of open habitats such as young clearcuts, muskegs, and NPOG where forage is abundant.

Current deer habitat is displayed in Table 11.

Table 11. Existing Deer Habitat, NFS Lands

WAA	Habitat	Historic (1954) Acres	2013 Acres	% Change
406	Deep Snow	3,866	2,463	-36%
	Average Snow	52,202	40,421	-23%
	Non-Winter	122,505	116,178	-5%
407	Deep Snow	1,168	940	-20%
	Average Snow	17,772	15,930	-10%
	Non-Winter	41,202	40,657	-1%

Deer Model

Forest Plan standards and guidelines direct the use of the most recent version of interagency models to assess project level impacts (USDA 2008b, WILD1.II.F, p. 4-89). The deer model, takes into account snow depth (indicative of average winter severity for the area), elevation, aspect, and vegetation to provide a habitat suitability index (HSI) of habitat capability (DHC). Habitat capability values were designed to estimate changes in deer carrying capacity that result from the timber harvest alternatives. The model was not designed to calculate actual deer populations since it does not include complex predator/prey relationships or recruitment/mortality interactions which can substantially alter actual deer populations. According to the 1997 Forest Plan FEIS (USDA 1997b, Appendix N, p. N-33): the deer model estimates long-term DHC and assumes that winter range is the limiting factor to deer populations in Southeast Alaska. Thus DHC is essentially the population that could be sustained each year through the most restricted period of the year, generally mid to late winter. The model does not consider annual deer demographics and does not include the annual increment of annual spring fawn production that may represent a 20-40 percent increase in population size until mid to late winter. This deer biomass is available to wolves essentially throughout the year but is not represented. It further states that other factors in addition to habitat may affect the current [deer/wolf] equilibrium including changes in wolf harvest or human harvest of deer (USDA 1997b, Appendix N, p. N-32).

The condition of previously harvested stands (e.g., stand initiation or stem exclusion) and stands proposed for harvest are compared to the habitat capability that existed prior to large-scale timber harvest. In general, higher value habitat is reduced in value when harvested and drops further at the stem exclusion stage; some lower value habitat initially increases in value when harvested due to increased forage, but drops below pre-harvest levels once stem exclusion occurs. Low-elevation, high-POG stands with southern aspects and low average snowfall are assumed to provide the best quality deer winter habitat. Areas above 1,500 feet in elevation are assumed to have no value as winter habitat.

Controversy has surrounded the deer model since its revision in 1995.

- The model is a linear habitat model that does not incorporate non-linear features such as predation, recruitment, disease, etc.
- The deer density multiplier was increased from 75 to 125 deer/mi^2 based upon professional judgment after model results seemed low when compared to eight year harvest data from Juneau and Sitka areas (Black-tailed Deer Habitat Model Review, June 17, 1996). Based upon additional work on Admiralty, Baranof, and Chichagof Islands [again higher snow levels], Person et al (1997) suggested that 100 deer/mi^2 would be the more appropriate deer density for the HSI score of 1.0.
- In 2008, HSI scores were standardized from a high of 1.3 to 1.0 in the version used for the 2008 Forest Plan (reduced by 30%) so that 1.0 is now the highest value. This latter change is questionable since the model was designed and calibrated using research data at intermediate snow levels from the Juneau/Douglas area (11/07/1995 Deer Panel Forum); a 30% increase was then applied to low snow areas and a decrease applied to high snow areas.
- Vegetation mapping changed from volume class to volstrata, then more recently to SDM in the version used for the 2008 Forest Plan. Use of volstrata caused additional controversy, even though Doerr et al. (2005) found a consistent relationship in habitat selection using timber volume strata (VOLSTRATA).

Table 12. Existing Deer Habitat Capability, NFS Lands WAAs 406 and 407

WAA	Historic DHC	Existing DHC	Percent Reduction
406	3,276	2,521	-23%
407	1,158	1,042	-10%

Deer habitat capability (DHC) does not equal actual deer; it is used as a tool to compare alternatives.

Additional information on the deer model is provided in the FP FEIS (USDA 2008c, pp. 3-231 & 3-323, 3-265 thru 3-267, and USDA 2008d, Appendix B, pp. B-31 & B-32).

Direct and Indirect Effects

NFS lands within WAAs 406 and 407 were used as the scale for direct effects analysis.

Effects Common to Alternatives 2-6.

All of the action alternatives would reduce deer habitat (deep snow winter, average winter and non-winter), but effects vary based on harvest prescriptions. Even-aged prescriptions (i.e., clearcutting) would directly reduce the amount of deer habitat. Short-rotation, clearcut logging reduces habitat capability for deer (Person et al. 1996) and loss of old-growth habitat to stem exclusion represents an irreversible commitment of resources (USDA 2008c p. 3-2). “Although during summer and mild winter conditions, deer may benefit from young clearcuts, the long-term prognosis is permanent loss of suitable foraging habitat” (Person and Brinkman 2013). Schoen and Kirchhoff (2007) also state that once old growth habitat is clearcut and placed under short-term rotations, its value as deer habitat is substantially and permanently reduced. Effects from clearcutting would be realized immediately after project completion, but more so in 25 to 30 years. Closed-canopy young-growth (roughly 26 to 150 years old) provides minimal forage due to the lack of light penetration to the forest floor (stem exclusion phase). See Biodiversity section above and Alaback et al. (2013) for further discussion of changes to old-growth ecological function and condition resulting from timber harvest.

Many stands within the Saddle Lakes area were pre-commercially thinned which can delay the onset of the stem exclusion phase (Hanley et al. 2013). However, analysis of past treatments by Alaback (2010) on Prince of Wales showed that while thinning can improve wildlife habitat for 5-10 years following treatment, one of the key limitations is its relatively short longevity. Alaback found that within 15 years, crop trees had expanded their branches and created a dense overstory canopy that created or re-created the stem exclusion phase. McClellan et al. (2014) noted similar canopy closure in stands 21 years post thin on the False Island area of Chichagof Island. I have observed this return to stem exclusion in previously thinned stands on Prince of Wales and Revillagigedo Island. Timeframe is dependent upon site productivity with higher productivity sites entering stem exclusion more quickly than lower productivity sites.

Review of historic uneven age “partial cut” treatments on the Tongass showed that partial cutting maintained deer forage and habitat better than clearcut harvest (Deal 2009, Deal 2001). Results indicated that stand structural diversity and plant composition and abundance were much greater in partially cut stands than in young-growth stands developing after clearcutting (Deal, 2001, Deal and Tappeiner 2002). Overall, partial cutting maintained diverse and abundant plant understories comparable to the plant communities typically found in old-growth. Less than 50 percent basal area removal did not differ statistically from uncut plots in understory plant abundance or understory community structure (Deal 2001). Fifty years after partial cutting, tree diameters, large tree numbers, species composition, stand complexity, and understory diversity were similar to original stand conditions (Deal 2009). However, partial cutting, at least in the short-term, opens the overstory canopy and thus provides less snow interception. Actual change in canopy depends upon the intensity of the treatment and individual stand prescription (Vanderwel et al. 2011). See Figure 10 removal patterns.

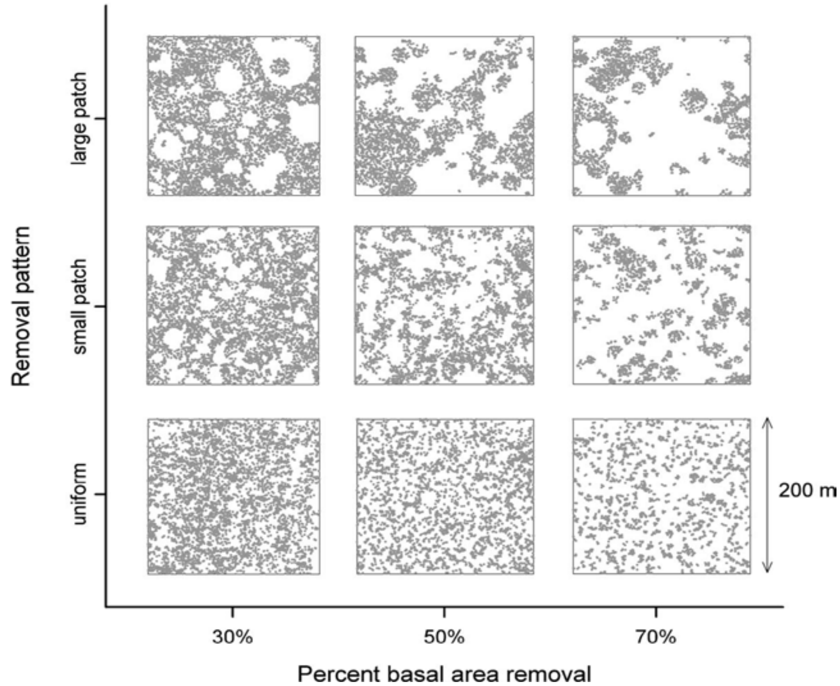


Figure 10. Variation in Partial Cutting Prescription Removal Patterns

Deep Snow Winter Habitat
Measurement criteria: acres of high-POG [SD5N, SD5S, SD67] ≤800' elevation on south aspects based upon research cited below.

The greatest adverse effect would result from clearcutting high volume, low elevation (i.e., high-POG ≤800 feet) stands that are critical to deer during winters with heavy snow fall (McNay and Voller 1995 cited in Porter 2013a). Following clearcut harvest, deer are impacted by reduced forage availability from the conversion of old-growth winter habitat to young-growth stands and the increase in snow accumulation (Hanley 1984). The size and distribution of clearcuts on the landscape over time is important. Clearcutting that begins at the lower elevations and moves upward results in a seral stage gradient that is superimposed directly on the elevational gradient and severely limits deer options for finding quality habitat during winter (Hanley 1984). The ability of deer to survive severe winter conditions is influenced by how well-nourished they are coming into the winter season, the persistence of deep snow conditions, and how rapidly they are re-nourished after conditions abate (Wallmo and Schoen 1980). Impacts would affect resident deer more than migratory ones since they would not move to forage rich alpine areas in the summer.

Isolating blocks of old-growth forest within young, second-growth forest creates three potential problems. First, isolated patches of low elevation winter range potentially serve to concentrate deer, with resulting overuse of forage and decreased carrying capacity. In fragmented landscapes where small, remnant patches of old growth exist, deep snow may also isolate deer by precluding movement between patches (McNay and Vollner 1995). Deer confined to isolated stands of POG consume available food resources and suffer higher rates of mortality from malnutrition than deer in unfragmented old-growth forest (Kirchhoff 1994). In Schoen and Kirchhoff's (1985) study, radio-collared deer rarely moved into or above clearcuts. Deer that wintered below clearcuts moved above them during the summer so Schoen and Kirchhoff assumed the reluctance to do so during the winter was attributable to greater snow accumulation in the clearcut. Locomotion costs associated with snow depths and supplementary thermoregulatory expenditures increase energy demands for deer during winter; the negative energy balance (energy debt) of deer during winter is a direct consequence of the decrease in abundant high quality food and is aggravated by additional costs associated with snow and cold temperatures (Parker et al. 1999).

Second, windthrow is common along the edges of clearcuts and may decrease the area of protected deer habitat (Hanley 1984). Windthrow along the edge of suitable old-growth habitat may also inhibit deer movement into these patches or increase energy expenditure.

Third, deer concentrated in remaining patches are more susceptible to predation by wolves. Van Ballenberghe and Hanley (1984) hypothesized that three things tend to increase the probability of wolves suppressing deer populations in southeast Alaska: 1) periodic winters of deep snow that result in increased killing by wolves, 2) the patchiness of deer winter habitat that reduces the time wolves spend searching for prey, 3) the availability of marine food resources that buffer wolves from cyclic fluctuations in their terrestrial prey.

Hunters and predators, (e.g., wolves and bears) also contribute to deer declines during or following severe winters and may inhibit subsequent recovery (see Wolf Section below). Farmer et al. (2006) studied deer on Heceta Island in Southeast Alaska during moderately severe winter conditions. Predation by wolves was the primary source of mortality for adult and yearling females, hunting was the major source of mortality for bucks, and malnutrition was the major cause of death in juveniles. Juveniles were particularly sensitive to habitat quality because they require food to support both growth and maintenance. Moderately deep snow increased energy costs, causing nutritional stress and contributing to death from malnutrition. Clearcuts and stands in stem exclusion generally increased risk of death for all sex and age groups of deer, and at all spatial scales, regardless of mortality source (Farmer et al. 2006). Where wolves are present, deer populations are slow to recover from die-offs during the occasional severe winters (Hanley 1984).

Partial cutting would affect deep snow winter habitat until sufficient canopy closure occurred to provide snow interception. Timeframe would likely be influenced by removal pattern and silvicultural prescription.

Changes in deer deep snow winter habitat are displayed in Table 13.

Average Winter Habitat
Measurement criteria: acres of POG <1500’ elevation, Deer model DHC.

Except for six units (16, 17,28, 71,72, & 140), all proposed timber harvest is less than 1,500 feet elevation so would affect average winter deer habitat (Table 6). Habitat would be more fragmented which may limit elevational mobility and make deer more susceptible to predation. Young clearcuts would provide forage during relatively snow free periods and can be a refuge from wolves. However, slash levels in young growth stands could hinder movement and increase the amount of energy expended in accessing forage (McClellan et al. 2014, Hanley 1984). Once stem exclusion occurs, stands may provide cover, but contain minimal forage and contribute to mortality from malnutrition and predation (Farmer et al. 2006). The absence of deer forage in second-growth stands continues for more than a century following canopy closure. Consequently, forest practices that reduce available forage and increase snow accumulation during winter months lower the long-term carrying capacity for deer. See deer model results for changes in habitat capacity during average winters.

Partial cutting would have short-term effects until sufficient canopy closure occurred to provide snow interception. Partial cut stands could provide winter habitat during relatively snow-free periods.

Non-Winter (Spring/Summer/Fall):
Measurement criteria: all habitats except older second growth.

Forage would increase temporarily in young clearcuts, but decrease long-term along all elevational gradients once stem exclusion occurs (Table 13). Stem exclusion reduces the amount of high quality forage available during spring through fall and can cause deer to enter the winter in poorer condition. It can also cause energy debt in lactating females and poor survival of fawns. Emphasis has been placed on the dramatic impacts of winter constraints on energy balance, but Parker et al. (1999) stated that it is equally important to recognize the value of high quality, abundant forage in summer and of transitional fall and spring habitats to restore body condition and accumulate body reserves.

Timber harvest can make deer more susceptible to hunting mortality in the fall. Farmer et al. (2006) found that deer use of shrub-sapling-stage clearcuts in landscapes accessible by roads increased risk of death from hunting. Hunting was the primary source of mortality for bucks in their study on Heceta Island; most bucks were killed on slopes near roads where they were easily visible in young clearcuts (Farmer et al. 2006). Initial hunting access within most of WAAs 406/407 is by boat, but logging roads are used for additional access to hunting areas.

Partial cutting would have less effect on non-winter habitat as stands would not develop into stem exclusion, but logging slash could affect access to available forage.

Changes in deer habitat for WAAs 406 and 407 during all seasons are shown in Table 13. Alternatives 2, 4, and 6 are similar in the overall amount of habitat affected, but vary in effects due to harvest prescriptions. See Marten, Hairy Woodpecker, and Red Squirrel sections for impacts to POG at the more localized VCU scale.

Table 13. Change in Deer Habitat, NFS Lands WAAs 406/407

		Remaining Habitat Acres (% reduction from *existing*)					
		Existing \ Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
WAA 406	Deep snow winter	2,463	2,411 (-2.1%)	2,457 (-0.2%)	2,418 (-1.8%)	2,411 (-2.1%)	2,429 (-1.4%)
	Average winter	40,421	39,322 (-2.7%)	40,065 (-0.9%)	39,196 (-3.0%)	38,890 (-3.8%)	39,373 (-2.6%)
	Non-winter	116,178	114,832 (-1.1%)	115,711 (-0.4%)	114,675 (-1.3%)	114,259 (-1.7%)	114,881 (-1.1%)
	Non-winter at stem exclusion		108,699 (-6.4%)	109,579 (-5.7%)	108,543 (-6.6%)	108,127 (-6.9%)	108,750 (-6.4%)
WAA 407	Deep snow winter	940	911 (-3.0%)	925 (-1.6%)	881 (-6.3%)	844 (-10.2%)	881 (-6.3%)
	Average winter	15,930	15,161 (-4.8%)	15,465 (-2.9%)	15,082 (-5.3%)	14,843 (-6.8%)	15,163 (-4.8%)
	Non-winter	40,657	39,797	40,112	39,718	39,461	39,811

		Remaining Habitat Acres (% reduction from *existing*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
			(-2.1%)	(-1.3%)	(-2.3%)	(-2.9%)	(-2.0%)
	Non-winter at stem exclusion		38,443 (-5.4%)	38,758 (-4.7%)	38,364 (-5.6%)	38,107 (-6.3%)	38,457 (-5.4%)
WAAs 406 & 407	Deep snow winter	3,403	3,323 (-2.4%)	3,382 (-0.6%)	3,298 (-3.1%)	3,255 (-4.3%)	3,309 (-2.8%)
	Average winter	56,351	54,483 (-3.3%)	55,530 (-1.5%)	54,278 (-3.7%)	53,733 (-4.6%)	54,537 (-3.2%)
	Non-winter	156,835	154,629 (-1.4%)	155,823 (-0.6%)	154,393 (-1.6%)	153,720 (-2.0%)	154,692 (-1.4%)
	Non-winter at stem exclusion		147,142 (-6.2%)	148,336 (-5.4%)	146,907 (-6.3%)	146,235 (-6.8%)	147,206 (-6.1%)

Deep snow winter habitat = high-POG ≤800' elevation on south aspect
Average winter habitat = POG≤1,500' elevation
Non-winter habitat = all habitats except stem exclusion young growth.

Deer model Results

The deer model was run to provide a comparison of average winter habitat capability under the various alternative scenarios. For the Saddle Lakes analysis, the deer model was with the following parameters for direct and indirect effects:

- Model was run by the GIS shop and interpreted by project biologist.
- Corporate GIS layers were used.
- Size density (SDM) was used for vegetation.
- Only NFS lands in WAAs 406 and 407 were used for direct effects.
- Standardized coefficients of 0.0 to 1.0 were used.
- 100 deer/mi^2 applies to multiplier at HSI 1.0.
- All harvest was treated as clearcut for modeling purposes.
- Model was run for historic (1954), current, initial implementation, and stem exclusion (26+ year) conditions.
- Historic harvest was considered to be high-POG if on non-hydric soils or medium-POG if on hydric soils (slope class<2).
- All elevations were used when calculating deer density.
- Freshwater lakes were excluded from calculations.

Because the model assigns values to habitats other than POG, changes from existing condition are less than the direct change in POG ≤1,500 feet. All action alternatives would reduce deer habitat capability. Effects would be occur immediately after project completion, and intensify in 25 to 30 years as the harvested stands transition into the stem exclusion stage and forage disappears from the understory. These reductions in habitat capability could lead to a decline in the deer population, particularly following severe winters. Deer model habitat capability results are shown by alternative in Table 14. Deer density results are discussed in the Wolf Section, Table 18. All action alternatives are within Forest Plan predictions (USDA 2008c, p. 3-269).

Table 14 Deer Model Habitat Capability, NFS Lands WAAs 406/407

	Time since harvest	Existing \ Alt. 1	DHC (% reduction from existing)				
			Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	0-25 years	2,521	2,482 (-1.5%)	2,505 (-0.6%)	2,479 (-1.7%)	2,472 (-1.9%)	2,485 (-1.4%)
	26-200 years		2,396 (-5.0%)	2,433 (-3.5%)	2,391 (-5.2%)	2,378 (-5.7%)	2,400 (-4.8%)
WAA 407	0-25 years	1,042	1,014 (-2.7%)	1,027 (-1.4%)	1,010 (-3.1%)	997 (-4.3%)	1,011 (-3.0%)
	26-200 years		978 (-6.1%)	995 (-4.5%)	971 (-6.8%)	954 (-8.4%)	974 (-6.5%)
WAAs 406/407	0-25 years	3,563	3,496 (-1.9%)	3,532 (-0.9%)	3,489 (-2.1%)	3,469 (-2.6%)	3,496 (-1.9%)
	26-200 years		3,374 (-5.3%)	3,429 (-3.8%)	3,363 (-5.6%)	3,332 (-6.4%)	3,374 (-5.3%)

[1] NFS lands only. Partial harvest was modeled as clearcut. Habitat capability does not equal actual deer; it is used as a tool to compare alternatives.

[2] 0 – 25 years represents the initial effect of project implementation

[3] 26 – 200 years represents the effect of stem exclusion.

Alternative 1

Alternative 1 would have no effect on deer. All existing deep snow habitat would remain to support current deer populations during winters with above average snowfall. With most of the project area below 1,500 feet elevation, Alternative 1 would maintain the highest level of average winter habitat. All non-winter (spring/summer/fall) habitat would be maintained which would help deer enter the winter in better nutritional condition with higher fat reserves. Forage would be maintained at current levels allowing adult females to meet the nutritional demands of lactation and current reproductive success. Alternative 1 would maintain the existing deer habitat capability.

Under Alternative 1, the level of fragmentation would remain unchanged, except for naturally occurring events (e.g., windthrow). Alternative 1 would not cause additional habitat fragmentation; deer would not be more susceptible to hunting or predation (see deer-wolf interactions in wolf section). Alternative 1 would maintain the existing OGR between Naha and George Inlet which would allow continued movement between source and sink habitat. It would also maintain current elevational corridors linking summer and winter habitat and allowing deer to move up and down slopes during the winter as snow levels allowed. Hunter access would remain the same on NFS lands as no project related road construction would occur. Current deer populations would be maintained unless affected by natural causes such as weather or disease.

Alternative 2

Alternative 2 would harvest 80 acres of deep snow winter habitat, 1,868 acres of average winter habitat, and 2,207 acres of non-winter habitat. Therefore, it would contribute to all of the effects mentioned above. This alternative maintains the second highest level of habitat of the action alternatives since it contains a higher percentage (52%) of uneven age “partial cutting” with up to 33 percent basal area removal (UA33).

Deep snow winter habitat would be maintained at 98 and 97 percent of existing levels, respectively within WAAs 406 and 407 (Table 13). The 53 acres of even-age clearcutting represent a long-term (150+ year) habitat loss of deer habitat during deep snow winters, whereas the 27 acres of partial cutting (UA33) represents a short-term (≤50 year) loss with actual impact dependent upon tree removal pattern and how quickly the stand regains interconnected canopies capable of snow interception (see discussion of partial cutting and removal patterns under "effects common to alternatives" above). Partial cut stands would not provide the same quality of habitat as existing old-growth forest in the short-term as they would have less snow interception in the winter and slash could deter movement within portions of the stand.

Average winter habitat would be maintained at 97 percent of the existing level in WAA 406, whereas 95 percent of existing average winter habitat would be maintained in WAA 407. The 952 acres of UA33 partial cutting would continue provide some level of habitat during average snow winters. Clearcut units (916 acres) could provide short-term forage during relatively snow-free periods, but represent a long-term to permanent habitat loss once stem exclusion occurs.

Non-winter habitat within WAAs 406 and 407 would be maintained at 94 and 95 percent of existing levels, respectively with the onset of stem exclusion. Approximately 52 percent (1,055 acres) would be partial cut (UA33) and 48 percent of the harvest (1,152 acres) would be clearcut. This reduction in available habitat increases the risk of malnutrition in does and fawns. Effects would be more pronounced in resident deer that do not migrate to high quality alpine areas during the summer. The clearcut units could affect a deer's ability to move up and down the slope as snow levels change since most units are below 1,500 feet.

Deer habitat capability would be maintained at 98 and 97 percent of current levels initially, within WAAs 406 and 407 respectively, then drop to 95 and 94 percent at stem exclusion. Actual impacts may be less as all harvest is modeled as clearcut in accordance with current deer model direction whereas partial cut (UA33) units would not transition into stem exclusion.

Except for road 8300280 which overlaps with the Ketchikan to Shelter Cove Road, the 15.8 miles of new road would be closed post-sale, but would provide increased walk-in access for hunters making bucks more susceptible to hunting mortality in the fall. Roads would facilitate easier access into some new areas within Saddle Lakes project area.

Alternative 2 would maintain elevational and connectivity corridors 2, 3, and 4 which would maintain links to important high elevation summer habitat. Alternative 2 would partial cut (UA33) elevational and connectivity corridors 6, 7, and 8 and would clearcut corridor 5. Partial cutting under UA33 prescriptions would maintain more forest structure than clearcuts and would therefore maintain some functionality of the corridor. Clearcut units would hinder movement up and down slopes and contribute to increased risk of winter malnutrition, predation and/or hunting mortality. Alternative 2 would partial cut (UA33) Units 28, 46, 48, 71, 116, and154 within the identified corridors and clearcut Units 8, and 9.

Alternative 2 would maintain the existing OGR in VCU 7470 maintaining connectivity between Naha and George and Carroll Inlets to replenish sink habitat. With deer numbers likely below carrying capacity, it is not known what affect the proposed harvest would have upon existing deer numbers. However, reduced habitat capability could hinder the State's intensive management objective to increase deer in GMU 1A.

Alternative 3

Alternative 3 would have the least effect on deer habitat of the action alternatives. It would log 21 acres of deep snow winter habitat, 821 acres of average winter habitat, and 1,013 acres of non-winter habitat. Many low elevation, south facing slopes were excluded from harvest in this alternative and no units were proposed within the identified elevational.

Deep snow winter habitat would be at 98 to over 99 percent of existing levels within WAAs 406 and 407, respectively with the 21 acres of harvest being clearcut. Winter habitat during average winters would be maintained at 97 to 99 percent of existing levels. As a result, deer would still be able to move up and down the slopes as snow levels allowed accessing additional foraging areas. Risk of malnutrition would be slightly higher than existing levels as would predation risk, but less than in other action alternatives. The 158 acres of partial cutting (UA33) would continue to provide some habitat during average winters and should recover within 50 years. The 663 acres of clearcutting would reduce average winter habitat long-term. Non-winter habitat would be maintained at approximately 99 percent of existing levels (Table 13) initially, then drop to 94 and 95 percent of WAAs 406 and 407 respectively. The 11.7 miles of new road would facilitate walk-in access by hunters. Alternative 3 roads are predominantly short extensions into units.

Deer habitat capability is maintained at 99 percent of current levels initially, then drops to 96 and 95 percent of existing habitat capabilities within WAAs 406 and 407 as harvested units move into stem exclusion. Actual impacts may be less as all harvest is modeled as clearcut in accordance with current deer model direction.

Alternative 3 was specifically designed to maintain the identified elevational and connectivity corridors. Alternative 3 would maintain the existing OGR in VCU 7470 so connectivity between Naha and George and Carroll Inlets would be maintained. The Saddle Lakes area would continue to function as coastal winter range and would support huntable populations of deer.

Alternative 4

Alternative 4 would harvest 105 acres of deep snow winter habitat, 2,073 acres of average winter habitat, and 2,424 acres of non-winter habitat. It would harvest the second highest amount of timber with 87 percent of total harvest done using even-age clearcut prescriptions. As a result, it would have the second highest impact on deer habitat and second highest risk to deer nutrition, reproduction, and predation.

Deep snow habitat in WAAs 406 and 407 would be reduced to 98 and 93 percent of current levels, respectively. Harvest would have long-term impacts on deer since 101 of the 105 acres harvested would be clearcut. As a result, deer could be more susceptible to winter die-off, malnutrition and/or predation by wolves.

Average winter habitat would be maintained at 97 and 95 percent of existing levels. Most stands (1,794 acres) would be clearcut resulting in long-term (150+ years) to permanent loss of habitat under 100 year rotations. The 279 acres of partial cutting (UA33) would continue to have some value during average winters and recover more quickly than the clearcut stands. Increased slash could hinder movement and increase energy debt accessing forage. Alternative 4 would also clearcut stands along elevational gradients limiting a deer’s ability to move up and down slopes in search of forage.

Alternative 4 would clearcut 2,112 acres of non-winter habitat and partial cut (UA33) 312 acres. Non-winter habitat would initially drop to 99 percent of existing levels in WAA 406 then drop to

93 percent at stem exclusion. Non-winter habitat in WAA 407 initially drop to 98 percent then drop further to 94 percent with the onset of stem exclusion. Alternative 4 would construct 29.4 miles of new road. Although closed post sale (except for road 8300280), these roads would provide easier access to many additional hunt areas within the Saddle Lakes area.

Deer habitat capability is maintained at 98 and 97 percent of current levels initially, then drops to 95 and 93 percent long-term within WAAs 406 and 407 as stem exclusion occurs.

Alternative 4 does not implement Forest Plan Standard and Guideline WILD1.B.2 (USDA 2008b) within the Modified Landscape LUD. Alternative 4 would clearcut many areas identified as being important elevational travel corridors or important to habitat connectivity. Others would be partial cut (UA33) which would reduce their effectiveness during the winter by allowing some snow to reach and build up within the understory. Both treatments would affect the functionality of corridors 3, 5, 6, 7, and 8 which would affect connectivity long term. Specific units in conflict include: partial cut (UA33) in Units 30, 49, 71-2, 203, 204, clearcutting in Units 8, 9, 28, 31, 40, 46, 48, 53 71-1, 71-3, 113, 114, 116, and 154. Alternative 4 would maintain the existing OGR in VCU 7470 maintaining connectivity between Naha LUD II and George and Carroll Inlets.

Alternative 5

Alternative 5 would have the greatest impact on deer by harvesting the greatest amount of deer habitat throughout all seasons by harvesting the greatest amount of timber. It would cut 148 acres of deep snow winter habitat, 2,619 acres of average winter habitat, and 2,875 acres of non-winter habitat. Ninety (90) percent of the stands harvested would be clearcut eliminating their function long term as winter habitat or non-winter habitat once stem exclusion occurs.

Alternative 5 would maintain 98 percent of the current deep snow winter habitat in WAA 406, and 90 percent in WAA 407. Of the 148 acres of deep snow winter habitat harvested, 141 acres would be clearcut. The highest amount of cedar would be harvested thus removing high use sites (bedding areas under cedar, cedar knobs from which to detect predators). Deep snow habitat would be the most fragmented under this alternative and most likely to concentrate deer increasing risk of mortality from malnutrition or predation.

Average winter habitat would be reduced to 93 and 96 percent of current levels. Most stands (2,410 acres) would be clearcut resulting in long-term (150+ years) to permanent loss of habitat under 100 year rotations. The 208 acres of partial cutting (UA33) would have limited capability to intercept snow and therefore have limited value during average winters. Actual impact would vary depending upon snow accumulation and persistence. Within the project area, this would limit habitat for migratory deer long-term to permanently under 100 year timber rotations by reducing forage along the elevational gradient, concentrating deer into less suitable areas, increasing risk of predation, and limiting mobility through and around harvested stands. Resident deer with home ranges within the project area would be impacted more than migratory deer; reproduction in females could be lower due to less available forage and higher energy costs.

Non-winter habitat would be reduced by to 98 and 97 percent of current levels in WAAs 406 and 407 initially, then reduced further to 93 and 94 percent at stem exclusion.

Deer habitat capability is maintained at 98 and 96 percent of current levels within WAAs 406 and 407 initially, then drops to 94 and 92 percent long-term at stem exclusion.

Alternative 5 does not implement Forest Plan Standard and Guideline WILD1.B.2 (USDA 2008b) within the Modified Landscape LUD. Alternative 5 would clearcut or partial cut (UA33) areas identified as being important elevational travel corridors or important to habitat connectivity. Partial cut (UA33) units include 30, 71-2, 203, 204, 224, clearcut units include 8, 9, 28, 31, 40, 46, 48, 49, 53, 71-1, 71-3, 113, 114, 115, 116, 122, and 154. Therefore, elevational connectivity is reduced or eliminated in portions of the project area.

Alternative 5 would move the existing OGR in VCU 7470 into the 2001 North Revilla IRA and reduce overall acres of protected deer habitat and sever the connectivity between Naha and George and Carroll Inlet by clearcutting units 300 through 312. This would limit the ability to replenish sink habitat given the movement patterns found by Colson et al. (2012) on nearby Prince of Wales Island and McNay and Vollner (1995) in British Columbia. Likewise, the Roadless OGR does not provide comparable achievement of OGR LUD goals and objectives as it relates to deer.

Alternative 6

Alternative 6 would cut 93 acres of deep snow winter habitat, 1,814 acres of average winter habitat, and 2,138 acres of non-winter habitat. It ranks in the middle (i.e., third) of the action alternatives. It would harvest slightly less acres than Alternative 2, but includes a higher percentage of clearcutting (77%).

Deep snow habitat in WAAs 406 and 407 would be reduced long-term to 99 and 94 percent of current levels. Almost all harvest (87 of 93 acres) in deep snow winter habitat would be clearcut.

Average winter habitat would be maintained at 97 and 95 percent of existing levels, respectively in WAAs 406 and 407. Most stands (1,423 acres) would be clearcut resulting in long-term (150+ years) to permanent loss of habitat under 100 year rotations. The 391 acres of UA33 partial cutting would have reduced capability to intercept snow and therefore have reduced value during average winters. Increased slash could hinder movement and increase energy debt accessing forage. Alternative 6 would also clearcut stands along elevational gradients limiting a deer's ability to move up and down slopes in search of forage.

Non-winter habitat would initially drop to 99 and 98 percent of existing levels in WAAs 406 and 407, respectively then drop to 94 and 95 percent of existing levels at stem exclusion.

Deer habitat capability is maintained at 99 and 97 percent of current levels initially, then drops to 95 and 93 percent as habitat capabilities within WAAs 406 and 407 move into stem exclusion.

Alternative 6 does not implement Forest Plan Standard and Guideline WILD1.B.2 (USDA 2008b) within the Modified Landscape LUD. Alternative 6 does not maintain elevation corridors 1, 3, 5, 6, and 7, and reduces the width and effectiveness of corridor 8. Specific units in conflict include: Partial cutting (UA33) in Units 30, 49, 203, 204, 224, and clearcutting in Units 8, 9, 31, 40, 48, 113, 114, 116, 154, and 207. Therefore, elevational connectivity is reduced or eliminated in portions of the project area. Alternative 6 would maintain the existing OGR in VCU 7470 maintaining connectivity between Naha and George and Carroll Inlets.

Cumulative Effects

Cumulative effects analysis for deer includes both NFS and non-NFS lands within WAAs 406 and 407. Past timber harvest and road construction, combined with the Saddle Lakes project and foreseeable future projects, would have the greatest impact on deer habitat carrying capacity and therefore long-term negative effects on deer and future hunter success.

Early harvest was generally at low elevation along the Carroll and George Inlet or along larger drainages such as Gunsight, Marble, Calamity, Licking, and Shoal Creeks in higher volume stands which affected both year-round and winter habitat. Much of the older harvest is currently in stem exclusion (see Table 3). Some older harvest stands on Cape Fox lands in George Inlet have recently been clearcut a second time (Figure 11). Transition to young growth harvest was recently mandated by the Secretary of Agriculture (USDA 2013). This will increase the harvest of young growth over the next 10-15 years confirming that harvest of old growth is an irreversible commitment of resources (USDA 2008c, p. 3.2) that cannot be renewed under short-term timber rotations.

Figure 11. Recent Young Growth Harvest

Approximately 500 acres of habitat was inundated on the east side of Carroll Inlet from the construction of the Swan Lake hydro facility. An additional 26 acres of could be affected by the proposed expansion. AMHT recently completed extensive (3,276 ac) low elevation harvest along Leask Creek. If the proposed AMHT land exchange is approved, substantial impacts could occur from logging within the 8,170 acre Shelter Cove parcel (AMHT 2014, Forest Resource Management Plan).

The Ketchikan to Shelter Cove road, when completed, will connect the communities of Ketchikan and Saxman to the Saddle Lakes project area, additional areas in WAA 407 and portions of WAA 406 west of Carroll Inlet. This would make the area more accessible to hunters and would likely increase hunting pressure. Similar to findings by Farmer et al. (2006) on nearby Prince of Wales Island, bucks in young clearcuts may be more susceptible to hunting mortality. Declines in the deer population resulting from reduced habitat capability may decrease the availability of deer to wolves and hunters (Person 2001, Farmer et al. 2006, Brinkman et al. 2009). Overall change to deer habitat across all ownerships is displayed in Table 15.

Table 15. Cumulative Change to Deer Habitat, All Ownerships WAAs 406/407

	Habitat	Acres (% reduction from *historic*) Historic	Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	Deep snow winter	4,194	2,775 (-33.8%)	2,723 (-35.1%)	2,769 (-34.0%)	2,729 (-34.9%)	2,723 (-35.1%)	2,741 (-34.6%)
	Average winter	54,385	42,506 (-21.8%)	41,408 (-23.9%)	42,150 (-22.5%)	41,281 (-24.1%)	40,975 (-24.7%)	41,459 (-23.8%)
	Non-winter	126,769	120,343 (-5.1%)	118,997 (-6.1%)	119,876 (-5.4%)	118,840 (-6.3%)	118,425 (-6.6%)	119,047 (-6.1%)
	Non-winter at stem exclusion	125,078	112,641 (-9.9%)	111,295 (-11.0%)	112,174 (-10.3%)	111,139 (-11.1%)	110,723 (-11.5%)	111,345 (-11.0%)
WAA 407	Deep snow winter	1,937	1,193 (-38.4%)	1,165 (-39.9%)	1,178 (-39.2%)	1,134 (-41.5%)	1,098 (-43.3%)	1.134 (-41.5%)
	Average winter	28,932	23,379 (-19.2%)	22,609 (-21.9%)	22,914 (-20.8%)	22,531 (-22.1%)	22,291 (-23.0%)	22,612 (-21.8%)
	Non-winter	65,777	62,893 (-4.4%)	62,032 (-5.7%)	62,347 (-5.2%)	61,954 (-5.8%)	61,696 (-6.2%)	62,046 (-5.7%)
	Non-winter at stem exclusion	61,000	55,446 (-9.1%)	54,585 (-10.5%)	54,900 (-10.0%)	54,507 (-10.6%)	54,250 (-11.1%)	54,599 (-10.5%)
WAAs 406 & 407	Deep snow winter	6,131	3,968 (-35.3%)	3,888 (-36.6%)	3,947 (-35.6%)	3,864 (-37.0%)	3,821 (-37.7%)	3,875 (-37.0%)
	Average winter	83,317	65,885 (-20.9%)	64,017 (-23.2%)	65,064 (-21.9%)	63,813 (-23.4%)	63,267 (-24.1%)	64,071 (-23.1%)
	Non-winter	192,545	183,236 (-4.8%)	181,029 (-6.0%)	182,223 (-6.3%)	180,794 (-6.1%)	180,120 (-6.5%)	181,093 (-5.9%)
	Non-winter at stem exclusion	186,078	168,087 (-9.7%)	165,880 (-10.9%)	167,074 (-10.2%)	165,646 (-11.0%)	164,973 (-11.3%)	165,944 (-10.8%)

Does not include Leask Lakes harvest or future projects.

With one-third to almost one-half of the deep snow deer habitat impacted (Table 15), deer populations may have a difficult time in rebounding after severe winter die-offs and be more susceptible to predation and malnutrition. These latter two factors could affect recruitment rates and predator/prey relationships. Concentrated timber harvest within these WAAs started at the beach and larger low elevation drainages and has moved up slope in elevational gradients or removed interspersed “leave strips” making it more difficult for deer to move between forage patches in the winter and/or causing them to expend more energy to do so. Impacts to average winter habitat has been less intensive, but more widespread. See Porter (2011a) for additional discussion of harvest effects on deer populations.

Deer model Results

For cumulative effects analysis, the deer model was used for average winter carrying capacity with the following changes or in additions to the parameters listed under direct effects:

- All ownerships in WAAs 406 and 407 were used.

- Historic condition on non-NFS lands was reconstructed using the same high-POG/medium-POG parameters listed above.
- Non-NFS lands were assigned zero habitat value for existing and future condition (conservative estimate) due to extensive past timber harvest and identified harvest objectives.
- Relevant projects in the foreseeable future were discussed qualitatively since final design features are not available.

Historic clearcut timber harvest on all ownerships within WAAs 406 and 407 has had the greatest impact on deer habitat and therefore, the greatest impact on carrying capacity. Deer model habitat capability is currently at 71 percent of historic capability WAA 406 and at 42 percent in WAA 407 and will be reduced further as previously clearcut stands transition into stem exclusion (Table 15).Comparison with historical condition across all ownerships for cumulative effects shows more substantial impacts to deer habitat capability (Table 16).

Table 16. Cumulative Change in Deer Habitat Capability, All Ownerships WAAs 406/407

		DHC (% reduction from historic)						
		Historic	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
WAA 406	0-25 years	3,568	2,521 (-29.3%)	2,482 (-30.4%)	2,505 (-29.8%)	2,479 (-30.5%)	2,472 (-30.7%)	2,485 (-30.4%)
	26-200 years		2,446 (-31.4%)	2,396 (-32.8%)	2,433 (-31.8%)	2,391 (-33.0%)	2,378 (-33.4%)	2,400 (-32.7%)
WAA 407	0-25 years	2,465	1,042 (-57.7%)	1,014 (-58.9%)	1,027 (-58.3%)	1,010 (-59.0%)	997 (-59.6%)	1,011 (-59.0%)
	26-200 years		1,019 (-58.7%)	978 (-60.3%)	995 (-59.6%)	971 (-60.6%)	954 (-61.3%)	974 (-60.5%)
WAAs 406/407	0-25 years	6,033	3,563 (-40.9%)	3,496 (-42.1%)	3,532 (-41.5%)	3,489 (-42.2%)	3,469 (-42.5%)	3,496 (-42.1%)
	26-200 years		3,464 (-42.6%)	3,374 (-44.1%)	3,429 (-43.2%)	3,363 (-44.3%)	3,332 (-44.8%)	3,374 (-44.1%)

[1] Historic capability was reconstructed for all ownerships using the best information available. Non-NFS lands were given zero current habitat capability per current model direction. Partial harvest was modeled as clearcut. Habitat capability does not equal actual deer; it is used as a tool to compare alternatives. Does not include Leask Lakes harvest or identified future projects.

[2] 0 – 25 years represents the initial effect of project implementation

[3] 26 – 200 years represents the effect of stem exclusion.

Alternative 1

Alternative 1 would not harvest POG or result in additional roads, it therefore would not contribute to cumulative effects to deer. However, past, and foreseeable projects will continue to affect deer habitat and deer. Alternative 1 would have the least cumulative impact on deer habitat. Deep snow habitat has been affected the most of any habitat by past projects and has the highest potential to limit deer populations. Overall, Alternative 1 deep snow habitat is at 67 and 62 percent, respectively of the original (1954) deep snow habitat within the project area WAAs. Average winter habitat has been reduced to 78 and 81 percent of historic habitat levels making it harder for deer populations to rebound after severe winters. Non-winter habitat has been impacted the least, because of the NPOG and other habitats. Non-winter habitat has been reduced to 95 and 94 percent of historic levels and will decline to 90 and 91 percent as stands continue to move into stem exclusion. Past harvest in the stand initiation phase (0-25yrs) would continue to move toward stem exclusion; until that time, it would provide some forage during relatively snow free winters and during the non-winter season. Once stem exclusion occurs, deer habitat would be permanently lost within suitable and available timber lands under the current 100 year rotation. Past harvest within beach and riparian buffers and OGRs would be reduced long-term, but would eventually recover.

According to deer model results, habitat capability has currently been reduced to 71 percent of historic capability in WAA 406 and would decrease to 69 percent as the remaining harvested stands move into stem exclusion. Likewise, deer habitat capability WAA 407 has currently been reduced to 42 percent of historic capability and would be reduced to 41 percent of historic levels long term as existing harvest continue to transition into stem exclusion.

Alternatives 2, 4, and 6

Alternatives 2, 4, and 6 are similar in the overall amount of habitat affected. Differences in prescriptions among alternatives are discussed under direct effects. Most past and recent harvest has been by clearcutting.

Deep snow habitat would be reduced long term to 65 percent of historic levels in WAA 406 and to 60 percent in WAA 407 under Alternative 2 and to 58 percent under Alternatives 4, and 6. Past impacts to the most limiting deer habitat may partially account for the low deer numbers within this portion of GMU 1A as deer populations may have a difficult time in rebounding after severe winter die-offs when predation is also a factor. Concentrated timber harvest within these WAAs started at the beach and larger low elevation drainages and has moved up slope in elevational gradients or removed interspersed “leave strips” making it more difficult for deer to move between forage patches in the winter and/or causing them to expend more energy to do so.

Impacts to average winter habitat has been less intensive, but more widespread. Roughly 76 percent of the average winter habitat would remain in WAA 406 and 78 percent in WAA 407. Therefore, approximately one-quarter of the historic average winter habitat could be permanently reduced under the current 100-year timber rotation.

Impacts to non-winter habitat has been substantially less due to the inclusion of NPOG and non-forested habitats. Non-winter habitat would be reduced to 94 percent of historic levels in WAAs 406 and 407; stem exclusion would reduce non-winter habitat to 89 percent of historic levels.

Habitat capability, as predicted by the deer model for WAA 406, would be reduced long term to approximately 67 percent of historic levels at stem exclusion. WAA 407 would be reduced to approximately 40 percent of historic capability at stem exclusion. Overall, habitat within the combined WAAs would be reduced to 56 percent of historic capability at stem exclusion.

Alternative 3

Differences between Alternative 3 and the other action alternatives are less pronounced under cumulative effects due to past clearcutting. Deep snow habitat would be reduced to 66 percent of historic levels in WAA 406 and to 61 percent in WAA 407. Roughly 78 percent of the average winter habitat would remain in WAA 406 and 79 percent in WAA 407. Impacts to non-winter habitat has been substantially less due to the inclusion of NPOG and non-forested habitats. Non-winter habitat would be reduced to 94 percent of historic levels in WAAs 406 and 407; stem exclusion would reduce non-winter habitat to 89 percent of historic levels.

Habitat capability in WAAs 406 and 407 would be reduced to 68 and 40 percent of historic levels, respectively at stem exclusion. As with other alternatives, this reduction would be permanent in timber production areas and long term in other areas.

Alternative 5

Effects of Alternative 5 are less pronounced under cumulative effects. Deep snow habitat would be reduced to 65 percent of historic levels in WAA 406 and to 57 percent in WAA 407. Roughly 75 percent of the average winter habitat would remain in WAA 406 and 77 percent in WAA 407. Impacts to non-winter habitat has been substantially less due to the inclusion of NPOG and non-forested habitats. Non-winter habitat would be reduced to 93 and 94 percent of historic levels in WAAs 406 and 407; stem exclusion would further reduce non-winter habitat to 88 percent of historic levels in both WAAs.

This would increase the risk of mortality particularly after a series of more typical mild winters which have allowed deer populations to increase to artificial levels (McCoy 2008).

Impacts to habitat capability would also be slightly higher under Alternative 5. Habitat capability in WAAs 406 and 407 would be reduced to 67 and 39 percent historic levels, respectively at stem exclusion. As with other alternatives, this reduction would be permanent in timber production areas and long term in other areas.

Summary of Deer Effects

Deer populations in Alaska are dynamic and fluctuate considerably with the severity of the winters. When winters are mild, deer numbers are likely to increase. Periodic severe winters may cause a major decline. In addition to population declines, excessive amounts of snow can hinder deer movements and that can lead to: a change in feeding patterns; increases in energy expenditure; increased risk of malnutrition; increased predation rate; increases in the probability of parasites; and poor condition of surviving does contributing to low survival of newborn fawns the following summer. Deer productivity depends on the nutritional status of deer, which mainly depends on the productive capacity of the habitat (Hanley et al. 1989).

Predation may speed population declines, as well as slow recovery. Forest management affects the balance between deer and wolves by changing the quantity and quality of food resources for deer and the effects of forest overstory on snow interception (Hanley et al. 1989). As stated in the ADF&G deer management report (Porter 2013a), clearcut logging continues to reduce old-growth habitat in portions of GMU 1A; previously logged stands no longer support deer, and local deer populations are expected to decline. With deer numbers remaining low in most of GMU 1A, hunters are selecting other more productive areas and consequently ADF&G is seeing less effort and fewer deer harvested in GMU 1A (Porter 2013a). Although the Forest Plan conservation strategy maintains population viability of deer, the cumulative reduction of elevational connectivity in association with a cumulative reduction in deer habitat capability as a result of past, proposed and future harvest activities and severe winters will likely result in a further decline in the deer population in WAAs 406 and 407. These reductions would further impact subsistence and sport deer hunter success making it harder for hunters to obtain deer and would likely alter deer/wolf predator-prey equilibriums for 150 years or longer until habitat returns to a fully functioning condition. ADF&G anticipates that the decline in deer numbers that they are currently seeing in GMU 1A will continue into the future as additional stands reach stem exclusion and they expect long-term negative effects on deer numbers and future hunter success in most areas near Ketchikan (Porter 2013a).

Alternative 1 ranks the highest in terms of least effect since it would maintain all current old-growth deer habitat which would contribute to maintaining current deer populations and hunter success. Of the action alternatives, Alternative 3 ranks highest followed by Alternatives 2, 6, and 4. Alternative 5 would have the greatest impact on deer habitat and therefore the greatest potential impact on deer populations and hunter success. Differences between alternatives are largely due to differences in silvicultural prescriptions and total acres harvested. Alternatives 4, 5, and 6 further impact deer by not implementing Forest Plan standards and guidelines to maintain elevational connectivity within the project area. Alternative 5 moves the small OGR in 7470 resulting in a loss of connectivity and a further reduction of habitat.

Alexander Archipelago Wolf (Canis lupus ligoni)

FP Direction (WILD1.XIV, p. 4-95 & WILD1.C., p. 3-115):

> Where wolf population data suggest that mortality exceeds sustainable levels, work with ADF&G and USFWS to identify probable sources of mortality. Examine the relationship among wolf mortality, human access, and hunter/trapper harvest. Conduct analyses for smaller islands (e.g., Mitkof Island), portions of larger islands, or among multiple wildlife analysis areas. Where road access and associated human-caused mortality has been determined, through an interagency analysis, to be a significant contributing factor to locally unsustainable wolf mortality, incorporate this information into Travel Management planning and hunting/trapping regulatory planning. The objective is to reduce mortality risk and a range of options to reduce this risk should be considered. In these landscapes, both open and total road density should be considered. Total road densities of 0.7 to 1.0 mile per square mile or less may be necessary. Options shall likely include a combination of Travel Management regulations, establishing road closures, and promulgating hunting and trapping regulations to ensure locally viable wolf populations.
>
> Provide, where possible, sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support 18 deer per square mile (using habitat capability model outputs) in biogeographic provinces where deer are the primary prey of wolves. Use the most recent version of the interagency deer habitat capability model and field validation of local deer habitat conditions to assess deer habitat, unless alternate analysis tools are developed.
>
> Coordinate road management with the needs of wildlife.

Introduction and Habitat correlation to the affected environment

The Alexander Archipelago wolf is restricted to Southeast Alaska, but occurs throughout the Southeast mainland and islands in the Alexander Archipelago except Admiralty, Baranof, and Chichagof (MacDonald and Cook 2007, Person et al. 1996). This subspecies is considered an MIS in the Tongass due to concerns about some populations (FP FEIS p. 3-238). The decision not to list *C. l. ligoni* in 1994 as threatened under the Endangered Species Act was based in large part on the Forest Service's commitment to enhance habitat protection. The USFWS was again petitioned to list *C. l. ligoni* as threatened in 2011. The 90-day finding was published on March 31, 2014 (Federal Register 2014). The USFWS found that the petition presents substantial information indicating that listing the Alexander Archipelago wolf may be warranted. Therefore, when resources become available, the USFWS will be conducting a status review to determine if listing the Alexander Archipelago wolf is warranted. This 90-day finding does not change the status of wolves.

Wolves are social animals that actively defend territories from encroachment from other packs or individuals (Mech 1970 as cited in Porter 2012a). Wolf home ranges on Revillagigedo Island average 279 km^2 [108 mi^2 or 69,189 ac] with an average of 5.4 (range 2-12) wolves/pack (Smith 1987). Most wolf use is at elevations below 1,200 feet (Person et al. 1996). Smith et al. (1987) identified one wolf pack, which he called East Chuck (EC) pack, between George and Carroll Inlets (Figure 12). The EC wolf pack overlaps the Saddle Lakes project area. Portions of four other packs identified by Smith et al. (1987) occur on Revillagigedo Island: Carroll Inlet (CI) Pack on the east side of Carroll Inlet, the Town (TP) Pack near Ketchikan, The Alava Bay Pack (AB), the Lake Grace Pack (LG), and suspected Naha River (NR) and Northeast (NE) Packs.

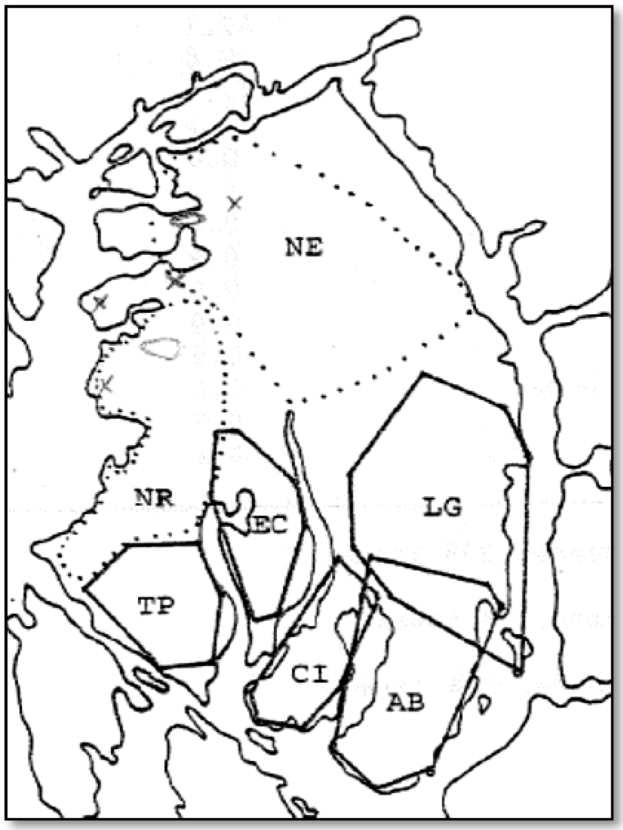


Figure 12. Revillagigedo Wolf Packs from Smith et al. 1987

Although wolves in Southeast Alaska are capable of swimming up to 2.5 miles, currents, high frequency of storms, and shapes and distribution of landmasses, combined with distance, impede dispersal among major island groups in the archipelago (Person et al. 1996. Nevertheless, wolves regularly travel between nearby adjacent islands in GMU 1A (Porter 2012a) and may therefore cross Carroll Inlet.

No statistically reliable population estimates are available for GMU 1A, which includes the Saddle Lakes area and WAAs 406/407, but the wolf population in GMU 1A appears to be stable at this point (Porter 2012a). Wolf harvest information is obtained through a mandatory sealing program that includes both State and Federal Subsistence harvest. Wolf harvest in GMU 1A fluctuates. Wolf harvest during the 2008-2011 reporting period was more than double the previous three years, and higher than the long-term average (Porter 2012a). Trapping is the primary method of harvest (79%) in GMU 1A, followed by shooting (21%) and the percentage of wolves harvested by trapping also increased over the previous three-year period (Porter 2012a).

Under either State or Federal Subsistence regulations, hunters may legally harvest five wolves; an unlimited number of wolves may be trapped. Illegal harvest of wolves has been documented (Porter 2012a). The most common method of hunter/trapper access is by boat (90%) and off-road vehicles (6%). Approximately 90-100 percent of the wolves harvested are taken by local residents; non-residents harvest wolves incidentally to other big game hunts and ADF&G extended the wolf hunting season in RY11 to allow nonresidents to take wolves during the spring bear hunt (Porter 2012a).

Wolves spend most of their time at low elevation, with over 90 percent of radio locations below 300 m [984 ft], regardless of season (Person 2001). Wolves are a habitat generalist; but data from radio-collared wolf relocations on Prince of Wales and Kosciusko Islands (Person 2001) indicated that wolves avoided clearcuts, young growth forests, and roads (although some roads were used at night). However, Person and Russell (2008) state that wolves are easily observed in open habitats such as grassy meadows, young clear-cuts, and muskegs. Wolves on Prince of Wales Island preferentially selected den sites in root wads of large trees (> 60 cm [27”] in diameter at breast height (dbh); living or dead) in old-growth stands with greater than 70 percent canopy cover (Person and Russell 2009). Den sites were primarily located in old-growth forest at low elevations on gradual slopes within 150 m [492 feet] of freshwater streams, ponds, or lakes. Dens were farther from logged stands and roads than unused locations. No wolf dens were found during field reconnaissance of Saddle Lakes, but suitable habitat is present adjacent to the numerous lakes and streams. At least five different wolves were photographed by trail cameras set at various locations within the Saddle Lakes project area.

Three issues related to wolf conservation were identified in Person et al. (1996): 1) decline in deer carrying capacity (deer density), 2) effect of roads on mortality and displacement, and 3) continued exploitation or overharvest of wolves. Three similar global protection needs were identified in NatureServe (2012): 1) Minimize habitat fragmentation and protect integrity of high-use corridors to ensure maintenance of gene flow between neighboring populations. 2) Close logging roads following timber harvest in areas important to the wolves and their prey. 3) Closely regulate wolf hunting and trapping to ensure long-term viability of the wolves. Wolf hunting and trapping regulations fall under the jurisdiction of the Federal Subsistence Board (FSB) and ADF&G. ADF&G is currently analyzing the feasibility of intensive management (predator control) within portions of GMU 1A in an attempt to increase deer populations (Alaska Statute AS 16.05.255(e)).

Deer Density

Wolf populations are closely tied to prey abundance (Person et al. 1996, MacDonald and Cook 2009). Sitka black-tailed deer are the principal prey of wolves in southeast Alaska representing up to 77 percent of their diet, but wolves also feed heavily on spawning salmon beaver, moose, mountain goat, and voles (Person et al. 1996, Smith et al. 1987, Szepanski et al. 1999. Lowell 2009a). Szepanski et al. (1999) found that wolves make substantial use of salmon and potentially other marine resources in southeast Alaska; relative salmon content ranged from roughly 2 to 89 percent of wolf diets.

Due to lack of actual population data, the deer model has been used as an indicator to assess the ability of an area to support deer populations capable of maintaining sustainable wolf populations and meeting human harvest demands. The deer model is a linear model and as such has limitations (see deer model section above). Model defined deer densities (deer/mi^2) analyzed below do not represent actual populations and are not related to wolf viability, but represent the functioning of the predator-prey system dynamic (USDA 2008c, p. 3-282). Person et al. (1997)

clarified that habitat capability of at least 18 deer per square mile is needed to support wolves and deer hunter demand on a sustainable basis. That density of deer “provides the envelope within which the predator-prey dynamics between wolves and deer has a high probability of functioning and persisting” (Person 2014).

In areas less productive for deer, maintaining current densities of deer is particularly important (Person et al. 1996). Deer densities above five (5) deer/mi^2, in conjunction with old growth reserves, were predicted to maintain viable wolf populations on the Tongass (Suring et al. 1993 VPOP Strategy). Because WAAs 406 and 407 contain extensive areas above 1,500 feet in elevation, historic deer densities on NFS lands were slightly below 18 deer/mi^2 (Table 17).

Table 17. Existing Deer and Road Densities, NFS Lands

WAA	Habitat	Original (1954) Density	2013 Density	% Change
406	Deer Density	17.1	13.1	-23%
	Open Road Density	N/A	0.68	--
	Total Road Density	N/A	1.40	--
407	Deer Density	17.8	16.0	-10%
	Open Road Density	N/A	0.63	--
	Total Road Density	N/A	0.93	--

1. Theoretical deer densities calculated from the deer model DHC. Actual deer density information not available.
2. Includes only NFS roads and lands below 1200 feet elevation; freshwater lakes not included.

Wolf/Deer Interactions in Fragmented Habitat

Wolf predation can be a primary factor in controlling deer populations in southeastern Alaska. McNay and Voller (1995) found predation by wolves to be highly efficient in fragmented, heavily logged landscapes on Vancouver Island, British Columbia. They calculated the annual survival rate for adult resident deer at low elevations to be 73 percent and concluded this level, if continuous, was inadequate to sustain the deer population. In contrast, migratory deer, which made greater use of high-elevation habitats and completely avoided low-elevation second-growth forests in winter were able to avoid predation and consequently had a high (95 percent) rate of survival. A predator-prey equilibrium may result, in which predation reduces deer density sufficiently to stimulate greater reproduction in deer, thereby making more deer available to the predators. The stability of such an equilibrium is contingent on the availability of suitable habitat for deer, such that the deer population can maintain a rate of growth sufficient to offset losses to predation (Person et al. 1996).

Population reductions resulting from increased wolf harvests and habitat fragmentation may enhance isolation of insular populations and result in an increased potential for inbreeding depression. However, the extent to which this factor actually affects wolf population viability is subject to debate (NatureServe 2012). See deer section for discussion of deep snow winter effects.

Road Density

In order to maintain viable, well-distributed wolf populations, the Viable Population (VPOP) committee (Suring et al. 1993, p. 157) recommended that road densities should be held below 1.0 mi/mi^2 in any three contiguous WAAs. Current Forest Plan Standards and Guidelines (USDA 2008c, WILD1.XIV, p. 4-9) states that total road densities of 0.7 to 1.0 mile/mi^2 or less may be necessary to address mortality concerns. Road density effect on wolf mortality has not been an issue in WAAs 406 and 407 in the past due to the lack of road connection to a community. Since the project area will be road accessible from the communities of Ketchikan and Saxman in the near future, I calculated road densities below 1,200 feet in elevations to determine the effects of road access on potential wolf harvest (see Table 17 above).

Direct and Indirect Effects

Measurement criteria: deer density (prey), fragmentation, and road density ≤1,200 elevation.

NFS lands within WAAs 406 and 407 were used as the scale for direct effects analysis.

Alternative 1

Alternative 1 would have no direct effects on deer habitat or deer density and therefore, no effect on deer/wolf interactions. Predation may naturally be higher during deep snow winters. Habitats are currently fragmented by interspersion of past harvest and muskeg habitat, but existing connectivity would be maintained allowing deer to utilize slopes to escape wolves. Secondary prey sources such as salmon would also be unaffected under this alternative. Wolf populations would continue to fluctuate based upon natural processes such as prey availability after average and severe winters and from both legal and illegal hunting and trapping mortality. Current road densities are below 0.7 mi/mi^2 in WAA 406, but are above 1.0 mi/mi^2 in WAA 407. Road density would not change under Alternative 1. Total road densities in WAA 407 would remain above the Forest Plan standard and guideline (USDA 2008b, WILD1.XIV.1 p. 4-95), but road density has not been an issue for the Saddle Lakes area since it is not currently connected to any community. Regulatory processes are currently in place to deal with human caused mortality. There are currently no restrictions on the number of wolves that can be trapped in either WAA 406 or 407. Alternative 1 ranks the highest since it would maintain the highest deer density to support wolves and the lowest road density to help prevent over harvest.

Alternatives 2 through 6

All action alternatives would affect current deer densities, increase fragmentation thereby affecting deer/wolf interactions, and increase road densities below 1,200 feet in elevation. Of the action alternatives, Alternative 3 ranks highest for protecting wolves followed by Alternatives 2, 6, 4, and 5.

Deer Density
Reduction of deer habitat and deer densities from clearcutting and habitat fragmentation can affect wolf populations. None of the alternatives would meet Forest Plan standard and guideline (USDA 2008b, WILD1.XIV.2, p.4-95) for maintaining 18 deer/mi^2 (Table 18). The deer density guideline was meant to assure wolf and deer population resilience, not a particular population level of either species (Person 2014). Person (2014) clarified that a small change in carrying capacity for deer (deer habitat capability) may result in a large change in actual deer numbers resulting from predation.

Alternatives 2, 4, 5, and 6 would reduce modelled deer densities in WAA 406 by less than one deer/mi^2 upon completion of the Saddle Lakes project (Table 18) and by less than one deer/mi^2 long term at stem exclusion. Deer densities in WAA 407 would be reduced by less than one deer/mi^2 initially (Table 18); the onset of stem exclusion would reduce deer density by roughly one deer/mi^2 under Alternatives 2, 3, and 6, but by slightly more than one deer/mi^2 under Alternatives 4 and 5.

Because wolves in southeast Alaska use other resources when deer are unavailable, switching to alternative prey such as salmon could delay long-term declines in wolf populations (Szepanski et al. 1999). Since Alternative 5 would have the highest likelihood of causing deer population declines, it also has the highest risk of affecting wolf populations.

Table 18. Effects to Wolf Conservation, NFS Lands WAAs 406/407

		Deer[1] and Road[2] Densities						
		Historic	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
WAA 406or	Deer Density	17.1	13.1	12.9	13.0	12.9	12.9	12.9
	Deer Density at stem exclusion			12.5	12.7	12.5	12.4	12.5
	Open Road (mi)	(108 mi$^{2)}$	73.8	82.2	76.9	87.9	88.9	86.1
	Max[3] Open road density (mi/mi^2)		0.68	0.76	0.71	0.81	0.82	0.80
	Total road (mi)		151.4	159.8	154.5	165.5	166.5	163.7
	Total road density (mi/mi2)		1.40	1.48	1.43	1.53	1.54	1.52
WAA 407	Deer Density	17.8	16.0	15.6	15.8	15.5	15.3	15.6
	Deer Density at stem exclusion			15.0	15.3	14.9	14.7	15.0
	Open Road (mi)	(38 mi2)	23.9	31.3	31.0	35.0	36.3	34.3
	Max Open road density (mi/mi^2)		0.63	0.82	0.82	0.92	0.96	0.90
	Total road (mi)		35.3	42.7	42.5	46.4	47.7	45.7
	Total road density (mi/mi2)		0.93	1.12	1.12	1.22	1.26	1.20
WAAs 406 / 407	Deer Density	17.3	13.9	13.6	13.7	13.6	13.5	13.6
	Deer Density at stem exclusion			13.1	13.3	13.1	13.0	13.1
	Open Road (mi)	(146 mi2)	97.7	113.5	108.0	122.9	125.2	120.5
	Max Open road density (mi/mi^2)		0.67	0.78	0.74	0.84	0.86	0.83
	Total road (mi)		186.7	202.5	197.0	211.9	214.2	209.5
	Total road density (mi/mi2)		1.28	1.39	1.35	1.45	1.47	1.43

1. Deer density calculations from deer model outputs; freshwater lakes not included in area calculations.

2. Open road density includes all open roads on NFS lands below 1,200 feet elevation; Total road density also includes closed roads on NFS lands below 1,200 feet elevation defined as Operating Maintenance Level 1 (closed) or as decommissioned.

3. Open road densities would increase during life of the sale then would revert to existing level of open road as project roads are closed.

Wolf/Deer Interactions in Fragmented Habitat

Interruption of deer/wolf equilibriums through events such as severe winters or reduction in the quality and quantity of suitable habitat may result in widely fluctuating wolf and deer populations. Lack of immigration and emigration of both deer and wolves between islands increase the probability that fluctuations may lead to local crashes of deer populations (Person et al. 1996). Timber harvest, road building, and subsequent spatial isolation of winter habitats may intensify predation on resident deer populations and impede recruitment in migratory deer. A strong, inverse relation between home range size of wolves and the proportion of deep snow winter habitat for deer was found with larger home ranges in areas with minimal deer winter habitat, reflecting a need for greater home ranges when deer densities are low (Hanley et al. 2005). Similarly, there was a strong positive relation between wolf pack size and proportion of deer winter habitat within home range, apparently reflecting greater habitat capability for wolves where deer densities are high (Person 2001).

All action alternatives would increase forest fragmentation (see deer section above). Fragmentation contributes to declines in deer populations and an overall loss of population resiliency (McNay and Voller 1995). Person et al. (1996) recommended avoiding further habitat fragmentation, especially at lower elevations where wolves commonly prey on deer in winter to enhance the likelihood of maintaining deer populations [and consequently wolf populations] in southeast Alaska. Logging roads in the Saddle Lakes area were constructed along the coastline or valley bottoms, with clearcuts spaced out along the roads on the lower hillsides. Residual patches of old-growth forest among clearcuts are connected by these roads, which are utilized by wolf packs. Deer concentrate in these patches during winter when snow depths prevent them from using areas that are more open and may suffer higher mortality from wolf predation (ADF&G 2009, Person et al. 1996, Kirchhoff 1994). Farmer et al. (2006) determined predation by wolves was the primary source of mortality for does and yearlings; topographic features such as flat terrain exerted the strongest influence on predation of females followed by open habitat such as muskegs or young clearcuts. Flat and/or open habitats with greater snow accumulation increased the risk whereas hillsides and steeper terrain enabled deer to detect predators more easily and made pursuit more difficult for wolves. Smith et al. (1987) also found that wolves were efficient at finding localized areas with relatively high deer numbers and concluded packs could be expected to take advantage of artificial concentrations of deer in habitat patches created through forest management. Therefore, while wolves may benefit short-term from concentrations of deer, overall declines in deer populations could lead to widely fluctuating wolf populations and result in less wolves over the long-term.

Road Density

Roads facilitate movements by wolves and may enhance wolf efficiency in areas where deer are concentrated (Person et al. 1996). Person (2006) updated the relationship between road density and wolf mortality related to legal and illegal hunting and trapping. This relationship was based on a regression analysis of average wolf harvest on Prince of Wales Island (POW) by WAA between 1990 and 1995 against total road density for lands below 370 m [~1,200 ft] elevation. Results presented the probability of an overkill (average harvest >30 percent of the population) or destructive harvest (harvest >90 percent of the population occurring once between 1985 and 1999), taking into account road density and whether the road system was connected to a main road system with access to a community or ferry. Results indicated that the probability of overkill was 40 percent for WAAs with total road density greater than 0.7 miles per square mile if the WAA is connected to a main road system, but 13 percent if the roads were not connected to a community or ferry. Therefore, results indicated that roads exerted a strong influence on wolf mortality, particularly when connected to main road systems. Roads themselves do not decrease habitat capability for wolves, but increased density of roads may lead to higher hunting and trapping mortality through improved human access (USDA 2008d Appendix D, p. D-26).

Under all action alternatives, open road densities within WAAs 406 and 407 would increase above 0.7 mi/mi^2, but remain below 1.0 mi/mi^2 during the life of the sale (Table 18). After project area roads are closed at the end of the sale (except for overlap with the State Ketchikan to Shelter Cove Road), open road densities would return to existing levels of less than 0.7 mi/mi^2. Total road densities are currently above 1.0 mi/mi^2 in WAA 406, but below 1.0 mi/mi^2 in WAA 407. Total road densities would remain above the Forest Plan standard and guideline (USDA 2008b, WILD1.XIV, p. 4-95). Wolf mortality from road density has not been an issue for the Saddle Lakes area since Saddle roads are not connected to a community (13 percent probability of overkill from above relationships). Increased total road density from project roads could facilitate walk-in access to additional hunting and trapping areas, but would not change the probability of overkill from 13 to 40 percent.

Ketchikan to Shelter Cove Road Right-of Way

The Ketchikan to Shelter Cove Road construction on NFS lands would increase the above (Table 18) open and total road miles in WAA 407 by 0.7 mile under Alternatives 2 and 3 and by 0.1 mile under Alternatives 4, 5, and 6. Open and closed road densities would increase less than 0.1 mile per square mile. Once new timber sale roads are closed (except for overlaying proposed road 8300280), open road densities in WAA 407 would equal 0.7 miles per square mile under all action alternatives. Total road density would equal 1.0 mile per square mile.

Cumulative Effects

For cumulative effects, all ownerships within WAAs 406 and 407 were used as the scale for analysis. Deer density and its impact on wolves was also considered at the Revilla Island/Cleveland Peninsula biogeographic province level. The Forest Plan FEIS (USDA 2008c, pp.3- 283 to 3-284) states: “Most of the WAAs that currently meet the Wolf guideline, but may not meet it in the future after 100+ years of implementation, are located in the North Central Prince of Wales and Revilla Island/Cleveland Peninsula biogeographic provinces”.

Forest fragmentation has occurred on much broader scale when all ownerships are considered. Most early harvest was concentrated along the beach and at low elevation along major drainages and therefore within areas used by wolves. Historic timber harvest and road construction on all ownerships has reduced deer habitat capability and therefore theoretical deer densities (deer/mi^2) as calculated by the deer model (Table 19). Harvest has likely affected predator/prey relationships by concentrating deer in the remaining deep snow winter range where they are more susceptible to predation (McNay and Voller 1995, Smith et al. 1987).

The Leask Lake sale harvested a high percentage of the Leask drainage (3,726 of 5,240 total acres) in WAA 407 and constructed an additional 26 miles of road, but habitat data and road status were not available at the time of this analysis. Habitat capability was reduced on the east side of Carroll Inlet (WAA 406) with the construction of the Swan Lake hydro facility and lake. The proposed expansion of the dam would impact another 105 acres of POG further reducing habitat capability. The proposed AMHT land exchange, if approved, would affect deer and road densities within the 8,170 acre parcel further reducing the habitat capability to support the primary prey base for wolves.

The Ketchikan to Shelter Cove Road will connect the communities of Ketchikan and Saxman to the Saddle Lakes project area, additional habitat within WAA 407, and the portion of WAA 406 west of Carroll Inlet. This connection could increase hunting and/or trapping pressure for deer and wolves and cause a shift from boat based to vehicle access. While wolf mortality has not been identified as a concern in the past, completion of the Ketchikan to Shelter Cove Road could lead to wolf mortality concerns in the future. Using the regression information from Person (2006), the probability of an overkill (i.e., unsustainable harvest) of wolves would increase from 13 percent to 40 percent with completion of the Ketchikan to Shelter Cove Road. Data from Brinkman et al. (2009) showed that most hunters on POW hiked an average of two miles from their vehicle or boat. Therefore, a much larger area would become accessible to trapping or hunting pressure and road density could contribute to wolf mortality concerns.

Alternative 1

Alternative 1would not contribute to cumulative effects. However, previously harvested stands have decreased, and will continue to decrease, deer density as additional stands move into stem exclusion. From deer model results, deer densities across all ownerships were historically above 18 deer/mi^2. As a result of land selections and past timber harvest, deer densities within WAAs 406 and 407are now below 18 deer/mi^2 (Table 19). Deer densities will decrease further as previously harvested stands transition into stem exclusion.

Person (2001) considered critical (i.e. deep snow) winter habitat to be a good measure of habitat quality for southern Southeast Alaska wolves. Deep snow habitat has decreased 34 percent in WAA 406 and 38 percent in WAA 407 (see Table 15). Therefore, over one-third of the quality habitat for wolves has also been decreased by past actions.

Alternative 1 would not contribute to road density cumulative effects. However, as discussed above, the Ketchikan to Shelter Cove Road will change access to the project area and increase the probability of unsustainable wolf harvest due to existing road densities.

Table 19. Cumulative Effects on Wolves, All Ownerships[1] WAAs 406/407

		Deer[1] and Road[2] Densities						
		Historic	**Existing / Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
WAA 406	Deer Density	18.0	12.7	12.5	12.7	12.5	12.5	12.6
	Deer Density stem exclusion		12.3	12.1	12.3	12.1	12.0	12.1
	Open Road (mi)	(115 mi2)	91.7	100.1	94.8	105.8	106.8	104.0
	Max[3] open road density (mi/mi^2)		0.8	0.9	0.8	0.9	0.9	0.9
	Total road (mi)		170.0	178.4	173.1	184.1	185.1	182.3
	Total road density (mi/mi^2)		1.5	1.6	1.5	1.6	1.6	1.6
WAA 407	Deer Density	23.7	10.0	9.8	9.9	9.7	9.6	9.7
	Deer Density stem exclusion		9.7	9.4	9.6	9.3	9.2	9.4
	Open Road (mi)	(75 mi2)	136.2	143.6	143.3	147.2	148.6	146.6
	Max Open road density (mi/mi^2)		1.8	1.9	1.9	2.0	2.0	2.0
	Total road (mi)		149.1	156.5	156.2	160.1	161.5	159.5
	Total road density (mi/mi^2)		2.0	2.1	2.1	2.1	2.2	2.1
WAAs 406 & 407	Deer Density	20.0	11.8	11.6	11.7	11.6	11.5	11.6
	Deer Density stem exclusion		11.4	11.2	11.4	11.1	11.0	11.2
	Open Road (mi)	(190 mi2)	227.9	243.7	238.2	253.1	255.4	250.7
	Max Open road density (mi/mi^2)		1.2	1.3	1.3	1.3	1.3	1.3

	Total road (mi)		319.1	334.9	329.4	344.3	346.6	341.9
	Total road density (mi/mi^2)		1.7	1.8	1.7	1.8	1.8	1.8

1. Deer densities from deer model; freshwater lakes not included.

2. Open road density includes both NFS and non-NFS roads and lands below 1,200 feet elevation; Total road density also includes closed roads on all lands below 1,200 feet elevation defined as Operating Maintenance Level 1 (closed) or as decommissioned. Recent Leask Lakes harvest and road construction and Ketchikan to Shelter Cove road construction were not included due to lack of specific information.

3. Open road densities would increase during life of the sale then would revert to existing level of open road.

Alternatives 2 through 6

None of the action alternatives would provide 18 deer/mi^2 to support wolves at the cumulative level across all ownerships. Instead, deer densities would be further reduced from historic condition. Alternatives 2-6 would reduce deer densities in WAA 406 down to roughly 12 deer/mi^2 at stem exclusion (6 deer/mi^2 or 33% reduction). Deer densities in WAA 407 would drop from to roughly 9 deer/mi^2 (15 deer/mi^2 or 63% reduction) at stem exclusion.

While wolves may benefit short-term from concentrations of deer, overall declines in deer populations could lead to widely fluctuating wolf populations and result in less wolves over the long-term. Person (2001) found a strong positive relation between wolf pack size and proportion of deer winter habitat within home range, apparently reflecting greater habitat capability for wolves where deer densities are high. Deep snow deer habitat would be reduced 34 and 39 percent, respectively from historic levels. As a result, wolf home range sizes may have already been forced to expand to contain sufficient deer, wolves may have already shifted to other less advantageous prey sources. Addition of the Saddle Lakes project would exacerbate the situation and pack size could be reduced due to insufficient deer numbers. Alternative 5 would move the current small OGR in VCU 7470 into the North Revilla Roadless Area. This would result in the loss of the important connectivity corridor between Naha and George/Carroll Inlets and could affect the gene flow between the East Chuck (EC) Pack and neighboring Ketchikan Town (TP) Pack and the North Revilla (NR) pack (see Figure 12).

Open road densities under Alternatives 2 through 6 would be below 1.0 mi/mi^2 in WAA 406, but up to 2.0 mi/mi^2 in WAA 407. Total road density would increase further above 1 mi/mi^2 in both WAAs 406 and 407. While mortality of wolves from higher road densities has not been a concern in the past, dynamics could shift with the completion of the Ketchikan to Shelter Cove Road. Access methods for trapping could shift from boats to vehicles and/or snowmobiles making trapping less weather dependent. Therefore, high road densities within Saddle Lakes WAAs may lead to wolf mortality concerns in the future. It is uncertain what, if any, regulatory changes on wolf harvest limits would occur given the State of Alaska's intensive management goals for GMU 1A and/or the positive 90-day finding recently released by USFWS.

Unsustainable Harvest Mortality Risk Assessment

Since deer density are below 18 deer/mi^2 and road densities are above 0.7mi/mi^2, I used the methodology in Person and Logan (2012) to determine if wolves in WAAs 406 and 407 are at risk of chronic unsustainable mortality or pack depletion. Person and Logan (2012) divided the mean number of wolves harvested annually by the area of the WAA to calculate an average harvest density. Next, they multiplied that density by the mean area of wolf pack home ranges (~300 km^2 or 116mi^2) to estimate a harvest rate at the scale of individual wolf packs. They assumed that an annual reported harvest rate $\geq$3 wolves/300 km^2 (30–33% of wolves within 300 km^2) indicated unsustainable harvest mortality within a WAA and >5 years indicated chronic unsustainable harvest. Kill of >7 wolves/pack were considered "pack depletion". Average wolf pack size on

Prince of Wales (7-8 wolves plus 1-2 non-resident wolves) is slightly higher than the average of 5.4 wolves/pack reported by Smith (1987) for Revillagigedo Island; therefore, risk may be higher.

Similar calculations using ADF&G wolf harvest data for WAAs 406 and 407 (Porter 2014) are:

> Average kill / WAA size (mi^2) = average harvest density x 116 mi^2 average size wolf pack home range = harvest rate at the scale of individual wolf packs.
>
> WAA 406: 5.2 avg. kill/ 198 mi^2 WAA = 0.026 x 116 mi^2 home range = 3.0 kills per pack
> WAA 407: 1.5 avg. kill/ 104 mi^2 WAA = 0.014 x 116 mi^2 home range = 1.6 kills per pack

Looking at individual years between 2000 and 2013 (

WAA 407 had annual harvests of ≥3 wolves 3 times during the 14-year reporting period indicating risk of unsustainable mortality, but not chronic unsustainable mortality. No pack depletion (≥7 wolves harvested) occurred in WAA 407. As with WAA 406, boats have been the most commonly used access method in WAA 407, but access could change with the completion of the Ketchikan to Shelter Cove Road and mortality could increase.

Table 20), WAA 406 had annual harvests of ≥3 wolves 8 times during the 14-year reporting period indicating that WAA 406 is at risk for chronic unsustainable mortality. WAA 406 also showed pack depletion (harvest rates ≥7 wolves) twice during the reporting period. Boats are the most commonly used transport and the road system is not connected to a community.

WAA 407 had annual harvests of ≥3 wolves 3 times during the 14-year reporting period indicating risk of unsustainable mortality, but not chronic unsustainable mortality. No pack depletion (≥7 wolves harvested) occurred in WAA 407. As with WAA 406, boats have been the most commonly used access method in WAA 407, but access could change with the completion of the Ketchikan to Shelter Cove Road and mortality could increase.

Table 20. Annual Reported Wolf Harvest, All Ownerships, WAAs 406 and 407

Year	Wolf Harvest WAA 406	Kills/pack	Wolf Harvest WAA 407	Kills/pack
2000		1	1	1
2001		0	1	1
2002	5	3	2	2
2003	5	3	0	0
2004	0	0	1	2
2005	1	1	0	0
2006	2	1	1	2
2007	3	2	1	2
2008	13	8	3	3
2009	8	5	3	3
2010	6	4	1	1
2011	9	5	3	3
2012	6	4	0	0

2013	14	8	0	0
Average	5.2	3	1.3	1.4

ADF&G_wolfharvest_WAA.xlsx (Porter 2014) does not include estimate of unreported kill; calculations use methodology in Person and Logan (2012).

Evaluating effects of harvest mortality on wolf population using WAAs as the spatial units is not ideal; however, they are the smallest unit by which harvest data are reliably tabulated. Person and Logan urged caution about inferring the sustainability of wolf harvest for any particular WAA without considering neighboring areas. Therefore, I analyzed wolf harvest on Revillagigedo Island to determine widespread risk of unsustainable mortality (Table 21 and Figure 13).

Table 21. Wolf Mortality Risk Assessment Revillagigedo Island

WAA	TM, ML, or SV Development LUD Present	Number of Years of Unsustainable Harvest (≥3 wolves)	Number of Years of Pack Depletion (≥7 wolves)
404	N	0	0
405	Y	3	0
406	Y	8	2
407	Y	3	0
408	N	0	0
509	Y	3	0
510	Y	4	0
511	N	1	0

[1.] Calculated from ADF&G Wolf harvest data 2000-2013 (Porter 2014).

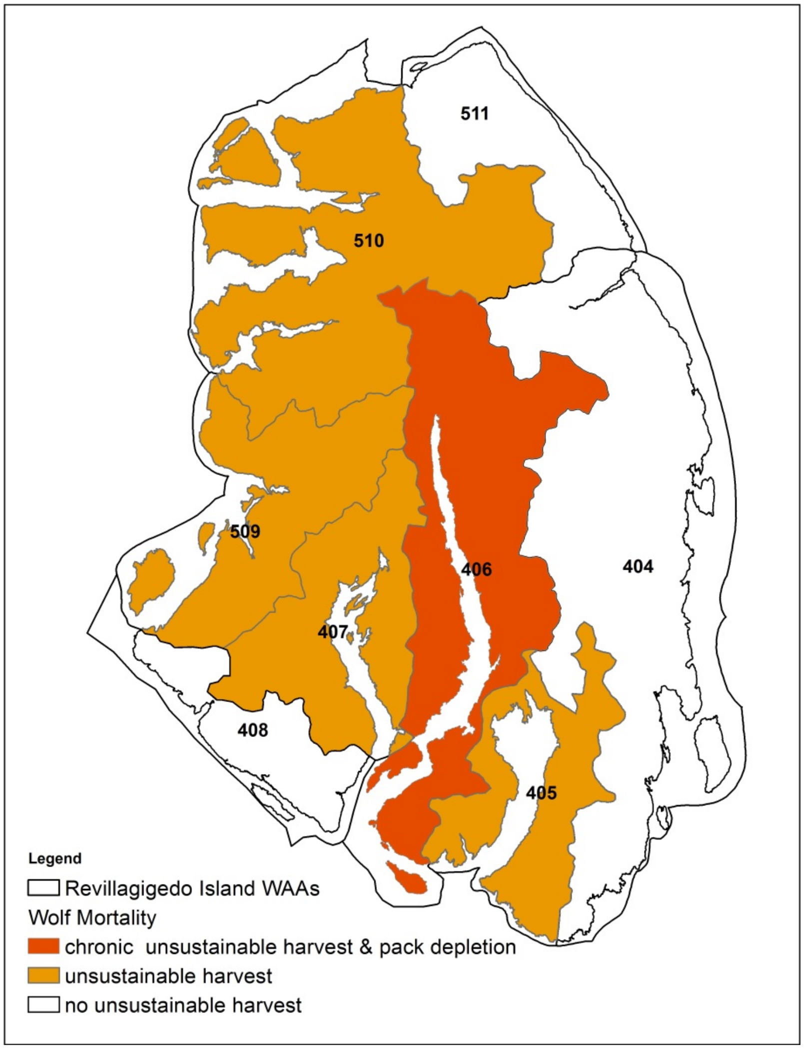


Figure 13. Wolf Mortality Revillagigedo Island

Revillagigedo Island/Cleveland Peninsula Biogeographic Province

Current direction is to consider deer density model outputs for all WAAs within the biogeographic province. In 1954, there were 5 out of the 19 WAAs in the Revilla Island/Cleveland Peninsula Biogeographic Province (province 15) where deer density was 18 deer/mi^2 or greater (Table 22). Currently there are four WAA s.

WAAs 303,404, 511, 613, 614, and 715 are within non-development LUDs where management activities such as timber harvest are generally not allowed. Deer densities should remain at current values for the foreseeable future. WAAs 101, 408, 509, 612, 1815, and 1817 are within both development and non-development LUDs, but relatively minor management activity has occurred on NFS lands to date. Future management within these WAAs may be restricted because of Roadless (IRAs). As a result, deer densities may remain close to current values within the foreseeable future. WAAs 405, 406, 407, 510, 1816, and 1902 contain development LUDs (SV, ML, and TM) where more substantial management activities have occurred in the past. Additional activities are likely in the future leading to further reductions in deer density.

Table 22. Deer Model Densities Biogeographic Province 15 Revilla Island/Cleveland Peninsula

WAA	Timber Harvest Allowed	Deer Density Historic[1]	Deer Density Current[1]	1997 FP historic[1]	2008 FP NFS historic	2008 FP current	2008 FP alt6
101	Y[2]	15	14	12	**22**	***21***	**19**
202[a]	N/A	0	0	0	0	0	0
303	N	**18**	**18**	**19**	**19**	***18***	18
404	N	12	12	15	12	12	12
405	Y	**25**	**21**	**25**	**22**	***18***	16
406	Y	17	13	16	16	12	10
407	Y	11	10	11	17	15	12
408	N	6	6	5	13	13	13
509	Y	14	13	14	15	14	13
510	Y	15	10	14	14	10	8
511	N	5	5	6	5	5	5
612	Y[2]	**18**	**18**	**18**	**18**	***18***	15
613	N	**21**	**20**	**21**	**20**	***19***	**19**
614	N	15	13	13	**20**	***20***	**20**
715	N	9	9	8	8	8	8
1815	Y	9	9	8	9	9	8
1816	Y	11	10	13	11	10	9
1817	Y[2]	17	17	16	16	16	14
1902	Y	**21**	17	**22**	**21**	16	14
#>18 deer		**5**	4	**5**	**7**	*6*	3

1. All non-NFS lands were assigned zero habitat capability (*historic and present*) due to lack of non-NFS data at the biogeographic province scale and to be consistent with Forest Plan methods.

2. Most development is currently restricted on NFS lands due to the 2001 Roadless Rule

a. WAA 202 is the Annette Island Indian Reservation. No NFS lands are present within the WAA.

Deer density results are similar to those predicted in the 1997 Forest Plan. Deer density calculations for the 2008 Forest Plan show an additional two WAAs: WAA 101-Gravina and WAA 303 Duke Island. The Forest Plan calculations for WAA 101 showed deer density being above 18 deer/mi^2 both historically and currently whereas calculations run for the Saddle Lakes project show these areas below 18 deer/mi^2. This may be due to the extensive non-NFS lands on Gravina that were not included in Forest Plan density calculations. WAA 303 shows slight differences and may be due to updated GIS layers since Duke Island is a non-development LUD with zero non-NFS lands. The Forest Plan calculations for WAA 303 are slightly over 18 deer/mi^2 whereas Saddle Lakes historic and current calculations are slightly below 18 deer/mi^2.

The above data suggests that, based on modeled deer densities, Saddle Lakes area WAAs and the Revilla Island/Cleveland Peninsula Biogeographic Province may not be capable of sustaining wolf populations and meeting hunter demand. While deer hunting could be affected sometime in the future, all WAAs in Province 15 are projected to remain above 5 deer/mi^2 necessary for viability (Suring et al. 1993 VPOP Strategy). Therefore, deer densities within the Revillagigedo

Island/Cleveland Peninsula Biogeographic Province are expected to contribute to maintaining viable wolf populations on the Tongass.

Summary of Wolf Effects

Timber harvest would decrease habitat capability for deer, the primary prey for wolves, for up to 150 years or longer. Current modelled deer densities in WAAs 406 and 407are below the Forest Plan guideline of 18 deer per square mile. Therefore, the Saddle Lakes project would result in higher risk that there will be insufficient number of deer to sustain both wolves and hunter demand. The Saddle Lakes project by itself would have relatively minor impacts on deer density (approximately 1 deer/mi^2 reduction). However, cumulative management actions and activities in WAAs 406 and 407 have reduced deer densities by 33 and 63 percent, respectively, which has likely affected predator/prey equilibriums. This concern exists despite the limited availability of alternative prey. Alternative prey may delay a decline in wolf numbers relative to declines in deer potentially causing wolf predation to have greater impact on declining deer numbers. This can cause wolf home ranges to expand or lead to reductions in pack size or condition. Of the 19 WAAs in the Revilla Island/Cleveland Peninsula Biogeographic Province (Province 15), only 4 are currently at or above 18 deer/mi^2.

Roads facilitate movements by wolves and may enhance wolf efficiency into areas where deer are concentrated. The Saddle Lakes project would have a minor impact on road density (<1 percent). However, the completion of the Ketchikan to Shelter Cove Road would connect the Saddle Lakes area to the communities of Saxman and Ketchikan and could shift access from boats to vehicles or snowmobiles. The Ketchikan to Shelter Cove Road could cause an increase in trapping pressure potentially making road density and wolf mortality a concern. Roads constructed under Saddle Lakes would add to the concern since they would provide easier access into new areas. Wolf populations within GMU 1A are currently thought to be stable with unlimited trapping allowed. Intensive management for deer by ADF&G could further decrease wolf populations if expanded to the Saddle Lakes WAAs. Conversely, USFWS was petitioned in 2011 to list the Alexander Archipelago wolf under ESA, but findings have not been released to date.

Alternative 1 ranks the highest since it would maintain the highest deer density to support wolves and the lowest road density to help prevent over harvest. Of the action alternatives, Alternative 3 ranks highest followed by Alternatives 2, 6, 4, then 5. Since Alternative 5 would have the highest likelihood of causing deer population declines, it has the highest risk of impacting wolf populations.

Black Bear (Ursus americanus)

FP Direction (WILD1.IX, p. 4-92):

> A. Continue to implement strategies, in cooperation with the Alaska Department of Environmental Conservation, ADF&G, cities, and boroughs, that prevent habituation of bears to human foods/garbage and reduce chances of human/bear incidents. Strategies that can be used to reduce human/bear incidents include the following:
>
> Where feasible, locating seasonal and permanent work camps, recreation facilities, mineral exploration and operational facilities, LTFs, where allowed by the LUD, more than 1 mile from sites of important seasonal bear concentrations to reduce chances of human/bear confrontations.

Introduction and Habitat correlation to the affected environment

Black bears were selected as MIS due to their economic value for hunting and recreational viewing. Black bears, scat, and/or rooted out skunk cabbage were observed in most units and on the roads. Three current bear dens were located and confirmed by ADF&G wildlife biologist within the Saddle Lakes project area; a fourth suspected den was found by the timber crew, but needs to be confirmed. A young bear was observed in the vicinity of the historic Sea Level den, but the den was not relocated. Two of the confirmed dens are within proposed units.

Black bears occur along the mainland and on most of the islands in the Alexander Archipelago south of Frederick Sound (MacDonald and Cook 2007, 2009). Two lineages of black bear (coastal and continental) were described based on morphology within the Alexander Archipelago (Peacock et al. 2007, MacDonald and Cook 2007). Revillagigedo Island was more closely linked to the coastal lineage. The coastal lineage minimally extends from the Takhin River, north of Glacier Bay National Park, to northern California and contact between the two lineages is thought to occur in Southeast Alaska (Stone and Cook 2007). Peacock et al. (2007) also found that breakdowns in genetic clarity occur suggesting secondary contact between the two lineages. They suggested that that contact between the two lineages occurred in the proximity of Cleveland Peninsula, which is separated from Revillagigedo Island by Behm Canal. They recommended that further investigation was needed to characterize the extent and dynamics of hybridization of these distinctive black bears in Southeast. Due to lack of specific information and widespread distribution of coastal lineage, this issue is not discussed further in this report.

Black bears are the most abundant bear in Alaska (Schoen and Peacock 2007), but no population information is available for Southeast Alaska or GMU1A. Using data from studies in western Washington, where black bear habitat is similar to that in GMU 1A, it was estimated that the density of black bears in forested habitats across Southeast Alaska in 1990 was approximately 1.4 bears/mi^2 (Bethune 2011). The estimate for Revillagigedo Island in 1990 was 1,764 bears. Black bears have been hunted in GMU 1A for many years and hide sealing requirements have been in place since 1973 (Bethune 2011). Since 2009, black bear hunters are required to obtain a harvest ticket/report form prior to hunting; hunting by non-guided non-residents is by drawing permit only. Annual black bear harvest in GMU 1A increased from 25 bears in the 1970s to a current range of 77 to 102 bears with fluctuations believed to be more linked to weather than changes in bear numbers (Bethune 2011). Residents historically harvested roughly 75 percent of the GMU 1A bears, but since 2000, non-residents have accounted for roughly 50 percent of the harvest. Some of the highest bear harvest continues to come from WAAs 406 and 407 because of its close proximity to Ketchikan (Bethune 2011). Due to concerns over the amount of non-resident bear harvest, the Alaska Board of Game at the November 2010 Region I meeting, changed to a drawing permit for non-resident black bear hunters hunting without a guide in GMUs 1-3. The Board also took the mean annual number of bears harvested by each individual guide from 2007-2009, and used this mean to set annual bear harvest limits for each guide.

Based upon the following information, I selected POG to represent bear denning habitat and all habitats except older second growth in stem exclusion to represent foraging habitat. Although brown bear do not occur, I also calculated impacts to POG within 500 feet of anadromous fish streams to address the importance of riparian habitat to black bear. See Table 23 for existing bear habitat within WAAs 406 and 407.

Black bears prefer mixed deciduous-coniferous forests with a dense understory, but occur in various habitats. Estuaries, riparian areas, and old-growth forests provide the highest quality habitat ((Schoen and Peacock 2007). In Alaska, black bears are associated with a variety of habitats from sea level to alpine. Information on the denning habits in Southeast Alaska is limited, but bears on Mitkof Island made exclusive use of large-diameter trees, snags, or hollow logs for their winter dens, presumably because heavy precipitation and the poorly drained soils rendered ground dens less suitable (Erickson et al. 1982). Several of these dens were in large diameter hollow logs within young clearcuts, but the continued lifespan of these dens was questionable. Similar results were found by Davis et al. (2012) on northern Vancouver Island, British Columbia in that dens occurred in or beneath large diameter trees that provided thermal and security benefits. The combination of persistent rainfall, lack of permanent snow cover, and cool temperatures affected the types of structures that provided shelter from these abiotic factors. Davis et al. (2012) also found that bears often reused the same dens over multiple years, particularly in areas where thermally efficient den sites were limited. Re-use was partially dependent upon security from predators including other bears and wolves.

No information was found on the effects of partial cutting on bear denning habitat. The closest information was DeGayner et al. (2005) which looked at the effects of windstorm disturbance on bear denning habitat in Southeast Alaska. DeGayner et al. (2005) found that areas exposed to windthrow generally contained denser, smaller diameter trees and fewer large trees with heart-rot suitable as denning structures than stands located in wind-protected landscapes. The majority of black bear dens were located in wind-protected areas with large trees and large downed logs that may provide security or thermal advantages. If general trends apply, then bear use of partial cut stands as denning sites could depend on the availability of large diameter trees left after harvest, particularly large diameter trees with heart rot.

Young clearcuts, muskegs, small openings, and subalpine meadows provide high levels of forage (Schoen and Peacock 2007, USDA 2008c p. 2-233). Bears frequent beaches during the spring to forage on grasses and sedges as they emerge from their dens. In late spring, bears can be efficient predators of deer fawns. During mid-summer, bears begin foraging on berries as they begin to ripen, and make use of habitats with large openings or fully open habitats, such as riparian forest, avalanche slopes, young clearcuts, and subalpine and alpine areas that produce berries in abundance (Schoen and Peacock 2007). The habitat selection of young clearcuts is similar to studies by Brodeur et al. (2008) in Quebec where black bears selected 6-20 year old stands, avoided older regenerating stands, and used mature stands for denning. However, bears in the Brodeur et al. (2008) study differed from Alaska bears by selected against new clearcuts (0-5 years old) for foraging due to limited shrub/berry abundance. Berries that are important for foraging black bears in Southeast Alaska, and the Saddle Lakes area, include salmonberries (*Rubus spectabilis*), blueberries (*Vaccinium* spp.), currants (*Ribes* spp.), and devil's club (*Oplopanax horridus*).

Table 23. Existing Bear Habitat, NFS Lands

WAA	Habitat	Historic (1954) Acres	Existing (2013) Acres	% Change
406	Denning Habitat[1]	61,321	48,982	-20%
	Foraging Habitat[2]	122,385	110,046	-10%
	POG within 500 feet of Class I streams	7,615	6,433	-16%
407	Denning Habitat[1]	19,789	17,946	-9%
	Foraging Habitat[2]	41,146	39,303	-4%
	POG within 500 feet of Class I streams	2,517	2,320	-8%

1. Denning = POG – all SD categories SD4H through SD67 at all elevations.
2. Foraging = All habitats except stem exclusion

The use of salmon-spawning streams by bears in late summer and fall in Southeast Alaska is well documented. For example, bears were frequently observed near Gunsight Creek and the un-named Class I stream in the OGR above George Inlet salt chuck (see Aquatics Report for more information on Class I streams). The late-summer season has been identified as the most critical or limiting period for bears when they must build up energy reserves that are adequate to survive the winter and successfully reproduce (Schoen and Peacock 2007, Peacock 2004 *PhD Thesis*). During this season, many bears concentrate along low elevation valley bottoms and salmon streams where their efforts focus on consuming large quantities of fish. Not all bears utilize salmon; some remain at higher elevations and forage on vegetation, deer, and small mammals. However, Schoen and Peacock (2007) assumed, similar to more abundant research on brown bear in Alaska, that black bears with access to salmon occur in higher densities and have large body size and higher reproductive success than bears not feeding on nutrient rich salmon. Schoen and Peacock (2007) also discuss the importance of the bear/salmon relationship on riparian ecosystem productivity and nutrient recycling.

Direct and Indirect Effects

<u>Measurement criteria</u>: acres of POG for denning habitat; all habitats except older second growth for foraging habitat; POG within 500 feet of anadromous fish streams to address the importance of riparian habitat.

Effects Common to Action Alternatives

The greatest impact to black bear habitat is the clearcutting of POG, which removes the large trees used for denning, reduces foraging habitat long-term, and leads to lower bear reproductive success and population density (Schoen and Peacock 2007). Clearcutting can also increase dispersal distance and subsequent mortality (Schoen and Peacock 2007). Davis et al. (2012) found that conversion of late-successional forests to younger even-aged stands was detrimental to the supply of black bear dens in coastal British Columbia which may lead to decreased black bear populations from increased cannibalism, predation by other bears or wolves, or increased energetic costs from using less thermally advantageous dens.

Secondary losses occur when young clearcuts transition into stem exclusion and understory forage essentially disappears due to the inability of light to penetrate the dense conifer regeneration. Young clearcuts (3-20 years after logging) provide bears with an abundance of forage, but forage disappears with the onset of stem exclusion. In addition, second growth stands often lack the root masses and large hollow trees used as denning sites (Bethune 2011).

Partial cutting could affect suitable denning habitat if large diameter trees are removed or if large trees with rot are felled for safety reasons. However, stands would develop large trees more quickly than clearcut units (Deal et al. 2009). Partial cut units would continue to provide forage (Deal 2007); actual change in available forage would depend upon individual stand removal pattern.

Insufficient quantitative data is available on the seasonal habitat relationships of black bears in Southeast Alaska; however, the availability of spawning salmon in the summer and fall is thought to positively affect body size, reproductive success, and population density (Schoen and Peacock 2007). Based upon multiple studies, maintenance of riparian habitat and abundant salmon runs is considered essential for maintaining brown bear populations in Southeast Alaska and is likely also important for black bears (Schoen and Peacock 2007). Riparian buffers (RMAs) protect the first 100 feet adjacent to the stream, but not the adjacent habitat heavily utilized by foraging bears. See Table 24 for changes to denning and foraging habitat.

Effects of road densities on bear hunter access would be similar to those discussed in under wolf.

Table 24. Change in Bear Habitat, NFS Lands WAAs 406/407

		Acres (% reduction from existing)						
		Historic	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
WAA 406	Denning Habitat[1]	61,321	48,982	47,873	48,626	47,756	47,441	47,934
				(-2.3%)	(-0.7%)	(-2.5%)	(-3.1%)	(-2.1%)
	Foraging Habitat[2]	122,385	110,046	108,699	109,579	108,543	108,127	108,750
				(-1.2%)	(-0.4%)	(-1.4%)	(-1.8%)	(-1.2%)
	POG within 500 feet of Class I streams	7,615	6,433	6,288	6,350	6,285	6,252	6,279
				(-2.3%)	(-1.3%)	(-2.3%)	(-2.8%)	(-2.4%)
WAA 407	Denning Habitat[1]	19,789	17,946	17,169	17,478	17,093	16,852	17,179
				(-4.3%)	(-2.6%)	(-4.8%)	(-6.1%)	(-4.3%)
	Foraging Habitat[2]	41,146	39,303	38,443	38,758	38,364	38,107	38,457
				(-2.2%)	(-1.4%)	(-2.4%)	(-3.0%)	(-2.2%)
	POG within 500 feet of Class I streams	2,517	2,320	2,272	2,318	2,275	2,233	2,275
				(-2.1%)	(<0.1%)	(-1.9%)	(-3.8%)	(-1.9%)
WAAs 406 & 407	Denning Habitat[1]	81,110	66,928	65,042	66,104	64,849	64,292	65,114
				(-2.8%)	(-1.2%)	(-3.1%)	(-3.9%)	(-2.7%)
	Foraging Habitat[2]	163,531	149,349	147,142	148,336	146,907	146,235	147,206
				(-1.5%)	(-0.7%)	(-1.6%)	(-2.1%)	(-1.4%)
	POG within 500 feet of Class I streams	10,132	8,753	8,560	8,668	8,560	8,485	8,553
				(-2.2%)	(-1.0%)	(-2.2%)	(-3.3%)	(-2.3%)

1. Denning = POG – all SD categories SD4H through SD67 at all elevations.

2. Foraging = All habitats except stem exclusion - shown for stem exclusion phase. See Table 13 deer non-winter for initial effects.

Alternative 1

Alternative 1 would have no effect on black bear denning habitat, foraging habitat or foraging habitat/cover within 500 feet of Class I streams. Existing levels of predation would not be influenced by timber harvest nor would Alternative 1 increase energy costs associated with less thermally sufficient dens. No roads would be constructed so hunting access would continue to be predominantly by boat with no change in access. Existing stands would continue to move toward stem exclusion and individual den sites could be affected by natural processes such as windthrow.

Alternative 2

Alternative 2 would harvest a total of 1,886 acres of bear denning habitat of which 916 acres would be clearcut. It would maintain roughly 98 percent of existing habitat level in WAA 406 and roughly 96 percent in WAA 407. Impacts to bear denning from clearcutting would be long term until second growth reached sufficient size to provide the trees and snags necessary to accommodate bear use. This loss of habitat could result in increased predation and loss of thermally efficient dens. Alternative 2 would clearcut around one confirmed den and partial cut (UA33) around a second confirmed den. The remaining dens fall outside unit boundaries. The partial cutting with UA33 removal prescriptions could maintain denning structures, particularly in large unmerchantable trees, but extent will not be known until individual stand prescriptions are written and OSHA safety regulations implemented during logging. Alternative 2 would clearcut 1,055 acres of foraging habitat and partial cut (UA33) 1,152 acres decreasing foraging habitat to 99 and 98 percent of current habitat levels, respectively in WAAs 406 and 407. The amount of forage in young clearcuts would temporarily increase due to shrub and berry productivity (Schoen and Peacock 2007, Brodeur et al. 2008), but then decrease with the onset of stem exclusion. Partial cut units would continue to provide forage long term, but abundance could vary based upon removal pattern. Alternative 2 would decrease foraging/security habitat within 500 feet of Class I streams by harvesting 193 acres using a combination of UA33 and clearcutting. Habitat would be maintained at 98 percent of existing levels.

Alternative 2 would maintain the existing OGR connectivity in VCU 7470 preserving the important link with Naha source populations and the important habitat along the un-named Class I stream ("Salt Creek"). Alternative 2 has the second lowest impact on bear habitat of the action alternatives.

Alternative 3

Alternative 3 would clearcut 663 acres of bear denning habitat and partial cut (UA33) 161 acres maintaining 99 and 97 percent of the existing habitat, respectively in WAAs 406 and 407. As with Alternative 2, impacts to bear denning from clearcutting would be long term. Alternative 3 would partial cut around one confirmed bear den; the remaining dens fall outside unit boundaries. Alternative 3 would harvest 816 acres of bear foraging habitat by clearcutting and 196 acres of bear foraging habitat by partial cutting (UA33). This would maintain roughly 99 percent of the existing level of bear foraging habitat at the stem exclusion phase. While there could be localized effects to individual foraging areas in the Saddle Lakes area, few large-scale impacts are anticipated. Effects would be similar to those described above. Partial harvest (UA33) would likely maintain some level of denning and foraging habitat. Alternative 3 would clearcut 85 acres of cover/forage habitat within 500 feet of Class I streams or maintain approximately 99 percent in WAA 406 and essentially all (99.9%) of the existing habitat in WAA 407.

Alternative 3 maintains the existing OGR connectivity in VCU 7470 preserving the important link with Naha source populations and important habitat along the un-named [Upper Salt] Class I stream. Alternative 3 would have the least impact on bear habitat of the action alternatives.

Alternative 4

Alternative 4 would harvest 2,079 acres of bear denning habitat and maintain 97 and 95 percent of the existing habitat, respectively in WAAs 406 and 407. Denning habitat would be reduced long term from the 1,798 acres of clearcutting, but less so from the 281 acres of partial cutting (UA33). Actual impacts from partial cutting would likely depend upon specific trees removed and removal pattern. Alternative 4 would clearcut around one confirmed bear den and partial cut (UA33) around a second confirmed den; the remaining known dens are outside units. Alternative 4 would clearcut 2,112 acres of bear foraging habitat and partial cut (UA33) 312 acres. Foraging habitat would decrease to 99 and 98 percent of current habitat levels, respectively in WAAs 406 and 407 with the onset of stem exclusion. Partial cut units would maintain forage. Alternative 4 would also harvest 193 acres of habitat within 500 feet of Class I streams, but would clearcut these acres thereby affecting security cover and forage long-term.

Alternative 4 maintains the existing OGR connection with Naha. It has the second highest impact on bear habitat overall.

Alternative 5

Alternative 5 would harvest 2,635 acres of bear denning habitat or 97 and 94 percent of existing habitat, respectively in WAAs 406 and 407. It would clearcut both units that contain bear dens resulting in a direct loss of den sites and forcing bears to find alternative sites. Denning habitat would be reduced long term from the 2,414 acres of clearcutting, but less so from the 222 acres of partial cutting (UA33). Alternative 5 would have the greatest long-term impact on foraging habitat by harvesting 2,875 acres of POG predominantly through clearcutting (2,594 acres). It would maintain 96 to 98 percent of existing foraging habitat. Alternative 5 would have the greatest impacts to habitat within 500 feet of Class I streams since 268 acres of existing habitat would be clearcut and leaving only the 100-foot riparian buffer.

Alternative 5 moves the small OGR severing the connection between Naha LUD II and George and Carroll Inlets. In addition, Alternative 5 would clearcut important foraging/security habitat within 500 feet of the Class I stream located within the current OGR. Alternative 5 has the highest impact on bear habitat overall.

Alternative 6

Alternative 6 would clearcut 1,423 acres of bear denning habitat and partial cut (UA33) 391 acres thus maintaining 98 and 96 percent of existing habitat. It would clearcut around one confirmed den and partial cut (UA33) around a second confirmed den; the remaining dens fall outside unit boundaries. Alternative 6 would harvest 2,138 acres of foraging habitat. Impacts to foraging habitat would be similar, but slightly less than described in Alternative 4 due to a higher proportion of partial cutting. Roughly 98 and 96 percent of existing forage habitat maintained, respectively in WAAs 406 and 407. Alternative 6 would harvest 200 acres of foraging/security habitat within 500 feet of Class I streams.

It maintains the existing OGR preserving the connection with Naha source populations and the foraging habitat along the Class I stream within the OGR. It has the third highest impact on bear habitat overall.

Cumulative Effects

All past and current activities on within WAAs 406/407 have affected bears or bear habitat in some manner. Changes in denning and foraging habitat have contributed to reductions in black bear populations in GMU 1A (Bethune 2011). Due to conservation concerns over reduced bear populations and increased harvest of black bears non-resident hunter, ADF&G recently enacted draw permits and harvest tickets to limit bear hunting in GMUs 1-3. Timber harvest, particularly even-age clearcut prescriptions, has had the greatest impact on bear habitat as these stands are currently in stem exclusion or will be in stem exclusion within 30 years. Recent clearcut harvest on AMHT lands at Leask Lakes removed 3,726 acres of denning habitat, but currently provides short-term forage. This foraging habitat will be lost long-term with the onset of stem exclusion. If the AMHT land exchange is approved, 8,170 acres would be taken out of NFS ownership and Forest Plan standards and guidelines, including beach buffers and RMAs, would no longer apply.

Road construction removed denning habitat and foraging habitat where roads were constructed through POG. The planned Ketchikan to Shelter Cove Road construction would remove additional habitat. This road connection is likely to increase hunting pressure within the portions of WAAs 406 and 407 that can be accessed from the road system.

Table 25 shows cumulative reduction in bear habitat. Cumulative effects are similar to, but more substantial than those discussed under direct effects.

Table 25. Cumulative Effects to Black Bear Habitat, All Ownerships WAAs 406/407

		Acres (% reduction from existing)						
		Historic	Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	Denning Habitat[1]	63,536	51,099 (-19.6%)	49,990 (-21.3%)	50,743 (-20.1%)	49,873 (-21.5%)	49,558 (-22.0%)	50,051 (-21.2%)
	Foraging Habitat[2]	125,078	112,641 (-9.9%)	111,295 (-11.0%)	112,174 (-10.3%)	111,139 (-11.1%)	110,723 (-11.5%)	111,345 (-11.0%)
	POG within 500 feet of Class I streams	8,944	7,143 (-20.1%)	6,998 (-21.8%)	7,060 (-21.1%)	6,995 (-21.8%)	6,961 (-22.2%)	6,988 (-21.9%)
WAA 407	Denning Habitat[1]	31,257	25,704 (-17.8%)	24,927 (-20.3%)	25,235 (-19.3%)	24,850 (-20.5%)	24,609 (-21.3%)	24,937 (-20.2%)
	Foraging Habitat[2]	61,000	55,446 (-9.1%)	54,585 (-10.5%)	54,900 (-10.0%)	54,507 (-10.6%)	54,250 (-11.1%)	54,599 (-10.5%)
	POG within 500 feet of Class I streams	6,244	3,734 (-40.2%)	3,686 (-41.0%)	3,732 (-40.2%)	3,689 (-40.9%)	3,647 (-41.6%)	3,689 (-40.9%)
WAAs 406 & 407	Denning Habitat[1]	94,793	76,802 (-19.0%)	74,917 (-21.0%)	75,978 (-19.8%)	74,723 (-21.2%)	74,166 (-21.8%)	74,988 (-20.9%)
	Foraging Habitat[2]	186,078	168,087 (-9.7%)	165,880 (-10.9%)	167,074 (-10.2%)	165,646 (-11.0%)	164,973 (-11.3%)	165,944 (-10.8%)
	POG within 500 feet of Class I streams	15,188	10,877 (-28.4%)	10,684 (-29.7%)	10,792 (-28.9%)	10,684 (-29.7%)	10,609 (-30.1%)	10,677 (-29.7%)

1. Denning = POG all elevations. Table does *not* include the 3,726 acres of harvest at Leask Lakes or future projects.
2. Foraging = All habitats except stem exclusion shown for stem exclusion phase. See Table 15 deer non-winter for initial effects on similar habitat.

Alternative 1

Alternative 1 would not contribute to cumulative effects within the Saddle Lakes area. However, past timber harvest and other management activities on all ownerships have reduced black bear denning habitat in WAAs 406 and 407 to 80 and 82 percent respectively, of what was available historically. Leask Lakes harvest and the proposed Ketchikan to Shelter Cove Road and Swan Lake expansion would affect an additional 4 percent of denning habitat within the combined WAAs. Loss of habitat may lead to reduced black bear populations due to increased cannibalism, predation by wolves, and/or increased energetic costs from using less thermally advantageous dens (Davis et al 2012). Foraging areas along Class I streams have been impacted the greatest with less than 60 percent of the historic habitat remaining in WAA 407and less than 80 percent remaining within WAA 406. Reductions in foraging habitat may mean that bears enter the winter in poorer condition, which can affect overwinter survival and reproductive success. The Ketchikan to Shelter Cove Road will change hunter access and could further reduce bear populations within WAAs 407 and 406 west of Carroll Inlet. Regulatory processes limit the impacts from hunting within GMU 1A, but localized impacts could occur.

Alternatives 2 thru 6

Cumulative impacts are similar between the action alternatives and include incremental impacts from past and future harvest discussed under Alternative 1. Denning habitat would be reduced to 78 to 80 percent of historic levels in WAA 406 and 79 to 81 percent in WAA 407. Foraging habitat would be at 88 to 90 percent (11 percent average reduction) of what was available historically in WAAs 406 and 407, respectively. Long-term effects on habitat within 500 feet of Class I streams are the greatest under Alternative 5 where habitat in WAA 407 is reduced down to 58 percent of what was available historically and the small OGR is moved away from a major Class I stream. Alternative 5 also has the greatest impact on habitat within 500 feet of Class I streams in WAA 406. The Ketchikan to Shelter Cove Road will change hunter access and increase hunting pressure within the Saddle Lakes Area. Project related roads would provide easier walk-in access to areas not previously hunted due to their distance from boat access and/or existing roads (see wolf and marten sections for discussions on road densities at WAA and VCU scales).

Summary of Bear Effects

Past, present, and future management actions have reduced bear denning habitat by up to 22 percent and foraging habitat along streams up to 42 percent, and have reduced bear populations as a result. Alternative 1 would have no direct impact on current bear habitat or populations. Alternative 3 would have the next lowest impact followed by Alternative 2, 6, and 4 with Alternative 5 having the greatest impact. ADF&G expects bear numbers to decline as clearcut areas reach the stem exclusion stage. The long-term effects of clearcut logging, even with precommercial thinning, is detrimental to black bear populations in GMU 1A (Bethune 2011).

Mountain Goat (Oreamnos Americanus)

FP Direction (WILD1.XV p. 4-96):

A. Provide for the long-term productivity of mountain goat habitat and viability of mountain goat populations, both native and introduced.

1. Locate facilities and concentrated human activities as far from important wintering and kidding habitat as feasible. a) Where feasible, locate facilities, camps, LTFs, campgrounds, and other developments 1 mile or more from important wintering and kidding habitat. b) If the 1 mile or more distance cannot be achieved, mitigate possible adverse impacts by seasonally restricting or regulating human use and other site-specific mitigation measures.

2. Forest Service and State of Alaska permitted or approved aircraft flights (fixed wing and helicopter), including helicopter yarding of timber, should maintain a 1,500-foot vertical or horizontal clearance from traditional summer and kidding habitat and animals whenever feasible. Where feasible, flight paths should avoid known mountain goat kidding areas from May 15 through June 15. Pilots will not compromise safety.

3. Where feasible, maintain mountain goat important winter habitat capability. During project planning, use the most recent version of the interagency mountain goat habitat capability model, which shows the most important habitat to generally be productive old-growth forest within 1,300 feet of escape terrain (greater than 50 percent slope or cliff). Travel corridors used by mountain goats between important seasonal sites should be identified and maintained, especially when they occur in forested areas.

Introduction and Habitat correlation to the affected environment

Mountain goats are considered an MIS in the Tongass because they are an important game species. They are one of the easier species in Southeast Alaska to monitor by virtue of their predictable use of open terrain during summer and fall (USDA 2008c, pg. 3-233). Mountain goats inhabit rugged, mountainous habitats in western North America. In Alaska, mountain goats occur in coastal regions in southeastern and south-central Alaska. They have also been introduced to non-native range including Revillagigedo Island where they are now firmly established (ADF&G 2013a). Revillagigedo Island transplants include Swan Lake (WAA 406) in 1983 and Upper Mahoney Lake (WAA 407) in 1991. Mountain goat populations are often small and geographically isolated. As a result, mountain goat population trends throughout Alaska vary considerably from place to place and from year to year. Overall, there are estimated to be 24,000–33,500 mountain goats in Alaska; the majority (13,500–20,000) occurs in southeast Alaska (ADF&G 2013a). GMU 1A has an estimated 3,000 to 4,000 goats and the populations, except for Cleveland Peninsula, appear to be stable (Porter 2012b). Current regulations within WAAs 406/407 portions of GMU 1A are 1 goat by registration permit only on the east side of Carroll Inlet or 1 goat by drawing permit only on the west side of Carroll Inlet. Most access is by floatplane into high elevation lakes. A lone mountain goat was observed on the “Lemon Lake” road (8337000) in October 2012. Goats are more frequently sighted at higher elevations adjacent to the project area or at higher elevations on the east side of Carroll Inlet above Swan Lake.

Winter snowfall is one of the most important factors influencing mountain goat populations in Alaska. The quantity and quality of winter habitat is the most limiting factor for mountain goats in Southeast Alaska (USDA 2008c, p. 3-232). High snowfall can result in substantially reduced survival of adults (ADF&G 2013a). In southeast Alaska, mountain goats commonly use forested wintering sites when wet snow pack in the alpine zone forces goats down into more protected forests with less snow accumulation (Fox and Smith 1988). Elevations between 250-750 meters

[800-2,500 ft] were used most often (Smith 1986), but both lower and higher elevations were used. Fox et al. (1989) recommended that mountain goat travel corridors between important wintering sites be identified and maintained, especially when they occurred in forested areas. Goats in coastal areas exhibit altitudinal migrations from alpine summer ranges to winter ranges at or below tree line, typically in old-growth forest habitats (ADF&G 2013a, Fox et al. 1989). In addition, the steep slopes that provide escape terrain generally accumulate the least amount of snow (Fox et al. 1989). Fox and Smith (1988) found that conifers, lichens, and mosses were more prevalent in mountain goat winter diets on Cleveland Peninsula than reported from other areas outside southeast Alaska. Taylor and Brunt (2007) found that goats in coastal British Columbia selected western hemlock dominated forests greater than 250 years in age with abundant shrubs 1-2 meters [3-7 ft] high within 150 meters [492 ft] of rock-outcrop polygons as preferred winter habitat. Wilson (2005) also found that forest cover with good snow interception cover adjacent to escape terrain was an important characteristic of mountain goat winter range in British Columbia.

When predators (i.e., wolves and bears within Saddle Lakes WAAs) are detected and an attack is possible, mountain goats move to very steep or rocky escape terrain where predators are unable to follow or attack without substantial risk of injury (Festa-Bianchet and Côté 2008, Fox and Streveler 1986). Therefore, the presence of steep, rough terrain is an important habitat feature common to natal areas, alpine summer and winter ranges, and forested winter habitats (Hengeveld et al. 2004). Hamel and Côté (2007) found that female goats in Canada spent more time foraging near escape terrain than away from it; females with kids foraged the closest to escape cover even though habitat quality may be less. Quality escape terrain for mountain goats has been defined as slopes from 45-75 degrees (summarized in Suring et al. 1988). Smith (1986) found the highest goat use on slopes 31-65 degrees in southeast Alaska. Taylor and Brunt (2007) found similar selection for similar slopes (41 to 60 degrees) in British Columbia.

Smith (1986) found that over 95 percent of all radio-collared goat relocations in southeast Alaska were within 1,300 feet of a cliff (defined as slopes greater than 50 degrees). Therefore, based upon discussion with Tongass Supervisor's Office biologists B. Logan and T. Schenck (pers. comm.), I used POG habitat within 1,300 feet of slopes 50 *degrees* or greater as the definition of important goat habitat in the effects analysis rather than the 50 *percent* slope listed in the Forest Plan standard and guideline. Existing habitat is displayed in Table 26.

Table 26. Existing Mountain Goat Habitat, NFS Lands

WAA	Historic Habitat (acres)	Existing Habitat (acres)	% Change
406	46,296	37,896	-18%
407	15,280	13,939	-9%

POG habitat within 1,300 feet of slopes 50 degrees or greater

Direct and Indirect Effects

<u>Measurement criteria</u>: acres of POG within 1,300 feet of slopes ≥50 degrees (cliffs).

NFS lands within WAAs 406 and 407 were used as the scale for direct effects analysis.

Effects Common to Action Alternatives

Timber harvest can effect mountain goat populations by reducing the amount of habitat available during the critical winter season (ADF&G 2013a). The amount and distribution of escape terrain within suitable winter habitat is a primary determinant of goat winter range (Fox et al. 1989). Due to the importance of conifers and arboreal lichens in the winter diet, timber harvest may also produce a serious decline in forage availability for goats in southeast Alaska (Fox and Smith 1988). Winter snowfall increases energy expenditures by forcing goats to paw through snowpack to obtain forage and by making travel between areas more difficult (Fox et al. 1989). Forest development also has the potential to reduce or eliminate access to mineral licks, cause disturbance to goats on their winter range, influence predator-prey dynamics, and create access for hunters to previously un-hunted and vulnerable goat populations (see Hengeveld et al. 2004). All action alternatives would construct varying miles of new roads. New roads, except for road 8300280, would be closed at the end of the sale, but would provide additional walk-in access for hunters.

Table 27. Change in Mountain Goat Habitat[1], NFS Lands

Area	Historic	Acres (% reduction from *existing*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	46,296	37,896	37,407	37,775	37,328	37,191	37,482
			(-1.3%)	(-0.3%)	(-1.5%)	(-1.9%)	(-1.1%)
WAA 407	15,280	13,939	13,433	13,667	13,383	13,241	13,470
			(-3.6%)	(-2.0%)	(-4.0%)	(-5.0%)	(-3.4%)
WAAs 406/407	61,575	51,836	50,840	51,442	50,711	50,432	50,952
			(-1.9%)	(-0.8%)	(-2.2%)	(-2.7%)	(-1.7%)

1. POG within 1,300 feet of a cliff (slope 50 degrees or greater).

Alternative 1

There would be no effect on mountain goats or goat habitat under Alternative 1. All current habitat would remain fully functional and continue to provide escape cover from predators and forage. No roads would be constructed, so current hunting access would not change.

Alternative 2

Alternative 2 would harvest 996 acres of mountain goat habitat of which 651 acres are partial cut (UA33) removal and 344 acres are clearcut. As a result, goat habitat would be maintained at 99 and 96 percent of existing levels in WAAs 406 and 407, respectively (Table 27). Partial cut areas would continue to provide forage. Snow interception could be reduced short-term in partial cuts, but would recover over time based upon canopy and stand structure information presented in Deal (2010). Clearcuts would result in long term to permanent habitat loss under current 100 year timber rotations due to stem exclusion. There could be a slight change in hunter access as the 15.8 miles of new road make areas more accessible for walk-in hunting, but proposed roads do not access higher elevation areas where the goats are more frequently observed. Hunter access would likely continue to be predominantly by floatplane to high elevation lakes. Compared to other action alternatives, Alternative 2 would have the second lowest risk of affecting goat habitat and predator/prey equilibrium due to the amount of partial harvest.

Alternative 3

Alternative 3 would harvest 393 acres of goat habitat of which 124 acres are partial cut (UA33) and 269 acres are clearcut. There would be minimal (<1%) change in WAA 406 and 98 percent of the existing habitat would be maintained in WAA 407. Similar to Alternative 2, partial cut area would continue to provide habitat, but quality would be reduced in more severe winters. Clearcut areas represent long-term to permanent habitat loss. Alternative 3 would construct 11.7 miles of new road. New roads in Alternative 3 are mainly shorter segments into areas with existing harvest and do not access higher elevation areas where the goats are more frequently observed. Hunter access would likely continue to be predominantly by floatplane to high elevation lakes. Alternative 3 could impact individual goats, particularly nannies with kids that remain close to escape cover, but would have the least impact of the action alternatives on goat habitat and has low risk of altering predator/prey equilibrium.

Alternative 4

Alternative 4 would harvest 1,125 acres of goat habitat in the project WAAs of which 239 acres are partial cut (UA33) and 885 acres are clearcut. Alternative 4 would maintain 98 and 96 percent of existing habitat, respectively in WAAs 406 and 407. Partial cuts would continue to provide forage, but value as winter habitat could be reduced due to snow accumulation. Clearcut areas represent long-term to permanent habitat loss. Alternative 4 would construct 29.4 miles of new road. Additional ridges could be accessed making it easier for hunters to walk in to areas frequented by goats. Alternative 4 has the second highest effect on mountain goat habitat and predator/prey equilibrium.

Alternative 5

Alternative 5 would harvest 1,404 acres of goat habitat with 201 acres partial cut (UA33) and 1,203 acres clearcut. It would maintain 98 and 95 percent of the existing habitat within WAAs 406 and 407, respectively. Alternative 5 proposes the greatest amount of clearcutting representing the greatest long-term to permanent habitat loss. Alternative 5 would construct 32.3 miles of new road. As with Alternative 4, additional ridges could be accessed making it easier for hunters to walk in to areas frequented by goats. Alternative 5 would have the greatest impact on goat habitat and the greatest risk of altering predator/prey equilibrium.

Alternative 6

Alternative 6 would harvest 884 acres of goat habitat of which 236 acres are partial cut (UA33), 75 acres are partial cut (UA33), and 573 are clearcut. Goat habitat would be maintained at 99 and 96 percent of existing levels in WAAs 406 and 407, respectively. Alternative 6 would construct 24.5 miles of new road providing easier walk-in access for hunters but roads would not access higher elevation ridges. Alternative 6 would have the third lowest risk of affecting goats and predator/prey equilibrium. Alternative 6 harvests less habitat overall than Alternative 2, but proposes more clearcutting and removes more basal area within partial cuts.

Cumulative Effects

Cumulative impacts to mountain goat habitat are incremental to direct effects and have been more substantial across time and all ownerships. Past timber harvest has directly removed both winter foraging areas and escape terrain. Additional impacts could occur from the proposed Swan Lake and Mahoney Lake hydropower projects. However, actual impacts to goat populations are unknown since they are a relatively new introduction in the area. Actual populations, except for Cleveland Peninsula, appear to be stable (Porter 2012b). The planned Ketchikan to Shelter Cove Road would increase access into the Saddle Lakes area WAAs and facilitate hunter access. This could shift some hunting from floatplane-based access to road access, but higher ridges where goats are most commonly observed would most likely still be accessed by floatplane.

Table 28. Cumulative Change in Mountain Goat Habitat[1], All Ownerships

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	47,600	38,865	38,376	38,744	38,297	38,159	38,451
		(-18.4%)	(-19.4%)	(-18.6%)	(-19.5%)	(-19.8%)	(-19.2%)
WAA 407	24,279	17,760	17,253	17,487	17,203	17,061	17,290
		(-26.9%)	(-28.9%)	(-28.0%)	(-29.1%)	(-29.7%)	(-28.8%)
WAAs 406/407	71,880	56,625	55,629	56,231	55,500	55,220	55,741
		(-21.2%)	(-22.6%)	(-21.8%)	(-22.8%)	(-23.2%)	(-22.5%)

1. POG within 1,300 feet of a cliff (50 degree slope or greater).

Alternative 1

Alternative 1would not contribute to cumulative effects since there are no direct or indirect effects. However, past management activities in WAA 406 have reduced goat habitat by 18 percent maintaining 82 percent of historic habitat (see Table 28 above). Habitat in WAA 407 is currently at 73 percent of what it was historically. The Leask Lakes timber sale would have affected additional habitat in WAA 407. Additional habitat would be affected in both WAAs 406 and 407 if the proposed AMHT land exchange is approved since the Shelter Cove parcel includes forest habitat adjacent to higher elevation ridges with escape terrain.

Alternatives 2 through 6

Cumulative impacts to mountain goats would be similar to direct effects but more substantial in scope and intensity (Table 28). All action alternatives would reduce important goat habitat to approximately 80 percent of historic levels in WAA 406 and to 70 percent of historic levels in WAA 407. Present and future management action may start to affect the established populations as habitat is reduced below existing amounts. Nannies with kids would be the most impacted as they have the most restricted area within escape cover to avoid predators. Reduced winter habitat would affect available foraging areas and/or the amount of forage available. This could either push goats into areas further from escape cover making them more susceptible to predation, cause then to expend more energy obtaining forage, and/or affect body condition and subsequent reproductive success.

Summary of Mountain Goat Effects

Impacts from the Saddle Lakes project would be limited (up to 5% reduction from existing condition). Past, present, and future management actions would have more substantial impacts on mountain goat winter foraging and escape habitat (up to 30% reduction). However, since these mountain goat populations are a relatively recent introduction (1983 and 1991), it is uncertain how much past management activities have actually impacted goat populations. Both populations appear to be stable (Porter 2012b) and have limited hunting seasons. Alternative 1 would have no direct impact on current goat habitat or populations. Alternative 3 would have the next lowest impact followed by Alternative 2, 6, and 4 with Alternative 5 having the greatest impact.

American Marten (Martes americana)

FP Direction (WILD1.XVIII, pp. 4-96 & 4-97):

> Implement a Forest-wide program, in cooperation with ADF&G, to provide and conserve habitat to assist in maintaining long-term sustainable marten populations.
>
> Where marten mortality concerns have been identified, cooperate with ADF&G to assist in managing marten mortality rates to within sustainable levels. Both access management on National Forest lands and hunter/trapper harvest regulations administered by the ADF&G shall be considered. Participate in interagency monitoring of marten populations on the Forest. (See also Legacy Forest Structure Standards and Guidelines.). Where marten data suggest that mortality exceeds sustainable levels, work with ADF&G to identify probable sources of mortality. In an interagency analysis, examine the relationship between hunter/trapper marten harvest and human access. Where road access and associated human-caused mortality has been determined, through this analysis to be the significant contributing factor to unsustainable marten mortality, incorporate this information into Travel Management planning with the objective of reducing mortality risk.

Introduction and Habitat correlation to the affected environment

The American marten is considered an MIS in the Tongass because of its close association with old-growth forests, its susceptibility to habitat fragmentation from forest management practices. Marten were specifically considered in the design of medium-sized old-growth reserves (10,000 to 40,000 acres) under the Forest Plan Conservation Strategy (Suring et al. 1993; Flynn et al. 2004; USDA 2008a). Marten also are important furbearers on the Tongass, and Southeast Alaska trappers are more interested in marten than other furbearers (Porter 2010). Natural populations of marten are found on the mainland and on Revillagigedo, Etolin, Kuiu, Kupreanof, Mitkof, Woewodski, and Wrangell Islands and were introduced on Baranof, Chichagof, and Prince of Wales Islands (MacDonald and Cook 2007). Marten on Revillagigedo Island belong to the subspecies *M. a. americana* (Small et al. 2003b). Since there is no indication that Pacific marten (*M. caurina)* occur on Revillagigedo Island and management effects would be similar, *M. caurina* will not be discussed further in this report.

ADF&G does not have population data for marten in GMU 1A. Marten abundance, as measured by densities and home range sizes, is known to vary spatially and temporally throughout Southeast Alaska, in association with habitat suitability, prey densities, and trapping pressure (Schoen et al. 2007a, Flynn and Schumacher 2009). Home ranges of female marten are typically smaller than males, and on Chichagof Island in the northern portion of the Archipelago, home ranges averaged 5.3 km^2 (1,310 acres) for females and 7.8 km^2 (1,927 acres) for males (Flynn and Schumacher 1999). Flynn and Schumacher (2009) found that densities Chichagof Island varied annually and seasonally over an eight year period (0.44 to 1.42 martens/mi^2), but the range of variation was similar to other studies on Chichagof and Etolin Islands and elsewhere in the United States. Flynn et al. (2012) have found densities ranging from 0.25 to 0.70 marten/mi^2 on Kuiu Island. Density indices in Thompson (1994) also varied by habitat and ranged from 0.80 martens/km to 1.80 martens/km (125% change) in uncut areas and 0.05–0.08 martens/km (60% change) in logged forests. Pauli et al. (2012) found that most (72%) of the hair marked marten in their Southeast Alaska/Queen Charlotte Island study were residents whereas the remaining 28% dispersed distances of 15-40 km [9-25 mi]; the latter were generally young of the year or yearlings.

Trappers in Southeast Alaska are more interested in marten than other furbearer species since marten are easy to trap, pelts are easy to process, and pelt prices are generally higher (Porter 2010). Trapping pressure generally fluctuates with pelt price. The 2006-2008 average harvest of 329 marten (range 140-548) was approximately 30 percent higher than the 10-year average of 251 marten (Porter 2010). Pelt prices increased substantially from an average of $24/pelt in 1998 to $106/pelt in 2008, but fell to $40/pelt in 2009. However, 2009 prices were close to the 12-year average of $47/pelt (Porter 2010). Under the current State and Federal Subsistence regulations, there is no trapping limit for marten in GMU1A.

Marten are generalist predators and will vary their diet seasonally based on available prey. Marten feed on small mammals year-round, and voles are the most common prey for marten range-wide (Flynn et al. 2004; Poole et al. 2004; Potvin et al. 2000). Small mammals such as mice, voles, and shrews rely on winter snow cover for survival. These mammals move to subnivean (in or under the snow) habitat for protection from heat loss and some predators. Long-tailed voles, red-backed voles, salmon, and other small rodents are the most common species eaten by marten in Southeast Alaska (Flynn et al. 2004, Ben-David et al. 1997), but squirrels, birds, deer carcasses, and intertidal organisms are utilized in years when preferred foods were not readily available (Flynn and Schumacher 2009). See Red Squirrel and Small Endemic Mammal Sections for further discussion of these two prey species.

Marten in western temperate North America occur in coniferous forests and select moist stands with complex physical structure near the ground. Thompson and Harestad (1994), summarized 10 studies from across marten range documenting selection for overmature timber and against pole sized or smaller stands. The association of marten with structurally complex forests is related to their need for avoiding predators, accessing prey beneath the snow, and finding protected microenvironments for resting in winter and for giving birth and sheltering neonates.

Due to body shape, they are energy constrained in the winter and select habitat structure that helps them to conserve energy (Buskirk and Powell 1994). Buskirk (2002) summarized the information about marten habitat dynamics:

> The American marten appears to meet the criteria proposed by Van Horne (1983) for species in which population density is coupled to habitat quality: it is a habitat specialist, its reproductive rate is low, and it lacks a pattern of social dominance in high quality habitats, although juveniles may avoid high quality habitats occupied by territory-holding adults. Further, marten have not been reported to undergo seasonal shifts in home ranges, and only rarely do they migrate in the face of environmental unpredictability. Therefore, the use of population density to estimate habitat quality seems valid. The marten has a K-style life-history strategy, with small litters, high longevity, and large spatial requirements for its body size and trophic level. Therefore, marten populations would be unable to respond quickly to sudden environmental changes or mortality events. Populations are structured around intra-sexual territories, and home range size is generally considered to be a crude index of habitat quality or resource density, with large home ranges indicating scarce resources.

In Southeast Alaska, marten are dependent on high-quality winter habitat that includes low-elevation, productive old-growth forest. Habitat requirements reflect a strong interaction between food, cover, and climate, with forest cover being particularly important for travel, denning and resting sites, hunting, avoiding avian predators, and thermoregulation (Flynn et al. 2004). Consequently, the quantity and quality of winter habitat is a limiting factor for marten in Southeast Alaska (USDA 2008c, p. 3-234). Research on nearby Chichagof Island showed 82 percent of marten use was in forest habitat. Marten selected large multi-storied and medium multi-storied habitats during the winter with 63 percent of winter locations occurring at less than 250 meters [820 ft] elevation (Flynn and Schumacher 2001, Flynn 2004 Appendix B), but they recommended still using 1,500 feet for winter analysis due to the number of locations (32%) between 800 and 1,500 feet elevation. Additional marten research is currently underway on Kuiu Island (Flynn et al. 2012 and 2013 progress reports), but habitat selection is not yet available.

Within Southeast Alaska, marten select for POG and select against NPOG and clearcuts, even those with established conifer cover (Flynn Conservation Strategy presentation 2006, Porter 2010). Natal dens were within cavities in trees, snags, or hard logs >24” DBH; mean diameter of logs used by martens for resting was 87 cm [34 in] DBH (Flynn & Schumacher 1999, Flynn & Schumacher 2001, Schumacher 1999). These large diameter trees are most likely to occur in high-or medium-POG stands, but can also occur in low-POG (USDA 2008c, Figure 3.9-4, p. 3-141). Both younger and older clearcuts were avoided during the winter in Southeast Alaska (Flynn & Schumacher 1999, Flynn & Schumacher 2001).

Marten will travel through other habitat types and include a wide range of habitat types in their home ranges (Flynn 2006, Buskirk 2002). Habitat use and movements are strongly related to the distribution and abundance of food. Snyder and Bissonette (1987) found that marten travel through clearcuts to adjacent residual stands was generally in a straight line as opposed to longer zigzag patterns throughout uncut forest. Lack of small mammal prey and overhead cover were two rationale. Steventon and Major (1982) observed similar behavior in that hunting patterns in uncut and partially cut stands tended to be circular and /or zigzagging. Thompson and Colgan (1994) found that biomass of prey killed by marten in unlogged areas was greater than twice the amount taken in clearcut areas in abundant prey years although diets were not significantly different, and biomass was 30 percent greater in scarce years. Andruskiw et al. (2008) found that marten in Ontario hunted with less success in regenerating forest stands than in uncut boreal forest. Although small mammals were equally abundant in regenerating vs. uncut forests in their study, the frequency of prey encounter, prey attack, and prey kill were higher in old uncut forests. Predation risk differed greatly due to differences in the amount of coarse woody debris. Marten were able to use this debris to better access subnivean (i.e., below the snow surface) prey, enhancing their hunting success. Structural habitat complexity enhanced, rather than diminished, the efficiency of predatory search by marten. The Viable Population (VPOP) committee for the 1997 Tongass Forest Plan strongly recommended that conservation areas (i.e., OGRs) be connected by POG travel corridors at least 330 feet wide so marten could move between protected habitat areas (Suring et al. 1993).

An increase in road access can increase trapping pressure on marten as they are easily trapped along roads accessible to vehicles (Flynn et al. 2004). Open roads receive the highest and most consistent use and therefore are likely to have the greatest effect on marten. Closed roads facilitate additional access (e.g., off-highway vehicle, snowmobile, pedestrian). Since road density can affect marten populations, I included roads as an analysis measurement.

Existing marten habitat and road densities are displayed in

Table 29.

Table 29. Existing Marten Habitat and Road Densities[1], NFS Lands

VCU	Habitat	Historic (1954) Acres or mi/mi[2]	Existing (2013) Acres or mi/mi[2]	% Change
7460	Winter[2]	12,541	7,317	-42%
	Year-round[2]	19,869	14,493	-27%
	Open Road Density	0	1.0	--
	Total Road Density	0	2.2	--
7470	Winter	5,548	4,064	-27%
	Year-round	9,388	7,903	-16%
	Open Road Density	0	0.7	--
	Total Road Density	0	1.2	--
7530	Winter	10,250	5,637	-45%
	Year-round	17,073	12,433	-27%
	Open Road Density	0	0.7	--
	Total Road Density	0	1.5	--

1. NFS road density below 1,500 feet elevation corresponding with trapping season.
2. Winter habitat equals high-POG ≤1500' elevation; year-round habitat equals POG, all elevations.

Direct and Indirect Effects

Measurement criteria: acres of high-POG (SD 5N, SD5S, SD67) ≤1,500' elevation as the winter measurement, POG at all elevations for year-round effects, fragmentation (patches ≥40 acres), and road densities ≤1,500 feet elevation. NFS lands within VCUs 7460, 7470, and 7530 were used as the scale for direct effects analysis.

The Suring et al. (1992) marten model has not been used in recent analyses. I did not use it for the Saddle Lakes analysis for the following reasons: 1) selected winter high-POG habitat corresponds to the highest HSI values from the model; 2) I considered habitat loss, based upon the available research, to be a more direct approach than including a "multiplier" to predict a "theoretical" number of marten. Well-distributed marten populations were defined as occurring in every third order watershed, or generally a 10,000 acre landscape approximately the size of an average VCU (USDA 1997a, p. 3-398). Consequently, I calculated marten effects at the VCU level but also considered the WAA scale for broader cumulative effects. The Saddle Lakes project is within the Revillagigedo Island/Cleveland Peninsula bio-geographic province, which is considered a high-risk province for marten habitat under the 1997 Forest Plan (USDA 1997a). However, 2008 Forest Plan Legacy Standards and Guidelines do not apply to the Saddle Lakes project area VCUs (USDA 2008b, WILD1.IV.D., pp. 4-90 & 4-91).

Effects Common to Action Alternatives

Clearcutting directly affects marten habitat and can reduce the connectivity of remaining patches (i.e., fragmentation). Clearcut harvest reduces canopy cover, the amount of coarse woody debris, the availability of denning and resting sites, habitat for prey species, and marten hunting efficiency. Clearcutting creates a relatively fine-grained, highly fragmented landscape pattern that includes increases in forest-opening edge and decreases patch size (Thomas et al. 1988). Clearcutting differs from natural disturbances in that it represents a large-scale change rather than small dispersed patches where trees remain standing or partially standing (Hansen et al. 1991, Alaback et al. 2013). Clearcuts and forest openings reduce forest cover exposing martens to much higher snow accumulations and predation risks (Schoen et al. 2007a). Avoidance of both young and older clearcuts in the winter is well documented both in Alaska (Flynn 2006, Flynn &

Schumacher 2001, Flynn & Schumacher 1999) and other areas. Therefore, clearcuts represent long-term to permanent winter habitat loss.

Marten densities are notably higher in intact forests with less fragmentation indicating that large, contiguous blocks of old growth are important for this species (USDA 2008c, p. 3-234). Research across marten distribution has shown a negative linear relationship between clearcut logging and marten density. The more fragmented the area, the lower the carrying capacity. Soutiere (1979) found a 67 percent reduction in marten abundance where 60 percent of the landscape was comprised of large clearcuts. Likewise, Thompson (1994) found a 90 percent drop in marten abundance where 90 percent of the landscape was clearcut. Thompson and Harestad (1994) predicted a linear decline in carrying capacity if units were greater than 3 ha [7.4 ac] with a 50 percent loss of carrying capacity at about 50 percent forest in clearcut. Their prediction was based on the assumption that martens moved short distances into recently cut areas to exploit resources there, but not into the center of large clearcuts.

Since then, studies of landscape-scale habitat use have examined the relationship of clearcutting to marten density and found that martens are more sensitive than Thompson and Harestad predicted. Chapin et al. (1998), Hargis et al. (1999), and Potvin et al. (2000) noticed significant drops in marten use when clearcuts comprised more than 25 percent of a marten home range. Maximum clearcut tolerance was 40 percent for males and 31 percent females. Based on these three widespread studies (Utah, Maine, Québec), Potvin et al. (2000) concluded that the maximum amount of clearcut that martens can tolerate in their home range is about 30 percent. Poole et al. (2004) observed similar results in British Columbia: over half of the marten either abandoned home ranges or died when an average of 37 percent of their home range was cut. The other half shifted their home ranges in the subsequent year so that only 19 percent of their range contained harvested areas. Poole et al. (2004) concluded that marten could tolerate small amounts of cleared area within their home ranges but not large percentages. Wasserman et al. (2012) found similar results in Idaho. Cushman et al. (2011) in Wyoming found marked change in foraging behavior and movement path selection at the landscape level after loss of only 24 percent of habitat area.

Feldhammer et al. (2003) summarized multiple studies suggesting that martens fail to colonize or abandon home range size landscapes with less than 60 percent mature forest. Below this threshold, marten inhabit suboptimal habitat, spend excessive energy on hunting, and have less time available for social interaction and breeding. Recent studies by Godbout and Ouellet (2008) in Quebec found similar results.

Fragmentation constrained foraging paths to the extent that marten were unable to select cover types that offered the highest densities of prey species, which likely affected foraging efficiency. Flynn found similar trends in Southeast Alaska: indices of fragmentation correlated with marten density with marten numbers higher in less fragmented habitats (Flynn 2006, Flynn et al. 2004). Flynn et al. (2004) interpreted the fragmentation variables to indicate collectively that areas with larger and more evenly distributed patches of forest supported higher densities of martens than areas with more fragmented forest. Findings by Flynn suggest that trends may be consistent across marten range and that research from other areas may have applicability in Alaska.

Potvin et al. (2000) showed a strong negative linear relationship between the size of the core area of marten home range and the proportion of it that was uncut forest. Thompson (1994) found home ranges that were 3-4 times larger in areas that have been clearcut, and mortality markedly higher in clearcuts than in uncut forests. Godbout and Ouellet (2008) also found that home ranges increased as habitat quality decreased due to logging and roading. Based upon review of multiple studies on marten response to clearcutting, Buskirk (2002) concluded that marten increased the size of their home range as forest was cut, until their home range became too large to maintain, at which point the home range was abandoned and marten became locally extinct. Conversely, Cheveau et al. (2013) found that in Quebec, home range size was not related to the proportion of clear-cuts. However, the most utilized habitat was late-seral conifer forest and core use areas had significantly [statistically] less clearcuts, and less edge, and lower road densities.

Cheveau et al. (2013) found that female body index was positively related with the amount of remnant forest within the home range, and negatively related to the amount of recent clearcut. A similar relationship between habitat quality and marten body condition was found by Johnson et al. (2009) for dispersing juveniles, who experienced poorer body condition in regenerating than in uncut forest landscapes. Johnson et al. (2009) found that juveniles from 20-60 year old regenerating forests dispersed shorter distances than juveniles in the older uncut forests and suffered twice the mortality risk with increasing dispersal distance. Results indicated that juveniles from the regenerating landscape were less able to cope with the energetic demands of dispersal and that mean dispersal distance was shaped, in part, by mortality risk. Johnson et al. (2009) further theorized that reduced foraging success and poorer body condition also contributed to the reduced disperser survival in the regenerating landscape.

The Marten Scientific Panel (USDA 1997b, Appendix N) concluded that clearcut silviculture on a 100 year rotation would result in further fragmentation of marten habitat and that while breeding populations would occur across the Forest, there could be substantial gaps in marten distribution which could be permanent and result in limited interaction between populations. They defined the spatial scale of a gap to be one vacant marten territory one to three square miles [640-1,920 ac] in size. These gaps were areas in which habitat capability was reduced to the point that reproductively successful marten populations may no longer exist (USDA 1997a, pp. 3-396 & 3-397). The consequence of a gap would be some measure of reduced gene flow within the population and the greater the size and number of gaps, the higher the risk of reducing gene flow.

Populations that have become isolated or reduced in size face increased risks of extirpation from inbreeding, genetic drift, and random environmental events (Flynn and Schumacher 1997). Schumacher (1999) concluded that, to maintain marten populations in managed landscapes in Alaska, it is necessary to provide for a continuous recruitment of old, large-diameter trees for denning and resting sites and prey habitat throughout the affected area.

Partial cutting may have less effect on marten populations. Thompson and Harestad (1994) theorized that selective logging that removed less than 30 percent of the basal area every 100 years in temperate rain forests would not reduce habitat carrying capacity. Godbout and Ouellet (2008) found similar results in that marten selected neither for nor against units that had been partial cut as long as dense canopy cover and structure was maintained.

Roads can indirectly affect marten by facilitating trapper access. Habitat suitability for marten begins to decline when road density reaches 0.2 miles/mile^2 and decreases sharply when road density reaches 0.6 miles/mile^2 (Suring et. al. 1992). Existing open road densities below 1,500 feet elevation range from 0.7 to 1.0 miles per square mile (mi/mi^2) with total road densities between 1.2 and 2.2 mi/mi^2 (Table 30). New project roads would be closed post-sale except for road 8300280 which overlaps the Ketchikan to Shelter Cove state road (see discussion below) Closed roads could provide additional walk-in access for trappers. Interior areas away from roads can act as a refugia from trapping (Flynn et al. 2007). Marten within these source areas are able to disperse into heavily trapped sink areas after the trapping season ends. Extensive roading results in most marten home ranges being intercepted by roads, which can result in the entire population being vulnerable to overharvest (Suring et al. 1993).

Table 30. Change in Marten Habitat, NFS Lands

			Acres (% reduction from *existing*) and Road Density[1]					
VCU	**Habitat**	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	Winter[2]	12,541	7,317	6,941	7,246	6,871	6,820	6,947
				(-5.1%)	(-1.0%)	(-6.1%)	(-6.8%)	(-5.1%)
	Year-round[2]	19,869	14,493	13,641	14,277	13,524	13,321	13,713
				(-5.9%)	(-1.5%)	(-6.9%)	(-8.1%)	(-5.4%)
	Open Road mi	(35 mi^2)	32.87	36.83	34.13	43.60	44.24	40.73
	Open Road Density mi/mi^2		1.0	1.1	1.0	1.3	1.3	1.2
	Total Road mi							
	Total Road Density mi/mi^2		2.2	2.3	2.2	2.5	2.5	2.4
VCU 7470	Winter	5,548	4,064	3,649	3,856	3,598	3,438	3,642
				(-10.2%)	(-5.1%)	(-11.5%)	(-15.4%)	(-10.4%)
	Year-round	9,388	7,903	7,126	7,435	7,050	6,809	7,136
				(-9.9%)	(-5.9%)	(-10.8%)	(-13.8%)	(-9.7%)
	Open Road mi	(18 mi^2)	12.36	19.72	19.5	24.79	26.1	22.78
	Open Road Density mi/mi^2		0.7	1.1	1.1	1.4	1.4	1.3
	Total Road mi		21.57	28.93	28.71	34.0	35.31	31.99
	Total Road Density mi/mi^2		1.2	1.6	1.6	1.9	2.0	1.8
VCU 7530	Winter	10,250	5,637	5,584	5,610	5,583	5,518	5,583
				(-0.9%)	(-0.5%)	(-1.0%)	(-2.1%)	(-1.0%)
	Year-round	17,073	12,433	12,176	12,293	12,177	12,064	12,166
				(-2.1%)	(-1.1%)	(-2.1%)	(-3.0%)	(-2.1%)
	Open Road mi	(41 mi^2)	23.79	28.32	25.68	27.94	28.32	28.32
	Open Road Density mi/mi^2		0.7	0.8	0.7	0.8	0.8	0.8
	Total Road mi							
	Total Road Density mi/mi^2		1.5	1.6	1.6	1.6	1.6	1.6
All VCUs	Winter	28,340	17,018	16,174	16,712	16,051	15,776	16,172
				(-5.0%)	(-1.8%)	(-5.7%)	(-7.3%)	(-5.0%)
	Year-round	46,331	34,829	32,944	34,005	32,750	32,194	33,015
				(-5.4%)	(-2.4%)	(-6.0%)	(-7.6%)	(-5.2%)
	Open Road mi	(95 mi^2)	69.02	84.88	79.32	93.33	98.65	91.83
	Open Road Density mi/mi^2		0.8	0.9	0.9	1.1	1.1	1.0
	Total Road mi							
	Total Road		1.7	1.9	1.8	2.0	2.0	1.9

			Acres (% reduction from *existing*) and Road Density[1]					
VCU	Habitat	Historic	Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
	Density mi/mi[2]							

1. NFS total road density below 1,500 feet elevation.
2. Winter habitat equals high-POG ≤1500' elevation; Year-round habitat equals POG, all elevations.

Ketchikan to Shelter Cove Road Right-of Way

The Ketchikan to Shelter Cove Road construction on NFS lands would increase the above (Table 30) open and total road miles in VCU 7470 by 0.7 mile under Alternatives 2 and 3 and by 0.1 mile under Alternatives 4, 5, and 6. Open and closed road densities would increase less than 0.1 mi/mi^2. Once new timber sale roads are closed (except for overlaying proposed road 8300280), open road densities in VCU 7470 would equal 0.7 miles per square mile under all action alternatives. Total road density would equal 1.3 mi/mi^2.

Alternative 1

Alternative 1 would have no direct or indirect effect on marten or marten habitat. Existing winter and year-round habitat would be maintained and would continue to function at current levels with no change in habitat connectivity or carrying capacity. Population dynamics would continue to function. No changes in patch size or home range would occur except through natural processes such as windthrow. Prey abundance (see red squirrel and endemic mammal sections) would continue to fluctuate from natural causes. Therefore, current hunting efficiency and social interactions should continue. The small OGR would be maintained in its current location providing connectivity between source and sink habitat and facilitating marten movement across the landscape.

Existing open and total road densities are above 0.6 mi/mi^2 but have not created mortality concerns leading to changes in harvest regulations. Most trapping is via boat and trappers are currently allowed to trap an unlimited number of marten. Existing roads would continue to facilitate trapping. Pelt price and weather currently influence trapping pressure more than road density. Under this alternative, changes in marten populations are expected to be directly attributable to natural causes (e.g., fluctuations in prey populations), changes in pelt price, or both.

Alternative 2

Alternative 2 would harvest a total of 844 acres of high-POG winter habitat and 1,885 acres of year-round POG habitat. Roughly 370 acres would be clearcut and 474 acres partial cut (UA33). Alternative 2 would have the second lowest impact on marten habitat and marten of the action alternatives. Alternative 2 would maintain 95, 90, and 99 percent, respectively of the current high-POG winter habitat in VCUs 7460, 7470, and 7530. Denning and foraging sites and subnivean access would be directly affected within the 370 acres of clearcut harvest and remaining habitat would be more fragmented (

Figure 21 to Figure 27). This could lead to reduced overwintering success, cause a shift in use, or directly impact individuals.

Slightly over half (474 ac or 56%) of the harvest in winter habitat would be partial cut (UA33) and may have less effect on marten. Similar impacts would occur to year-round habitat since 94, 90 and 98 percent of the current POG would remain.

The 916 acres of clearcutting within year-round POG (49% of harvest) would directly affect denning and resting sites and prey abundance. Home ranges of affected individuals would likely increase in size. Marten could inhabit suboptimal habitat where they spend excessive energy on hunting and have lower reproductive success or territories could be abandoned causing gaps in distribution within the project area. Based on identified linear relationships, timber harvest in Alternative 2 could result in up to a 10 percent reduction in marten populations, but actual impacts could be less based upon partial cutting results found by Thompson and Harestad (1994) and Godbout and Ouellet (2008). Roughly half (969 ac or 51%) of the harvest in year-round POG habitat would be partial cut (UA33). Habitat for important prey species would also be reduced under Alternative 2 (see red squirrel and red-backed vole sections). Alternative 2 would maintain connectivity corridors 2, 3, and 4. Based upon limited information, the partial cutting in corridors 6, 7, and 8 may have minimal effect on marten and maintain dispersal throughout the project area. Corridor 5 would be eliminated which would affect marten dispersal and use in that area. The small OGR would be maintained in its current location providing connectivity between source and sink habitat and facilitating marten movement across the landscape.

Alternative 2 would increase open and total road densities by 0.1 mi/mi^2 in VCU 7460 during the life of the sale, by 0.4 mi/mi^2 in VCU 7470, and by 0.1 mi/mi^2 in VCU 7530. Roads constructed under the Saddle Lakes sale would be closed post-sale except for road 8300280, which overlaps the Ketchikan to Shelter Cove Road. Alternative 2 roads would not cause a shift in access from boats to vehicles, but would provide additional walk-in access for trappers and facilitate easier access into additional areas.

Alternative 3

Alternative 3 would harvest 306 acres of high-POG winter habitat and 824 acres of year-round POG habitat. Alternative 3 would have the least impact on marten habitat and marten of the action alternatives. Roughly 201 acres of winter habitat would be clearcut (66%) whereas 105 acres would be partial cut. Alternative 3 would maintain 99, 95, and 99 percent, respectively of the current high-POG winter habitat in Saddle lakes VCUs. Similar levels of impact would occur to year-round habitat since 98, 94, and 99 percent, respectively of the current POG would be maintained in project area VCUs. Roughly 663 acres of year round habitat would be clearcut (80%) and 161 acres of UA33 partial cut. Based on identified linear relationships, timber harvest in Alternative 3 could result in a one to six percent reduction in marten populations. Partial cut areas may still provide marten functional habitat. Alternative 3 would cause the least amount of habitat fragmentation harvesting fewer low elevation stands and by maintaining all elevational connectivity corridors. The small OGR would be maintained in its current location providing connectivity between source and sink habitat and facilitating marten movement across the landscape.

Alternative 3 would not increase open road densities in VCUs 7460 or 7530, but would increase open road densities in VCU 7470 to 1.1 mi/mi^2. Roads constructed under the Saddle Lakes sale would be closed post-sale except for road 8300280. Total road densities would increase <0.1 mi/mi^2 in VCU 7460, increase by an additional 0.4 mi/mi^2 in VCU 7470, and increase by an additional 0.1 mi/mi^2 in VCU 7530. Alternative 3 roads would not cause a shift in hunter access from boats to vehicles, but would provide additional walk-in access for trappers and facilitate easier access into additional areas.

Alternative 4

Alternative 4 would harvest 967 acres of high-POG winter habitat and 2,079 acres of year-round POG habitat. Alternative 4 would have the second highest impact on marten habitat and marten. About 772 acres of winter habitat would be clearcut (80%) and 195 acres partial cut (UA33). Alternative 4 would maintain 94, 88, and 99 percent, respectively of the current high-POG winter habitat in VCUs 1460, 7470, and 7530. Alternative 4 would retain 93, 89, and 98 percent, respectively of the current year-round habitat. Approximately 1,798 acres of year-round habitat would be clearcut (86%) with the remaining 195 acres partial cut (UA33). Partial cut (UA33) stands should continue to provide marten habitat. Based on identified linear relationships, timber harvest in Alternative 4 could result in up to a 12 percent reduction in marten populations. Denning and foraging sites and subnivean access would be directly affected within harvest units and remaining habitat would be fragmented into smaller blocks. Harvest within POG would directly affect denning and resting sites and prey abundance long-term or permanently under current 100 year timber rotations. Home ranges of affected individuals would likely increase in size. Marten could inhabit suboptimal habitat where they spend excessive energy on hunting and have lower reproductive success or territories could be abandoned causing gaps in distribution within the project area. Habitat for important prey species would be reduced under Alternative 4 (see red squirrel and red-backed vole sections). Connectivity corridors 2 and 4 would be maintained, but corridors 1, 3, 5, 6, 7, and 8 would be eliminated due to clearcutting within the corridors. This would have long-term impacts on marten dispersal. The small OGR would be maintained in its current location providing connectivity between source and sink habitat and facilitating marten movement across the landscape.

Alternative 4 would increase open and total road densities by 0.3 mi/mi^2 in VCU 7460 during the life of the sale, by 0.7 mi/mi^2 in VCU 7470, and by 0.1 mi/mi^2 in VCU 7530. As with the other alternatives, roads constructed under the Saddle Lakes sale, except for road 8300280, would be closed post-sale. Alternative 4 roads would not cause a shift in access from boats to vehicles, but would provide additional walk-in access for trappers and facilitate easier access into multiple new areas.

Alternative 5

Alternative 5 would harvest 1,242 acres of high-POG winter habitat and 2,635 acres of year-round POG habitat. Alternative 5 would have the greatest impact on marten habitat and marten. Alternative 5 would maintain 93, 85, and 98 percent, respectively of the current high-POG winter habitat in VCUs 7460, 7470, 7530. Roughly 1,132 acres of winter habitat would be clearcut (91%) and 109 acres partial cut (UA33). Alternative 5 would retain 92, 86, and 97 percent, respectively of the current year-round habitat. Most units in year-round marten habitat would be clearcut under Alternative 5 prescriptions (2,414 ac or 92%). The 222 acres of partial cut (UA33) should continue to provide marten habitat. Based on identified linear relationships, timber harvest in Alternative 5 could result in up to a 14 percent reduction in marten populations, Harvest within POG would directly affect denning and resting sites and prey abundance long-term or permanently under current 100 year timber rotations. Home ranges of affected individuals would likely increase in size. Marten could inhabit suboptimal habitat where they spend excessive energy on hunting and have lower reproductive success and/or territories could be abandoned causing gaps in distribution within the project area. Habitat for important prey species would be reduced to the greatest extent under Alternative 5 (see red squirrel and red-backed vole sections). This reduction in prey could also reduce the number of marten present within the Saddle Lakes area.

Alternative 5 would maintain corridor 4, but corridors 1, 2, 3, 5, 6, 7, and 8 would be eliminated due to clearcutting within the corridors. This would have long-term impacts on marten dispersal. Alternative 5 would move the small OGR in VCU 7470 into the North Revilla Roadless Area severing the connection with Naha LUD II and reducing the overall amount of protected high-POG and POG habitat. OGR relocation would restrict movement of marten from source habitat in Naha to recolonize vacant territories within the project area. Clearcutting the 300 series units within the current OGR would affect marten movement patterns and/or make marten more susceptible to predation if they attempt crossing the clearcuts.

Alternative 5 would increase open and total road densities by 0.3 mi/mi^2 in VCU 7460 during the life of the sale, open road density by 0.7 mi/mi^2 and total road density by 0.8 mi/mi^2 in VCU 7470, and open and total road densities by 0.1 mi/mi^2 in VCU 7530. As with the other alternatives, roads constructed under the Saddle Lakes sale (except for road 8300280) would be closed post-sale, but would facilitate easier walk-in access to multiple new areas.

Alternative 6

Alternative 6 would harvest 846 acres of high-POG winter habitat and 1,814 acres of year-round POG habitat. Alternative 6 would fall in the middle of the action alternatives for impacts on marten habitat and marten. Alternative 6 would maintain 99, 95, and 99 percent, respectively of the current high-POG winter habitat in VCUs 7460, 7470, 7530. Roughly 599 acres of winter habitat would be clearcut (71 percent) with the remaining 247 acres being partial cut. Impacts to year-round habitat would be greater as Alternative 4 would retain 93, 89, and 98 percent, respectively of the current year-round habitat. Most units within year-round marten habitat (1,423 ac or 78%) would be clearcut under Alternative 6 prescriptions. The 391 acres of UA33 partial cut harvest should maintain marten habitat. Based on identified linear relationships, timber harvest in Alternative 6 could result in up to a 10 percent reduction in marten populations, Harvest within POG would directly affect denning and resting sites and prey abundance for the long-term or permanently under current 100 year timber rotations. Home ranges of affected individuals would likely increase. Marten could inhabit suboptimal habitat where they spend excessive energy on hunting and have lower reproductive success or territories could be abandoned causing gaps in distribution within the project area. Connectivity corridors 2 and 4 would be maintained, but corridors 1, 3, 5, 6, and 7 would be eliminated due to clearcutting within the corridors. The width of corridor 8 would be reduced due to clearcutting in Unit 46. The small OGR would be maintained in its current location providing connectivity between source and sink habitat and facilitating marten movement across the landscape.

Alternative 6 would increase open and total road densities by 0.2 mi/mi^2 in VCU 7460 during the life of the sale, by 0.6 mi/mi^2 in VCU 7470, and open and total road densities by 0.1 mi/mi^2 in VCU 7530. As with the other action alternatives, roads constructed under the Saddle Lakes sale, except for road 8300280, would be closed post-sale. Alternative 6 roads would provide additional walk-in access for trappers and facilitate easier access into additional areas.

Cumulative Effects

Cumulative effects on marten come from clearcut timber harvest and road construction. Long-term effects were considered to be 150 years or longer to provide the full suite of marten habitat requirements. An additional 3,726 acres of timber harvest recently occurred on the AMHT Leask

Lake parcel that is not reflected in Forest Service GIS data for WAA 407. Therefore, impacts to marten would be higher for WAA 407 than shown in Table 31. The proposed AMHT land exchange, if approved, could reduce over 4,000 acres marten habitat in VCUs 7460 and 7470. The additional six miles of road to be constructed under the Ketchikan to Shelter Cove Road would not have a substantial impact on road density. It could however, have a substantial impact on trapper access as it would connect Ketchikan and Saxman to the project area VCUs and WAAs and add an additional means of access that is less weather dependent. With this road connection, road built under the proposed Saddle Lakes timber sale would contribute to open and closed road densities and increase the amount of trapper access. Project roads would open new areas to trapping during the life of the sale and provide easier walk-in access post-sale.

Habitat loss under alternatives 2, 4, 5, and 6 would exceed the research threshold of 30 percent (i.e., ≥30% of the landscape clearcut) putting VCUs 7460 and 7470 at increased risk of not maintaining marten populations. VCUs 7470 and 7530 are approaching this threshold, but would not exceed it as a result of the Saddle Lakes Timber Sale. Unlike the above direct effects, cumulative effects would be higher during winter further affecting marten populations. If linear relationships also apply to winter habitat (limiting factor for marten), then impacts would be more substantial and populations could take longer to recover during high prey, low snow years or could lead to permanent gaps in distribution.

Table 31. Cumulative Change in Marten Habitat, All Ownerships

Scale	Habitat	Historic	Acres and Road Density[1] (% reduction from *historic*)					
			Existing \ Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	Winter[2]	12,639	7,317	6,941	7,246	6,871	6,821	6,947
			(-42.1%)	(-45.1%)	(-42.7%)	(-45.6%)	(-46.0%)	(-45.0%)
	Year-round	19,967	14,494	13,641	14,277	13,524	13,321	13,713
			(-27.4%)	(-31.7%)	(-28.5%)	(-32.3%)	(-33.3%)	(-31.3%)
	Over 30% clearcut tolerance?[3]	--	No	**Yes**	No	**Yes**	**Yes**	**Yes**
	Open Road Density	($35 mi^2$)	1.0	1.1	1.0	1.3	1.3	1.2
	Total Road Density		2.2	2.3	2.2	2.5	2.5	2.4
VCU 7470	Winter	7,353	4,634	4,219	4,425	4,168	4,008	4,212
			(-37.0%)	(-42.6%)	(-39.8%)	(-43.3%)	(-45.5%)	(-42.7%)
	Year-round	12,278	9,434	8,657	8,965	8,580	8,339	8,667
			(-23.2%)	(-29.5%)	(-27.0%)	(-30.1%)	(-32.1%)	(-29.4%)
	Over 30% clearcut tolerance?		No	**Yes**	No	**Yes**	**Yes**	No
	Open Road Density	(24 mi2)	1.1	1.4	1.4	1.6	1.7	1.6
	Total Road Density		1.5	1.8	1.8	2.0	2.1	1.9
VCU 7530	Winter	10,830	6,216	6,164	6,190	6,162	6,097	6,162
			(-42.6%)	(-43.1%)	(-42.8%)	(-43.1%)	(-43.7%)	(-43.1%)

	Year-round	18,401	13,761	13,504	13,621	13,505	13,392	13,494
			(-25.2%)	(-26.6%)	(-26.0%)	(-26.6%)	(-27.2%)	(-26.7%)
	Over 30% clearcut tolerance?	--	No	No	No	No	No	No
	Open Road Density	(46 mi^2)	1.0	1.1	1.1	1.1	1.1	1.1
	Total Road Density		1.8	1.9	1.8	1.9	1.9	1.9

Scale	Habitat	Historic	Acres and Road Density[1] (% reduction from *historic*)					
			Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCUs 7460, 7470, 7530 Combined	Winter	30,822	18,167	17,324	17,861	17,201	16,925	17,322
			(-41.1%)	(-43.8%)	(-42.1%)	(-44.2%)	(-45.1%)	(-43.8%)
	Year-round	50,646	37,688	35,802	36,864	35,609	35,052	35,873
			(-25.6%)	(-29.3%)	(-27.2%)	(-29.6%)	(-30.8%)	(-29.2%)
	Over 30% clearcut tolerance?		No	No	No	**Yes**	**Yes**	No
WAA 406	Winter	36,435	24,555	24,127	24,458	24,055	23,940	24,132
			(-32.6%)	(-33.8%)	(-32.9%)	(-34.0%)	(-34.3%)	(-33.8%)
	Year-round	63,536	51,099	49,990	50,743	49,873	49,558	50,051
			(-19.6%)	(-21.3%)	(-20.1%)	(-21.5%)	(-22.0%)	(-21.2%)
	Over 30% clearcut tolerance?	--	No	No	No	No	No	No
	Open Road Density	(134 mi^2)	0.7	0.8	0.7	0.8	0.8	0.8
	Total Road Density		1.3	1.4	1.4	1.4	1.4	1.4
WAA 407[4]	Winter	15,865	10,443	10,028	10,235	9,977	9,817	10,022
			(-34.2%)	(-36.8%)	(-35.5%)	(-37.1%)	(-38.1%)	(-36.8%)
	Year-round	31,257	25,704	24,927	25,235	24,850	24,609	24,937
			(-17.8%)	(-20.3%)	(-19.3%)	(-20.5%)	(-21.3%)	(-20.2%)
	Over 30% clearcut tolerance?	--	No	No	No	No	No	No
	Open Road Density	(85 mi^2)	1.6	1.7	1.7	1.8	1.8	1.8
	Total Road Density		1.8	1.9	1.9	1.9	1.9	1.9

1. Total road density below 1,500 feet elevation.

2. Winter habitat equals high-POG ≤1500' elevation; year-round equals POG all elevations;

3. Consistent research threshold.

4. Does not include 3,726 acres of recent AMHT harvest or associated roads or the proposed 8,170 acre land exchange.

The amount, location, and type of modification to POG can directly affect connectivity within the project area. Snyder and Bissonette (1987) found tree height, percent overhead cover, presence of slash, distance to edge, and patch size to be important variables in determining suitability of residual habitat patches. Thompson (1994) found that residual stands of less than 40 acres were used less than expected. Bissonette et al. (1989) and Chapin, et al. (1998) found similar results on patch size. Hargis et al. (1999) noted that marten captures were zero to low in areas with less than 100 m [328 feet] between openings. They concluded that landscapes lacking interior habitat may not

not sustain reproducing populations. These findings also appear to be valid in Southeast Alaska. Flynn, (Marten Presentation, Conservation Strategy Meeting 2006) stated that matrix lands need to to be managed as productive habitat with adequate corridors among OGRs. See POG maps

Figure 21 to Figure 27. Since ownership and WAA boundaries are administrative rather than physical limitation on patch size, I calculated patch size across the combined 406/407 WAA and across all ownerships (Table 28).

Table 32. Change in Marten Habitat Patch Size, All Ownerships, WAAs 406/407 Combined

	Historic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5	Alt 6
# of patches ≥40 acres	57	93	92	93	93	92	93
Total acres in patches ≥40 acres	92,532	73,651	71,622	72,807	71,527	71,135	71,826
% Reduction in acres	--	-20.4%	-22.6%	-21.3%	-22.7%	-23.1%	-22.4%
Average size patches ≥40 acres	1,623	792	779	783	769	773	772
% Reduction average patch size	--	-51.2%	-52.0%	-51.8%	-52.6%	-52.4%	-52.4%

Patch size calculated on the combined WAAs 406/407.
Source: GIS, pogpatch082313.xlsx

Alternative 1

The Saddle Lakes project would not contribute to cumulative effects under Alternative 1. However, due to past activities that have long-term effects, marten winter habitat (high-POG ≤1,500 feet elevation) within project area VCUs is currently at 57 to 63 percent of what was available historically; year-round habitat (POG) is at 73 to 77 percent of historic levels. Both younger and older clearcuts were avoided during the winter on nearby Chichagof Island (Flynn & Schumacher 1999, Flynn & Schumacher 2001). As a result, past and recent clearcutting represent long-term to permanent loss of marten winter habitat. More recent clearcut harvest on AMHT lands (3,726 acres) is mostly below 1,500 feet elevation and at least a portion may have been high-POG winter habitat; remaining areas would have been POG and provided year-round habitat in WAA 407. As discussed under direct effects, marten are most energy constrained during the winter and require suitable habitat where prey are not only abundant, but also available beneath the snow. Stem exclusion stands are unlikely to support abundant prey. Use of these or similar stands would cause marten to expend excess energy searching for prey increasing chance of mortality since body shape severely limits body fat reserves (Buskirk and Powell 1994, Harlow 1994). Impacts are slightly less at the broader WAA scale, but winter habitat has been reduced 33 percent from historic levels at the combined WAA scale and year-round habitat has been reduced by 19 percent. As a result, permanent gaps in distribution have likely occurred.

From identified linear relationships between clearcut harvest and marten density, marten populations could be reduced 27 percent from historic levels in VCU 7460, 23 percent in VCU 7470, and 25 percent in VCU 7530. POG would continue to dominate the project area VCUs as the amount clearcut would remain below the 30 percent threshold identified by research. Marten would be more influenced by fluctuations in prey.

Most trappers in GMU 1A access trapping areas using boats (Porter 2010) and this trend would likely continue for trapping near the beach or areas east of Carroll Inlet, but the Ketchikan to Shelter Cove Road will connect the project area to Ketchikan and Saxman and enable vehicle and/or snowmobile access to nearby trapping areas.

Alternatives 2 through 6

Alternatives 2, 4, and 6 would reduce marten winter habitat within project area VCUs by approximately 43 to 45 percent (Table 31) maintaining slightly over half of the winter habitat that was available historically. Impacts would be slightly less under Alternative 3 and slightly more under Alternative 5. Reductions in year-round habitat in project VCUs would range from to 26 to 33 percent of historic levels. With inclusion of Leask Lakes harvest, habitat loss under Alternatives 2, 4, 5, and 6 would exceed research thresholds of 30 percent maximum clearcut tolerance in VCUs 7460 and 7470 putting these VCUs at increased risk of not maintaining marten populations. Habitat loss in VCU 7530 is approaching this threshold, but would not exceed it as a result of the Saddle Lakes Timber Sale. Alternatives 4 and 5 would reach or exceed the 30 percent maximum clearcut tolerance for all VCUs combined. As a result, localized permanent gaps in distribution would likely occur throughout the Saddle Lakes landscape. Impacts are slightly less at the WAA scale.

The action alternatives, combined with past and foreseeable future management actions, could reduce marten populations by up to 33 percent. If linear relationships also apply to winter habitat (i.e., the limiting factor for marten), populations could be reduced by 43 to 45 percent in project area VCUs. Populations fluctuate in response to habitat and prey and would likely rebuild toward year-round habitat levels during favorable conditions with abundant prey availability. Winter habitat has been reduced 41 to 45 percent at the broad combined VCU scale and year-round habitat has been reduced 26 to 31 percent (Table 27). Affected marten may inhabit suboptimal habitat where they spend excessive energy on hunting prey and have lower reproductive success, may increase or shift home ranges into vacant territories resulting from overwinter mortality, or could abandon home ranges causing localized gaps in distribution.

Research in Southeast Alaska by Flynn et al. (2004) supports the conclusion that all action alternatives would further reduce the effective patch size and connectivity of marten habitat since marten do not use younger or older second growth. Other research (see above) has shown that clearcuts affect marten movements. Under Alternatives 2 through 6, POG habitat in patches ≥40 acres will have decreased roughly 20 percent from historic levels and the number of patches almost doubled (Table 32). The average size of the available patches has decreased by over 50 percent. Reduction in available habitat and connectivity could change marten foraging behavior and foraging efficiency, change movement path selection, cause marten to inhabit suboptimal habitat, spend excessive energy on hunting, cause marten to have less time available for social interaction and breeding, and affect female body index reducing reproductive success. Reduction in available habitat and connectivity may force juveniles to disperse farther distances where they experience poorer body condition and suffered twice the mortality risk.

OGRs and 2001 Roadless Areas would act as refugia from trapping and continue to provide habitat for marten, but Flynn et al. (2004) found that OGRs do not support the densities of marten predicted under 1997 Forest Plan FEIS assumptions. They stated that management of matrix lands may have the greatest potential for enhancing marten conservation and that increased connectivity would increase the likelihood that OGRs would be re-populated after local extinctions occur. The current small OGR in VCU 7470 would be maintained under Alternatives 2, 3, 4, and 6, which would maintain the important connectivity, link with source habitat in Naha LUD II to repopulate vacant territories within Saddle Lakes VCUs. Alternative 5 would move the existing small OGR into habitat that does not provide comparable achievement of old-growth goals and objectives, and sever this important link by clearcutting the current connection. As a result, vacant territories within WAAs 406/407 may not be repopulated causing gaps in marten distribution on a broad scale.

With the completion of the Ketchikan to Shelter Cove Road, some trapper access could shift from boats to vehicles or snowmobiles. Therefore, open road densities ranging from 1.0 to 1.7 mi/mi^2 within project VCUs and 0.7 to 1.8 within project WAAs (Table 31) could affect habitat suitability and lead to overharvest of marten. Trapping pressure would continue to fluctuate with pelt price. There is currently no limit on the number of marten that can be trapped. Alternative 3 would have the least cumulative effect of the action alternatives on marten habitat and marten populations. Cumulative effects of Alternatives 2 and 6 are roughly equal and rank second of the action alternatives; impacts under Alternative 2 may be slightly less because of the UA33 partial cutting proposed for Saddle Lakes. Alternative 4 has the second highest cumulative effect on marten with Alternative 5 having the greatest effect on marten habitat, connectivity, dispersal capability, and populations.

Summary of Marten Effects

Habitat loss under alternatives 2, 4, 5, and 6 would exceed research threshold of 30 percent clearcut tolerance in VCU 7460 putting this VCU at increased risk of not maintaining marten populations. Habitat loss in VCU 7470 would exceed research thresholds under Alternatives 2, 4, and 5 and would be borderline under Alternative 6. Habitat loss in VCU 7530 would not exceed thresholds under any alternative. The consequence of additional harvest would be gaps in distribution and reduced gene flow within the population, lower densities of marten, lower body condition and reproductive success, altered foraging patterns and efficiency, and lower winter survival due to loss of subnivean denning sites. The greater the size and number of gaps, the higher the risk of reducing gene flow. Alternative 5 would move the small OGR in VCU 7470 severing the important connection between Naha LUD II source populations and sink habitat within the George and Carroll Inlet areas.

Bald Eagle (Haliaeetus leucocephalus)

FP Direction (WILD1.VIII, p. 4-92):

> The Bald Eagle Protection Act provides for special management for the bald eagle. Manage bald eagle habitat in accordance with the Interagency Agreement established with USFWS to maintain habitat to support the long-term nesting, perching, and winter roosting habitat capability for bald eagles. Coordinate with USFWS for bald eagle habitat management. *MOU has expired and been superseded by 50 C.F.R.* § *22.26 Permits for eagle take that is associated with, but not the purpose of, an activity*.

Introduction and Habitat correlation to the affected environment

The bald eagle is a MIS in the Tongass because of its association with coastal forested habitats, and because nesting and foraging habitats could be affected by forest management activities in Southeast Alaska. The bald eagle is protected under the Bald and Golden Eagle Protection Act, which provides for special management of bald eagles, their young, and their nests.

Bald eagles are common year-round residents in Southeast Alaska, where they nest and winter in high numbers. The Tongass, historically and presently, has supported the largest breeding population of bald eagles in the world. Populations in Southeast have increased from a corrected plot sample of 8,473 adult birds in 1967 to 12,934 birds in 2007; populations increased until 1982 and have remained stable thereafter. (Hodges 2011). Due to funding limitations, USFWS has not flown nest surveys on Revillagigedo Island in recent years. However, approximately 300 nests have been recorded on the island in the past with 87 nests occurring in George or Carroll Inlets. Eagles were frequently observed while boating to the Saddle Lakes project area.

Nearly all bald eagles nests in southeast Alaska are in old-growth forest habitats within the beach fringe (Stenhouse 2007, Jacobson and Hodges 1999, Gende et al. 1997, King et al. 1972). Large diameter old-growth trees with stout supporting branches are necessary to support the large heavy nests. Of almost 3,000 bald eagle nests observed by Robards and Hodges (1976) in Southeast Alaska, 84 percent were in old-growth stands, in trees greater than 36 inches in diameter; no nests were recorded in second-growth trees. The Forest Plan designates and protects a 1,000-foot forested beach-buffer along shorelines and estuaries (USDA 2008b BEACH1, p. 4-4).

Habitat loss is the most significant long-term threat to bald eagle populations (USFWS 1986, USFWS 2008), but human disturbance, contaminants, food availability, and weather can also affect eagle densities and nesting success (summarized in Gende et al. 1998). Gende et al. (1998) noted that the nesting density of eagles along the shoreline was reduced within 100m [~330 ft] of clearcuts although individual nesting success was similar. They recommended buffers of 300m [~1000 ft] to maintain eagle populations in Alaska. In spite of past logging in southeast Alaska, availability of nesting habitat is not seen as a significant limiting factor; full protection of the shoreline timbered fringe on the Tongass National Forest (80% of the land base in southeast Alaska) began in 1997 with the establishment of a 1000 foot buffer strip of no cutting (Hodges 2011). Current habitat is shown in Table 33.

Table 33. Existing Bald Eagle Habitat, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	2,711	1,875	-31%
VCU 7470	32	22	-31%
VCU 7530	2,581	1,794	-30%

Habitat is POG within the beach/estuary buffer

The Bald and Golden Eagle Protection Act provides specific protections for bald eagles and their nests. An amendment to the Bald and Golden Eagle Act (50 C.F.R. § 22.26), finalized in November of 2009, authorizes the USFWS to issue “take” permits to applicants associated with development projects or other activities that may impact eagles or their nests. In conjunction, USFWS Alaska Region developed step-by-step guidelines to assist landowners in determining if new or intermittent activity near an eagle nest is likely to take or disturb bald eagles and conservation measures that can be adopted to avoid that disturbance (USFWS 2009a).

The following conservation measures should be should be implemented during the breeding season (March 1 through August 30) to prevent disturbance:

- Avoid clear-cutting or removal of overstory trees within 330 feet (100 meters) of both active and alternate nests at any time.
- Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the nesting season within 660 feet (200 meters) of the nest. The distance may be decreased to 330 feet around alternate nests within a particular territory, including nests that were attended during the current nesting season but not used to raise young, after eggs laid in another nest within the territory have hatched.
- Avoid construction of log transfer facilities and in-water log storage areas within 330 feet (100 meters) of active and alternate nests.

- Avoid operating aircraft [helicopters or fixed-wing] within 1000 feet (305 meters) of the nest during the breeding season, except where eagles have demonstrated tolerance for such activity.
- Avoid blasting and other activities that produce extremely loud noises within 1/2 mile of active nests (or within 1 mile in open areas), unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area.

Direct and Indirect Effects All Alternatives

Measurement criteria: POG within beach/estuary buffers; potential disturbance within buffers. NFS lands within VCUs 7460, 7470, and 7530 were used as the scale for direct effects analysis.

Forest Plan beach/estuary standards and guidelines (USDA 2008b, pp. 4-4 to 4-5) maintain the 1000 foot wide beach fringe that protects bald eagle nesting, perching and roosting habitat. There are no activities proposed within disturbance avoidance zones listed in the USFWS conservation measures for avoiding take. However, the proposed rock pit at milepost 4.208 on Road 8340000 is mapped at the edge of the ½ mile blasting restriction (0.51 mile from nest) and actual location may require timing restrictions to prevent disturbance. With timing restrictions, there would be no effect on bald eagle habitat or bald eagles under any alternative. The proposed fisheries enhancement in Salt Creek is roughly one mile from the closest known eagle nest. Natural processes such as windthrow and weather would continue to affect productivity.

Cumulative Effects All Alternatives

The Saddle Lakes project would not add to bald eagle cumulative effects under any alternative. Cumulative effects come from Long-term Sale era timber harvest and associated activities within in the beach buffer on NFS lands and from past and more recent harvest along the coastline on non-NFS lands including the Leask Lakes sale. It appears from recent photos of the Leask LTF that some trees were left along the shoreline, but I did not find specific requirements for beach buffers on the AMHT or DNR websites. Effects from Ketchikan to Shelter Cove Road are dependent upon final road location. The AMHT proposed land exchange does not contain beach habitat. Other projects, such as the Swan Lake hydropower expansion, would not alter coastal nesting habitat. Previously harvested stands along the coastline would remain unsuitable until existing trees become large diameter and contain the branch structure capable of supporting eagle nests. From field observations, this could take 80 years or longer depending upon site productivity. Past activities have removed up to 48 percent of the historic POG nesting habitat limiting its suitability and affecting bald eagle densities within the area (Table 34).

Table 34. Cumulative Effect on Bald Eagle Habitat

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	2,714	1,877 (-30.8%)	There would be no further impacts on NFS lands. Impacts to non-NFS beach nesting habitat would depend upon final project designs and future management plans.				
VCU 7470	1,303	675 (-48.2%)					
VCU 7530	3,030	2,125 (-29.9%)					
WAA 406	7,995	6,089					

		(-23.8%)	
WAA 407	4,390	2,779	
		(-36.7%)	
WAAs 406/407	12,385	8,868	
		(-28.4%)	

1. POG within 1000 foot beach buffer.

Summary of Bald Eagle Effects

There would be no impacts to known bald eagle nests or nesting habitat from the Saddle Lakes project. Bald eagle populations in Southeast Alaska are thought to be stable (Hodges 2011).

Brown Creeper (Certhia americana)

FP Direction (WILD1.V, p. 4-91):

> *Reserve Tree/Cavity-Nesting Habitat* - Provide habitat for cavity-nesting wildlife species. The legacy forest structure standard and guideline considers snags and replacement snag needs for those VCUs at risk for not providing sufficient snags within the watershed. Other VCUs will have snags retained within the development LUDs because habitat will be maintained in riparian buffers, the beach fringe, old-growth habitat reserves, and other Non-development LUDs within the VCU. 1. Retain reserve trees in all LUDs. a) Retain reserve trees (which may be soft or hard snags) with a reasonable assurance of wind firmness, while meeting management objectives and considering safety needs for people and equipment. Use the Reserve Tree Selection Guidelines (R10-MB-215) for guidance. b) Reserve trees do not need to be evenly distributed; clumped distributions are preferred. e) Retain live trees for future reserve tree recruitment.

Introduction and Habitat correlation to the affected environment

The brown creeper was selected as an MIS because of its close association with large diameter old-growth trees. It is an uncommon year-round resident that is widely distributed throughout Southeast Alaska and the Tongass (Heinl and Piston 2009). Although widespread, this species can be difficult to detect and monitor due to its small size and cryptic coloration as well as its low volume, high-pitched call. The predominant subspecies in the Tongass is the resident, *C. a. occidentalis,* which occurs along the Pacific Coast from Southeast Alaska to northern California. Quantitative data on the abundance of brown creepers in the Tongass is lacking. Further, it is unlikely that trend information from broad-scale surveys (e.g., BBSs and CBCs) can be used to determine if population fluctuations are due to habitat alterations or to other causes. “These are large scale monitoring programs and may not detect changes in avian populations at a scale and resolution appropriate for the Tongass National Forest” (USDA 2008c, p. 3-240).Statewide populations are estimated at 350,000 with an upward trend (22.3%), but estimates are suspected to be inaccurate (from Rosenberg 2004 & Sauer 2004 as listed in ADF&G 2005). Long-term (1966-2011) BBS data shows a slightly positive trend for Alaska (12.0), but again, data should be used with caution due to small detection rates and limited samples (Sauer et al. 2012).

Brown creepers depend on cavities in the large-diameter snags characteristic of old-growth stands. They forage primarily on trunks of live, large (>60 cm [24”]) diameter trees with abundance positively correlated with trees >100 cm [39”] DBH suggesting this species is an old growth obligate (Kissling, et al., Forest Bird Presentation, Conservation Strategy Meeting, 2006). Similar ties to old-growth forest in southeast Alaska were documented in Cotter (2007b), ADF&G (2005), Andres et al. (2004), Stotts et al. (1999), and DellaSala et al. (1996). There is a strong association of this species with large-diameter live trees for foraging sites and large-diameter, dead or dying trees with sloughing bark or thick bark for nest sites (Poulin et al. 2013). The preference for old-growth forests appears to be correlated with the abundance of snags and large diameter live trees, and perhaps with structural components and microclimate (Poulin et al. 2013, Poulin et al. 2008, Wiggins 2005).

Numerous studies in the US and Canada have found that brown creepers are negatively affected by edge and that densities are consistently lower in edge habitat (Poulin et al. 2013, McWethy et al. 2009, Poulin et al. 2008, Wiggins 2005, Keller and Anderson 1992, Hagar 1999, Hobson and Bayne 2000, Brand and George 2001, George and Brand 2002, Hejl et al. 2002, Hejl et al. 2002b, ADF&G 2005). In studies in Washington State by Blewett and Marzluff (2005), brown creepers responded both to forest cover at the landscape scale (1-km^2 blocks) and to local habitat conditions (snag density). Studies by Poulin et al. (2008) in New Brunswick, Canada, indicate that brown creepers respond to the amount of mature old-growth forest cover within 250 m [800 ft] of nests; 62 percent of brown creeper nests in their study were located greater than 100 m (328 ft) from edges with the average distance 143 m [470 ft]. Kissling and Garton (2008) found similar effects on brown creepers within southeast Alaska: brown creepers were more abundant in buffers (>250 m [820 ft]) with most detections in the largest buffers (>400 m [1,312 ft]) and controls. However, the limited number of detections prevented Kissling and Garton from doing statistical analysis on brown creepers preference.

Interior habitat was historically limited in portions of the Saddle Lakes area due to muskegs and other non-forested vegetation; much of the historic interior POG was low elevation habitat associated with coastal shorelines or major stream or lake systems (Figure 13). Existing interior habitat is shown for NFS lands in Table 35.

Table 35. Existing Brown Creeper Interior POG, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	10,885	3,050	-72%
VCU 7470	4,469	2,417	-46%
VCU 7530	7,832	2,493	-68%

Interior habitat based upon edge effect distances in Concannon (1995).

Direct and Indirect Effects

Measurement criteria: acres of interior POG (calculated using edge effects in Concannon 1995).

Based upon the habitat information above, I selected interior old-growth habitat as the measurement criteria for analyzing effects to brown creepers and calculated interior POG habitat from GIS layers using the edge effect distances identified in Concannon (1995). I considered Concannon (1995) as the best available information for the Tongass since they were relatively close to and more detailed than the distances found in Kissling and Garton (2008) and found by Chen et al. (1992) in the Pacific Northwest. I incorporated the following assumptions into the analysis due to lack of specific information: 1) all clearcuts were buffered (200 m/656 ft) regardless of age; 2) effects from roads through forested areas were calculated using the same effective distance as clearcuts (200 m/656 ft) due to the similar abrupt edge that is created; 3) muskeg/non-forested areas were buffered (120 m/394 ft) since the edge was naturally feathered by the muskeg/forest interface; 4) roads clearing through non-forested areas were calculated using the same distance as muskegs (120 m/394 ft).

Effects Common to Action Alternatives

Brown creepers across their range are sensitive to fragmentation and consequently increases in edge habitats (Wiggins 2005). Therefore, forest management practices are likely to affect brown creeper populations. Hejl et al. (2002) and Poulin et al. (2013) summarized multiple studies across the United States where brown creepers were substantially more abundant in unlogged versus logged conditions including clearcuts, partial cuts, and regenerated pole-sapling stands. Preston and Harestad (2007) also found that brown creeper on Vancouver Island, British Columbia were more abundant in unlogged stands than in partial cut group retention stands. Immature and mature second-growth forests (even 100-yr old stands) often did not contain essential structural characteristics; suitability second-growth forest was likely dependent on the size of the clearcut and the number of large snags and large trees left in cutover areas.

Logging (including clear-cut, partial-cut, and salvage logging), forest thinning, and the consequent fragmentation of forest habitats may affect creepers in the following ways: 1) reducing the overall availability of suitable nesting and foraging habitat; 2) increasing the distance between suitable nesting/foraging habitat patches (i.e., habitat fragmentation); and 3) decreasing reproductive success by lowering prey availability (Wiggins 2005). Nest failures can be caused by alteration of the nest site by wind or rain, predation, human disturbance (Kissling, et al., Forest Bird Presentation, Conservation Strategy Meeting, 2006). Habitat fragmentation may hamper adult and juvenile dispersal among neighboring forest patches; however, the primary effect of forest fragmentation is that brown creepers may simply avoid breeding in small forest fragments (Hejl et al. 2002a, 2002b). Hobson and Bayne (2000) found that brown creepers were one of only two forest species that never bred in fragmented (0.2 to 123 hectare [0.5 to 304 ac]) plots. Hejl et al. (2002b) found a trend of lower nesting success among creepers breeding in fragmented forests in Idaho.

From review of multiple studies, Wiggins (2005) concluded that the fragmentation of mature and old-growth forests due to logging, road building, and other sources of habitat partitioning has numerous negative effects on brown creeper populations. In some cases, creepers completely abandoned logged sites, likely because of the loss of large mature and old-growth trees that provide both foraging and nesting sites (peeling bark). Paired comparisons of creeper abundance/presence in logged vs. nearby unlogged forests showed strong, negative effects of logging (i.e., “complete absence or significantly lower abundance”) with no exceptions (Wiggins 2005, Hejl et al. 2002a). The extent to which brown creepers will avoid nesting in fragmented forest blocks likely depends on local habitat conditions such as canopy closure, snag abundance, and other factors that determine habitat suitability for this species (Poulin et al. 2013, Wiggins 2005).

Brown creepers are one of the species most sensitive to partial harvesting (Mahon et al. 2008, Vanderwel et al. 2007, Guénette and Villard 2005), although partial harvest maintained higher relative abundance than clearcutting. Based on the above literature, even low- to moderate-intensity harvest regimes may exacerbating edge effects in POG forest stands (Concannon 1995) and negatively affect brown creeper populations. Mahon et al. (2008) found reduced numbers in partial cuts in British Columbia with even 30 percent removal of individual trees or small groups affecting brown creeper abundance. Young and Hutto (2002) found that brown creeper abundance was statistically different between uncut and partial cut forest stands in the Rocky Mountains with brown creepers being more abundant on points in uncut stands. When the effect of canopy cover was included in the regression models along with the treatment effect, they found that the treatment effect could be explained almost entirely by canopy cover change. Vanderwel et al. (2011) found that brown creepers were sensitive to partial harvest at all levels of removal in

Ontario, particularly with the removal of larger diameter trees. Brown creeper densities decrease as the amount of timber removed increased. Therefore, I suspect that brown creeper densities would be reduced in partial cut stands in the Saddle Lakes area.

Few of the studies I found quantified actual relationships between the amount of habitat loss and population decline. Instead, terms such as “relative abundance” and “avoidance” were often used. Low detectability rate or detection only in old-growth or mature habitat was often cited as the reason for lack of statistical analysis. As a result, it is uncertain how far brown creeper populations have actually declined, but with the amount of clearcutting, substantial declines are possible. Several Southeast Alaska studies (DellaSala et al. 1996, Kissling and Garton 2008) have found substantially fewer or an absence of creepers in logged habitat or narrow buffers. It is likely that some brown creepers may be inhabiting less suitable edge habitat affecting survival, reproductive success, and dispersal of juveniles. Others have likely abandoned territories or died leaving substantial gaps in distribution both at the VCU and at the larger WAA scale.

Changes to brown creeper habitat are shown in Table 36.

Table 36. Effect on Brown Creeper / Interior Habitat[1], NFS Lands

		Acres (% reduction from *existing*)					
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	10,885	3,050	2,704	2,940	2,661	2,651	2,691
			(-11.3%)	(-3.6%)	(-12.8%)	(-13.1%)	(-11.8%)
VCU 7470	4,469	2,417	2,174	2,248	2,153	2,060	2,165
			(-10.1%)	(-7.0%)	(-10.9%)	(-14.8%)	(-10.4%)
VCU 7530	7,832	2,493	2,471	2,474	2,473	2,471	2,471
			(-0.9%)	(-0.8%)	(-0.8%)	(-0.9%)	(-0.9%)
VCUs Combined	23,186	7,960	7,350	7,662	7,288	7,154	7,327
			(-7.7%)	(-3.7%)	(-8.4%)	(-10.1%)	(-8.0%)

1. Interior habitat based upon vegetative & climatic edge effect distances for Southeast AK (Concannon 1995).

Alternative 1

Alternative 1 would have no effect on brown creeper habitat or populations. Hejl, et al. (2002a) summarized that retaining continuous, unfragmented areas of unlogged mature and old-growth forests would provide optimum creeper habitat. Although the project area is currently fragmented, all existing patches of interior habitat would be maintained and would continue to provide optimal habitat.

Alternative 2

Alternative 2 would affect 610 acres of brown creeper habitat. Roughly 90 percent of the current brown creeper habitat would remain within VCUs 7460 and 7470, but partial cutting in units 47, 48, 50, 75, 80, and 123 would impact the large patch of interior habitat on the south shore of North Saddle Lakes. Partial cutting in units 28, 29, and 147 would affect the patch on the north side of the lake. According to work by Deal et al. (2009), partial cut stands may regain large tree structural diversity and function within 50 or more years, but brown creepers require large decadent trees with sloughing bark which could take longer to develop. Based upon available research, brown creeper densities would be reduced in the interim. Clearcutting of unit 67 would affect the patch near Granite Island/George Inlet (see Figure 16) and preclude brown creeper use long term or permanently under a 100 year rotation. Other smaller patches would be affected throughout the project area with roughly 99 percent of the habitat being maintained in VCU 7530. Large interior patches within OGRs and Roadless areas would be unaffected by this alternative. Two small patches would be affected by buffering units 43 and 44. The number of individual brown creepers are expected to decline with habitat loss and/or reproductive success be reduced from current levels as birds occupy sub-optimal habitat. Fragmentation can also affect juvenile dispersal success. Alternative 2 would have the second lowest risk to brown creeper populations of the action alternatives. It harvests the second lowest number of acres and treats more acres using partial cutting, which may support reduced brown creeper densities (Mahon et al. 2008, Vanderwel et al. 2008, 2011).

Alternative 3

Alternative 3 would affect 298 acres of interior brown creeper habitat. Impacts would be greatest in VCU 7470 where habitat would be reduced 7 percent or to 93 percent of existing levels (Figure 17). Units impacting this VCU include 43, 44 (affecting interior POG within the OGR), and 67. VCU 7460 has the second highest effects where 96 percent of existing habitat would be maintained; partial cutting in unit 123 would reduce the size of the large interior patch on the south side of North Saddle Lakes. Over 99 percent of the existing habitat would remain in VCU 7530. Smaller patches of interior brown creeper habitat would be affected throughout the project area. Fewer individuals would be impacted as most large patches would remain. Alternative 3 causes the least fragmentation of the action alternatives and has the least risk to affect reproductive success and/or continued overall population decline.

Alternative 4

Alternative 4 would affect 672 acres of interior brown creeper habitat reducing available habitat throughout project area VCUs. Roughly 87 and 89 percent of existing habitat would remain in VCUs 7460 and 7470, respectively with 99 percent remaining in VCU 7530. In addition to the effects described under Alternative 2, the entire large patch by North Saddle Lakes would be removed and additional impacts would occur near George Inlet salt chuck from clearcutting units 64, 65, 66, and 155. Clearcutting the wildlife corridor through units 203, 204, 207, and 224 would remove the interior patch north of Island Point. Compare Figure 11 and Figure 18 for changes to existing habitat. The intensity of clearcutting would lead to avoidance by brown creepers and subsequent gaps in distribution; partial cuts (UA33) may support limited numbers of brown creepers, but nests can be more subject failure due to climatic impacts. Increased fragmentation would likely reduce nesting success and juvenile dispersal. Alternative 4 has the second highest effect on brown creeper habitat, breeding success, dispersal, and overall populations.

Alternative 5

Alternative 5 would impact 806 acres of brown creeper habitat predominantly through clearcutting. Roughly 87, 85, and 99 percent of the current brown creeper habitat would be maintained in VCUs 7460, 7470, and 7530, respectively. Clearcutting in units 46, 47, 48, 49, 50, 74, 75, 80, 115, 118 and 123 would eliminate the large patch of interior habitat on the south shore of North Saddle Lakes; units 28, 29, 30 and 147 would eliminate the patch on the north side of the lake (Figure 15). Additional impacts would occur near George Inlet salt chuck from clearcutting units 64, 65, 66, and 155. By not implementing wildlife corridor #3 through units 203, 204, 207, and 224, the interior patch north of Island Point would be removed. The large block of interior POG in the current VCU 7470 OGR would be reduced as the OGR is moved in this alternative into the currently protected North Revilla Roadless Area and units 300-308 and 310-312 are clearcut. Unit 309 would be partial cut. Under this alternative, interior habitat would be highly restricted outside OGRs and Roadless areas. Since most units would be clearcut, harvest would result in long-term loss of brown creeper habitat. Therefore, brown creepers would either be forced into less suitable habitat causing reduced reproductive success, decreased over-winter survival, and substantially reduced numbers (Wiggins 2005, Hejl et al. 2002), or additional gaps in distribution would occur within the project area, or both. Alternative 5 would have the greatest effect on brown creepers of all alternatives.

Alternative 6

Alternative 6 would affect 633 acres of interior brown creeper habitat reducing available habitat but retaining 88 and 90 percent of existing habitat in VCUs 7460 and 7470 (Figure 20), and 99 percent of the existing habitat in VCU 7530. Harvest of units 48, 49 50, 118, and 123 will remove most of the block located south of North Saddle Lakes. Additional impacts would occur near George Inlet salt chuck from units 64, 65, 66, and 155 and to the 7470 OGR from units 44 and 106. Alternative 6 has the third lowest risk of the action alternatives or the third highest overall.

Cumulative Effects

Buffers were applied as described above to determine historic interior POG as a baseline for alternative comparison. All ownerships within project VCUs and WAAs 406/407 were used to look at the effects at a broader landscape scale (Table 37), but data is lacking for the Leask Lakes area. Some of the greatest interior POG losses have been along the eastern shore of Carroll Inlet with smaller losses along the western shore within the Saddle Lakes project area. Remaining habitat within the project area is predominantly restricted to OGRs and Inventoried Roadless Areas. Impacts from the proposed 8,170 acre land exchange would depend upon approval, but could affect multiple patches of interior habitat within the Saddles Lakes project area including patches within the small OGR in VCU 7470. Maps of interior habitat are shown in Figure 14 through Figure 20.

Table 37. Cumulative Change in Brown Creeper/Interior Habitat[1], All Ownerships

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	10,983	3,050	2,704	2,940	2,661	2,651	2,691
		(-72.2%)	(-75.4%)	(-73.2%)	(-75.8%)	(-75.9%)	(-75.5%)
VCU 7470	6,363	3,070	2,820	2,897	2,799	2,656	2,811
		(-51.8%)	(-55.7%)	(-54.5%)	(-56.0%)	(-58.3%)	(-55.8%)
VCU 7530	8,248	2,623	2,601	2,605	2,604	2,601	2,602
		(-68.2%)	(-68.5%)	(-68.4%)	(-68.4%)	(-68.5%)	(-68.5%)
WAA 406	30,321	14,193	13,824	14,063	13,783	13,771	13,811
		(-53.2%)	(-54.4%)	(-53.6%)	(-54.5%)	(-54.6%)	(-54.5%)
WAA 407	13,949	7,440	7,190	7,267	7,168	7,025	7,180
		(-46.7%)	(-48.5%)	(-47.9%)	(-48.6%)	(-49.6%)	(-48.5%)
WAAs 406/407	44,270	21,633	21,014	21,329	20,951	20,796	20,991
		(-51.1%)	(-52.3%)	(-51.8%)	(-52.7%)	(-53.0%)	(-52.6%)

1. Interior habitat based upon vegetative & climatic edge effect distances for Southeast AK (Concannon *MS thesis* 1995)
Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx.

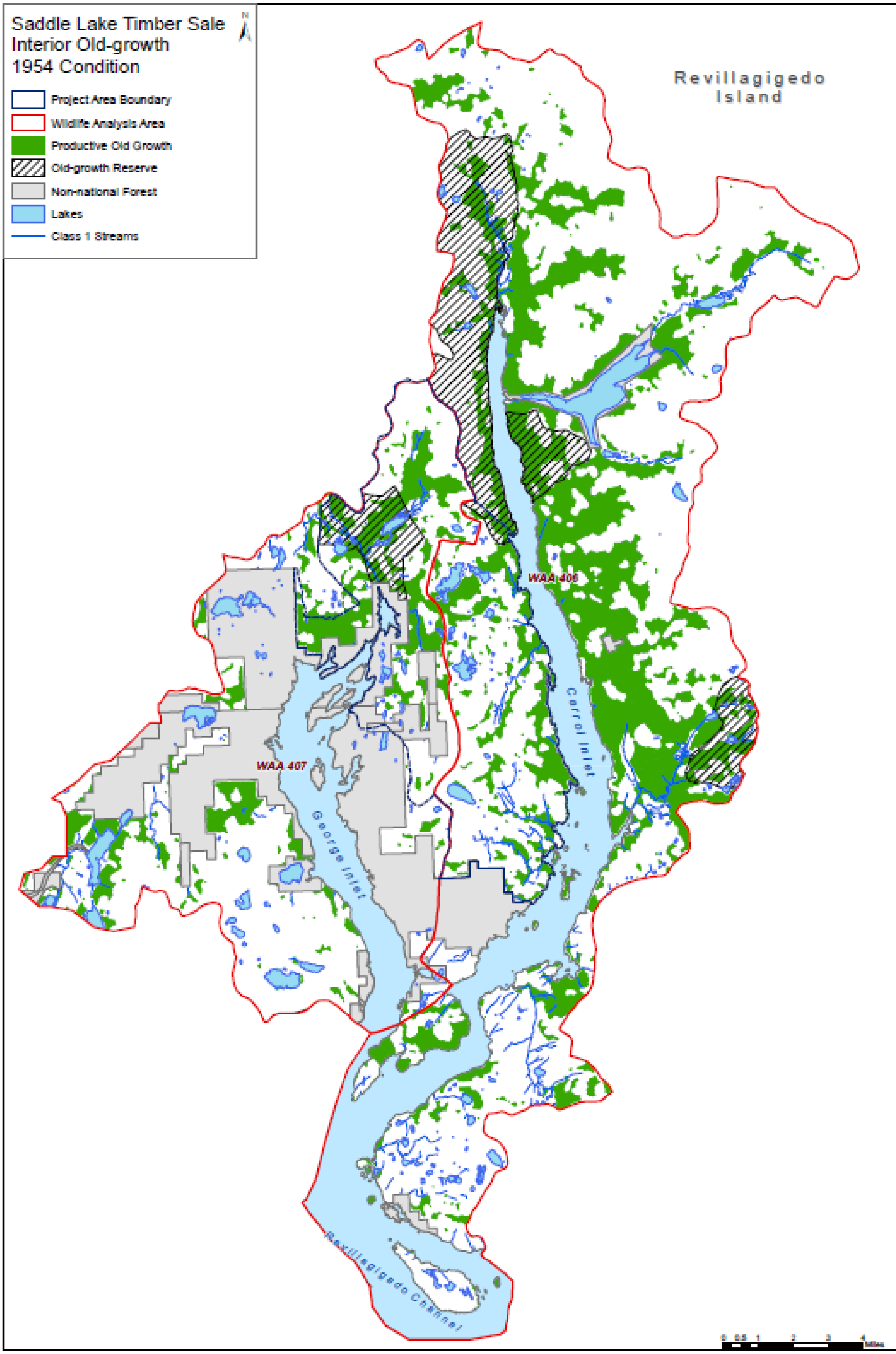


Figure 14. Historic Interior POG Habitat

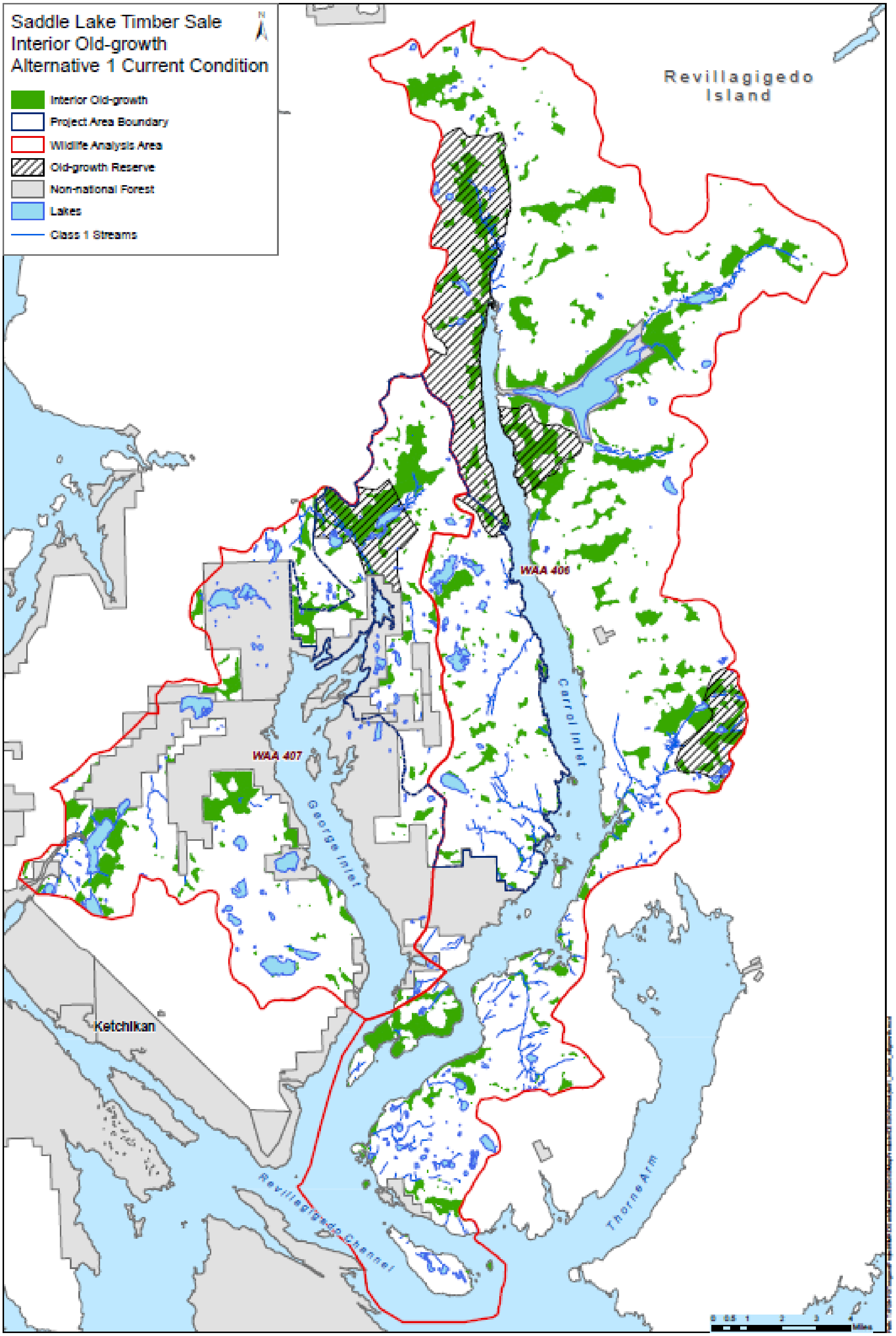


Figure 15. Alternative 1 Interior POG Habitat

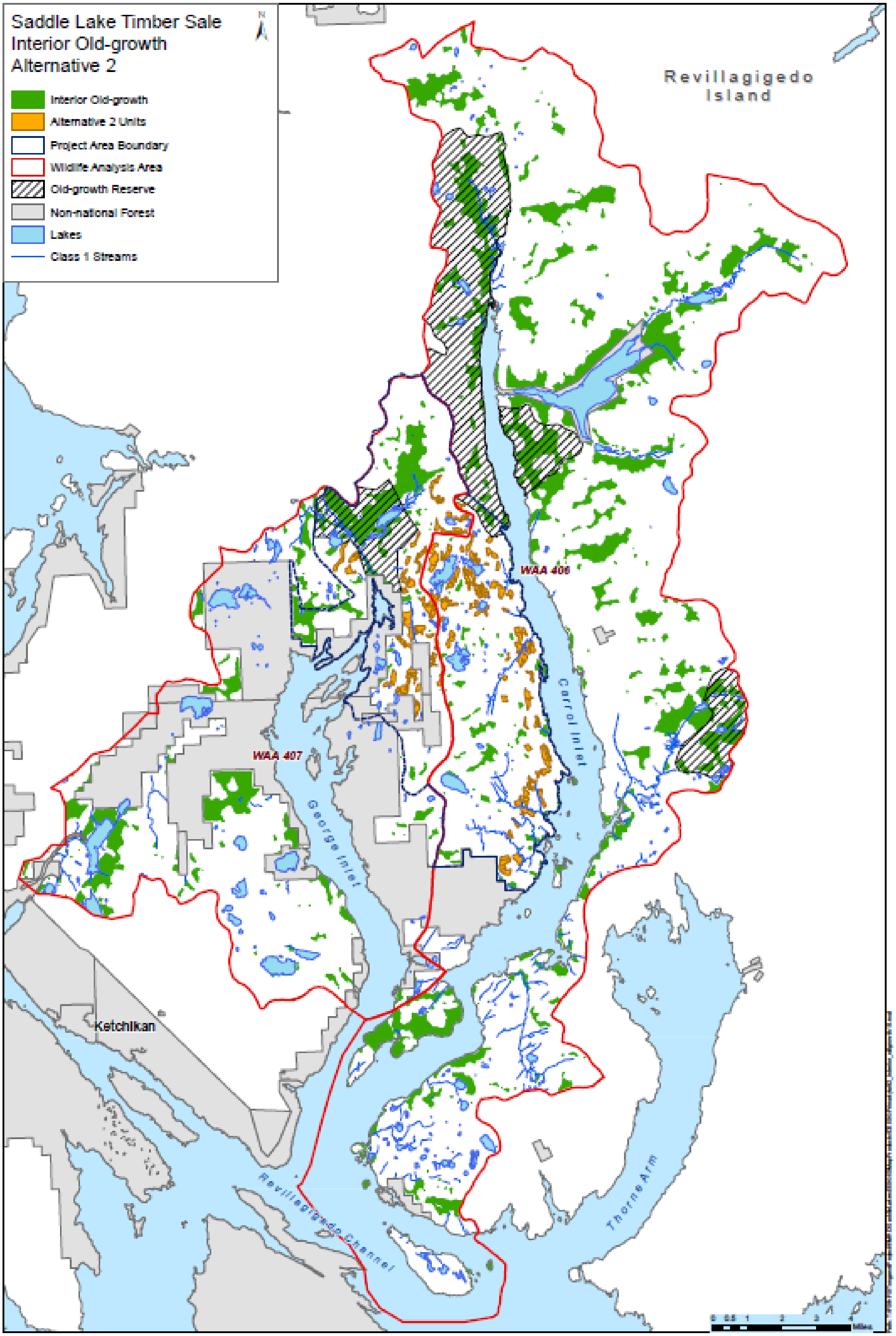


Figure 16. Alternative 2 Interior POG Habitat

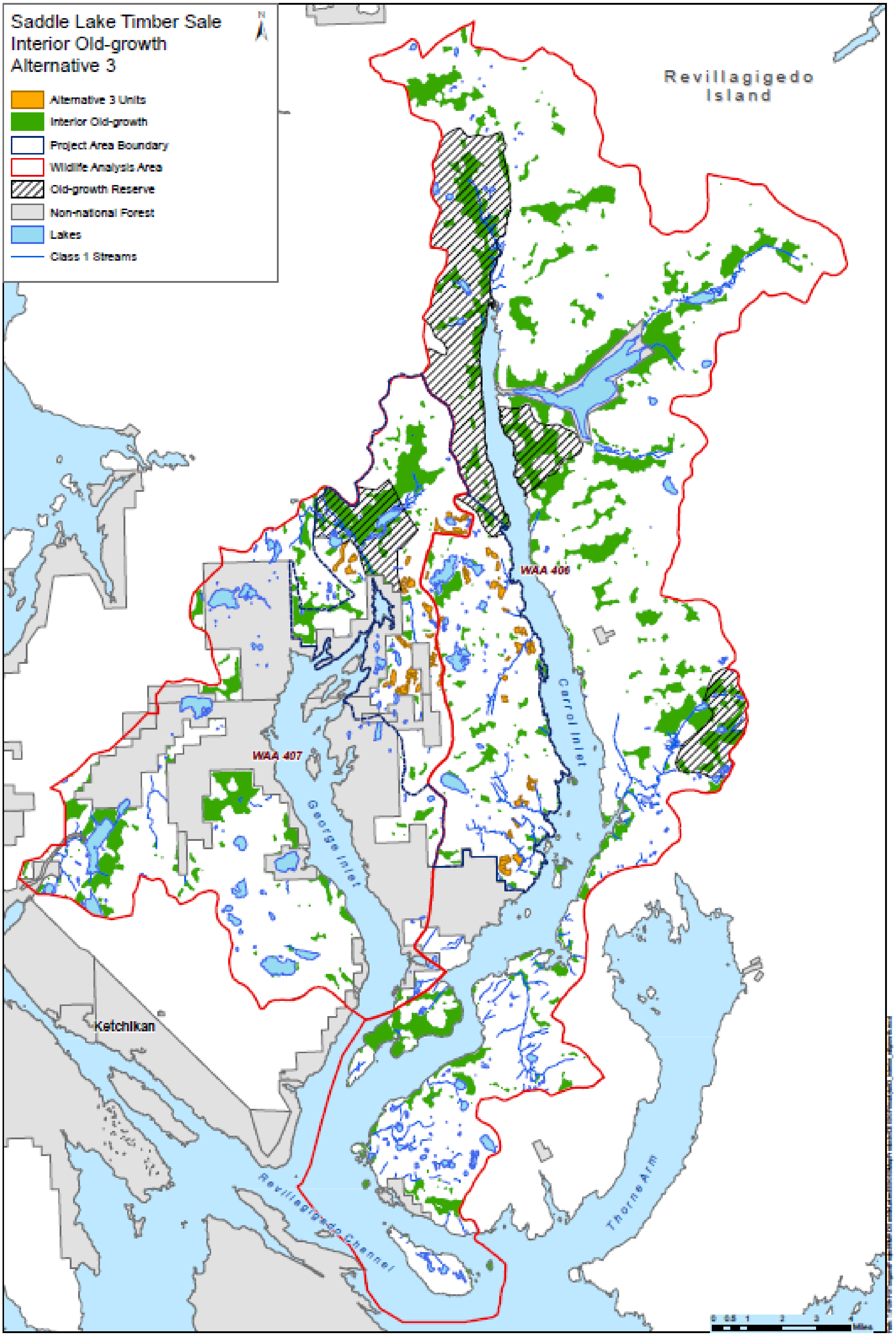


Figure 17. Alternative 3 Interior POG Habitat

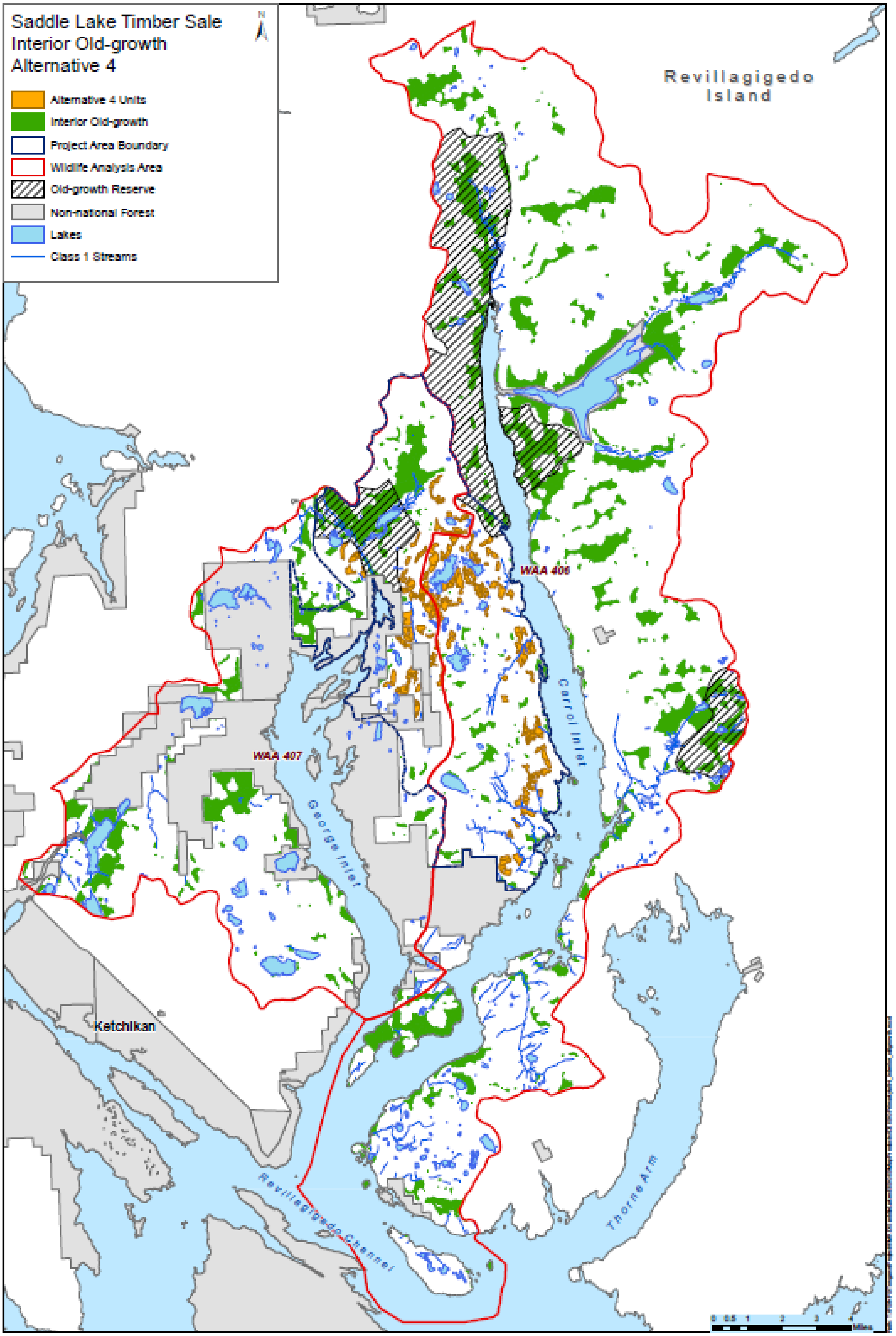


Figure 18. Alternative 4 Interior POG Habitat

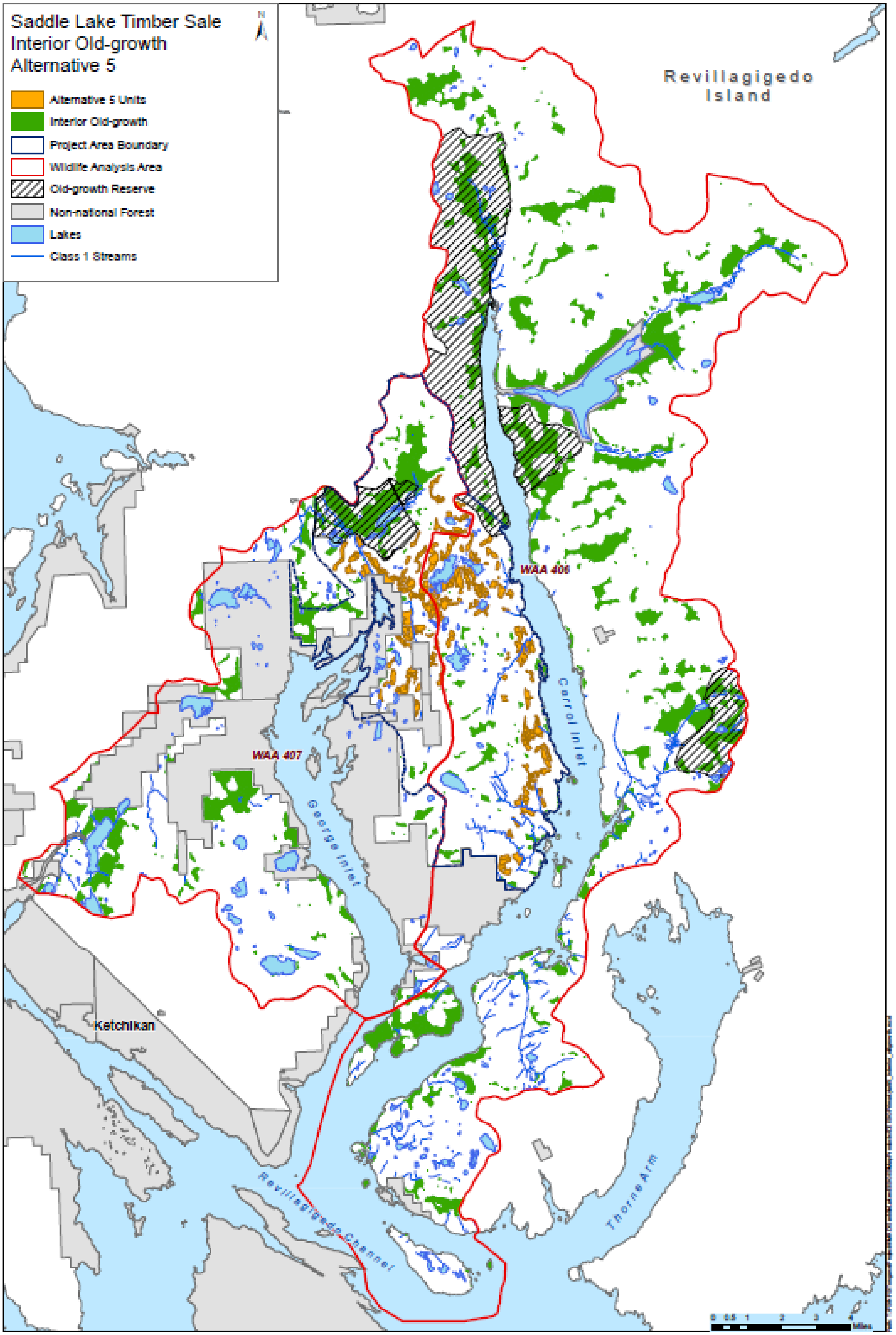


Figure 19. Alternative 5 Interior POG Habitat

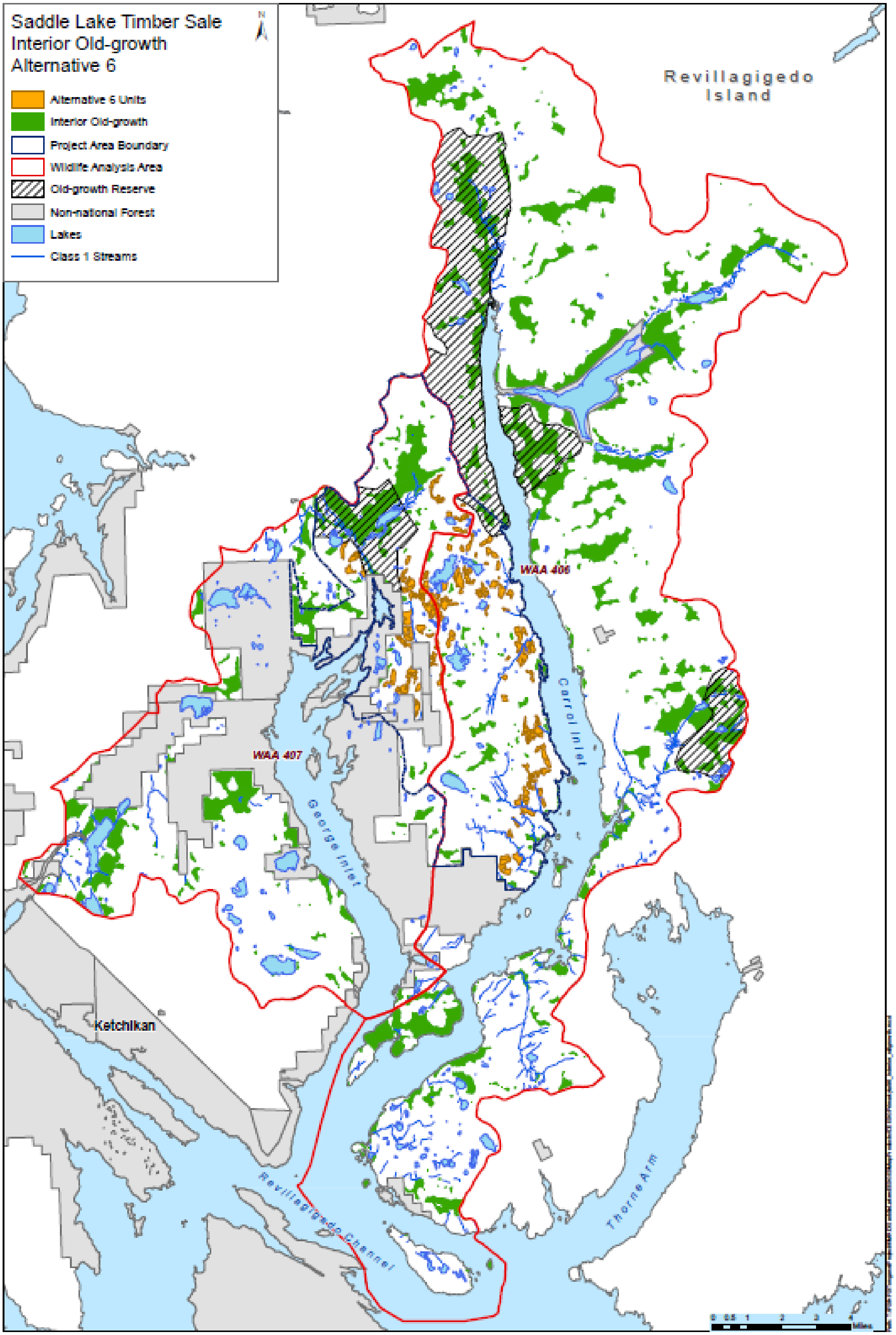


Figure 20. Alternative 6 Interior POG Habitat

Alternative 1

The Saddle Lakes project would not contribute to cumulative effects. Cumulative effects to brown creeper come from historic and more recent timber harvest and associated road construction on all ownerships with smaller impacts from hydroelectric projects. Since brown creepers appear to be impacted by all types of harvest or large tree removal (Wiggins 2005, Hejl et al. 2002a, Vanderwel et al. 2011, Mahon et al. 2008, Young and Hutto 2002), all activities would reduce brown creeper habitat. Additional fragmentation would occur with the completion of the Ketchikan to Saddle Lakes road. Impacts to brown creeper interior habitat have been substantial (up to 72%) representing long-term to permanent habitat loss under 100 year rotations. Since beach buffers are currently protected, some historic coastal habitat could be restored after 150+ years, but suitability would be influenced by adjacent upland condition. A limited amount of interior POG (28, 48, and 32 percent of historic) would remain within VCUs 7460, 7470, and 7530, respectively; 47 and 53 percent of historic habitat would remain at the broader WAA 406/407 scale. Alternative 1 would have the least impact on brown creepers and their habitat.

Alternative 2

Alternative 2 would contribute to cumulative effects and further reduce brown creeper habitat and populations. Approximately 24, 44, and 31 percent of historic interior habitat would remain in VCUs 7460, 7470, and 7530, respectively; 46 and 51 percent would remain at the larger WAA 406/407 scale. The Leask Lakes sale likely removed additional interior POG from VCU 7470, but specific data is lacking. The proposed 8,170 acre AMHT land exchange has the potential to further reduce interior habitat including one of the larger blocks near George Inlet. The small OGR in VCU 7470 and adjacent North Revilla Roadless Area contains the largest block of interior habitat that remains within the Saddle Lakes project area. This contributes to the slightly lower impact within VCU 7470 and WAA 407. Alternative 2 would have the third lowest impact on brown creepers.

Alternative 3

Cumulative impacts would be slightly less under Alternative 3 since 26, 45, and 32 percent of historic interior habitat would remain in project area VCUs; 46 and 51 percent of existing interior habitat would remain in WAAs 406 and 407. Therefore, additional drops in brown creeper populations and additional gaps in distribution would result both within project area VCUs and across the larger WAAs. Alternative 3 would have the second lowest impact on brown creepers.

Alternative 4

Alternative 4 would reduce brown creeper habitat to the second lowest level maintaining 24, 44, and 32 percent of historic habitat in VCUs 7460, 7470, and 7530, respectively. WAAs 406 and 407 would have 45 and 50 percent maintained. Most harvest treatments have or would be clearcutting or higher removal partial cutting (UA33). Therefore, there would be long-term substantial drops in brown creeper densities and associated widespread gaps in distribution.

Alternative 5

Alternative 5 results in the least amount of brown creeper habitat: 24, 42, and 31 percent of historic levels in VCUs 7460, 7470, and 7530, respectively and 45 and 50 percent in WAAs 406 and 407, respectively. Since most units have been or would be clearcut under this alternative, this represents the greatest impact on brown creeper populations given that multiple studies document creeper avoidance of clearcut stands. Habitat loss would be long term to permanent, leading to substantial impacts on brown creeper populations and widespread gaps in distribution.

Alternative 6

Alternative 6 would reduce habitat slightly more than Alternative 2 maintaining 24, 44, and 31, percent, respectively of historic VCU interior habitat and 46 to 51 percent at the broader WAAs 406/407 scale. Effects on brown creeper populations would be higher than Alternative 6 would have the third highest effect on brown.

Summary of Brown Creeper Effects

Impacts to brown creeper interior habitat from past management activities have been substantial (over 72% loss in VCU 7460) and would be reduced further with implementation of the Saddle Lakes timber sale and identified future management activities (up to76% loss). Clearcutting represents long-term to permanent habitat loss under 100 year rotations. Partial cutting would reduce habitat, but impacts could be of shorter duration (50 years or longer). Actual time of recovery within partial cut units would depend upon the structure maintained during harvest. Since beach buffers are currently protected, some historic coastal habitat could be restored after 150+ years, but suitability would be influenced by adjacent upland condition. Past, present, and future management actions have reduced the amount of and increased the distance between suitable nesting and foraging habitat. From the available research, these actions have likely lowered reproductive success, decreased juvenile dispersal success, and caused substantial reductions in brown creeper populations resulting in widespread gaps in distribution within project area VCUs and WAAs. Remaining habitat is predominantly within OGRs and other non-development LUDs, or 2001 Roadless Areas. Alternative rankings from greatest risk to lowest are 5, 4, 6, 2, 3 then 1. Alternative 1 does not contribute to direct or cumulative effects.

Hairy Woodpecker (Picoides villosus)

FP Direction (WILD1.V, p. 4-91): Same as for brown creeper.

Introduction and Habitat correlation to the affected environment

The hairy woodpecker was selected as an MIS as a representative primary cavity excavator (USDA 2008c, p. 3-240). Hairy woodpeckers are a widely distributed permanent resident throughout Southeast Alaska (Heinl and Piston 2009). Compared to passerine species, hairy woodpeckers occur in low densities in the Tongass. The species was recorded on 83 percent (10 of 12) of BBS routes in the Tongass, and occurred at an estimated density of 0.1 birds per acre (Cotter 2007b). Statewide populations are estimated at 340,000 with an slight upward trend (6.8%), but estimates are suspected to be inaccurate (ADF&G 2005). Long-term (1966-2011) BBS data (Sauer et al. 2012) shows a stable trend for Alaska (3.0), but again, data should be used with caution due to small detection rates and limited samples. Hairy woodpeckers were observed in Unit 47 and occasionally seen or heard elsewhere in the project area.

Hairy woodpeckers rely on dead and decaying trees, both standing and fallen, for nesting, foraging, and roosting; consequently, they are sensitive to timber-harvest activities that decrease the abundance of these large-tree resources (Cahall and Hayes 2009). They are primary cavity excavators for other cavity-dependent wildlife species, and play an important role in forest ecosystems because of their ability to excavate harder substrates than other primary excavators, such as red-breasted sapsuckers (Walters et al. 2002). The abundance of hairy woodpeckers seems to be positively correlated with increasing snag density, an increasing proportion of large snags, and the incidence of heartwood decay (Ripper et al. 2007, Saab et al. 2009). Anderson (2003) summarized data from earlier studies throughout hairy woodpecker range: hairy woodpeckers preferred taller trees and intact snags with larger diameters and less bark than random trees in areas with higher tree densities but tree size and species vary by region. Nests were located in areas with good foraging and multiple nest sites; therefore, the characteristics of the area immediately around the nest tree were also important.

High-volume, western hemlock or Sitka spruce old-growth forests receive more use in the Tongass than medium or low volume stands or cedar (Hughes 1985, USDA 2008c pp. 3-231 & 3-240). Hughes reported winter densities of 32 hairy woodpeckers per square mile in high volume POG, but only 5 hairy woodpeckers per square mile in low and mid volume stands. Habitat patches greater than 500 acres are thought to provide optimal habitat (USDA 2008c p. 3-240). In their study in Southeast Alaska, Kissling and Garton (2008) only detected hairy woodpeckers in buffers >250 meters [820 ft] and controls. While hairy woodpeckers exhibited notable patterns, too few detections prevented statistical analysis. Kissling and Garton speculated that absence of hairy woodpeckers from narrow buffers (<250 m) may indicate these species avoid edge habitats or that the forested area was small relative to their territory size. Conversely, Ripper et al. (2008) found that hairy woodpeckers did not select >30ha [75 ac] forest patches disproportionately or prefer forest interior in managed stands in northwestern Washington, but cautioned that use of smaller patches could be the result of higher habitat quality.

Based upon available information, I used high-POG (SD5N, SD5S, SD67) at the VCU scale to analyze direct effects on hairy woodpecker. Patch size is discussed under cumulative effects, as ownership boundaries do not affect patch size. Existing hairy woodpecker habitat is displayed in Table 38.

Table 38. Existing Hairy Woodpecker Habitat, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	14,358	8,982	-37%
VCU 7470	5,946	4,461	-25%
VCU 7530	10,909	6,268	-43%

Habitat is high-POG at all elevations.

Direct and Indirect Effects

Measurement criteria: acres of high-POG [SD5N, SD5S, SD67] all elevations; patch size ≥500 acres.

Effects Common to Action Alternatives

Hairy woodpeckers depend on cavities in large-diameter trees and hard snags characteristic of high-POG stands. Clearcutting has an immediate effect on hairy woodpecker habitat by altering the complex ecological structure afforded by old-growth forest stands (Cotter 2007). Replacing mature stands with young stands eliminates decaying trees and reduces insect infestations, which will reduce woodpecker populations (Anderson 2003). Therefore, clearcutting and forest fragmentation are detrimental to habitat capability and likely results in population declines (Jackson et al. 2002, Kissling and Garton 2008, Anderson 2003, Penhollow and Stauffer 2000, Cahall and Hayes 2009). I did not find information on the specific quantitative correlation between habitat loss and reduction in hairy woodpecker populations, but information in Zarnowitz and Manuwal (1985) suggest that it may not be a linear relationship. Under current 100 year rotations, clearcutting represents permanent habitat loss since stands would be re-harvested before producing large trees with sufficient decay to create cavities for nesting and support sufficient insect populations for foraging.

Partial cutting prescriptions may preserve some habitat characteristics as Vanderwel et al. (2007) found no clear trends on the effects of partial harvest on hairy woodpeckers in Ontario as long as key structural components were maintained. However, without individual stand prescriptions, it was not possible to know how much of the large tree component and structure preferred by hairy woodpeckers would remain. In addition, partial cutting would affect stand volume and likely decrease preferred high-POG to less preferred medium- or low-POG.

Legacy standards and guidelines currently do not apply to VCUs within the Saddle Lakes area (USDA 2008b p. 4-90). Controversy exists on the usefulness of scattered residual trees for hairy woodpeckers. Jackson et al. (2002) state that the importance of snags standing in clearcuts is questionable for hairy woodpeckers. They theorized that a snag standing in a clearcut is out of the context of a forest, the microclimate of the snag is changed, and woodpeckers flying to or from the snag are more exposed to potential predators. Conversely, Zarnowitz and Manuwal (1985) in Washington point out the importance of the retention of snags in managed forests. Zarnowitz and Manuwal observed hairy woodpecker nests in stands of several different ages; nests were denser in plots that had substantially more snags with larger diameters than plots with few snags, even if stands were clearcut or 25-50 years old. Nest density, however, was still the highest in old-growth habitat (Zarnowitz and Manuwal 1985). From my observations doing project area recon, past clearcuts within the Saddle Lakes area contain few to no reserve trees suitable for hairy woodpecker cavity construction.

Not only would timber harvest affect hairy woodpecker habitat and abundance, reductions in hairy woodpeckers would affect the prey base available to goshawks.

Changes in high-POG hairy woodpecker habitat are shown in Table 39. Direct effects would be the greatest within VCU 7470 under all action alternatives, increasing the importance of the large block of high-POG within the existing small OGR.

Table 39. Effect on Hairy Woodpecker High-POG Habitat, NFS Lands

		Acres (% reduction from *existing*)					
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	14,358	8,982	8,596	8,911	8,535	8,476	8,612
			(-4.3%)	(-0.8%)	(-5.0%)	(-5.6%)	(-4.1%)
VCU 7470	5,946	4,461	4,044	4,252	3,994	3,833	4,039
			(-9.3%)	(-4.7%)	(-10.5%)	(-14.1%)	(-9.5%)
VCU 7530	10,909	6,268	6,216	6,241	6,214	6,149	6,214
			(-0.8%)	(-0.4%)	(-0.9%)	(-1.9%)	(-0.9%)
VCUs Combined	31,213	19,711	18,856	19,405	18,744	18,458	18,865
			(-4.3%)	(-1.6%)	(-4.9%)	(-6.4%)	(-4.3%)

Habitat is high-POG at all elevations.
Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx

Alternative 1

Alternative 1 would have no effect on hairy woodpecker habitat or populations. All existing high-POG habitat would be maintained and current nest sites would remain unaffected by forest management. Fragmentation would be limited to natural interspersion of vegetation types and historic harvest; no additional habitat fragmentation would occur from the proposed project.

Hairy woodpecker populations would remain at current levels unless affected by natural causes such as windthrow or predation.

Alternative 2

Alternative 2 would have the second lowest impact on hairy woodpecker nesting and foraging habitat. Alternative 2 would clearcut 370 acres of preferred high-POG hairy woodpecker habitat and partial cut 485 acres with UA33 basal area removal. Based upon the above research, this would reduce hairy woodpecker habitat by reducing nest trees and insects associated with stand decay. The 1 to 10 percent habitat reductions (Table 39) could cause reductions in individuals or shifts in territories. Fewer high-POG stands and large diameter trees would be available as nesting and foraging habitat. Habitat quality would be reduced within partial cut stands short-term (up to 50 years or longer), but could provide quality habitat over the longer-term according to stand structure responses found by Deal et al. (2010). Effects would be greater than alternatives 1 and 3, but less than alternatives 4, 5, or 6. Alternative 2 maintains the current small OGR, which contains some of the largest blocks of high-POG habitat currently present in the area.

Alternative 3

Alternative 3 would have the least impact of the action alternatives on hairy woodpeckers since it would retain the greatest amount of nesting and foraging habitat and associated insect populations. Alternative 3 would clearcut 201 acres of preferred high-POG habitat and partial cut (UA33) 106 acres. Hairy woodpeckers within VCU 7470 would be affected the most, but 95 percent of the existing nesting habitat would be maintained. Approximately 99 percent of the existing habitat would be maintained within VCUs 7460 and 7530. Alternative 3 maintains the large block of habitat within the existing small OGR in VCU 7470.

Alternative 4

Alternative 4 would have the second highest impact on hairy woodpecker nesting and foraging habitat and individuals by clearcutting 772 acres and partial cutting (UA33) 195 acres of high-POG habitat. About 95, 89, and 99 percent of the existing habitat, respectively would remain in VCUs 7460, 7470, and 7530. Partial cut stands may continue to provide the more closed canopy habitat preferred by hairy woodpeckers. Quality would depend upon actual prescriptions and removal patterns.

Alternative 5

Alternative 5 would have the greatest impact on both hairy woodpecker habitat and populations since the impacts of logging increase as more large trees and snags are removed (Anderson 2003). Habitat would be permanently reduced by 1,133 acres of clearcutting but may be maintained in the 120 acres of partial cutting (UA33). High-POG habitat would be reduced by 1 to 10 percent or to 94, 86, and 98 percent of existing levels, respectively in VCUs 7460, 7470, and 7530. In addition to habitat loss under the other action alternatives, Alternative 5 would move the small OGR in VCU 7470 into the North Revilla Roadless Area. Clearcutting of units 300-312 would remove a large block of high-POG currently present within the OGR and would result in a permanent habitat loss.

Alternative 6

Alternative 6 ranks third of the action alternatives for impacts and would remove 599 acres of habitat by clearcutting and 246 acres of habitat by partial cutting (UA33). Alternative 6 would maintain 96, 89, and 99 percent of the existing habitat, respectively in VCUs 7460, 7470, and

7530. Similar to other alternatives, UA33 partial cut stands may maintain suitable closed canopy habitat.

Cumulative Effects

I used project VCUs and WAAs as the scale to evaluate cumulative effects on high-POG habitat and WAAs to evaluate cumulative effects on patch size since VCU and ownership boundaries are administrative, not physical, breaks. I used all POG categories for analyzing patch size since hairy woodpeckers do utilize other POG classes (Hughes 1985); I concluded from the data that low- and medium-POG, while less preferred, did not fragment habitat. All ownerships within project area VCUs and WAAs were used for cumulative effects analysis.

Cumulative effects to hairy woodpeckers come primarily from past and recent timber harvest and road construction activities. The 3,726 acres of Leask Lake clearcut harvest are not included in Table 40 as it is unknown what percentage of the harvest may have been high-POG. Therefore, the table likely underestimates the overall effect to hairy woodpecker habitat within WAA 407. The Ketchikan to Shelter Cove road clearing could affect approximately 16 acres POG (2 miles x 66 foot clearing width. The Swan Lake dam expansion may affect an additional 64 acres of high-POG habitat. Either impact is dependent upon final construction design. The 8,170 acre proposed AMHT land exchange (Shelter Cove parcel) would further affect hairy woodpecker habitat.

Table 40. Effect on Hairy Woodpecker High-POG Habitat, All Ownerships

		Acres (% reduction from *historic*)					
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	14,455	8,982	8,596	8,911	8,535	8,476	8,612
		(-37.9%)	(-40.5%)	(-38.4%)	(-41.0%)	(-41.2%)	(-40.4%)
VCU 7470	7,750	5,031	4,614	4,822	3,994	3,833	4,609
		(-35.1%)	(-40.5%)	(-37.8%)	(-48.5%)	(-50.5%)	(-40.5%)
VCU 7530	11,523	6,883	6,830	6,856	6,214	6,149	6,829
		(-40.3%)	(-40.7%)	(-40.5%)	(-46.1%)	(-46.6%)	(-40.7%)
WAA 406	41,994	29,557	29,119	29,459	29,057	28,932	29,133
		(-29.6%)	(-30.7%)	(-29.8%)	(-30.8%)	(-31.1%)	(-30.6%)
WAA 407	16,951	11,528	11,111	11,319	11,061	10,900	11,107
		(-32.0%)	(-34.5%)	(-33.2%)	(-34.7%)	(-35.7%)	(-34.5%)
WAAs 406/407	58,945	41,085	40,230	40,779	40,118	39,832	40,240
		(-30.3%)	(-31.7%)	(-30.8%)	(-31.9%)	(-32.4%)	(-31.7%)

Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx

In addition to directly removing nesting and foraging habitat, the action alternatives would affect the amount of POG habitat in block 500 acres or larger (Table 41). The number of patches would increase slightly, but amount of habitat within these patches would decrease to 72 to 75 percent of historic levels; average patch size would decrease to less than 65 percent of historic level. Remaining large patches of POG are predominantly located within OGRs, other non-development LUDs, and 2001 Roadless Areas (see

Figure 21 through Figure 27).

Table 41. Change in Hairy Woodpecker Habitat Patch Size, All Ownerships WAA 406/407

	historic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5	Alt 6
# of patches ≥500 acres	13	19	19	19	19	19	19
Total acres in patches ≥500 acres	87,956	63,812	62,006	63,028	61,812	61,432	62,074
% Reduction in acres		(-27.5%)	(-29.5%)	(-28.3%)	(-29.7%)	(-30.2%)	(-29.4%)
Average size of patches ≥500 acres	6,766	3.359	3,263	3,317	3,253	3,233	3,267
% Reduction average patch size		(-50.4%)	(-51.8%)	(-51.0%)	(-51.9%)	(-52.2%)	(-51.7%)

Alternative 1

Alternative 1 would not contribute to cumulative effects. However, effects from past management will continue into the foreseeable future. Proposed future projects will cause further decline. Approximately 60 to 65 percent of the historic habitat currently remains within project area VCUs (Table 40). Impacts are slightly less at the broader WAA scale with 68 to 70 percent of the historic habitat remaining. This level of habitat loss has likely affected hairy woodpecker populations, but the actual extent is unknown.

The total amount of habitat within patches 500 acres or larger have been reduced to 74 percent of historic levels (Table 41). The average size of the patches has decreased by over 50 percent. It is uncertain how patch size changes have affected hairy woodpeckers as research results on patch size are varied.

Alternative 2

Alternative 2 would have similar effects on all three project area VCUs. Hairy woodpecker habitat would decline to 59 percent of historic habitat levels. Effects on habitat and populations is slightly less at the larger WAA scale as roughly 65 to 69 percent of the preferred habitat would be maintained (not including undisclosed levels of Leask Lakes harvest). Likewise roughly 70 percent of the large (≥500 ac) patch habitat would be maintained. Average patch size has decreased by 52 percent. Loss of habitat has had an impact on hairy woodpecker populations by reducing nesting success and/or affecting distribution on a localized scale. In addition to habitat reduction, timber harvest and associated activities has the potential to destroy active nests, disturb nesting adults and young, and/or cause nest abandonment.

Alternative 3

Alternative 3 has the least direct and cumulative impact on hairy woodpeckers of the action alternatives, but reduces habitat in the project area VCUs down to 60 to 62 percent of historic habitat. Area WAAs would be reduced to 70 and 67 percent, respectively so would affect abundance and distribution of hairy woodpeckers on the landscape. Patches 500 acres or larger have been reduced to 71 percent of historic levels. The average size of the patches has decreased by over 51 percent. It is uncertain how patch size changes have affected hairy woodpeckers as research results on patch size are varied.

Alternative 4

Alternative 4 would have the second highest impact on hairy woodpeckers. It would retain 59, 51, and 54 percent of historic VCU habitat, respectively and 65 and 69 percent of the historic habitat within area WAAs, respectively. Large patch habitat would be reduced to 70 percent of historic levels. Average patch size has decreased by 52 percent. The cumulative reduction in nesting and foraging habitat would result in local declines in cavity nester populations due to reduced habitat availability, and consequently in gaps in distribution of hairy woodpeckers throughout Saddle Lakes VCUs and WAAs.

Alternative 5

Alternative 5 would have the greatest cumulative impact on Saddle Lakes area VCUs and WAAs. Resulting habitat would be at 49 to 59 percent of historic levels within VCUs and 64 to 69 percent within WAAs 406 and 407. Large patch habitat would be reduced by over 30 percent or to 70 percent of historic levels. Average patch size has decreased by over 52 percent. Hairy woodpecker viability would remain across the Tongass NF, but there would be localized gaps in distribution within the Saddle Lakes area VCUs and WAAs. Moving the small OGR in VCU 7470 would further fragment hairy woodpecker habitat.

Alternative 6

Effects under Alternative 6 are very similar to those discussed under Alternative 2. The main difference is the additional amount of clearcutting under Alternative 6. Gaps in distribution and lower nesting success would occur due to lower snag and large tree densities. Patches 500 acres or larger have been reduced to 70 percent of historic levels. The average size of the patches has decreased by 52 percent.

Summary of Hairy Woodpecker Effects

Direct effects to preferred hairy woodpecker varies from less than 1 percent up to 14 percent depending upon alternative and VCU. However, cumulative effects are more substantial. Thirty-eight (38) to 51percent of the historic VCU habitat would be lost long-term from harvesting large diameter, high-POG habitat. Large patches (≥500 ac) would decrease 26 to 28 percent from historic levels. Alternative rankings from least effect to greatest: 1, 3, 2, 6, 4, and 5.

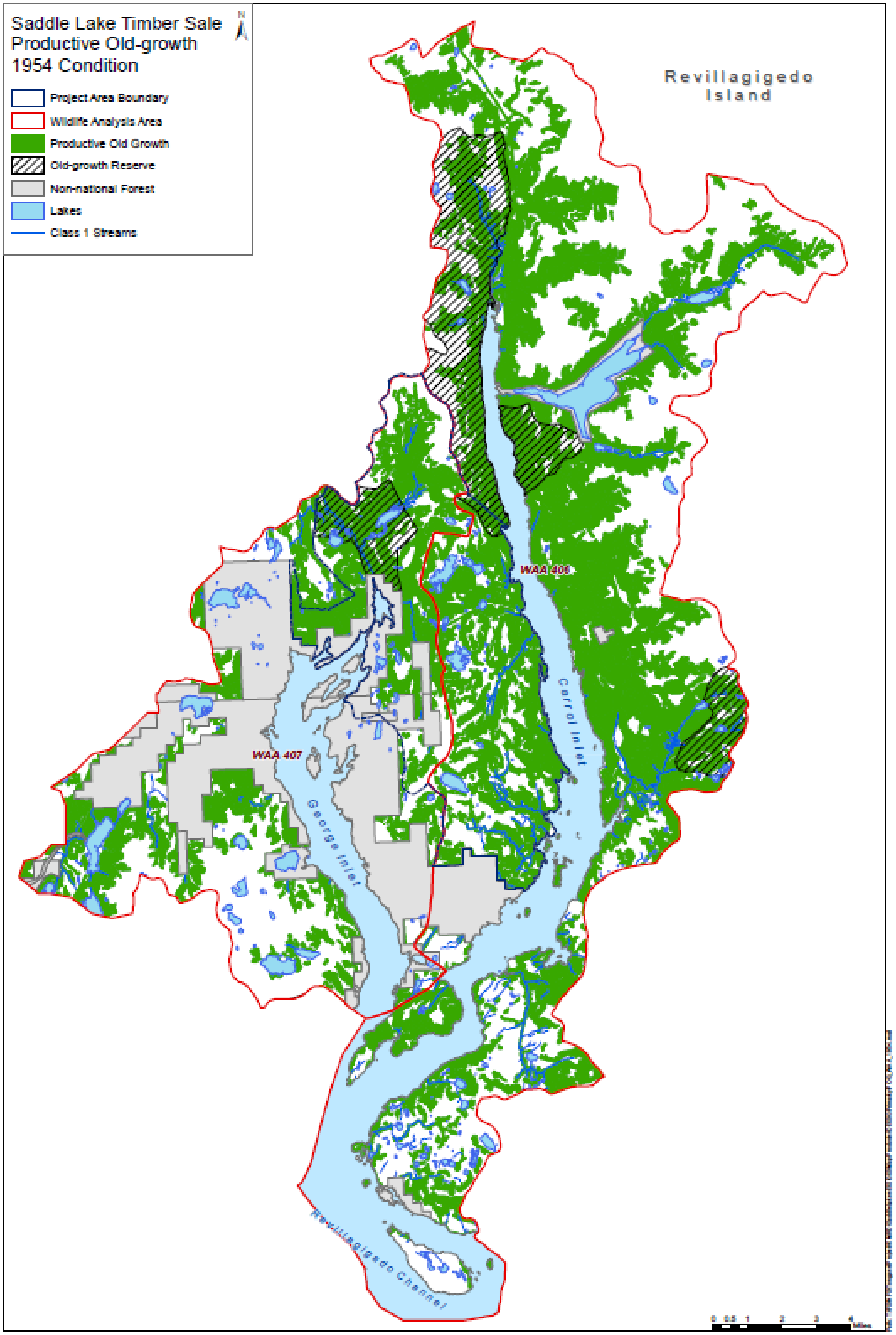


Figure 21. Historic POG

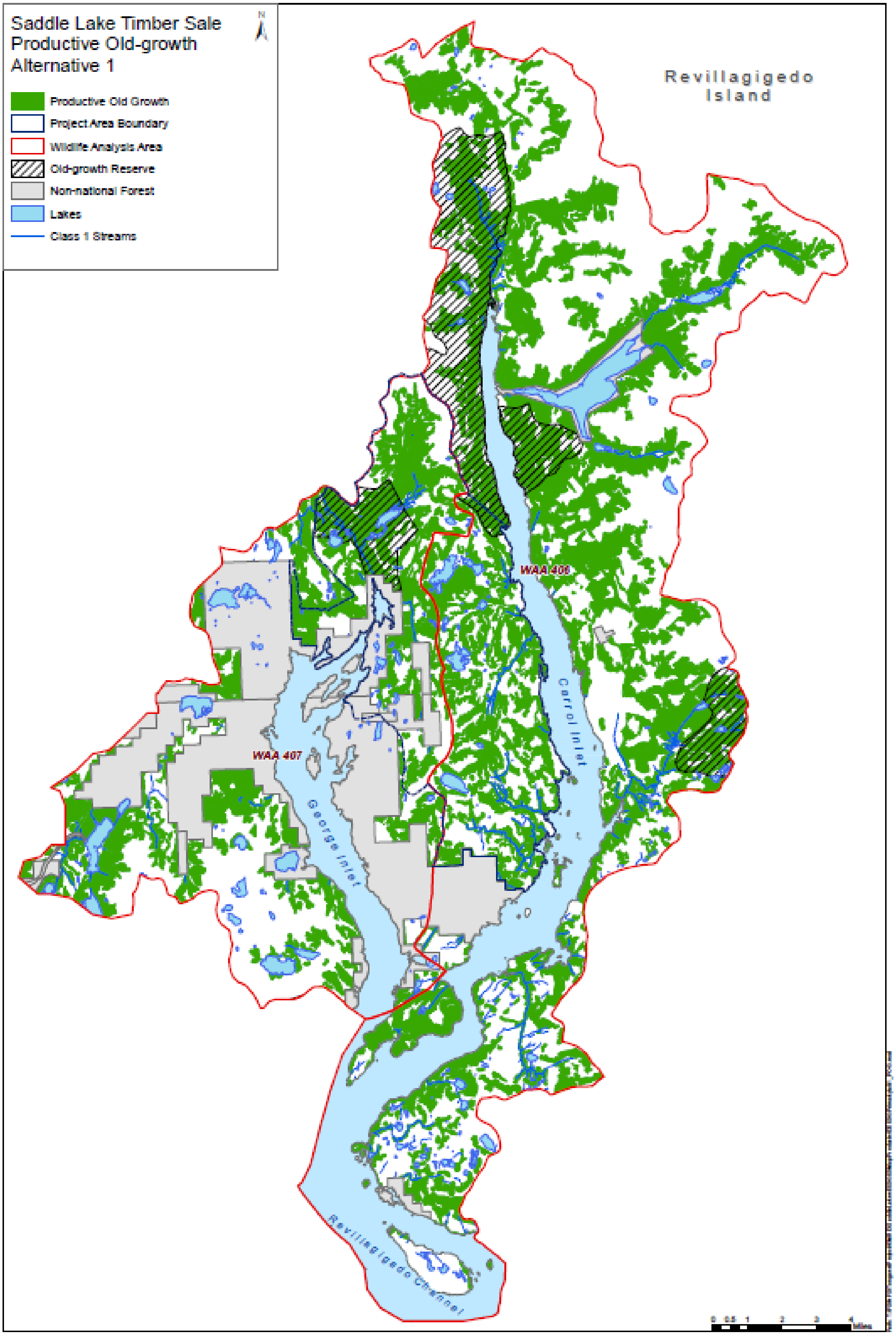


Figure 22. Existing POG

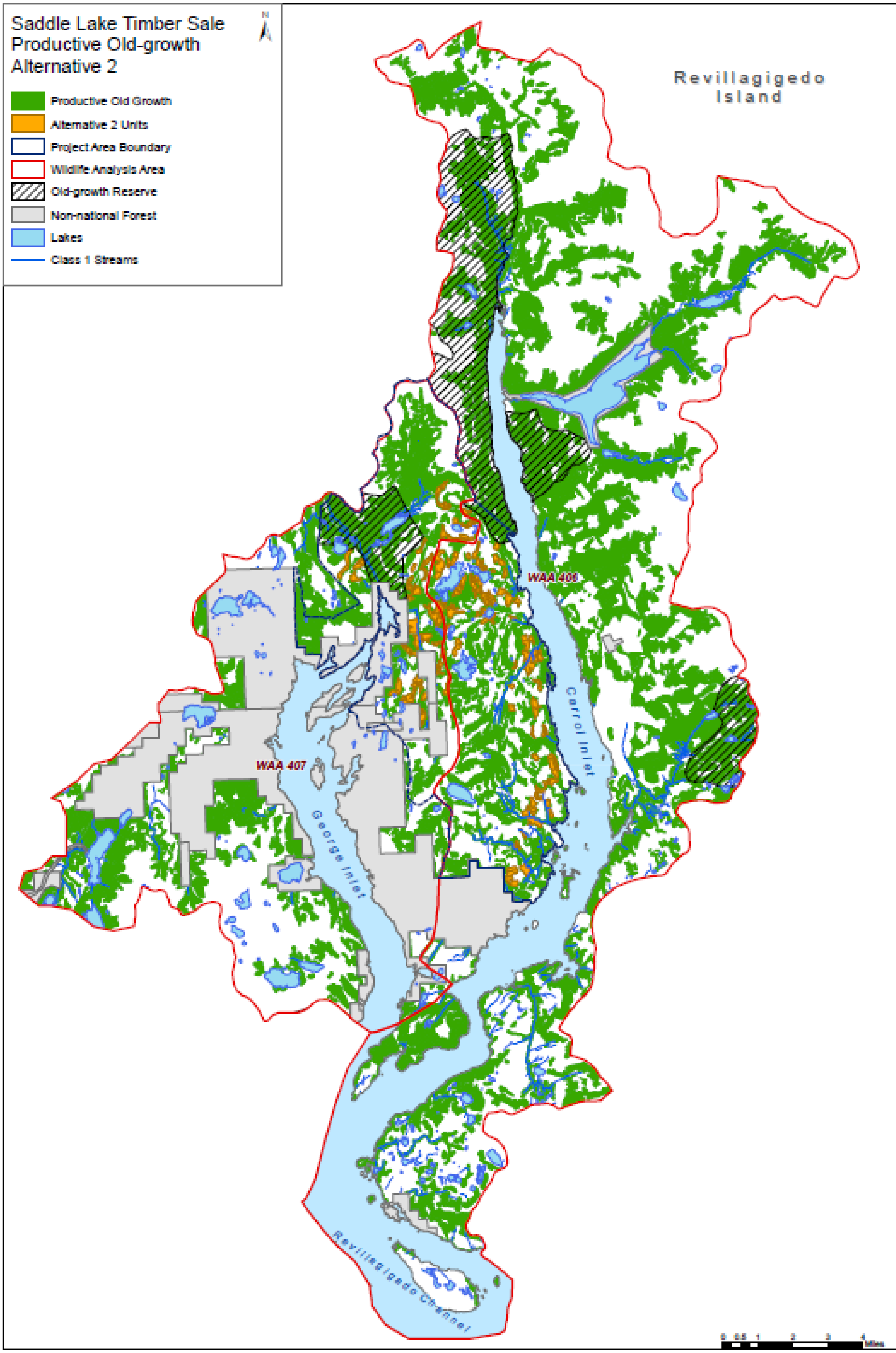


Figure 23. Alternative 2 Remaining POG

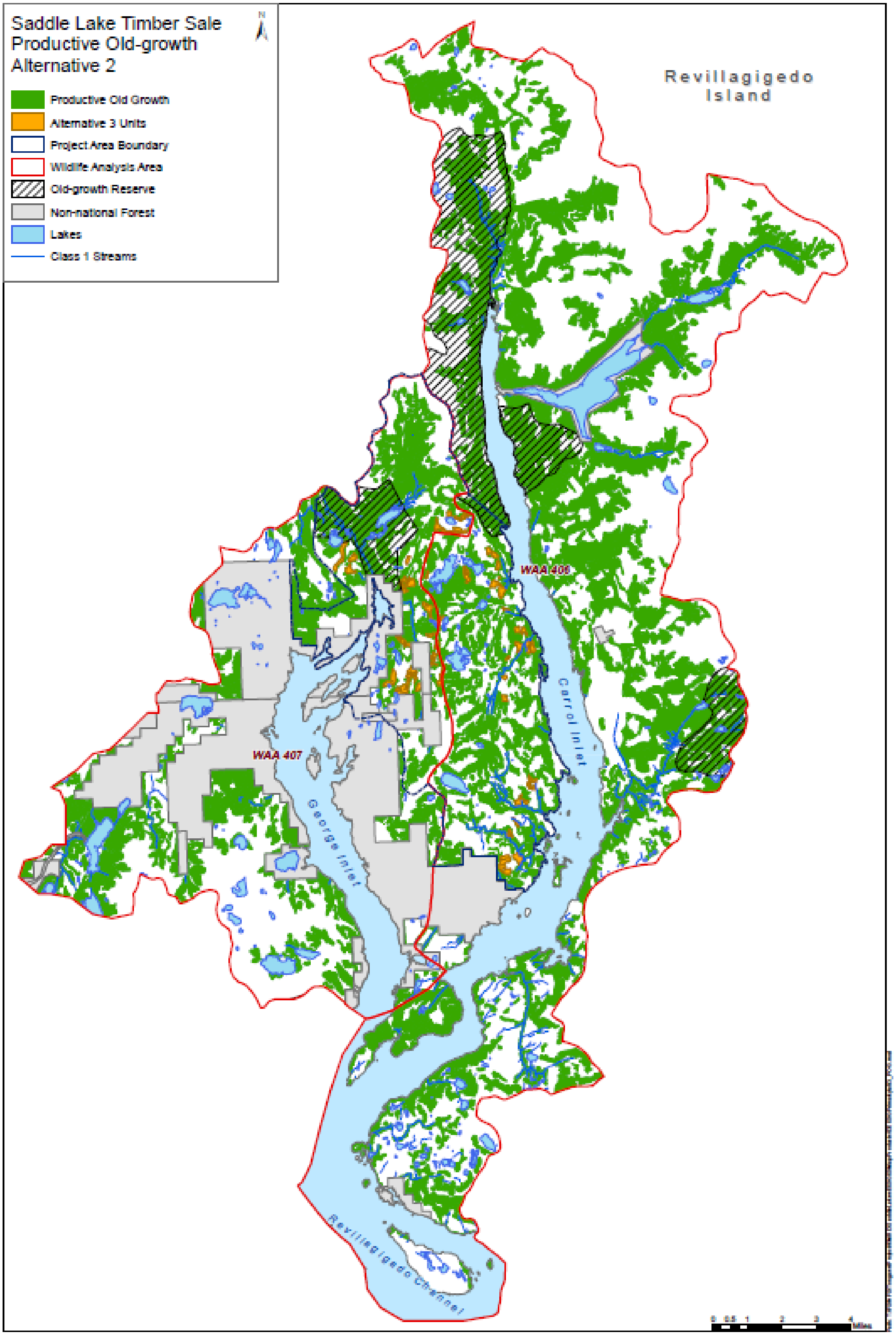


Figure 24. Alternative 3 Remaining POG

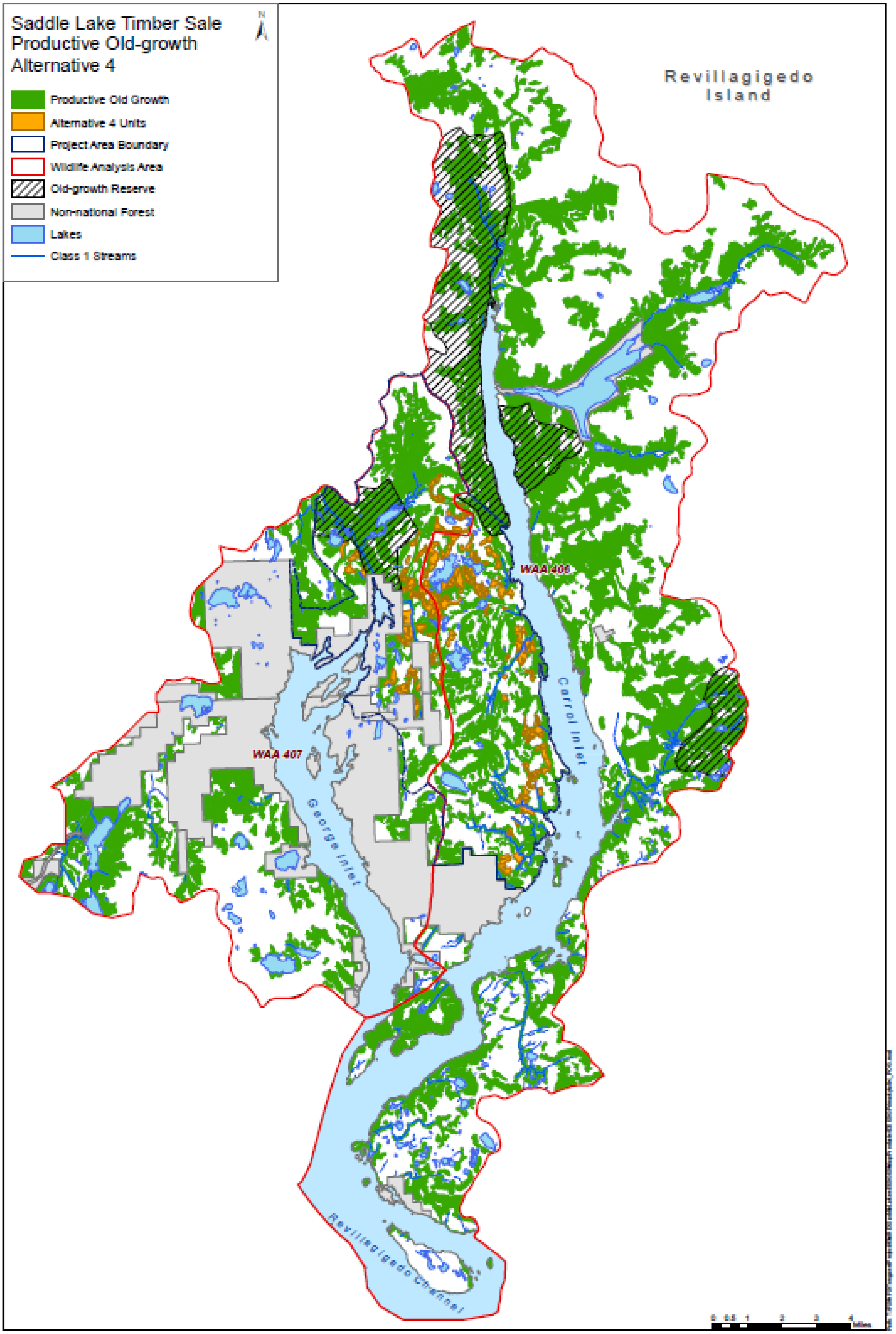


Figure 25. Alternative 4 Remaining POG

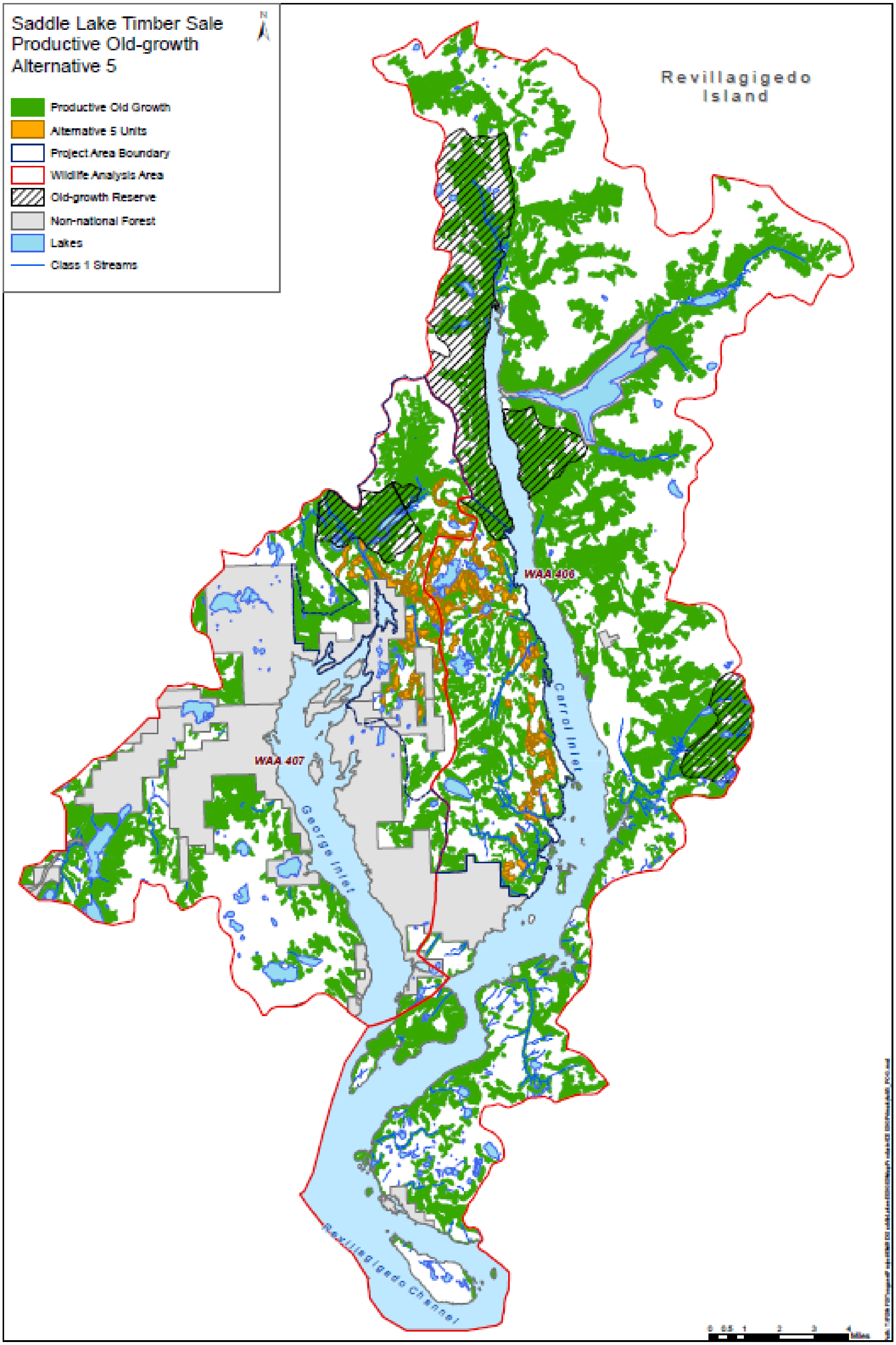


Figure 26. Alternative 5 Remaining POG

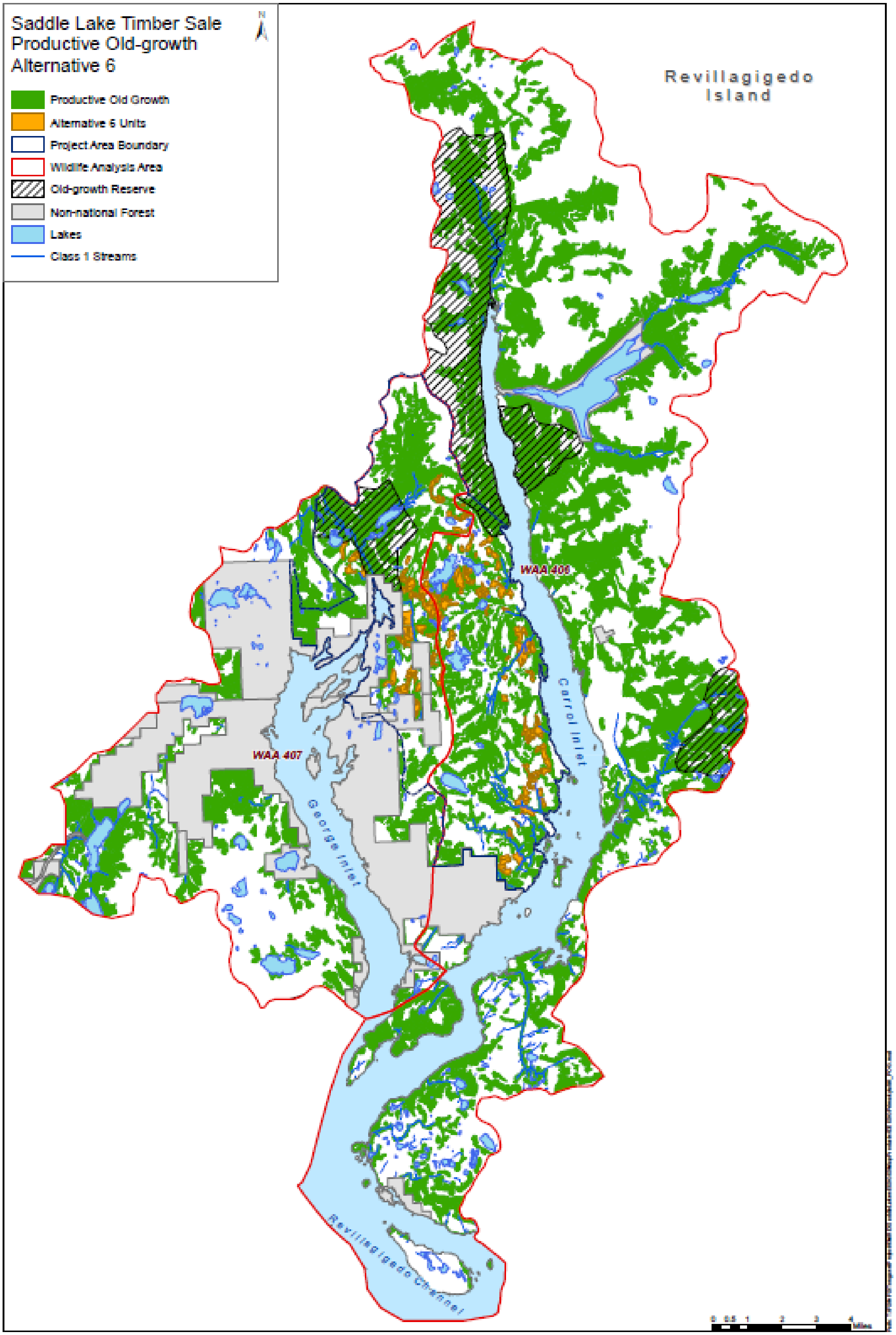


Figure 27. Alternative 6 Remaining POG

Red-breasted Sapsucker (Sphyrapicus ruber)

FP Direction (WILD1.V, p. 4-91): Same as for brown creeper.

Introduction and Habitat correlation to the affected environment

The red-breasted sapsucker was selected as an MIS as a representative primary cavity excavator in more open habitat. The red-breasted sapsucker is a common, primary cavity excavator that depends on soft, decaying wood in snags and partially dead trees for nesting and foraging. The species is widely distributed throughout Southeast Alaska forests during the spring, summer, and fall seasons and is a documented breeder on Revillagigedo Island (Heinl and Piston 2009).

Approximately 32 percent of the global population of red-breasted sapsuckers breeds in Southeast Alaska (Kissling et al. 2006). Relatively little quantitative data are available on the abundance of red-breasted sapsuckers on Revillagigedo Island. Because this species can be silent and difficult to detect, data from broad-scale surveys (BBSs and CBCs) may not accurately reflect the occurrence and abundance of red-breasted sapsuckers or be useful in determining population trends. Nevertheless, broad-scale survey data can at least provide indices of relative abundance. Data from BBSs indicate that Southeast Alaska has some of the highest breeding densities with average abundances of 3 to 10 individuals per route, and more than 35 individuals recorded on some routes (Sauer et al. 2008). Statewide populations are estimated at 800,000 with a stable trend (1.9%), but estimates are suspected to be inaccurate (from Rosenberg 2004 & Sauer 2004 as listed in ADF&G 2005). Long-term BBS data (Sauer et al. 2012) shows a slightly positive trend for Alaska (7.0), but data should be used with caution due to small detection rates and limited samples. Red-breasted sapsuckers were frequently observed or heard during Saddle Lakes field surveys. Nests were found near Units 51, 201, and 240.

Red-breasted sapsuckers prefer late-successional forests (greater than 200 years old) with higher densities of larger snags (Joy 2000, Kissling and Garton 2008, DellaSala et al. 1996). Joy (2000) found that snags containing red-breasted sapsucker nests on northern Vancouver Island, BC, were statistically taller (32.5 m [107 ft]) and larger diameter (mean 93.3 cm [37 in]) DBH snags than snags without nests. He concluded that choice of large diameter snags may reflect an attempt to maximize nest space for large clutch size, thermal insulation, and/or protection from predators and that snag retention is important for creating suitable habitat in regenerating forests. Zarnowitz and Manuwal (1985) listed red-breasted sapsuckers as nesting in 133 cm [52 in] trees on the Olympic Peninsula. Wagner (2011) found that tree size and presence of fungal infection (visible conks) were good indicators of nest tree selection by red-breasted sapsuckers in Southeast Alaska. Nest sites contained a lower volume of trees, larger diameter trees, increased incidence of fungal infection, and older decay classes of coarse woody debris than non-selected sites.

In Southeast Alaska, red-breasted sapsuckers are associated with low to moderate volume old-growth forest habitat (low-POG and medium-POG classes SD4H, SD4N, SD4S, SD5H) that should be in patches greater than 250 acres (USDA 1997b, p. 3-357) or in buffers wider than 300 meters [984 ft] (USDA 2008c, p. 3-239) or at least 400 meters [1,312 ft] (Kissling 2003). Hughes (1985) found a preference for low volume POG followed by medium-POG with the lowest density in high-POG. In addition, red-breasted sapsuckers were commonly found in forested areas with 30-60 percent crown closure and along clearcut edges during Alaska breeding bird surveys (Cotter and Andres 2000). Existing habitat is displayed in Table 42.

Table 42. Existing Red-breasted Sapsucker Habitat, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	5,512	5,512	-0%
VCU 7470	3,442	3,442	-0%
VCU 7530	6,165	6,165	-0%

Habitat is medium-POG (SD4N,SD4S, SD5H) and low-POG (SD4H).

Direct and Indirect Effects

Measurement criteria: acres of medium- and low-POG [SD5H, SD4S, SD4N, SD4H] at all elevations and patch size.

Effects Common to Action Alternatives

Effects to red-breasted sapsuckers are similar to those described under hairy woodpecker. The main difference is in the type of POG affected (medium- and low-POG vs. high-POG). Matsuoka et al. (2012) and DellaSala et al. (1996) found that red-breasted sapsuckers on nearby Prince of Wales Island occurred in greater densities in POG than in any young growth type. Joy (2000) concluded that the population sizes of the cavity nesting species, (e.g., red-breasted sapsucker) are reduced in coastal British Columbia as mature forests are logged. The choice of large diameter snags may reflect an attempt to maximize nest space for large clutch size, thermal insulation, and/or protection from predators; therefore, snag retention is important for creating suitable habitat in regenerating forests.

Legacy standards and guidelines do not apply, therefore all harvest is expected to impact current habitat and reduce red-breasted sapsucker populations. The extent of the reduction is unknown due to poorly understood timber harvest/population relationships (Joy 2000). Kissling and Garton (2008) mention a fragmentation threshold, but did not state what percentage of young growth was required to cause populations to decline.

Effects of partial harvest on red-breasted sapsuckers are varied. Beese and Bryant (1999) found higher densities in un-harvested stands than in shelterwood or green tree retention stands in British Columbia. Conversely, Mahon et al. (2008) found higher densities of red-breasted sapsuckers in northwestern British Columbia in partially harvested stands with up to 60 percent of the stand volume removed. This occurred in stands where single tree or group tree selection simulated high-frequency, small scale disturbance and retained a functioning forest matrix (i.e., retention of all tree species across all size classes resulting in stands with high species and structural diversity where multiple disturbance agents such as disease, insects, and wind events created nesting and forage sites). Partial cutting within high-POG stands could make them more suitable for red-breasted sapsuckers and potential be neutral within medium-POG stands as long as large diameter trees are maintained.

OSHA safety regulations will likely require many existing snags to be felled during logging operations further reducing suitable habitat. Changes in red-breasted sapsucker preferred medium- and low-POG habitat are shown in Table 43.

Table 43. Effect on Red-breasted Sapsucker Habitat, NFS Lands

VCU	Historic	Acres (% reduction from *existing*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	5,512	5,512	5,045	5,366	4,988	4,845	5,101
			(-8.5%)	(-2.6%)	(-9.5%)	(-12.1%)	(-7.5%)
VCU 7470	3,442	3,442	3,083	3,182	3,056	2,976	3,097
			(-10.4%)	(-7.6%)	(-11.2%)	(-13.5%)	(-10.0%)
VCU 7530	6,165	6,165	5,961	6,052	5,962	5,915	5,952
			(-3.3%)	(-1.8%)	(-3.3%)	(-4.1%)	(-3.5%)
VCUs Combined	15,118	15,118	14,088	14,600	14,006	13,736	14,150
			(-6.8%)	(-3.4%)	(-7.4%)	(-9.1%)	(-6.4%)

Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx

Alternative 1

There are no direct or indirect effects on red-breasted sapsuckers from Alternative1. All existing medium- and low-POG habitat within the project area would remain. Populations of red-breasted sapsuckers are expected to remain at current levels unless altered by natural events.

Alternative 2

Alternative 2 would reduce red-breasted sapsucker habitat within project area VCUs by 1,030 acres or by 7 percent across all project area VCUs combined (Table 43). Approximately 546 acres would be clearcut and 484 acres partial cut (UA33). Impacts would be greatest in VCU 7470. Nesting and foraging habitat would be reduced within clearcuts. Alternative 2 ranks third of the action alternatives behind Alternatives 3 and 6 for maintaining habitat based upon total acres harvested, but second of the action alternatives overall because of the higher amount of partial cutting in Alternative 2 versus Alternative 6.

Alternative 3

Alternative 3 would reduce red-breasted sapsucker habitat within project area VCUs by 518 acres. Impacts would be similar to those under Alternative 2, but less extensive. Approximately 462 acres would be clearcut and 56 acres partial cut (UA33).Partial cuts (UA33) could provide habitat preferred by red-breasted sapsuckers as long as sufficient large diameter trees with suitable decay are maintained. Around 97, 92, and 98 percent of the existing habitat would be maintained within VCUs 7460, 7470, and 7530 respectively. Alternative 3 ranks first among the action alternatives for maintaining red-breasted sapsucker cavity nesting habitat.

Alternative 4

Alternative 4 would reduce red-breasted sapsucker habitat within project area VCUs by 1,112 acres or to 94, 89, and 97 percent of existing habitat levels in project area VCUs. Impacts would be similar to those under Alternative 2, but more intensive. Approximately 1,026 acres would be clearcut and 86 acres partial cut (UA33). Partial cuts (UA33) could provide habitat preferred by red-breasted sapsuckers as long as sufficient large diameter trees with suitable decay are maintained. Research on use of these stands conflict. Alternative 4 ranks fourth of the action alternatives for maintaining habitat since it harvests the second highest amount of existing habitat.

Alternative 5

This alternative would have the greatest impact on red-breasted sapsucker habitat and number of individuals. Habitat would be reduced by 1,382 acres. Approximately 1,281 acres would be clearcut and 102 acres partial cut (UA33). Eighty-six (86) to 96 percent of the existing habitat would be maintained within individual VCUs or 91 percent overall. Loss of suitable large diameter nesting trees and snags and foraging sites would be more widespread across the project area and could lead to vacant territories. Alternative 5 ranks last of the action alternatives for maintaining red-breasted sapsucker habitat.

Alternative 6

Alternative 6 would red-breasted sapsucker habitat within project area VCUs by 969 acres. Impacts would be similar to those under Alternative 2, but 90 to 96 percent of the existing habitat would be maintained within individual VCUs or 94 percent overall. Approximately 824 acres would be clearcut and 145 acres partial cut (UA33). Again, partial cutting effects conflict in research, but could maintain suitable habitat for red-breasted sapsuckers. Alternative 6 ranks second of the action alternatives for maintaining more open old-growth habitat preferred by red-breasted sapsuckers.

Cumulative Effects

All ownerships within project area VCUs and WAAs were used for cumulative effects analysis. In managed landscapes, forest buffers and residual forest patch sizes are important for red-breasted sapsuckers. Kissling and Garton (2008) found that in Southeast Alaska, red-breasted sapsucker densities were positively correlated with forest buffer width and appeared to be maximized when buffers were at least 400 m (1,312 feet) wide. Since red-breasted sapsuckers will also use high-POG, I deemed it would not fragment patch size so analyzed patches of POG>250 acres during cumulative effects analysis. I used all ownerships at the WAA scale for patch size analysis since VCU and ownership boundaries are arbitrary breaks that do not influence habitat use.

Effects would be very similar to those listed for area VCUs under direct effects, but broader in context. Cumulative effects come mainly from recent and proposed timber harvest and road construction activities as most historic harvest targeted higher volume stands. Existing clearcut stands in VCU 7470 would continue to move toward or remain in stem exclusion. I estimate approximate 16 acres of POG habitat would be affected by the Ketchikan to Shelter Cove road clearing, but exact impact would depend upon actual road clearing. The Swan Lake dam expansion may affect an additional 41 acres of med- and low-POG habitat. Either impact is dependent upon final construction design. The proposed AMHT land exchange would further reduce red-breasted sapsucker habitat if conveyed.

Cumulative change in red-breasted sapsucker habitat for all ownerships is shown in Table 44.

Table 44. Effect on Red-breasted Sapsucker Habitat, All Ownerships

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	5,512	5,512	5,045	5,366	4,988	4,845	5,101
		(0%)	(-8.5%)	(-2.6%)	(-9.5%)	(-12.1%)	(-7.5%)
VCU 7470	4,527	4,403	4,043	4,143	4,016	3,936	4,058
		(-2.7%)	(-10.7%)	(-8.5%)	(-11.3%)	(-13.1%)	(-10.4%)

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7530	6,878	6,878	6,674	6,765	6,676	6,628	6,665
		(0%)	(-3.0%)	(-1.6%)	(-2.9%)	(-3.6%)	(-3.1%)
WAA 406	21,542	21,542	20,871	21,284	20,817	20,626	20,918
		(0%)	(-3.1%)	(-1.4%)	(-3.4%)	(-4.3%)	(-2.9%)
WAA 407	14,306	14,175	13,816	13,916	13,789	13,709	13,830
		(-0.9%)	(-3.4%)	(-2.7%)	(-3.6%)	(-4.2%)	(-3.3%)
WAAs 406/407	35,848	35,717	34,687	35,199	34,605	34,335	34,748
		(-0.4%)	(-3.2%)	(-1.8%)	(-3.5%)	(-4.2%)	(-3.1%)

Medium- and Low-POG all elevations.
Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx

Kissling & Garton (2008) chose to use buffer width as opposed to patch area, because buffer width directly related to forest management policy and patch boundaries were difficult to define when forested landscape features were interconnected. Although threshold details were not published, they found a relationship between sapsucker density in the buffer and the amount of young growth on the landscape: “while red-breasted sapsuckers clearly benefited from the characteristics of forested buffers and were positively related to buffer width at both stand and landscape scales, they appeared to reach a fragmentation threshold where density began to stabilize or decline and wide forested buffers became increasingly important on the landscape”. However, to be consistent with other analysis, I used the 250 acre patch size. Remaining large patches of POG are predominantly located within OGRs, other non-development LUDs, and 2001 Roadless Areas. Changes in patch size are shown in Table 45 and

Figure 21 thru Figure 27.

Table 45. Change in Red-breasted Sapsucker Habitat Patch Size, All Ownerships

	Historic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5	Alt 6
# of patches >250 acres	17	32	32	32	32	32	32
Total acres in patches ≥250 acres	89,131	68,107	66,724	67,323	66,107	65,726	66,369
% Reduction in acres		(-23.6%)	(-25.1%)	(-24.5%)	(-25.8%)	(-26.3%)	(-25.5%)
Average size patches ≥250 acres	5,243	2,128	2,022	2,104	2,066	2,054	2,074
% Reduction average patch size		(-59.4%)	(-61.4%)	(-59.9%)	(-60.6%)	(-60.8%)	(-60.4%)

Patch size calculated on the combined WAAs 406/407.
Source: GIS, pogpatch082313.xlsx

Alternative 1

Alternative 1 would not contribute to cumulative effects, but past clearcut harvest would continue to reduce available habitat long term. Cumulative effects occur from a combination of past harvest and road construction on all ownerships, proposed road construction, hydropower expansion, and the proposed land exchange. This has reduced available habitat to 97 percent of historic levels within VCU 7470 and 99 percent within WAA 407. Habitat was maintained within other VCUs and WAA 406 according to available information. Impacts are greater at the patch scale. The 17 historic patches of POG ≥250 acres have been split into 32 smaller blocks. Approximately 76 percent of the original POG in blocks ≥250 acres is currently present and would be maintained under Alternative 1. Average patch size has decreased by over 59 percent.

Alternative 2

Alternative 2 would retain 91, 89, and 97 percent, respectively of the original red-breasted sapsucker habitat within VCUs 7460, 7470, and 7530. Approximately 97 percent of the medium- and low-POG habitat would be maintained at the broader WAA scale. The loss of habitat would reduce the number of large diameter trees capable of supporting cavities large enough to handle large clutch size, provide thermal insulation, and/or protection from predators. All 32 current patches ≥250 acres would be maintained, but habitat within the patches would be reduced to 75 percent of what was historically available. Average patch size would decrease by 61 percent. The loss of POG habitat combined with habitat reduction within large patches has reduced red-breasted sapsucker populations within Saddle Lakes area VCUs and WAAs since densities in Southeast Alaska are substantially higher in old growth versus young growth (DellaSala et al. 1996). The reduction in sapsuckers has likely caused localized gaps in distribution potentially affecting predators such as goshawks.

Alternative 3

Red-breasted sapsucker habitat would be reduced 9 percent or to 91 percent of what was available historically in VCU 7470, but 97 to 98 percent of historic habitat would remain in VCUs 7460 and 7530, respectively and within WAAs 407 and 406, respectively. Habitat within patches ≥250 acres would be reduced from existing conditions, but Alternative 3 would also maintain 75 percent of the historic habitat. Average patch size would decrease by 60 percent. Alternative 3 would have lower, but measurable impacts on populations and distribution of red-breasted sapsuckers.

Alternative 4

Habitat within VCUs 7460, 7470, and 7530 would be maintained at 90, 89, and 97 percent, respectively of historic habitat levels. WAAs 406 and 407 would retain 97 and 96 percent, respectively of historic large tree, open canopy POG habitat. As with the other action alternatives, impacts are greatest at the patch size. Alternative 4 would reduce POG habitat within patches ≥250 acres down to 74 percent of historic levels affecting population abundance and distribution. Average patch size would decrease by 61 percent. Effects to red-breasted sapsuckers would be similar to those described above reducing suitable nesting trees and densities.

Alternative 5

Alternative 5 would retain 88, 87, and 96 percent of the historic red-breasted sapsucker habitat in Saddle Lakes VCUs and 96 percent in affected WAAs. The non-development LUDs and 2001 Roadless Areas would maintain the greatest amount of existing habitat in the largest blocks to support core populations of red-breasted sapsuckers. Unlike the other alternatives, the small OGR in VCU 7470 would be moved into Roadless and the current area harvested (300 series units) which would further reduce the amount of habitat within larger patches. Approximately 74 percent of the historic POG in blocks ≥250 acres would be maintained; this would not affect the number of patches as there would still be 32 as opposed to the 17 historic patches. Average patch size has decreased by 61 percent. Alternative 5 poses the greatest risk to red-breasted sapsucker populations.

Alternative 6

Alternative 6 would retain 92, 90, and 97 percent, respectively of the original red-breasted sapsucker habitat within VCUs 7460, 7470, and 7530. Approximately 97 percent of the medium- and low-POG habitat would be maintained at the broader WAA scale. Habitat within patch sizes ≥250 acres would be reduced to 74 percent of historic levels. Average patch size has decreased by over 60 percent.

Summary of Red-breasted Sapsucker Effects

The loss of medium and low-POG habitat from management activities would reduce the number of large diameter trees capable of supporting cavities large enough to handle large clutch size, provide thermal insulation, and/or protection from predators. The loss of POG habitat combined with habitat reduction within large patches would further reduce red-breasted sapsucker populations within Saddle Lakes area VCUs and WAAs. This reduction in sapsuckers has likely caused localized gaps in distribution potentially affecting predators such as goshawks. Alternatives ranked from least effect to greatest effect are 1, 3, 6, 2, 4, lastly 5.

Red Squirrel (Tamiasciurus hudsonicus)

FP Direction (WILD1.V, p. 4-91): Same as other cavity nesters above.

Introduction and Habitat correlation to the affected environment

The red squirrel is a MIS in the Tongass because it is an important prey species for the northern goshawk and marten and requires forests with cone-producing trees and cavities in trees and snags (USDA 2008c, p.3-329). One of two arboreal rodents in the region, red squirrels are common in Alaska and are endemic in the coastal mainland of Southeast Alaska and islands in the Alexander Archipelago south of Fredrick Sound and east of Clarence Strait (MacDonald and Cook 2007). Densities of red squirrels range from 0.22 to 7 squirrels/ha (0.09 to 3 squirrels/acre) in British Columbia (Sullivan and Moses 1986, Sullivan and Sullivan 1982). No population densities are available on Revillagigedo Island, but Smith (2012) found average densities of 2.0 and 3.7 squirrels/ha (0.8 and 1.5 squirrels/acre) during spring and autumn, respectively on nearby Mitkof Island. The red squirrel is considered a “species of least concern” by the International Union for Conservation of Nature and Natural Resources (IUCN, accessed August 2012). Under the current State and Federal Subsistence regulations, there is no harvest limit for squirrels in GMU 1A and no closed season.

Red squirrel population density is strongly correlated with the density of large trees and snags, which may limit breeding females. Old-growth forests provide higher densities of cavities and interlocking branches for homesites, and produce important cone seeds for squirrels. Spruce trees in mature to old-growth forest provide the highest value; NPOG had breeding females, but further demographic analysis showed it was a sink habitat (Cook, et al. 2006). Red squirrels can live in young growth stands that have reached seed-producing age (30-40 years, Burns and Honkala 1990, Suring 1988), but seed crops may be unreliable at this age and stands do not provide the snags and downed logs necessary for food caching and reproduction until at least 100 years of age (Suring 1988).

Steele (1998) summarized key literature on red squirrels: 1) they prefer boreal coniferous forests that provide abundant conifer seeds, fungi, and interlocking canopies for efficient foraging and escape from predators; 2) nest site selection in is most critical for winter survival and thermoregulation, efficient winter use and protection of food caches, and avoidance of predators; 3) tree diameter, branching structure, and especially the availability of canopy escape routes are the most important proximate factors influencing nest-tree selection; 4) squirrels are highly selective in their foraging behavior, first harvesting cones from the tree species with the highest seed energy per cone, and then concentrating on the tree species with the next highest energy value. Cone selection is based on the number of seeds/cone, ratio of seed weight to cone weight, cone hardness, arrangement of cones on the branch, and the distance from the midden to where cones are harvested. Koprowski (2005) summarized information showing that red squirrel reproduction and density were often related to food availability; years when conifers produced prolific numbers of cones were usually followed by excellent reproduction and squirrel population growth while cone failures resulted in poor reproduction and recruitment.

Existing red squirrel habitat is displayed in Table 46.

Table 46. Existing Red Squirrel Habitat, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	19,869	14,493	-27%
VCU 7470	9,388	7,903	-16%
VCU 7530	17,073	12,433	-27%

Habitat is all classifications of POG at all elevations

Direct and Indirect Effects

Measurement criteria: acres of POG at all elevations.

Effects Common to Action Alternatives

Clearcutting directly impacts red squirrels by reducing the number of seed producing trees and nest sites and removing canopy escape routes. The lack of overstory cover makes red squirrels more subject to predation, especially by marten. Red squirrels typically rely upon mature forests that produce large quantities of tree seed, shaded microclimates for fungal growth and long-term cone storage, and cavities for nesting. Disturbances that disrupt these conditions reduce persistence of the red squirrel populations in a local area in the short term; management schemes that do not promote the return of forests to these conditions following disturbance will not favor re-establishment and long-term persistence of red squirrels (Koprowski 2005). King et al. (1998) also found that red squirrel densities were often substantially higher in mature forests compared to clearcuts. Coté and Ferron (2001) determined that red squirrels persisted for at least three to five years in residual forest blocks and corridors through clearcuts, but midden numbers were reduced from those found in control sites.

The dispersal ability of red squirrels is enhanced by an abundance of logs and interconnected low vegetation in proximity to arboreal escape routes, clearcuts can limit the availability of down logs and interconnected vegetation over time and create barriers to red squirrel dispersal (Bakker 2006). Red squirrels in Southeast Alaska will cross gaps caused by clearcutting if the distance is short when compared to alternative routes and microhabitat (logs, tree proximity) provides rapid, inconspicuous travel (Bakker and Van Vuren 2004, Bakker 2006). DeSanto and Willson (2001) cited red squirrel predation on bird nests within clearcuts in Southeast Alaska supporting some use of clearcuts as long as sufficient ground cover is available.

Stand age of second growth appears to influence red squirrel abundance and use. Haughland and Larsen (2004) looked at red squirrel use in commercially thinned stands (81-100 years old) and mature stands (120-140 years old) in British Columbia and use in the edges in between the stands. Results were consistent with mature forest providing the best habitat followed by mature edge, thinned edge, and lastly thinned forest. Squirrel density was highest in the mature forest, adults had the highest overwinter success, and females had the highest reproductive success in mature forest. Females in the mature forest also had the smallest territories likely due to more consistent cone crops.

Research concerning edge effect on red squirrels is varied. Wolff and Zasada (1975) concluded that clearcutting in Interior Alaska directly removed red squirrel habitat, degraded habitat by creating edge effects near openings, and potentially increased vulnerability to predation. Squirrel densities decreased from 1.2 to 0 squirrels/ha [2.5 ac] in clearcut blocks, whereas edge habitats of uncut forest and interior uncut forest showed little change in density (1.6 to 1.3 squirrels/ha and 1.3 to 1.5 squirrels/ha, respectively). Conversely, King et al. (1998) found increases in number of red squirrels at edges near clearcut borders. Anderson and Boutin (2002) found that juveniles born in the forest edge in western Yukon had slightly higher survival rates than those in interior forest likely due to less time spent travelling and foraging. Haughland and Larsen (2004) also found use of edge in British Columbia mature and commercially thinned stands although reproductive success and overwinter survival was greater in interior mature forest, and female home ranges were smaller indicating better habitat.

Herbers and Klenner (2007) studied the effects of partial harvest on red squirrels in central British Columbia. They found an approximate 1:1 relationship between logging intensity and declining red squirrel density two to four years after logging. When 50 percent of the basal area was removed from the stand, red squirrel abundance diminished by 40 percent. They speculated that red squirrel densities adjusted to the postharvest habitat conditions once cached stores of conifer seed became depleted and animals either died or abandoned their territories. If finding by Herbers and Klenner (2007) are applicable in Southeast Alaska, partial harvest will reduce red squirrel habitat and densities, at least in the short-term with higher basal area removals having greater impacts on density than lower basal area removals.

Small forest roads appear to have minimal direct impact on microclimate beyond the road margins and thus at the scale that red squirrels interact with the environment (Gucinski et al. 2001). They speculated that the greatest effect of roads on red squirrels were likely those associated with fragmentation. Road building and widening that reduces connectedness of the canopy likely results in decreased connectivity of habitat and may increase vulnerability to predation due to increased visibility and the facilitation of carnivore travel (Gucinski et al. 2001).

Table 47. Change in Red Squirrel Habitat, NFS Lands

			Acres (% reduction from *existing*)				
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	19,869	14,493	13,641	14,277	13,524	13,321	13,713
			(-5.9%)	(-1.5%)	(-6.7%)	(-8.1%)	(-5.4%)
VCU 7470	9,388	7,903	7,126	7,435	7,050	6,809	7,136
			(-9.8%)	(-5.9%)	(-10.8%)	(-13.8%)	(-9.7%)
VCU 7530	17,073	12,433	12,176	12,293	12,177	12,064	12,166
			(-2.1%)	(-1.1%)	(-2.1%)	(-3.0%)	(-2.1%)
VCUs Combined	46,331	34,829	32,944	34,005	32,750	32,194	33,015
			(-5.4%)	(-2.4%)	(-6.0%)	(-7.6%)	(-5.2%)

[1]. POG all elevations

Alternative 1

There are no direct or indirect effects to red squirrels under Alternative 1. Large trees and snags would continue to provide quality cavity nesting habitat, thermoregulation during winter denning, and foraging habitat with abundant cone production. Overstory canopy would continue to provide interlocking canopies for efficient foraging and as escape routes from predators.

Alternative 2

Alternative 2 would harvest 1,885 acres of POG habitat, 969 acres by uneven age UA33 prescription. Approximately 94, 90, and 98 percent of the existing red squirrel habitat would be retained in Saddle Lakes VCUs 7460, 7470, and 7530, respectively (Table 47). If trends found by Wolff and Zasada (1975) in Interior Alaska similarly apply in Southeastern Alaska, then red squirrels densities in clearcutting would be zero (0). This would either reduce the total number of individual red squirrels or cause a shift into territories that are vacant from overwinter mortality. It is unknown whether population responses found by Herbers and Klenner (2007) in nearby British Columbia would similarly apply to the Saddle Lakes area, but if so then partial cutting (UA33) could reduce existing red squirrel populations by about 30 percent for several decades. Dependent upon final prescription design, partially cut stands could still provide cone producing trees and large trees suitable for providing nest cavities. Haughland and Larsen (2004) found that mature-forest squirrel density increased each spring despite apparently high winter mortality, indicating that squirrels immigrated to vacant mature forest and/or reproduction was high enough to replace individuals lost to winter mortality. Depending upon how harvest units fall within red squirrel home ranges, the proposed timber harvest could cause an increase in territory size to compensate for areas of less suitable habitat. Alternative 2 maintains the connectivity through the small OGR in VCU 7470 Alternative 2 would maintain connectivity corridors 2, 3, and 4, but the partial cutting in corridors 6, 7, and 8 could affect red squirrel densities and dispersal. Corridor 5 would be eliminated which would affect red squirrel dispersal and use. Alternative 2 would have the second lowest impact of the action alternatives since it has a higher percentage of partial cutting than Alternative 6.

Alternative 3

Alternative 3 would harvest 824 acres of POG habitat with 161 acres partial cut (UA33), or about half the amount of harvest as any other action alternative. Slightly over 97 and 94 percent of the existing habitat would be maintained in VCUs 7460 and 7470, respectively, and 99 percent would be maintained in VCU 7530. Impacts would be similar, but less intensive, to those described under Alternative 2. Alternative 3 maintains important wildlife corridors facilitating dispersal through the Saddle Lakes project area into vacant territories. It also maintains the important connectivity through the small OGR between source populations in Naha and the remainder of the project area. Alternative 3 would have the lowest impact on red squirrels of the action alternatives.

Alternative 4

Alternative 4 would harvest 2,079 acres of POG habitat with 281 acres partial cut (UA33). Alternative 4 would retain 93, 89, and 98 percent, respectively of the original red squirrel habitat within VCUs 7460, 7470, and 7530. Impacts would be more intensive than impacts described under Alternatives 2 since more clearcutting would occur. This would make red squirrels more susceptible to predation by marten and other predators. Red squirrel densities could be reduced by 30 percent in UA33 partial cuts and eliminated from clearcuts. Alternative 4 eliminates elevational or landscape connectivity corridors 1, 3, 5, 6, 7, or 8 within the Modified Landscape LUD, so would have greater impacts on connectivity hence limiting the availability of escape routes and creating barriers to red squirrel dispersal. As a result, it may be harder for red squirrels to move to vacant territories that develop from winter die-offs and to disperse throughout the project area. Alternative 4 would have the second greatest impact on red squirrels.

Alternative 5

Alternative 5 would harvest 2,635 acres of POG breeding habitat with 222 acres partial cut (UA33). Approximately 92, 87, and 97 percent, respectively of the original habitat would be maintained within VCUs 7460, 7470, and 7530 (Table 47 above). Alternative 5 would have the greatest impact on red squirrel habitat and affect the greatest number of individuals or populations since clearcutting represents long-term to permanent reductions in breeding habitat and 40 year reductions in foraging habitat or until trees produce consistent cone crops. As in the other alternatives, some shifts in home ranges could occur, but with the higher amount of clearcut harvest increased competition for remaining suitable habitat could also occur. Red squirrels would be more susceptible to predation by having fewer and/or more open canopy escape routes. Alternative 5 Alternative 5 eliminates elevational or landscape connectivity corridors 1, 2, 3, 5, 6, 7, and 8, so would have the greatest impact on connectivity, hence limiting the availability of escape routes, and creating barriers to red squirrel dispersal. In addition, Alternative 5 would move the small OGR in VCU 7470 eliminating the connectivity with source populations in Naha. This would affect success in recolonizing the George/Carroll area in the event of serious winter die-offs. Alternative 5 would have the greatest impact on red squirrels.

Alternative 6

Alternative 6 would harvest 1,814 acres of POG breeding habitat with 391 acres partial cut. Roughly 95, 90, and 98 percent of the existing habitat would be maintained in VCUs 7460, 7470, and 7530, respectively. Effects of UA33 partial cuts would be similar to Alternatives 2 and 4; clearcuts would not provide denning habitat long term, but could provide foraging habitat within

40 years as trees reached seed-producing age. Alternative 6 does not implement elevational corridors within the Modified Landscape LUD (USDA 2008b, WILD1.B.2, p. 3-115), so would have greater impacts on connectivity hence limiting the availability of escape routes and creating barriers to red squirrel dispersal. Connectivity corridors 2 and 4 would be maintained, but corridors 1, 3, 5, 6, and 7 would be eliminated due to clearcutting within the corridors. The width of corridor 8 would be reduced due to clearcutting in Unit 46. Alternative 6 would have the third lowest impact of the action alternatives on red squirrels. It ranks below Alternative 2 because it has a higher percentage of clearcutting than Alternative 2.

Cumulative Effects

Cumulative effects for red squirrels are similar to those described above under direct effects. Suitable habitat has been reduced by timber harvest and hydropower facility construction. Recent clearcut harvest has the greatest effect followed by partial cutting and lastly historic harvest since some of these older stands may provide foraging habitat if they produce consistent cone crops. AMHT recently harvested 3,726 acres (71 percent of the land base) at Leask Lakes. It is assumed that all harvested acres were POG and therefore reduced red squirrel habitat. Timber harvest within the proposed AMHT land exchange, if approved, could remove over 4,000 acres of habitat for red squirrels. Road construction through POG has generally minor impacts in the form of reducing canopy escape routes, potentially making red squirrels more susceptible to predation (Gucinski et al. 2001). The Ketchikan to Shelter Cove Road would reduce habitat in two ways: 1) it would remove roughly 16 acres of POG during right-of-way clearing and 2) create additional gaps in the canopy.

The Swan Lake hydropower facility flooded 500 acres during construction although it is uncertain how much of this was POG. The proposed expansion would remove an additional 105 acres of habitat. The Mahoney Lake hydropower construction would not expand the current lake, but would remove clear an undisclosed amount of habitat on non-NFS lands for support facilities in the near future. No other projects have been identified in the foreseeable future that would have a measurable impact red squirrels or their habitat. Cumulative effects on red squirrel habitat on all ownerships are shown in Table 48.

Table 48. Change in Red Squirrel Habitat, All Ownerships

Area	Historic	Acres (% reduction from *existing*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	19,967	14,494	13,641	14,277	13,524	13,321	13,713
		(-27.4%)	(-31.7%)	(-28.5%)	(-32.3%)	(-33.3%)	(-31.3%)
VCU 7470	12,278	9,434	8,657	8,965	8,580	8,339	8,667
		(-23.2%)	(-29.5%)	(-27.0%)	(-30.1%)	(-32.1%)	(-29.4%)
VCU 7530	18,401	13,761	13,504	13,621	13,505	13,392	13,494
		(-25.2%)	(-26.6%)	(-26.0%)	(-26.6%)	(-27.2%)	(-26.7%)
WAA 406	63,536	51,099	49,990	50,743	49,873	49,558	50,051
		(-19.6%)	(-21.3%)	(-20.1%)	(-21.5%)	(-22.0%)	(-21.2%)
WAA 407	31,257	25,704	24,927	25,235	44,850	24,609	24,937
		(-17.8%)	(-20.3%)	(-19.3%)	(-20.5%)	(-21.3%)	(-20.2%)
WAAs 406/407	94,793	76,802	74,917	75,978	74,723	74,166	74,988
		(-19.0%)	(-21.0%)	(-19.8%)	(-21.2%)	(-21.8%)	(-20.9%)

[1]. POG, all elevations.
Source: GIS, SaddleWildlfieSummariesByAlt0618.xlsx

Alternative 1

Alternative 1 would have no effects on red squirrel habitat and would not contribute to cumulative effects. Impacts to red squirrels are from past timber harvest, associated road construction, and hydropower construction which have reduced habitat to roughly 75 percent of historic levels in Saddle Lakes VCUs. Impacts have been slightly less at the broader WAA scale with roughly 81 percent of the habitat maintained excluding the estimated 3,726 acre reduction at Leask Lakes in WAA 407 and the 605 acres at Swan Lake hydropower facility in WAA 406.

Alternatives 2 through 6

All action alternatives would maintain 67 to 71 percent of the red squirrel habitat in VCU 7460, 69 to 73 percent in VCU 7470, and 73 to 74 percent in VCU 7530. Habitat would be reduced to approximately 80 percent of historic levels in WAAs 406/407. As under direct effects, clearcutting would have the greatest impact on red squirrel densities and distribution by reducing density to zero within clearcut units. Partial cutting UA33 could maintain 70 percent of existing densities. All harvest would affect canopy closure increasing the risk of predation and eliminating or reducing escape routes. Harvest would directly reduce the number or large trees suitable for denning and affect cone crop production. Young growth stands over 40 years of age may again produce cones, but are less reliable than older trees and do not have sufficient size or decay to support dens. Long timeframes would be required to develop suitable denning cavity trees or habitat could be permanently lost under 100 year rotations.

Summary of Red Squirrel Effects

All action alternatives would reduce historic red squirrel habitat by 26 to 33 percent and likely cause gaps in distribution. Squirrel densities documented in British Columbia and interior Alaska declined to zero after clearcutting and by 30 to 40 percent (roughly 1:1 relationship) under partial cutting regimes. Increased fragmentation negatively affects squirrel dispersal, increases the risk of predation, and reduces overwinter survival. Reductions in red squirrel numbers could affect populations of predators such as marten and goshawk. Alternative ranking in terms of highest risk to lowest: Alternative 5, 4, 6, 2, 3, and 1.

River Otter (Lontra canadensis)

FP Direction (Riparian S&Gs RIP1. II.A.7 p. 4-50; RIP2.II.F, p. 4-53):

> Maintain riparian areas in mostly natural conditions for fish, other aquatic life, old-growth and riparian-associated plant and wildlife species, water-related recreation, and to provide for ecosystem processes, including important aquatic and land interactions. Consider the management of both terrestrial and aquatic resources when managing riparian areas.
>
> Consider wildlife needs in the design and management of RMAs. Give special emphasis to habitats of riparian associated species, for example, designated brown bear feeding areas.

Introduction and Habitat correlation to the affected environment

The river otter is considered an MIS in the Tongass because of its association with coastal and freshwater aquatic environments and adjacent upland habitats. Their strong association with aquatic habitats and susceptibility to pollution and habitat degradation makes river otters good indicators of high water and environmental quality (Melquist et al. 2003). *Lontra canadensis mira* occurs on the islands and mainland throughout southeast Alaska and coastal British Columbia; *L. c. mira* is distinctly different morphologically from interior subspecies (Suring et al. 1993).

ADF&G and the Federal Subsistence Board manage river otter harvest throughout southeast Alaska. The ADF&G furbearer management report (Porter 2010) provides information on GMU 1A otter. No population data exist for GMU 1A, but populations appear to be healthy and thriving at this point. Population levels are derived from information obtained from trappers and from mandatory sealing pelts; there is currently no limit on the number of otter that can be harvested in GMU 1A. (Porter 2010, Federal Subsistence regulations). Otter are difficult to trap and preparing pelts is time consuming. Therefore, pelt prices must be high to substantially influence harvest levels. Pelt prices dropped from a high of $100/pelt in 2004 to $31/pelt in 2009; trapping effort is expected to remain low at these prices (Porter 2010). Weather and relatively high fuel costs also have a profound influence on trapper effort. An average of 34 otter were harvested annually between 2006 and 2008 in GMU 1A; down substantially from the 10-year average of 68 otter per year (Porter 2010). Most trappers use boats as the primary means of access.

Otters are highly mobile and often move in response to shifting availability of food; consequently, home range size and location are dynamic (Boyle 2006). River otters forage both singly and in groups; foraging in groups appears to increase foraging efficiency in coastal Alaska (Blundell et al. 2002). River otters feed almost exclusively on fish, but may occasionally forage on crustaceans, amphibians, insects, birds, and mammals (Larsen 1984; Melquist et al. 2003, Guertin et al. 2010). In Southeast Alaska, fish, particularly sculpin (*Cottus* spp.), were the most important food source documented in river otter diets (Larsen 1984).

Range-wide, river otters inhabit almost every kind of aquatic habitat, including marine coasts, lakes, marshes, reservoirs, and streams. The primary habitat requirement for river otters is permanent water with abundant fish or crustacean prey, and relatively high water quality (Boyle 2006). The second most important physical habitat attribute is riparian vegetation, which provides security cover when river otters are feeding, denning, or moving on land. The third essential habitat component is structural diversity and complexity provided by objects such as fallen trees, logjams, stumps, undercut banks, and rocks (Boyle 2006).

In Southeast Alaska, river otters are associated with coastal and fresh water aquatic environments and the immediately adjacent (within 100-500 feet) old-growth forest (Larsen 1984, Woolington 1984 *MS thesis*). Old-growth forests with canopy cover and large-diameter trees and snags provide habitat for burrows and den sites. Otters commonly rest in cavities or beneath the roots of large conifers or snags in POG forests with moderately open understory and greater than 50 percent canopy closure (Ben-David et al. 1996). Natal dens were on well drained sites near streams in old-growth habitat and riparian zones were used as travel corridors between den sites and coastal foraging areas. Bowyer et al. (2003) also documented importance of old growth forests in Prince William Sound, Alaska. Larsen (1983 *MS thesis*) and Woolington (1984 *MS thesis*) ascertained that river otters in coastal Alaska avoided clearcut areas 5 to 23 years old. Avoidance was apparently due to dense shrub growth, extensive slash, and lack of overstory cover.

Based upon the above, I selected POG within 500 feet of fish streams (Class I and II streams – see aquatics report) and within beach/estuary buffers as the measurement criteria for analyzing impacts to river otter. Quality habitat was noted in the small OGR above George Inlet salt chuck, along Gunsight Creek, and along multiple unnamed fish streams in the project area. Existing river otter habitat is displayed in Table 49

Table 49. Existing River Otter Habitat, NFS lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	8,177	5,777	-29%
VCU 7470	3,102	2,679	-14%
VCU 7530	10,929	7,965	-27%

Habitat is POG within 500 feet of Class I and Class II fish bearing streams.

Direct and Indirect Effects

Measurement criteria: acres of POG within 500 feet of Class I and II streams; POG within beach buffers.

Effects Common to Action Alternatives

Threats to river otter include degradation or development of coastal and riverine/riparian habitat adjacent to fish streams. Since Larsen (1983 MS thesis) found that river otters avoided young clearcuts, clearcutting represents a direct habitat loss, at least in the short-term. Structural components such as large diameter trees for denning structures would be affected long term (up to 150+ years or permanently under 100 year timber rotations). Habitat destruction is the primary cause of declines in river otter populations in the contiguous United States, and river otters have been extirpated from a major portion of their former range because of substantial habitat degradation (Melquist et al. 2003). Habitat alterations that result in reductions in prey populations, inadequate shelter, or increases in exposure to contaminants are particularly detrimental to river otters.

Effects to water quality would be minimal and temporary in nature. Likely sources would be LTF reconstruction, road construction, and bridge or culvert installation. These activities are not expected to have a measurable impact on otters or prey species (see Aquatics report). Spill response plans are required to prevent contamination by hazardous materials.

Measurable impacts would come from loss of security cover and structural habitat components. Beach buffers provide the highest quality habitat and are protected by forest-wide standards and guidelines. All habitat within roughly the first 100 feet of fish streams would be protected by riparian management area (RMA) standards and guidelines, which would maintain security, cover. Security and denning habitat and travel corridors further from the stream would be reduced to 88 to 99 percent of existing depending upon VCU and alternative (Table 50).

Table 50. Effect on River Otter Habitat[1] NFS Lands

VCU	Historic	Acres (% reduction from *existing*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	8,177	5,777	5,419	5,643	5,406	5,352	5,477
			(-6.2%)	(-2.3%)	(-6.4%)	(-7.4%)	(-5.2%)
VCU 7470	3,102	2,679	2,462	2,563	2,435	2,351	2,435
			(-8.1%)	(-4.3%)	(-9.1%)	(-12.2%)	(-9.1%)
VCU 7530	10,929	7,965	7,820	7,892	7,824	7,767	7,815
			(-1.8%)	(-0.9%)	(-1.8%)	(-2.5%)	(-1.9%)
VCUs Combined	22,209	16,421	15,701	16,098	15,664	15,470	15,727
			(-4.4%)	(-2.0%)	(-4.6%)	(-5.8%)	(-4.2%)

[1]. Acres of POG within beach buffers and within 500 feet of Class I or II fish streams.
Source: GIS, river_otter_beach_stream.xlsx

Alternative 1

Alternative 1 would maintain all existing river otter habitat. All denning and burrowing structures would remain as would security cover. Populations would continue to fluctuate from natural causes; pelt price would continue to dictate trapping pressure. Alternative 1 does the best job of maintaining river otters and all components of their habitat.

Alternative 2

Alternative 2 would retain 94, 92, and 98 percent, respectively of the existing river otter habitat in VCUs 7460, 7470, and 7530. All habitat within roughly the first 100 feet of anadromous or resident fish streams would be protected within RMA stream buffers, but 720 acres of denning and burrowing habitat would be affected outside these buffers. Once clearcut units reach stem seclusion, they would provide security cover, but would continue to lack the structural diversity and complexity of POG. With the RMAs, security cover would remain directly adjacent to streams protecting otters while feeding. Loss of habitat could cause shifts in home ranges or loss of individual otters. Alternative 2 would maintain the existing small OGR in VCU 7470. As a result, it would continue to maintain quality river otter habitat above the George Inlet salt chuck within and outside the stream buffer. Trapping pressure would likely remain dependent upon pelt price. Alternatives 2 and 6 rank in the middle of the alternatives – Alternative 6 harvests slightly less habitat overall, but Alternative 2 harvests less within 2 of the 3 project VCUs and has less clearcutting.

Alternative 3

Alternative 3 would harvest 325 acres of river otter habitat, but maintain 98, 96, and 99 percent of the existing habitat respectively within VCUs 7460, 7470, and 7530. Alternative 3 would have the least impact of the action alternatives on river otters and their habitat, but would remove den structures, security cover, and foraging habitat and reduce travel corridor width along some streams. Alternative 3 would maintain the small OGR in its current location protecting the area outside the RMA above George Inlet salt chuck. Alternative 3 would construct 11.7 miles of new road mainly as short spurs into units. Trapping pressure would likely remain dependent upon pelt price.

Alternative 4

Alternative 4 would retain 91 to 98 percent of the existing river otter habitat harvesting 757 acres of stream associated habitat. Harvest would reduce denning habitat, security cover, and travel corridors. It could affect individual otters and/or cause shifts in distribution or home range size. Alternative 4 would construct 29.4 miles of new road and cross multiple streams facilitating trapper access (see Aquatics report for stream crossings). Alternative 4 would maintain the current small OGR protecting important habitat above George Inlet salt chuck. Otter populations are thought to be stable to increasing. With the limited amount of trapping that has occurred in GMU 1A, the Saddle Lakes project would not affect overall trapper success even though individual otter could be affected. Alternative 4 ranks next to the highest for overall impact due to the amount of habitat that would be removed.

Alternative 5

Alternative 5 would have the greatest effect on denning and burrowing habitat. Habitat would be maintained within RMAs, but denning and burrowing habitat outside the RMAs would be reduced by 951 acres or to roughly 93, 88, and 97 percent, respectively of current levels within VCUs 7460, 7470, and 7530. Road construction would increase 32.3 miles under this alternative providing more access for trappers to otters along fish streams. With the proposed move of the small OGR into 2001 Roadless in Alternative 5, habitat above the George Inlet salt chuck would be limited to the RMA. The loss of this habitat contributes to the decline in VCU 7470 and could affect travel from the salt chuck into the large Class I system above this area. The proposed timber harvest is unlikely to impact otter numbers to the point that current regulations would need to be changed.

Alternative 6

Alternative 6 would harvest 694 acres maintaining 95, 91, and 98 percent of the existing river otter habitat. Alternatives 2 and 6 rank in the middle of the alternatives – Alternative 6 harvests slightly less habitat overall, but Alternative 2 harvests less within 2 of the 3 project VCUs. Trapping pressure would likely remain dependent upon pelt price. Alternative 6 would construct 24.5 miles of new road and cross multiple streams (see Aquatics report for stream crossings).

Cumulative Effects

Habitat on NFS lands is currently protected by the 1000 foot beach buffer and riparian stream buffers. However, timber harvest was allowed prior to the 1997 Forest Plan and has reduced river otter habitat. Coastal habitat on non-NFS lands is not protected and many areas have been altered by development, but some river otter foraging opportunities exist along the shoreline. Stream buffers on non-NFS lands appear to vary by ownership and age. Leask Lakes timber harvest likely impacted some otter habitat, but from photos of the area, some habitat was left along Leask Creek and the coastline. Swan Lake hydropower expansion would impact additional habitat above the lake. Impacts to POG denning and burrowing habitat along coastlines and riverine systems are shown in Table 51.

Table 51. Effect on River Otter Habitat[1] All Ownerships

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	8,218	5,777	5,419	5,643	5,406	5,352	5,477
		(-29.7%)	(-34.1%)	(-31.3%)	(-34.2%)	(-34.9%)	(-33.3%)
VCU 7470	6,378	4,296	4,079	4,180	4,052	3,968	4,052
		(-32.6%)	(-36.0%)	(-34.5%)	(-36.5%)	(-37.8%)	(-36.5%)
VCU 7530	13,288	9,097	8,952	9,024	8,956	8,899	8,947
		(-31.5%)	(-32.6%)	(-32.1%)	(-32.5%)	(-33.0%)	(-32.6%)
WAA 406	31,006	23,432	22,928	23,225	22,919	22,809	22,981
		(-24.4%)	(-26.1%)	(-25.1%)	(-26.1%)	(-26.4%)	(-25.9%)
WAA 407	17,197	10,413	10,195	10,297	10,169	10,085	10,169
		(-39.4%)	(-40.7%)	(-40.1%)	(-40.9%)	(-41.4%)	(-40.9%)
WAAs 406/407	48,203	33,844	33,124	33,522	33,088	32,893	33,150
		(-29.8%)	(-31.3%)	(-30.5%)	(-31.4%)	(-31.8%)	(-31.2%)

[1]. Acres of POG within beach buffers and 500 feet of Class I or II fish streams.
Source: GIS, river_otter_beach_stream.xlsx

Alternative 1

The proposed Saddle Lakes project would have no effect on river otters under Alternative 1 and therefore not contribute to cumulative effects. Effects to river otter come from past logging along the beach in George and Carroll Inlets and along major drainages. From what I saw in older (26+ years) young growth stands, it is not as structurally diverse as POG since it is lacking understory vegetation. It contains cover in the form of stumps and down logs, but most regeneration is small diameter (generally 2-12" dbh) so would not provide denning habitat. In addition, some older young growth on Cape Fox Corporation land was recently clearcut.

Alternatives 2 through 6

Impacts to river otter habitat would been more substantial when past, present, and future management actions and activities are included. Habitat has been reduced to approximately 65 percent of historic levels within VCUs 7460, 7470, and 7530, to roughly 75 percent in WAA 406, but to less than 60 percent of historic levels in WAA 407 due to past harvest along George Inlet. However, current populations appear to be healthy and thriving at this point and there is currently no limit on the number of otter that can be harvested in GMU 1A (Porter 2010, ADF&G 2013b).

Summary of River Otter Effects

Coastal habitat on NFS lands is currently protected by beach and estuary Standards and Guidelines. Likewise, generally the first 100 feet of POG along streams is protected by TTRA or other stream buffers. On the other hand, POG habitat between roughly100 and 500 feet and river otter habitat on non-NFS land is generally suitable and available for timber harvest. Past habitat loss has been fairly substantial, but otter populations are currently healthy and there is no limit on the number of otter that can be trapped. Trapping pressure is currently low due to lower pelt prices. The Ketchikan to Shelter Cove Road could shift some trapper access method from boat to vehicle. Alternative ranking in terms of highest risk to lowest: Alternative 5, 4, 6, 2, 3, and 1.

Vancouver Canada Goose (Branta canadensis Fulva)

FP Direction (Waterfowl and Shorebird Habitats WILD1.XII, pp. 4-93 & 4-94):

> Maintain or enhance wetland habitats that receive significant use by waterfowl and shorebirds.
>
> Conduct activities to avoid or minimize disturbance to habitats within the forest, riparian, and estuarine areas that are important nesting, brooding, rearing, and molting areas for Vancouver Canada geese, sandhill cranes, or trumpeter swans.

Introduction and Habitat correlation to the affected environment

The Vancouver Canada goose is considered an MIS in the Tongass because of its association with forested wetland habitats, and because nesting and brood-rearing could be affected by various forest-management activities. The Vancouver subspecies is found almost exclusively in Southeast Alaska and British Columbia with the breeding range in Alaska extending from near Glacier Bay south to Dixon Entrance. They are relatively non-migratory and move locally between nesting, brood rearing, and winter concentration areas (Hupp et al. 2010). Hupp et al. (2006) found that 73 percent of the females moved <30 km [~19 mi] between November and March and 96 percent nested <30 km from where they were in March.

Quantitative data are relatively scarce regarding the abundance of Vancouver Canada geese on the Tongass. No data on breeding densities is available. Further, it is unclear whether data from broad-scale surveys (Breeding Bird Surveys [BBS] and CBCs) accurately reflect the occurrence and abundance of a highly mobile species like Vancouver Canada geese, and whether those data can be used to determine population trends. Population estimates for Southeast Alaska range from 10,000 breeding residents (USDA 2008c p. 3-241) to 25,000 individuals observed along marine shorelines during winter (Hodges et al. 2008). The total population is estimated at 87,000 geese.

In contrast to other subspecies of Canada geese, which prefer open habitats for breeding, the Vancouver Canada goose uses forested habitats for nesting, brood rearing, and molting. Rose (C. Rose, unpubl. rep., AK. Coop. Res. Unit, Univ. AK, Fairbanks, 1979) discovered a high proportion of nests on Annette Island in muskeg with scattered shore pine. All nests located by Hupp et al. (2006) were in vegetation classified by the Tongass National Forest as “forested”, however 58 percent were in “low productivity” forest or muskeg beneath or near groups of shore pine. The remaining nests were generally in poorly drained, small or intermediate sized western hemlock with or mixed hemlock and spruce or cedar with 9-30 million board feet per acre. Nests in forested sites were close to muskegs or sedge meadows and were usually near the forest edge at the base of trees or snags that provided almost complete overhead cover. Forested nest sites were comparable to those described by Lebeda and Ratti (1983) on Admiralty Island, although Lebeda and Ratti also observed nests built in trees.

Lebeda and Ratti (1983) reported that habitat use shifted to forest edge and intertidal zones with increased age of goslings, use of open water by geese with broods was uncommon and birds observed along beaches, meadows, lake shorelines, or forest edge used the forest as escape cover rather than open water. During the summer molting period when geese are flightless, they are found on lakes and inlets (Hupp et al. 2010). In winter, geese concentrate in estuaries and marine waters adjacent to shorelines (Hodges et al. 2008). Upper George Inlet and salt chuck and upper Carroll Inlet near the estuary are identified as important wintering areas.

Based upon the above research in Southeast Alaska, I selected muskeg, NPOG, SD4H, and SD5H as the measurement criteria for impacts to Vancouver Canada goose habitat. All historic goose habitat remains within VCUs 7460, 7470, and 7530.

Direct and Indirect Effects

Measurement criteria: acres of hydric-POG [SD5H, SD4H], unproductive forest [NPOG], and forested muskeg.

Effects Common to Action Alternatives

Although breeding Vancouver Canada geese in Southeast Alaska often occur in low-productivity forests, there is some use of POG. Overstory canopy is an important component of nesting and brood rearing habitat in terms of nest location, roosting, and loafing sites (Hupp et al. 2006, Lebeda and Ratti 1983). Clearcut stands (i.e., <25 years old) may have an appropriate understory in terms of food and cover, but do not have a suitable tree canopy. Older second growth stands may contain appropriate tree cover, but stem exclusion prevents them from having the well-developed understory necessary for food and vegetative hiding cover. As a result, clearcut timber harvest would have a direct effect on goose habitat by reducing nesting, brood rearing, and escape habitat. Roads used for the proposed timber harvest may be constructed in habitats more readily used by geese for nesting and brood-rearing. Therefore, timber-harvest activities may negatively affect breeding geese.

I did not find information on the effects of partial harvest, but the 33 percent removal in these stands would likely maintain some areas of suitable canopy cover and thus have less impact than clearcutting. Uneven age prescriptions with 50 percent removal would have greater impact, but may still provide some habitat depending upon individual stand condition remaining after harvest.

Table 52 shows the impacts the various alternatives would have on primary goose habitat (muskeg, NPOG, SD4H, and SD5H).

Table 52. Effect on Vancouver Canada Goose Habitat[1], NFS Lands

			Acres (% reduction from *existing*)				
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	12,125	12,125	11,657	11,934	11,582	11,406	11,622
			(-3.9%)	(-1.6%)	(-4.5%)	(-5.9%)	(-4.1%)
VCU 7470	6,243	6,243	6,017	6,056	5,995	5,946	6,003
			(-3.6%)	(-3.0%)	(-4.0%)	(-4.8%)	(-3.8%)
VCU 7530	14,833	14,833	14,657	14,736	14,659	14,601	14,646
			(-1.2%)	(-0.7%)	(-1.2%)	(-1.6%)	(-1.2%)
VCUs Combined	33,202	33,202	32,330	32,726	32,236	31,952	32,271
			(-2.6%)	(-1.4%)	(-2.9%)	(-3.8%)	(-2.8%)

[1.] Acres of Muskeg, NPOG, and hydric POG (SD4H, SD5H).

Alternative 1

Alternative 1 would not harvest timber or construct roads so would not affect nesting, brood rearing, or foraging habitat, nor affect escape cover. Alternative 1 ranks the highest for maintaining Vancouver Canada goose habitat and individuals.

Alternative 2

Ninety-six (96) to 99 percent of the existing habitat would be maintained in project area VCUs under Alternative 2. Timber harvest would decrease suitable habitat by 872 acres of which 361 acres would be partial cut with less than 33 percent removal. Assuming road construction using a typical 66 foot clearing width, construction of 15.8 miles could affect a maximum of 126 acres. Not all roads are within suitable habitat and some would overlap proposed units. Timber harvest activities would directly impact nesting, brood rearing, foraging, and escape cover and could displace individual geese. Alternative 2 ranks third of all alternatives and second among the action alternatives for maintaining habitat and geese. The amount of timber harvest is not expected to reduce overall populations of geese or affecting hunting.

Alternative 3

Alternative 3 would harvest 476 acres or maintain 98, 97, and 99 percent of the available habitat within project area VCUs. This would have a limited effect on nesting and brood rearing. Similar to Alternative 2, the less than 33 percent removal partial cut (UA33) on 35 acres would maintain some habitat in harvested stands. Individual geese may be impacted, but it is not likely that overall populations using the Saddle Lakes area would be impacted to a measurable extent or affect huntable populations. Alternative 3 ranks the highest of the action alternatives for maintaining nesting, brood rearing, foraging, and escape habitat.

Alternative 4

Alternative 4 would harvest up to 966 acres of goose habitat directly impacting 1 to 5 percent of the existing nesting, brood rearing and foraging habitat. The 65 acres of partial harvest would maintain some habitat in harvested stands. Alternative 4 has the second highest impact on geese and nesting and rearing habitat and could cause displacement of individual geese. It ranks fifth among the alternatives for maintaining habitat and supporting geese.

Alternative 5

Alternative 5 proposes the highest amount of harvest, which would directly impact 1,250 acres of goose habitat reducing existing habitat to 94, 95, and 98 percent of existing levels. Roughly 80 acres would be partial cut UA33. Road construction would impact an estimated 129 acres, but not all acres would be in suitable habitat. The movement of the small OGR in VCU 7470 into 2001 Roadless Areas would eliminate habitat within close proximity to George Inlet, an important wintering area. This alternative reduces up to six percent of the available habitat and ranks last among the alternatives in protecting habitat. It has the highest probability of displacing geese, but would not restrict huntable populations.

Alternative 6

Alternative 6 would harvest up to 931 acres of habitat and includes 137 acres of partial cut UA33. This alternative removes 1 to 4 percent of the existing habitat and ranks fourth overall. It would maintain the existing small OGR. Individual geese could be impacted, but sufficient habitat remains to support huntable populations.

Cumulative Effects

Relevant cumulative effects on Vancouver Canada goose habitat come from road construction, past timber harvest, and transmission line construction (Table 53). Additional habitat loss may have resulted from Swan Lake hydropower construction and Shoal Cove Loran site construction, but the extent of suitable habitat is not known. Likewise, we do not have information on how much of the 3,726 acres AMHT harvest at Leask Lakes was on hydric soils. Future projects such as the Ketchikan to Shelter Cove Road and Swan Lake expansion may affect 40 acres of goose habitat. The proposed AMHT land exchange would transfer suitable goose nesting and brood rearing habitat, including the portion of the small OGR above George Inlet, to AMHT ownership.

Table 53 Effect on Vancouver Canada Goose Habitat[1], All Ownerships

Area	Historic	Acres (% reduction from *historic*)					
		Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
VCU 7460	12,126	12,126	11,657	11,934	11,582	11,406	11,622
		(0%)	(-3.9%)	(-1.6%)	(-4.5%)	(-5.9%)	(-4.2%)
VCU 7470	7,674	7,674	7,447	7,484	7,426	7,376	7,434
		(0%)	(-3.0%)	(-2.5%)	(-3.2%)	(-3.9%)	(-3.1%)
VCU 7530	15,557	15,557	15,380	15,460	15,382	15,324	15,369
		(0%)	(-1.1%)	(-0.6%)	(-1.1%)	(-1.5%)	(-1.2%)
WAA 406	56,938	56,938	56,292	56,649	56,219	55,985	56,247
		(0%)	(-1.1%)	(-0.5%)	(-1.3%)	(-1.7%)	(-1.2%)
WAA 407	31,471	31,471	31,244	31,281	31,223	31,173	31,231
		(0%)	(-0.7%)	(-0.6%)	(-0.8%)	(-0.9%)	(-0.8%)

WAAs 406/407 combined	88,409	88,409	87,537	87,930	87,442	87,158	87,477
		(0%)	(-1.0%)	(-0.5%)	(-1.1%)	(-1.4%)	(-1.1%)

[1.] Acres of Muskeg, NPOG, and hydric POG (SD4H, SD5H).

Alternative 1

Alternative 1 would not contribute to cumulative effects. Known past harvest has been on non-hydric soils and have had minimal to no impact on goose habitat or populations. Some units on hydric soils (SD5H SD$H) may have been harvested on non-NFS lands, including recent harvest within the Leask Lakes area, but habitat data is not available for these areas. Likewise, proposed projects such as the Ketchikan to Shelter Cove road and hydropower construction/expansion could affect up to 83 acres. This is less than one tenth of one percent of the total habitat available in the combined WAAs. Therefore, there would be no measurable impact on Vancouver Canada goose habitat or goose populations under this alternative. Populations would continue to fluctuate from natural causes such as predation, disease, hunting, and other factors. The completion of the Ketchikan to Shelter Cove road could have the greatest impact on area geese as it would provide road access during hunting seasons.

Alternative 2 through 6

Ninety-four (94) to 99 percent of historic habitat would be maintained at the VCU scale under Alternative 2 through 6 and 98 to 99 percent at the larger WAA scale. The 957 of disturbance from timber harvest, hydropower expansion and construction, and road construction would directly impact nesting, brood rearing, foraging, and escape cover. Some individuals could be displaced, fail to nest, or abandon broods due to habitat loss and/or disturbance. Suitable habitat elsewhere in the Saddle Lakes area would maintain overall goose populations. Huntable populations would still exist; the Ketchikan to Saddle Lakes Road would provide increased access for hunters making George and Carroll Inlets and area lakes accessible from Ketchikan and Saxman.

Summary of Canada Goose Effects

None of the alternatives would have an adverse impact on overall goose populations although some individuals could fail to nest, could abandon broods, be less successful foraging, or be more susceptible to predation as primary habitat is lost. Over 94 percent of the historic habitat would be maintained into the future. No restrictions in hunting are anticipated from implementing the Saddle Lakes project.

Other Wildlife Species of Interest

Endemic Small Mammals

FP Direction (WILD1.XIX, p. 4-97):

> The objective is to maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges.
>
> Use existing information on the distribution of endemic mammals to assess project level effects. If existing information is lacking, surveys for endemic mammals may be necessary prior to any project that proposes to substantially alter vegetative cover (e.g., road construction, timber harvest, etc.). Surveys are necessary only where information is not adequate to assess project-level effects. a) Survey islands smaller than 50,000 acres in

total size (e.g., Heceta Island and smaller) that have productive old-growth forest suitable for timber harvest. Conduct surveys on larger islands if there is a high likelihood that endemic taxa are present and a high likelihood that they would be affected by the proposed project. b) The extent and rigor of surveys will be commensurate with the degree of existing and proposed forest fragmentation, and potential risk to endemic mammals that may be present. c) Surveys should emphasize small (voles, mice, and shrews) and medium sized (ermine and squirrels) endemic mammals with limited dispersal capabilities that may exist within the project area. d) Use the most recent inventory protocols for surveys.

Assess the impacts of the proposed project relative to the distinctiveness of the taxa, population status, degree of isolation, island size, and habitat associations relative to the proposed management activity.

Where distinct taxa are located, design projects to provide for their long-term persistence on the island.

Introduction

Endemic species are distinct, unique species with a restricted area or range (Schoen et al. 2007b). Southeast Alaska has been found to be a region with an especially high degree of endemism in its small mammal fauna. This is apparently due to its archipelago geography and its highly dynamic glacial history. Mammal surveys on the Tongass have resulted in the documentation of new distributions, new species, and distinct populations that suggest a high level of endemism on the Tongass. However, there continue to be gaps in knowledge about the natural history and ecology of wildlife subspecies indigenous to Southeast Alaska (Hanley et al. 2005). There are currently 24 mammal species or subspecies considered endemic to southeast Alaska (Cook et al. 2001).

Island endemics are generally limited to an island or a portion of an island, have specific habitat requirements, usually have low population numbers, experience high rates of inbreeding leading to suppressed genetic variation, and are highly susceptible to predation, pathogens, and/or introduced competitors (Cook and MacDonald 2013a). Habitat destruction, hunting, competition for food, and other factors also put intense pressure on island endemics (Cook and MacDonald (2013a).

The long-term viability of these endemic populations is unknown, but of increasing concern since island endemics are extremely susceptible to extinction because of restricted ranges, specific habitat requirements, and sensitivity to human activities such as species introductions (ISLES website 2012). For terrestrial mammals, the proportion of endemics decreases from the outer islands in the archipelago eastward toward the inner islands nearer the mainland with the pattern more pronounced in the southern part of the archipelago (MacDonald and Cook 2007). Consistent with this pattern, Revillagigedo Island was mapped (Figure 28) fairly low on the biodiversity hotspot scale (Cook et al. 2006, ISLES website).

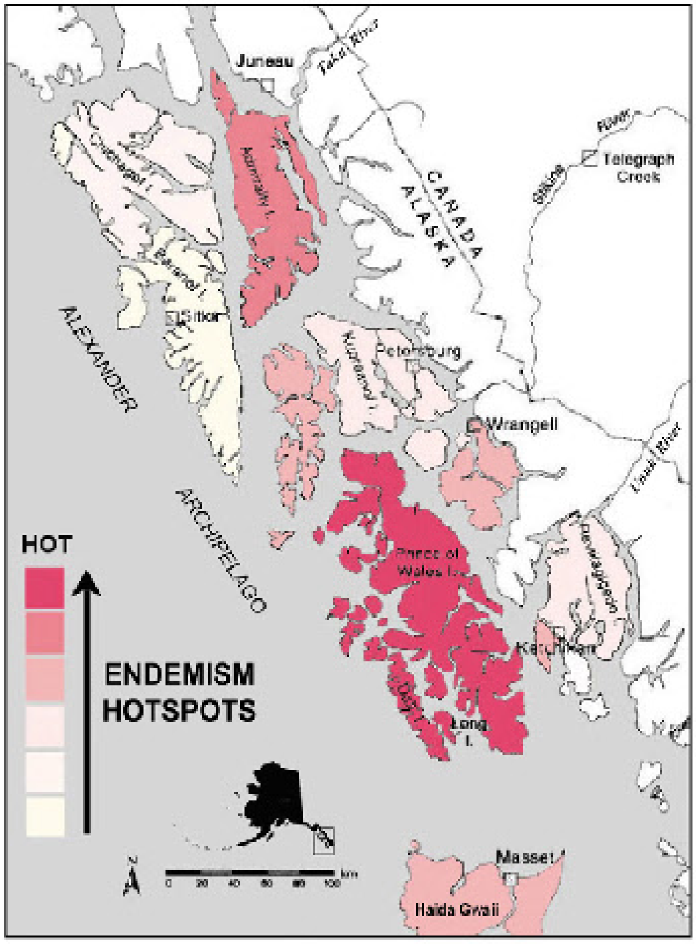


Figure 28. Endemism Hotspots (ISLES website)

No small mammal surveys were conducted specifically for this project; surveys are only necessary where information is not adequate to assess project-level effects. However, researchers with the University of Alaska Museum, Fairbanks, conducted numerous surveys on the Ketchikan/Misty Fiords Area between 1993 and 1999 (McDonald and Cook 1999). Additional endemic small mammal work was completed on Revillagigedo Island including the Saddle Lakes area by MacDonald and Cook during July and August 2013, as part of the ongoing ISLES project (see Cook and MacDonald 2013a). Five small mammal species were collected at the Shelter Cove site: dusky shrew, cinereus shrew, northwest deermouse, meadow jumping mouse, and southern red-backed vole; an additional species, long-tailed vole was collected at the head of Carroll Inlet. Of these species, southern red-backed voles have the most restricted habitat and are the most likely to be impacted by logging. Therefore, I selected the Revillagigedo Island southern red-backed vole as the indicator for small endemic mammal analysis.

Southern Red-backed Vole (*Myodes gapperi solus*)

The southern red-backed vole (*Myodes [Clethrionomys] gapperi solus*) is the only endemic small mammal restricted to Revillagigedo Island; (MacDonald and Cook 2009, MacDonald and Cook 2007; Smith 2005). *M. gapperi* is generally considered common to abundant (IUCN species of least concern), but *M. g. solus* is considered data deficient by the IUCN (Linzey and NatureServe (Hammerson, G). 2008). *M. g. solus* was described in 1952 from 13 specimens collected from 2 locations on Revillagigedo Island with an additional 18 specimens collected from 10 locations in 1993; its taxonomy has not been re-examined using larger samples or more modern techniques (Cook and Kirkland 1998).

Habitat correlation to the affected environment

Southern red-backed voles inhabit mesic areas in coniferous, deciduous, and mixed forests. Coniferous forest with mossy logs and tree roots provide optimal habitat (Linzey and NatureServe 2008). Smith et al. (2005) found that southern red-back voles were positively correlated the percent cover of deciduous shrubs and decayed down wood in the forest understory and that peatland mixed–conifer forest (i.e., forested muskeg) habitat contributed little to breeding populations in southeast Alaska. Muskegs and scrub forest (NPOG) supported the fewest voles and Smith and Nichols (2004) theorized that it was unlikely that these habitats supported breeding populations.

No habitat studies have occurred specific to the Revillagigedo Island red-backed vole. The best information on red-backed voles in southeast Alaska comes from nearby Wrangell Island (Smith and Nichols 2004, Smith et al. 2005). They tested the Wrangell Island red-backed vole (*Myodes gapperi wrangeli*) association with old growth. Unlike studies elsewhere, vole densities were not consistently higher in old growth but varied between years and were likely influenced by overall population density (Smith et al. 2005). Habitat features that were positively correlated with vole density included the amount of down, decayed wood and the cover of surface water during spring (Smith et al. 2005). Hanley et al. (2005) also reiterated the importance of abundant stumps, downed coarse woody debris (especially rotting logs), exposed roots within a loose forest litter and understory cover which maintains a moist microclimate, important foods, and escape cover.

Young growth supported a higher proportion of the population during a high density year than the following years when overall densities were much lower. Smith and Nichols (2004) theorized that higher use of young growth could be related to the amount of thinning slash on the ground, the cooler, wetter climate in southeast Alaska, and the amount of understory present. However, density of small (10–49 cm [4–19 inches] DBH snags and percentage of conifer seedlings were negatively associated with population density as was high moss cover in the spring (Smith et al. 2005). Densities in young growth showed substantially greater variation among years and average body mass and reproductive rates were lower with minimal evidence of juvenile recruitment into the population (Smith and Nichols 2004, Smith et al. 2005). They theorized that voles shifted between better and more marginal habitats as local populations fluctuated. Sullivan and Sullivan (2011) in British Columbia found substantially more red-back voles in partially cut stands than in 3-20 year old clearcut stands, but their sites were drier than southeast Alaska.

Smith and Nichols (2004) questioned whether young growth could sustain breeding populations in intensively managed landscapes. Smith et al. (2005) found that vole densities in old growth declined the least between years indicating that it was the highest quality habitat and that regenerating young growth was a dispersal sink. Hanley et al. (2005) listed several important areas that need further study:

- influence of annual fluctuation in population levels on vole habitat distribution and demography in managed landscapes;
- habitat capability of older second-growth (i.e., stem exclusion) stands;
- benefits to vole habitat of precommercial and commercial thinning; and
- stand and landscape features that limit dispersal.

Because densities and reproductive rates were highest in POG forest and questions remain on young growth, I selected all POG (SD67, SD5S, SD5N, SD5H, SD4S, SD4N, and SD4H) as the measurement criteria for red-backed voles. This is the same as year-round marten and red squirrel habitat.

Direct and Indirect Effects

Measurement criteria: acres of POG at all elevations.

Alternative 1

Alternative 1 would not impact small endemic mammals or more specifically the Revilla Island red-backed vole. All existing habitats would be maintained. Populations would continue to fluctuate from natural causes such as weather and predation.

Effects Common Alternatives 2 through 6

The effects of clearcutting and fragmentation on endemic populations of mammals are largely undocumented, but have potential for substantial impacts (Cook and MacDonald 2001). Clearcut harvesting creates a relatively fine-grained, highly fragmented landscape pattern that includes an increase in the amount of forest-opening edges and a decrease in the size of old-growth forest patches. Such patches may be too small or isolated from other similar stands to function effectively as wildlife habitat for species associated with old growth (Harris 1984, Thomas et al. 1988). The isolation of small mammal populations and the lack of connectivity of suitable habitat increase the risk and decrease the likelihood of maintaining the long-term persistence of local populations after extensive clearcut harvest (Swanston et al. 1996). Wilson and Carey, 2000 found that small mammals were 1.2 and 1.6 times as abundant in old-growth as in natural young or managed young forest, respectively, in the southern Washington Cascades and on the Olympic Peninsula. They hypothesized that the diversity of food sources underlies the structure and abundance of forest-floor small-mammal communities.

No studies have been completed on red-back vole response to partial cutting in Alaska. In general, red-backed voles seem to persist in some partially harvested forests if mature forest components such as large overstory coniferous trees, downed logs, and understory are maintained (Sullivan and Sullivan 2011, Fauteux et al. 2012, Glitzen et al. 2007, Fuller et al. 2004, Klenner and Sullivan, 2003). Klenner and Sullivan (2009) found that even on drier sites, basal area and density of residual trees appear to be critical components for maintaining red-tailed voles; individual tree selection with less than 50 percent of the basal area and group selections less than 4 acres maintained voles. In a long-term 14 year study, Ransome et al. (2009) found that red-backed vole numbers in British Columbia were highest in uncut forest, intermediate in 1 ha [2.5 ac] group selection cuts with 33% removal, and significantly [statistically] lower on large > 30 ha [74 ac] clearcuts.

Effects to red-backed vole habitat would be similar to those described under Red Squirrel (see Table 38). Partial cutting (UA33) would maintain habitat for red-backed voles although densities would likely be reduced based upon the above research. Clearcutting would remove habitat long-term, affect size and connectivity of remaining habitat patches, and put small mammal populations at higher risk of local extirpation.

One of the findings of the 1997 Forest Plan Scientific Committee was that Old-Growth Reserves, by themselves, do not appear to be adequate to maintain interconnected, functionally interrelated old-growth ecosystems (Swanston et al. 1996). A general landscape connectivity standard and guideline to maintain connectivity between large- and medium-OGRs and other non-development

LUDs was designed to provide benefit for all taxa, but particularly for the small mammals and other terrestrial vertebrates with limited dispersal capabilities. All alternatives would maintain Corridor 1 connecting Naha LUD II and the medium OGR at the northern extent of the project area. Alternatives 1, 2, and 3 would implement elevational connectivity corridors through the Modified Landscape LUD that would maintain some connectivity between the medium OGR and the non-NFS land south of the project area. While the Forest Service does not have jurisdiction over the non-NFS lands, limited connectivity currently exists through the non-NFS land to the Semi-Remote Recreation LUD south of the project area. In a similar fashion, these elevational corridors through the Modified Landscape LUD would also maintain connectivity between Naha LUD II and the non-NFS land.

Alternatives 4, 5, and 6 would further impact small endemics by not implementing/maintaining connectivity corridors 3, 5, 6, 7, and 8, which could reduce interaction between sub-populations. Since the predominant prescription in Alternative 5 is even aged clearcutting, it would have the most substantial effect overall. Alternative 5 would also move the small OGR in 7470 (corridor 2) which would eliminate the connectivity with source habitat in Naha LUD II making it harder for vacant territories to be recolonized.

Cumulative Effects

The extent to which cumulative disturbance from forest management poses a threat to the persistence of endemic Revillagigedo red-backed vole populations remains unclear and they may not be as sensitive to overstory removal as reported for voles elsewhere (Smith and Nichols 2004, Smith et al. 2005). However, the authors cautioned that results could also be the result of poorly understood natural population fluctuations where lower quality habitats are used during high densities. Smith et al. (2005) found that overall, young growth was a population sink.

Cumulative changes to POG habitat for red-backed voles (up to 35% reduction from historic levels) are the same as for red squirrels (Table 48).

Summary of Endemic Small Mammal Effects

All action alternatives, combined with past, present, and future activities, would reduce historic red-back vole habitat by approximately 25 percent. Young growth may provide habitat when cyclic populations are high, but their long-term value has been questioned. Densities were lower long-term and reproductive success and body condition were lower suggesting that young growth is a sink habitat. Changes in red-back vole numbers could affect predators such as goshawks and marten. Fragmentation and lack of connectivity under Alternatives 4, 5, and 6 would put small endemic mammals, and specifically Revilla Island red-backed voles, at higher risk of extinction.

Great Blue Heron (Ardea Herodias fannini)

FP Direction (WILD1.XIII, p. 4-94):

> Provide for the protection of raptor (hawk and owl) nesting habitat and great blue heron rookeries. 1. Conduct project-level inventories to identify heron rookeries and raptor nesting habitat using the most recent inventory protocols. 2. Protect active rookeries and raptor nesting habitat. Active nests will be protected with a forested 600-foot windfirm buffer, where available. Road construction through the buffer is discouraged. Prevent disturbance during the active nesting season (generally March 1 to July 31).

Introduction and Habitat correlation to the affected environment

This northwestern coastal subspecies of great blue heron is confined to the Pacific coast of North America from Prince William Sound, Alaska, south to Puget Sound, Washington; an estimated 4,000–5,000 pairs occupy this range (Butler and Baudin 2000). Isleib (1992 pers. com. cited by NatureServe) estimated that there were 500-1000 great blue herons north of Dixon Entrance, southeastern Alaska. No heron rookeries or concentrated use was observed during numerous field reconnaissance trips in the Saddle Lakes area, but herons were occasionally observed.

Habitat for great blue herons is tidal sloughs, estuaries and beaches, lower reaches of salmon spawning streams, large freshwater ponds and marshes; nests are located in upper parts of trees or rarely in bushes or on the ground (Armstrong 1995). Two of the more detailed reports I found were Gebauer and Moul from British Columbia (2001) and Butler and Baudin (2000). Gebauer and Moul (2001) summarize great blue heron breeding habitat in coastal areas of North America as deciduous, coniferous, or mixed species forest in close proximity to wetland feeding areas with the most common nest trees being red alder (48%) and black cottonwood (30%). Less common nest trees were big leaf maple (8%), Sitka spruce (9%), Douglas fir (2%), white birch (1%), western hemlock (1%) and western redcedar (<1%). Of 104 alders measured, the average diameter was 35 cm DBH [~14”] and the smallest was 22 cm DBH [~9”]. Butler and Baudin (2000) found the greatest number of herons nesting near large eelgrass meadows, marshes, and along rivers where they feed on small fish. Smaller numbers of herons forage in kelp forests and on shallow beaches. Schenck and Suring (1993) reported single nests and small colonies of two to three nests in large western hemlock and Sitka spruce in southeast Alaska.

Table 54. Existing Great Blue Heron Habitat, NFS Lands

VCU	Historic Acres	Existing Acres	% Reduction
VCU 7460	2,760	1,924	-30%
VCU 7470	128	117	-9%
VCU 7530	2,635	1,848	-30%

Habitat is POG within beach/estuary or lake buffers.

Direct and Indirect Effects

Measurement criteria: acres of POG within beach/estuary or lake buffers.

Alternative 1

There would be no effect on herons or heron rookeries under Alternative 1. All existing nesting and foraging habitat would be maintained and no project related disturbance would occur. Natural processes such as windthrow would continue to occur affect nesting and foraging habitat. Bald eagle and other predation would continue to affect nesting and chick survival

Effects Common to Alternatives 2 through 6 to here

Factors that possibly limit the maintenance of heron populations are breeding failure of adult herons that are regularly disturbed by eagles or by human activity near the colonies and reduced juvenile survival as a result of food shortages in autumn; the number of fledglings raised in heron colonies with frequent disturbances was substantially lower than at colonies with no disturbance (Butler and Baudin 2000). Bald Eagles are a primary predator of great blue herons (Vennesland and Butler 2011, Gebauer and Moul 2001, Vennesland and Butler 2004) and in some geographic areas predation and associated disturbance results in significantly higher nest and colony abandonment. Gebauer and Moul (2001) documented that unfledged chicks were particularly vulnerable to bald eagle predation in coastal British Columbia; common ravens, crows, great horned owls and raccoons were also responsible for egg and chick depredation. Human activity can disturb nesting herons but disturbance does not always lead to adverse impacts at the population level (multiple studies summarized in Vennesland and Butler 2011).

Overall, loss of habitat, particularly wetland nesting and feeding areas, may have had the strongest negative impact on the species through time (Vennesland and Butler 2011). Gebauer and Moul (2001) noted that in coastal British Columbia, great blue herons are likely more limited by the availability of high quality foraging habitats than the presence of suitable nesting habitat. Along the North Coast and in the Queen Charlottes where high quality foraging areas such as tidal mudflats are more limited, herons nested at much lower densities than in areas with extensive high-quality foraging areas. They also surmised that logging activity would have the most impact when mature timber in close proximity to prime foraging areas was removed. However, if the logging occurred outside of the breeding period herons could be expected to continue nesting in the remaining forested habitat, provided that a sufficient buffer existed.

Beach, lake, and riparian buffers would be applied under all alternatives which would protect primary habitat. Therefore, primary rookery habitat would be maintained under all alternatives. Some use could occur outside lake buffers. Up to two acres of previously disturbed habitat could be affected during Shelter Cove LTF reconstruction. This effect would be short-term (6-8 weeks) and limited in comparison to the available beach and lake habitat within the project area, affected VCUs and WAAs 406/407. Forest Plan direction to prevent disturbance would be applied if any rookeries are found during project implementation.

Cumulative Effects

Cumulative impacts to herons come from past and more recent timber harvest, road construction, and LTF construction in beach and riparian habitats. The proposed Swan Lake hydropower expansion could impact another 103 acres of habitat. The Mahoney hydropower project could affect herons by lowering existing lake levels, removing a limited number of suitable nest trees, and increasing the amount of human disturbance. Minor habitat could be lost in VCU 7470 and WAA 407 during Ketchikan to Shelter Cove road construction, but impact on heron habitat will depend upon actual road location. The road access will likely result in increased disturbance from recreational activities .The proposed AMHT land exchange could affect great blue herons by reducing nesting and foraging habitat since lake and riparian standards and guideline buffers would no longer apply. Additional impacts come from changes in riparian and lake habitats from aquatic farming and aquaculture operations.

Table 55. Cumulative Effect on Great Blue Heron Habitat, All Ownerships

<table>
<tr><th rowspan="2">Area</th><th rowspan="2">Historic</th><th colspan="6">Acres (% reduction from historic)</th></tr>
<tr><th>Existing \ Alt. 1</th><th>Alt. 2</th><th>Alt. 3</th><th>Alt. 4</th><th>Alt. 5</th><th>Alt. 6</th></tr>
<tr><td rowspan="2">VCU 7460</td><td rowspan="2">2,764</td><td>1,924</td><td rowspan="7" colspan="5">Potentially up to 105 acres of additional disturbance from Swan Lake hydropower expansion WAA 406. AMHT proposed land exchange could affect additional acres if approved.</td></tr>
<tr><td>(-30.4%)</td></tr>
<tr><td rowspan="2">VCU 7470</td><td rowspan="2">1,430</td><td>802</td></tr>
<tr><td>(-43.9%)</td></tr>
<tr><td rowspan="2">VCU 7530</td><td rowspan="2">3,081</td><td>2,175</td></tr>
<tr><td>(-29.4%)</td></tr>
<tr><td>WAA 406</td><td>8,298</td><td>6,392</td></tr>
</table>

		(-23.0%)	
WAA 407	4,740	3,115	
		(-34.3%)	
WAAs 406/407	13,038	9,507	
		(-27.1%)	

[1.] Acres of POG within beach/estuary or lake buffers.

All Alternatives

Alternative 1 would not contribute to cumulative effects. Effects from Alternatives 2 through 6 would be additive to past, present, and future management actions and activities. Beach and lake buffer habitats are now protected on NFS lands, but not on non-NFS lands. Past harvest has reduced heron nesting habitat to 56 to 77 percent of historic levels with the greatest impact occurring in along George Inlet in VCU 7470. Intertidal and riverine foraging areas have likely recovered from past disturbance. The proposed Swan Lake hydropower expansion could impact another 103 acres of habitat; initial dam construction flooded 500 acres. Minor habitat could be lost in VCU 7470 and WAA 407 during Ketchikan to Shelter Cove road construction, but impact on heron habitat will depend upon actual road location. The proposed Predation by bald eagles and other natural factors would continue to impact heron populations.

Summary of Great Blue Heron Effects

The proposed Saddle Lakes project would have no measurable effects on great blue herons. Primary nesting and foraging habitat is protected by beach, lake, and riparian buffers. Harvest activities near these areas could temporarily disturb herons, but based upon information from British Columbia, may not affect nesting success. Management activities has removed between 24 and 44 percent of the historic habitat and effect to nesting habitat continue for the long term into the future. Predation by bald eagles would continue and could have the greatest influence on great blue heron populations.

Forest Raptors

FP Direction (WILD1.XIII, p. 4-94) – same as herons:

Introduction and Habitat correlation to the affected environment

Habitat for raptors vary from fairly open habitat preferred by red-tailed hawks to more closed canopy POG habitat used by sharp-shinned hawks. Therefore, habitat can be affected by management actions and activities. Osprey will use a variety of habitats including man-made structures, but are most often found in close proximity to shorelines in Alaska.

Crews are trained in raptor identification and any nests are to be reported to the District biologist for follow-up. A red-tailed hawk was repeatedly observed near Unit 62, but no nest was found. Red-tailed hawks typically breed in open to semi-open habitats, such as coniferous and deciduous woodlands, with elevated nest/perch sites such as tall trees and avoid densely timbered areas, as well as areas with large expanses of terrain without trees or other elevated perch sites (Preston and Beane 2009).

Sharp-shinned hawks were observed overhead numerous times during the 2011 and 2012 field season. A nest was found in Unit 65 and will be buffered during layout if in the selected alternative. A sharp-shin was sighted several times in the beach buffer near Units 233/234. A sharp-shinned hawk was also observed in the OGR above George Inlet between the creek and the road, but no nest was found. The species' secretive nature and the dense vegetation of its nesting habitat make it difficult to find and study during the breeding season (Bildstein and Meyer 2000).

An osprey were observed on one occasion approximately ½ mile from Unit 52 between North and South Saddle Lakes. No other raptor nests were found during numerous field reconnaissance trips or while surveying for goshawks. If any nests are found during sale layout, they are to be reported to the district wildlife biologist for follow-up and appropriate buffers applied.

Direct and Indirect Effects

Alternative 1

There are no direct effects of choosing the no action alternative. All suitable nesting habitat would be maintained and the area would continue to support prey species. Natural fluctuation in populations would occur.

Alternatives 2 through 6

All alternatives would reduce the amount of POG habitat (see *Hairy Woodpecker (Picoides villosus*) and Red-breasted Sapsucker (*Sphyrapicus ruber*)sections above for closed and more open POG effects). Buffers were applied around identified raptor nests in accordance with Forest Plan direction. Any additional nests that are found during layout will be reported to the district wildlife biologist and buffered in accordance with Forest Plan standards and guidelines. No sharp-shinned nest was found in the small OGR but birds were observed. If a nest is present, it would need to be buffered and protected under Alternative 5 since OGR status would no longer apply to this area.

Cumulative Effects

Cumulative effects to forest raptors come from past and present timber harvest and related activities on all ownerships including the 3,726 acres of harvest at Leask Lakes not available former POG classification. Swan Lake and Mahoney Lake hydropower projects would have a minor impact in comparison to past harvest as would the Ketchikan to Shelter Cove Road.

All Alternatives

Alternative 1 would have no effect on forest raptors. Long-term impacts from past harvest have reduced closed canopy, high-POG by 35-40 percent at the VCU level and by roughly 30 across the broad WAAs 406/407 level. Project alternatives would further reduce available habitat up to 51 percent at the VCU level and to 32 percent at the combined WAA level (see Table 40). This represents long-term to permanent reductions in closed canopy habitat for raptors such as sharp-shinned hawks.

More open canopy, medium- and low-POG, has currently been reduced up to 3 percent. Habitat would be further reduced by proposed management actions – up to 13 percent at the VCU level and 4 percent at the WAA level (see Table 44).

Summary of Raptor Effects

Action alternatives in Saddle Lakes, when added to past, present, and foreseeable future activities would cause substantial impacts (up to 51% reduction of historic habitat) to forest raptors such as sharp-shinned hawks that utilize more closed canopy forest stands. This has likely caused reduced numbers and/or gaps in distribution or forced birds into less suitable habitat. Habitat for species such as red-tail hawks that utilize more open habitat would be less impacted (up to 13%).

Marbled Murrelet (Brachyramphus marmoratus)

FP Direction (WILD1.XVI, p. 4-96):

> If nests are found during project implementation, maintain a 600-foot, generally circular, radius of undisturbed forest habitat surrounding identified murrelet nests, where available. Minimize disturbance activities within this buffer during the nesting season (May 1 to August 15). Maintain the buffer zone and monitor the site for nesting activity for not less than two nesting seasons after nest discovery. Maintain the buffer if the nest site is active during the monitoring period. Buffer protection may be removed if the site remains inactive for two consecutive nesting seasons.

Introduction and Habitat correlation to the affected environment

The marbled murrelet (*Brachyramphus marmoratus*) is a robin-sized seabird that feeds below the water's surface on small fish and invertebrates. Marbled murrelets breed as far north as Bristol Bay and along the Aleutian Islands; however, their major breeding areas in Alaska are concentrated in the Kodiak Archipelago, Prince William Sound, and the Alexander Archipelago of Southeast Alaska (Piatt et al. 2007).

Marbled murrelets overlap in distribution with Kittlitz's murrelets in many areas, and efforts to determine accurate population numbers of marbled murrelets have been problematic because of difficulties in identifying the two species during survey efforts. Combined population estimates from different survey areas in Alaska from 1989 to 2006 suggested that the total Alaska population was once on the order of 940,000 birds, and data from 1994 indicated that 687,061 of those birds occurred in Southeast Alaska, particularly in Glacier and Icy Bays (Piatt et al. 2007). The species is thought to be suffering rapid population declines in Alaska (perhaps as much as 11%–13% per year in Southeast Alaska), and is thought to have declined by as much as 79% since the early 1990s (Piatt et al. 2007). However, long-distance movements have substantial implications in terms of determining murrelet abundance and distribution in the region. Whitworth et al. (2000) found that marbled murrelets in southeast Alaska consistently travel considerable distances (up to 250 km [155 mi] daily round trip) between potential nesting and foraging areas.

There are no historical or recent population estimates of marbled murrelet populations in the vicinity of Saddle Lakes or the larger Revillagigedo Island; Nests are difficult to locate and radio telemetry has been determined to be the most effective tool for locating nests (Waterhouse et al. 2007). Waterhouse et al. (2009) determined that low-level aerial surveys would enable biologists to identify likely nesting habitat for marbled murrelets in British Columbia, as key habitat features (platforms and moss development) are not discernible using lower-resolution tools such as aerial photographs or satellite images. It is now the recommended standard survey method for assessing forested landscapes for murrelet habitat in British Columbia.

Marbled murrelets spend most of their lives in the coastal marine environment in sheltered bays, fjords, leeward sides of islands, and island passes (Kuletz 2005 *MS thesis*, Piatt and Naslund 1995), but come onshore for nesting (Hobson 1990). Throughout much of their summer range, murrelets are often observed within 5 km [3.1 mi] of the shore in water less than 40 m [131 ft] deep (Day et al. 2003, Nelson 1997).

Only 34 nests have been recorded in Alaska and habitat associations are not well understood (Alaska natural heritage program species account, Piatt et al. 2007). They typically nest on mossy-limbed branches of large, mature coniferous trees within stands of structurally complex, coastal old-growth forest (USDA 2008c p. 3-241), but more recent studies suggest that 20% to

30% of marbled murrelets in Alaska may nest on the ground (Marks and Kuletz 2001). Key microhabitat characteristics of marbled murrelets nest sites include: (1) sufficient height to allow stall landings and jump-off departures, (2) openings in the canopy for unobstructed flight access, (3) sufficient platform diameter to provide a nest sight and landing pad, (4) soft substrate to provide a nest cup, and (5) overhead cover to provide shelter and reduce detection by predators, but also making marbled murrelet nests extremely difficult to find (USDA 2008c, pp. 3-242). Specific requirements for nesting habitat of marbled murrelets in Southeast are presumably similar to requirements in British Columbia (Cotter and Kirchhoff 2007).

Marbled murrelets are listed as threatened in Canada (Burger 2002) and as a result a substantial number of surveys and research has been done in British Columbia. The dependence of marbled murrelets on large, old-growth coniferous forests for nesting habitat is well-documented, particularly in the southern portions of their range (e.g., Manely et al. 1999, Burger and Waterhouse 2009, Burger et al. 2010). Marbled murrelets exhibit high breeding site fidelity and are likely to maintain traditional nesting sites as long as the stands retain suitable nesting structure and nesting is successful (Zharikov et al. 2006). Overall nest patch habitat quality is strongly dependent on large diameter trees, platform availability (limbs 15-75 cm [6-30”]), and moss development (Burger 2002, Waterhouse et al. 2009, Burger et al. 2010) as nests are simple depressions in the moss or duff. Nest trees are substantially larger than the surrounding stand (Manely et al 1999). Burger (2002) documented nests in trees from 66 to 370 cm [26-146”] in diameter. From examining nearly 30,000 trees, Burger et al. (2010) determined that tree size was the strongest predictor of nest platform availability, but that *minimum* tree size varied from >62 cm [25”] in many regions of British Columbia to >96 cm [38”] on East Vancouver Island. Roughly 72 percent of the trees with platforms contained sufficient epiphyte (moss) mats to facilitate nesting; tree species providing platforms varied by region.

Evidence on edge effects is seemingly contradictory. Surveys by van Rooyen et al. (2011) showed potential edge effects on epiphyte availability in the Coastal Western Hemlock and Mountain Hemlock biogeoclimatic zones in southwestern British Columbia. Forests adjacent to recent 5-11 year old clearcuts (hard edges) had substantially fewer trees with epiphyte cover than those ≥150m [492 ft] from the edge. Forest adjacent to older 17-39 year old regenerating cuts had somewhat higher levels of epiphytes, whereas those next to natural openings (rivers and avalanche chutes) had the highest levels of epiphyte cover and platform tree density. Ripple et al. (2003) on the coast of Oregon found less edge in successful nest stands and concluded that increased edge led to higher predation. Conversely, Burger (2002) documented nests near forest edges. Zharikov et al. (2006) also found that murrelets nested close to hard edges (i.e., clearcuts and roads) and that murrelets were able to successfully nest in small remnant patches of suitable old growth. They concluded that patch size was neither a consistent nor an important nesting habitat predictor. The above studies seem to indicate that murrelets will use edge habitat as long as a suitable habitat is available even though the number of epiphyte platforms may be less.

The amount of historic large tree (SD67) habitat is unknown and cannot be reconstructed from available information.

Direct and Indirect Effects Common to Action Alternatives

Measurement criteria: acres of large tree POG (SDM67) at all elevations.

Effects Common to Action Alternatives

Although marbled murrelets are common in the marine waters of southeast Alaska, no nests were found during numerous field reconnaissance trips or were birds observed flying inland from adjacent coastal waters. Nests are extremely difficult to locate (Waterhouse et al. 2007) and may have been missed without radio-telemetry or extensive surveys.

Direct impacts of logging on murrelet nesting habitat can be assumed because clear-cut logging and short (100-yr) timber rotation cycles, will permanently reduce murrelet nesting habitat in Southeast Alaska since trees in younger forests are much smaller and lack the large branches and epiphyte growth required for successful nesting sites (Cotter and Kirchhoff 2007). From looking at multiple studies in British Columbia and Washington, Burger and Waterhouse (2009) concluded that murrelets nest at low densities in suitable habitat, that populations usually exhibit a significant positive and linear relationship with available area of suitable habitat, and that in areas of reduced or fragmented habitat murrelets do not aggregate in the remaining habitat at higher densities. They caution however, that there is not a simple linear or threshold relationship between habitat quality and nest density and that there needs to be better understanding of regional response between habitat quality and nest density. Zharikov et al. (2006) also found that murrelet density did not increase in remaining fragments of suitable habitat and that patch size is not a good indicator of murrelet density.

The effects of fragmentation and edge on nesting success of murrelets remain unclear. Murrelet nesting habitat can be affected by edge, although research results vary and effects may decrease over time (van Rooyen et al. 2011, Cotter and Kirchhoff 2007, Zharikov et al. 2006, Ripple et al. 2003, Burger 2002). Patch size *per se* may not be an important or consistent predictor of nesting habitat (Zharikov et al. 2006). In studies by van Rooyen et al. (2011) natural-edged sites had the highest density of platform trees overall, while hard-edged sites had the lowest suggesting that the creation of artificial edges by forest fragmentation has negative consequences for epiphyte colonization, growth, and survival in western forests, and has the potential to reduce the availability of marbled murrelet nesting habitat. Burger (2002) documents multiple studies with inconsistent trends on nesting success near edges. Since murrelets nest in relatively low densities overall, as long as there are suitable nest platforms available, nest density and success may vary by locale, type of edge, and resultant change in predators or predation rates .Based upon available data, Burger (2002) suggests that total habitat area and habitat quality are more likely to affect murrelet populations than patch size. See Brown Creeper section for further discussion of edge effects and interior POG habitat.

Partial cutting was not a recommended forestry practice in marbled murrelet habitat in British Columbia as of 2010 and it is not known from available studies whether removal of some canopy trees affects the probability of nesting (Burger et al. 2010). Since murrelets generally nest in the largest trees in a stand, effects would likely be dependent upon individual harvest prescriptions.

Effects to marbled murrelet large tree POG habitat are displayed in Table 56.

Table 56 Effect on Marbled Murrelet Habitat[1], NFS Lands

		Acres (% reduction from *existing*)					
VCU	**Historic**	**Existing \ Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**
VCU 7460	??	709	643 (-9.3%)	696 (-1.8%)	583 (-17.8%)	573 (-19.2%)	607 (-14.4%)
VCU 7470	??	686	628 (-8.5%)	642 (-6.4%)	605 (-11.8%)	572 (-16.6%)	605 (-11.8%)
VCU 7530	??	531	531	531	531	531	531

			(0%)	(0%)	(0%)	(0%)	(0%)
VCUs Combined	??	1,927	1,802	1,869	1,719	1,676	1,743
			(-6.5%)	(-3.0%)	(-10.8%)	(-13.0%)	(-9.5%)

1. Acres of large-tree POG (SD67)

Alternative 1

Alternative 1 would have no effect on marbled murrelet habitat. Populations would remain at existing levels unless affected by natural causes or other outside factors.

Alternatives 2 through 6

All action alternatives would reduce nesting habitat containing large trees with large mossy-limbed branches and have a direct impact on marbled murrelets. However, multiple studies in British Columbia have shown that it is not a simple 1:1 relationship. Alternative 3 would have the least effect on existing habitat, followed by Alternative 2. Alternative 6 would have increased habitat loss followed closely by Alternative 4. Alternative 5 would have the greatest impact on nesting habitat and therefore the highest risk to murrelet populations.

Cumulative Effects

Cumulative effects to marbled murrelets come from past and recent timber harvest and road construction activities. It was not possible to reconstruct historic large tree POG from available information. Records indicate, and field reconnaissance confirms, that much of the historic harvested targeted higher volume stands, but it is unknown what the specific volume breakdown was. It was estimated that, Tongass-wide, 29 percent of the historic harvest was large tree SD67 POG (USDA 2008c Table 3.9-7 table note, p. 3-147), but that percentage may or may not hold true for the Saddle Lakes area. The 3,726 acres of Leask Lake clearcut harvest are not included in Table 37 as it is unknown what percentage of the harvest may have been large tree POG. The Ketchikan to Shelter Cove road clearing could affect approximately 16 acres POG (2 miles x 66 foot clearing width. The Swan Lake dam expansion may affect an additional 64 acres of high-POG habitat. Either impact is dependent upon final construction design.

Summary of Marbled Murrelet Effects

Historic conditions for large-tree SD67 POG cannot be reconstructed from currently available information. From field recon, it appears that early logging targeted larger, higher volume stands, but harvest ranged from volume classes five through seven. Therefore, although suitable habitat has been reduced, it is uncertain how marbled murrelets have been affected. Harvest proposed under the Saddle Lakes project would decrease existing habitat by 2 percent under Alternative 3 to 19 percent under Alternative 5. Alternative 1 has the lowest risk to marbled murrelets followed by Alternatives 3, 2, 6, 4, and 5.

Neotropical Migratory Birds

Direction: The Migratory Bird Treaty Act of 1918 (amended in 1936 and 1972) 16 U.S.C. 703; Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds; Memorandum of Understanding USFS/USFWS MOU 08-MU-1113-2400-264.

Introduction and Habitat correlation to the affected environment

The Migratory Bird Treaty Act of 1918 (MBTA; amended in 1936 and 1972) prohibits the taking of migratory birds, unless authorized by the Secretary of Interior. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of resident and migratory birds and their habitats and requires the evaluation of the effects of federal actions on migratory birds, with an emphasis on species of concern. Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions (USDA 2008c p. 3-244, MOU 08-MU-1113-2400-264). Under the MBTA, "take" has the same meaning as defined in 50 C.F.R. § 10.12 and means to "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect".

Neotropical migratory birds (herein migratory birds) are far ranging species that require a diversity of habitats for foraging, breeding, and wintering. Included in the broad category of visitants and migratory birds are Neotropical migrants that winter south of the Tropic of Cancer in Mexico, Central and South America, and the Caribbean. Other migrant species from Southeast Alaska winter in Canada, the lower 48 states, and northern Mexico. Most migratory birds in Alaska fly to the interior or northern Alaska and only pass through southeast Alaska on their way to the breeding grounds (USDA 2008c, p. 3-244).

An authoritative list of species occurring in the Ketchikan area (Revillagigedo Island) has been prepared (Heinl and Piston 2009). Of the roughly 150 bird species that regularly occur in the Ketchikan area on an annual basis, only 37 species (25%) are resident year round (Heinl and Piston 2009). The remaining 113 species (75%) occur as summer or winter visitants, or primarily during migration; 70 species (47%) are confirmed breeders in the region.

Twenty bird species are identified as species of concern in Southeast Alaska by the Boreal Partners in Flight program (BPIF 1999; USDA 2008c, Table 3.10-3, pp. 3-247 & 3-248). The USFWS lists another 29 species of conservation concern for Southeast Alaska (USFWS 2008). Sixteen of these species are linked to hemlock/spruce/cedar forest and could be affected by the proposed timber harvest. Four species are linked to shrub thickets and could be affected by stem exclusion. For other species, important habitats include, marshes, cliff bluffs and screes, moraines, alluvia and barrier islands, beach and tidal flats, rocky shores and reefs and inshore and offshore waters. Species present in the Ketchikan area are shown in Table 57. Refer to the FP FEIS (USDA 2008c pp. 3-244 through 3-248) for additional information on migratory birds.

Table 57. Migratory Bird Species of Conservation Concern

Common Name	Scientific Name	Habitat[1]	Abundance	BPIF (1999)	USFWS (2008)
MacGillivray's warbler	*Oporornis tolmiei*	1	uncommon	X	
Golden-crowned kinglet	*Regulus satrapa*	2,3	common	X	
Golden-crowned sparrow	*Zonotrichia atricapilla*	1	fairly common	X	
Varied thrush	*Ixoreus naevius*	1,2,3	abundant	X	
Northern goshawk	*Accipiter gentilis*	2	rare		X
Blackpoll warbler	*Dendroica striata*	2	rare	X	
Dusky grouse	*Dendragapus obscurus*	2,3	rare	X	
Western screech-owl	*Megascops kennicottii*	2	uncommon	X	
Vaux's swift	*Chaetura vauxi*	2	uncommon	X	
Red-breasted sapsucker	*Sphyrapicus ruber*	2	uncommon	X	
Hammond's flycatcher	*Empidonax hammondii*	2,3	uncommon	X	
Marbled murrelet	*Brachyramphus marmoratus*	2	common		X
Rufous hummingbird	*Selasphorus rufus*	2	common	X	X
Pacific-slope flycatcher	*Empidonax difficilis*	2,3	common	X	
Townsend's warbler	*Dendroica townsendi*	2,3	common	X	
Steller's jay	*Cyanocitta stelleri*	2	abundant	X	
Chestnut-backed chickadee	*Poecile rufescens*	2	abundant	X	
Northwestern crow	*Corvus caurinus*	2,6,7,8	abundant	X	
Olive-sided flycatcher	*Contopus cooperi*	3	uncommon	X	X
Western wood-pewee	*Contopus sordidulus*	3	uncommon	X	
American dipper	*Cinclus mexicanus*	4,5	fairly common	X	
Peregrine falcon	*Falco peregrinus*	5	rare		X
Black swift	*Cypseloides niger borealis*	5	uncommon	X	
Pelagic cormorant	*Phalacrocorax pelagicus*	5,8,9	fairly common		X
Hudsonian Godwit	*Limosa haemastica*	7	rare		X
Marbled godwit	*Limosa fedoa*	7	rare		X
Red knot	*Calidris canutus*	7	rare		X
Black oystercatcher	*Haematopus bachmani*	7,8	rare		X
Solitary sandpiper	*Tringa solitaria*	7	uncommon		X
Whimbrel	*Numenius phaeopus*	7	uncommon		X
Horned grebe	*Podiceps auritus cornutus*	7,9	uncommon		X
Lesser yellowlegs	*Tringa flavipes*	7,9	uncommon		X
Short-billed dowitcher	*Limnodromus griseus*	7,9	fairly common		X
Dunlin	*Calidris alpina*	7	common		X
Bristle-thighed Curlew	*Numenius tahitiensis*	7	casual		X
Bar-tailed Godwit	*Limosa lapponica*	7	casual		X
Buff-breasted Sandpiper	*Tryngites subruficollis*	7	casual		X
Rock sandpiper	*Calidris ptilocnemis*	8	uncommon		X
Yellow-billed loon	*Gavia adamsii*	9	rare		X
Laysan albatross	*Phoebastria immutabilis*	9	rare		X
Red-throated loon	*Gavia stellata*	9	fairly common		X
Black-footed albatross	*Phoebastria nigripes*	9	common		X

1. 1=shrub thicket; 2=hemlock/Sitka spruce/cedar forest; 3=mixed deciduous/spruce woodland; 4=fluvial waters; 5=cliffs, bluffs, and screes; 6=moraines, alluvia, and barrier islands; 7=beaches and tidal flats; 8=rocky shores and reefs; 9. Lakes or marine waters.

Direct and Indirect Effects

Alternative 1

Alternative 1 would maintain all existing habitat for neotropical migratory birds and have no effect.

Alternatives 2 through 6

Direct habitat and disturbance related effects to migratory birds would occur under alternatives 2 through 6. As with other species, clearcut harvest would have the greatest impacts on habitat. The primary effect to birds would be nest destruction or abandonment if management activities occur in suitable nesting habitat during the breeding/nesting period, which generally begins April 15 and continues until July 15 when young birds have fledged (USFWS 2009b). The normal timber operating season is April 1 through November, but activities may occur outside this season if weather permits. Therefore, there is substantial overlap with the nesting period of migratory birds and impacts are likely.

Species most likely to be affected are those that nest in hemlock/Sitka spruce forests (e.g., chestnut-backed chickadee, Pacific-slope flycatcher) where timber harvest occurs, and thus the amount of harvest proposed under the alternatives is a measure of the extent of potential effects (USDA 2008c pp. 3-288 & 3-289). Changes in POG habitat can be used to assess changes in nesting habitat for migratory bird species that use hemlock/spruce/cedar forest as primary or secondary habitats. POG would be reduced by up to 14 percent (see MIS section above for discussion of various POG habitats). Other effects of timber harvest and associated activities include the fragmentation and patch size reduction of suitable habitat. For species such as the Townsend's warbler, habitat removal would potentially reduce the effectiveness of interior habitat (up to 15 percent reduction and increase the potential for nest-site predation from avian predators that are associated with forest edges and fragmented landscapes (see Brown Creeper section above and USDA 2008b p. 3-288). Nesting birds that are repeatedly disturbed by people in proximity to the nest could abandon the effort.

Species that utilize early successional or shrub habitats such as McGillivray's warbler, golden-crowned sparrow, and golden-crowned kinglet may benefit in the short to mid-term from the proposed timber harvest due to the creation of new habitat. Habitat would be reduced with the onset of stem exclusion. Impacts to species using other habitats would either be negligible at the population level (road building in muskeg) or non-existent (riparian, tide flats, coastal beaches).

Suitable habitat is maintained for neotropical migratory birds in the OGRs, beach and stream buffers, and other areas deferred from harvest. While the Saddle Lakes project may affect habitat for neotropical migratory birds, "take" is not anticipated.

Cumulative Effects

Alternative 1

The Saddle Lakes Alternative 1 would not contribute to neotropical migratory bird cumulative effects. Previously harvested habitat would remain unsuitable for many species into the long term future.

Alternatives 2 through 6

Past activities have removed habitat suitable for forest related migratory birds. Impacts to POG habitat would be similar to MIS discussions above. POG would be reduced by up to 33 percent from historic levels. Habitat for species such as Townsend's warbler and brown creeper that are affected by edge would be reduced by up to 76 percent from historic levels.

Summary of Migratory Bird Effects

None of the alternatives are anticipated to impact migratory bird populations, although individuals and their nests may be impacted. Suitable habitat is maintained for neotropical migratory birds at the Revillagigedo Island scale in Old Growth Reserves, IRAs, beach and stream buffers, and other areas deferred from harvest.

Design Features and Mitigation Measures

Alternative 3 was designed to minimize impacts to wildlife by deferring many high value units. There is no wildlife cost of doing so as existing old-growth stands are maintained in their existing state. The FP FEIS (USDA 2008c) and the references in the analysis above support the importance of old-growth habitat to Tongass MIS and other species of interest.

Mitigation: adjust unit boundaries to implement 500 foot buffers around confirmed bear dens units 64, 116, and 123.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives would be in compliance with ESA, MMPA, and Bald Eagle Regulations.

Alternatives 1, 2, and 3 meet all regulations for wildlife. Alternatives 1, 2, and 3 do not maintain deer densities of 18 deer/mi^2 (USDA 2008b WILD1.XIV, p. 4-95). Project area WAAs 406 and 407 were historically at or above 18 deer/mi^2, but are currently below the standard and guideline. Alternative 1 does not contribute to further declines, but Alternatives 2 , 3, 4, 5, and 6 would reduce deer density further below 18 deer/mi^2.

Alternatives 4, 5, and 6 do not implement key elevational connectivity corridors (WILD1.B.2) within the Modified Landscape LUD where connectivity is currently limited. An example is Units 203/204/207/224 on the south end of the project area. This is the only remaining POG corridor connecting high elevation with the beach buffer within a six mile or greater area. According to the Forest Plan (USDA 2008b, p. 1-3), for all projects and activities considered, the standards and guidelines for each management prescription will be used, regardless of the levels of outputs or numbers of projects achieved, and regardless of actual budget allocations. Therefore, a Forest Plan amendment would be required to not implement elevational corridors within the Modified Landscape LUD under Alternatives 4, 5, or 6.

Alternative 5 would move the existing small OGR in 7470 into 2001 Roadless and would require a Forest Plan amendment. The alternative location is not biologically comparable based upon biological criteria in the Forest Plan (USDA 2008b Appendix K) and FP FEIS (USDA 2008c Appendix D.)

Other Relevant Mandatory Disclosures

Loss of old growth wildlife habitat is an irreversible commitment of resources (USDA 2008c, p. 3-2). The stem exclusion phase of young growth may last for 150+ years. Silvicultural thinning may enhance understory productivity in young growth, but no data exists that suggest that silvicultural thinnings or timber rotations less than 200 years will measurably increase either the diversity or productivity of understory vegetation over that present in old-growth forests (Alaback 1984). The greatest variation in stand structure, including multi-storied canopies important to many wildlife species, occur in stands greater than 200 years old (Alaback 1982). Following complete removal of the overstory [such as through clearcutting], it may take 300 years or more for stands to develop old growth ecological characteristics (Orians and Schoen 2013, discussion under photo 12). Under the current Forest Plan 100 year rotation, young growth timber in development LUDs, or more specifically the Modified Landscape and Timber Production LUDs within the Saddle Lakes project area, will be re-harvested before the stands develop old-growth characteristics. Therefore, timber harvest represents a permanent loss of old-growth habitat within development LUDs and a permanent loss of habitat capability to support wildlife populations.

Summary of Effects

Clearcut even-age prescriptions proposed under all action alternatives would reduce habitat for management indicator species, species of concern, and R10 Sensitive species for at least 150 years or permanently under the current 100 timber rotation. Effects of partial cutting vary by species, amount of basal area removed, and spatial arrangement of treatment (individual trees, groups, etc.).

While road densities may not have been an issue in the past, completion of the Ketchikan to Shelter Cove Road will connect the communities of Saxman and Ketchikan to the Saddle Lakes area. This will likely lead to increased hunting and trapping within the area and could lead to overharvest of wolves and marten. Hunting and trapping restrictions could be required in the future if pelt prices increase from current low levels.

Monitoring Recommendations

Continue to monitor the Saddle Lakes project area for goshawk presence.

Subsistence

Introduction

The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, mandates that rural residents of Alaska, including both Natives and non-Natives, be given a priority for subsistence uses of fish and wildlife. While there are a variety of cultural, popular, and sociological definitions and interpretations of subsistence, Congress addressed this subject in Title VIII of the 1980 Alaska National Interest Lands Conservation Act (ANILCA). Section 803 of ANILCA defines subsistence use as:

> "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of National Forest System land in Alaska, to evaluate the potential effects on subsistence uses and needs. This analysis typically focuses on food-related resources that are most likely to be affected by habitat loss or alteration associated with land management activities. Specific notice and determination procedures are required should there be a significant possibility of a significant restriction of subsistence uses.

There are two commonly used definitions for determining if an action would “significantly restrict subsistence use” (USDA 2008c p. 3-427). The Alaska Land Use Council’s definition:

> “A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions or stipulations, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources.”

The second definition is in the U.S. District Court Decision in *Kunaknana v. Watt*:

> “restriction for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites, or major increases in non-rural resident hunting”.

Affected Environment

The Saddle Lakes project area and WAAs 406/407 fall within the community use areas of Metlakatla, Saxman, and Ketchikan. Metlakatla and Saxman are classified as rural and receive subsistence priorities under ANILCA. Ketchikan is classified as a non-rural community and residents do not have a subsistence priority under ANILCA. Redetermination of Saxman as a non-rural community is currently on hold pending further analysis of the redetermination process by the Federal Subsistence Board (FSB).

Subsistence use areas vary by community, but the highest use generally occurs within a 15-mile radius of the community (USDA 2008c, p. 3-426). Subsistence users typically hunt and fish in ways to efficiently optimize food output per investment of effort and money. However, special trips to more distant parts of the community use area occur seasonally for special resources, or on certain years when local fish and game are scarce (Wolfe 2004). More extensive areas beyond the intensively used core are occasionally used. Intensive uses of core areas result from the economic need to be efficient. Wolfe (2004) contrasts the difference between sport hunting and subsistence objectives: sport hunting commonly promotes principles of “fair chase,” high-quality hunts, and greater opportunities for participation by other sportsmen. Less emphasis is placed on using the most efficient harvest method or on distance traveled.

Salmon and other finfish, shellfish, marine plants and mammals, terrestrial wildlife including deer and other mammals, as well as berries, cedar bark, and timber are all subsistence resources harvested by rural communities in Southeast Alaska.

Community Profiles

Subsistence research conducted in Southeast Alaska over the past two decades has included detailed community studies, use area mapping, household surveys, and studies of specific subsistence harvests. The Tongass Resource Use Cooperative Survey (TRUCS) was completed in 1988. The 1997 Forest Plan provided a comprehensive analysis of subsistence resources and potential effects, both Tongass-wide and for each rural community of Southeast Alaska. Detailed community use information is available in the 1997 Forest Plan FEIS (USDA 1997a, pp. 3-419 thru 3-435, 3-575 thru 3-714, and Appendix H). Additional information is presented in the FP FEIS (USDA 2008c, pp. 3-419 through 3-433).

Metlakatla

Metlakatla is located on Annette Island, 15 miles south of Ketchikan. Annette Island is a Federal Indian Reservation and Metlakatla a traditional Tsimshian community with a subsistence lifestyle. Metlakatla Indian Community is a Federally Recognized Tribe.

The majority (70 percent) of deer harvest by Metlakatla residents takes place in three WAAs (101, 202, and 405) located in the vicinity of the community (USDA 2008c, p. 3-649); therefore, while some Metlakatla residents may hunt in the Saddle Lakes area, it is currently not a major use area for deer.

Metlakatla residents harvest an average of 70.2 pounds of wild resources per person per year. Fish and other marine invertebrates comprised 75 percent of the total harvest; land mammals comprised 15 percent with minimal use other than deer (ADF&G 1999). Deer comprised 10.65 pounds/person or 15.2 percent of harvested resources. Birds and eggs accounted for 1.6 percent, [mountain] goat 0.1 percent, black bear ≤0.1 percent, and small land mammals 0.0 percent (ADF&G 1999).

Saxman

Saxman is located two miles south of Ketchikan on the South Tongass Highway. Tlingits from the old villages of Tongass and Cape Fox resettled at the present site of Saxman in 1894. Today Saxman continues as a predominantly Tlingit community, with its own city and tribal governing bodies. The Organized Village of Saxman is a Federally Recognized Tribe.

WAA 406 is one of the areas where Saxman residents obtain approximately 75 percent of their annual deer harvest. With the completion of the Ketchikan to Shelter Cove road, use within this area is expected to increase.

The 1988 TRUCS study found that marine resources (fish and marine invertebrates) accounted for 71 percent of per capita subsistence harvest in Saxman in 1987; deer accounted for 18 percent, and small mammals accounted for 0 percent. Subsistence use information for Saxman was updated by ADF&G in 2000. Fish and marine invertebrates made up 70.4 percent of the harvest in 1999 with all land mammals (including deer) dropping from 21.9 percent to 13.3 percent (ADF&G 2000). Birds and eggs comprised <0.1 percent.

Ketchikan

Ketchikan is classified as non-rural and does not have subsistence priority under ANILCA. However, many Ketchikan residents use the Tongass National Forest for hunting and fishing. The first Ketchikan residents were Tlingit members of the Tongass Tribe (Garza et al. 2006). Ketchikan became a European town in 1880 when the first cannery was built.

WAAs 406 and 407 are two of the areas where Ketchikan residents obtain approximately 75 percent of their annual deer harvest. With the completion of the Ketchikan to Shelter Cove road, use within these WAAs is expected to increase.

No comprehensive household harvest survey has been conducted for Ketchikan. In 2006, Ketchikan Indian Community (KIC) conducted their own survey. KIC used ADF&G standard household survey protocols and adapted the household survey questions used in Saxman (Garza et al. 2006). According to the survey results, Ketchikan residents harvest an average of 90.4 pounds of wild resources per person per year. Of that, 79 percent of the harvest was fish and marine invertebrates, and land mammals comprised 15 percent. Deer are the most important land mammal and averaged 10.49 pounds/person or roughly 12 percent of harvested resources. Black bear accounted for 0.5 percent, [mountain] goat 0.2 percent, and birds and eggs 0.1 percent.

Effects on Wildlife Subsistence Resources

ANILCA requires the analysis of the potential effects on subsistence uses of all actions on federal lands in Alaska. This analysis most commonly focuses on those food-related resources most likely to be affected by habitat alteration associated with land management activities.

Marine resources account for more than half of total per capita harvest in all Southeast Alaska communities. As a result, management activities that restrict access for subsistence harvest of land mammals have had a relatively small effect on overall subsistence harvest by weight (USDA 2008c, p. 3-424). The 1997 Forest Plan Record of Decision determined that, Forest-wide, under full implementation of the plan, the only subsistence resource likely to be significantly affected was Sitka black-tailed deer (USDA 1997a, p. 38). This finding was confirmed for the selected alternative in the 2008 Record of Decision (USDA 2008a, p. 61).

Effects to deer are discussed below. Subsistence use of other mammals, such as bear or marten, were minimal for Saxman or Metlakatla. Although harvest may be for subsistence purposes, the Federal Subsistence Board does not issue separate federal registration permits for any resource within the Saddle Lakes area or WAAs 406 or 407. Subsistence users must comply with all State of Alaska licensing, permitting, and reporting requirements.

Three factors related to subsistence uses are specifically identified by ANILCA: 1) resource distribution and abundance, 2) access to resources, and 3) competition for the use of resources.

Distribution and Abundance of Deer

Deer populations on Revillagigedo Island are thought to be at very low levels (Porter 2013a). Populations fluctuate seasonally in response to winter weather and predation and long-term in response to clearcutting. Under all alternatives, including the no action alternative, deer habitat capability will decrease as a result of proposed harvest and existing second growth stands entering the stem exclusion stage. The possibility of a change in abundance or distribution would be roughly the same for Alternatives 2, 4, and 6, slightly less for Alternative 3, and slightly more for Alternative 5.

The Saddle Lakes project could permanently reduce modelled deer habitat capability (DHC) by 1 to 8 percent from existing condition and by up to 61 percent from historic habitat capabilities (see MIS Table 14 and Table 16). This in turn, could lead to long-term non-linear reductions in deer abundance and make fewer deer available to subsistence users. The stem exclusion effect from clearcutting would override the short-term increase of forage. Reference the Sitka Black-tail Deer MIS Section for more information.

Some localized shifts in deer distribution could occur in response to the disturbance caused by harvest activities and the reduction in POG forest and habitat connectivity. However, this is not expect to change overall distribution within WAAs 406 or 407 or cause emigration to adjacent WAAs since most deer remain within a single watershed (Colson et al. 2012, BC Ministry of Forests 1996, McNay and Vollner 1995). Deer may be restricted to the remaining old-growth habitat once stem exclusion occurs. Under Alternative 5, and to a slightly lesser extent under

Alternatives 4, 6, 2, and 3, the proposed timber harvest would remove existing “leave strips” of POG between past harvest units. Remaining POG would be further away from roads so deer could be less accessible to hunters or require more effort to obtain.

Access to Deer:

ANILCA Section 811 states that rural residents engaged in subsistence uses shall have reasonable access to subsistence resources on the public lands. None of the alternatives would limit the use of public lands for the purposes of subsistence gathering activities.

Beach access would not be affected by the Saddle Lakes project. Initial access to most deer hunting within WAA 406 is currently by boat, but road systems are used to access additional areas. WAA 407 is accessed by boat in the George Inlet area, but the western portion can be accessed by vehicle via Revilla Road, Brown Mountain Road, and Tongass Highway. Additional roads exist in WAA 407on Cape Fox Corporation land, but most are not open to the general public.

The 2008 KMRD Access Travel Management Plan (ATM) Decision Notice And Finding of No Significant Impact determined which roads on Revillagigedo Island would remain open to public use. Roads closed under the ATM decision are technically closed already, even though not all physical barriers have been installed to date. The Saddle Lakes project decision will update the ATM to include project constructed roads, but would not change access decisions made in the ATM. Roads constructed for the Saddle Lakes timber sale would be closed post-sale except for road 8300280 that overlaps the State Ketchikan to Shelter Cove Road. Closed roads would provide easier walk-in access for hunters until such time as brush and alder make the roads impassable. Total impassability from brush is not expected to occur within the foreseeable future.

The Brinkman et al (2009) study of road effects on hunting on nearby Prince of Wales Island found that most hunters reported that the presence of roads increased their hunting success and decreased their effort. However, their perceptions of the effect of road closures on hunting success and effort were mixed. Hunters generally believed that roads had a negative effect on deer populations and that road closures had a positive effect. Many added that hunting is better on new roads because of increased access to previously remote deer habitat and because new roads are usually located next to young (2-5 year old) clear-cut forest, a preferred habitat type for hunting deer. Nonetheless, hunters perceived a decline in hunt quality along roads over time because of increased hunting pressure and forest regrowth (stem exclusion) next to roads.

The Ketchikan to Shelter Cove Road will connect will connect WAA 406 west of Carroll Inlet and additional areas in WAA 407 (including the Saddle Lakes area) to the communities of Saxman and Ketchikan. This additional road access is expected to increase hunting pressure within the Saddle Lakes project area. All communities having new road access to previously under-utilized subsistence areas have capitalized on the opportunity to expand their hunt area. Some access may shift from boats to vehicles. Subsistence use from Metlakatla may also expand given the daily ferry service between Metlakatla and Ketchikan. In addition, the Ketchikan to Shelter Cove Road will make access less weather dependent.

Competition for Deer

For analyzing competition, the following assumptions are made consistent with the FP FEIS (p. 3-432):

- Habitat reductions will result in increased competition if regulations allow sport use to remain constant, with the same number of users seeking fewer huntable resources.
- The demand for resources will remain constant or increase slightly as the habitat capability remains the same or declines over time.

Changes in deer abundance resulting from timber harvest and increased road access to deer by both rural and non-rural hunters, combined with a potential increase in hunter demand for deer, may affect competition for deer between Federally qualified subsistence users and non-subsistence "sport" hunters in the Saddle Lakes area. Increased competition may also result when less expensive access to the area, such as the State Ketchikan to Shelter Cove road, or within the area is provided. Such is the case when road systems are established to local communities (USDA 2008c, p. 3-421).

Over 90 percent of GMU 1A hunters are local residents living within GMU 1A (Porter 2013a). From the 1999 subsistence data, Saxman residents harvested an estimated 198 deer whereas non-rural Ketchikan residents harvested 760 deer in GMU 1A (ADF&G 1999). Similar trends are assumed for more recent years, but cannot be obtained from harvest reports as some Saxman residents have Ketchikan mailing addresses. ADF&G has recently gone to mandatory reporting by all deer hunters which, over time, will provide better information.

Because actual hunter demand is unknown, ADF&G deer harvest survey reports were used in this analysis to estimate the hunter demand. While these reports were extrapolated from random surveys for many years, the data provides the best available information and contain more recent data than Forest Plan projections. I used the average total number of hunters times two deer per hunter to estimate demand. This may be a slightly conservative approach since not all hunters are successful, and actual harvests are less. Some hunters may hunt in more than one WAA or GMU. For example, some hunters may hunt both George and Carroll Inlets (WAA 406 and 407) or do so once the Ketchikan to Shelter Cove Road is completed.

The average total number of hunters in WAA 406 from 2002-2011 (95) times 2 deer/hunter was used to represent hunter demand (190 deer). The average number of hunters in WAA 407 from 2002-2011 (71) times average successful harvest (2 deer/hunter) was used to represent hunter demand (142 deer). ADF&G deer harvest survey results for WAA 406 (email from B. Porter, 08/19/2013) show an average of 56 deer/year being harvested from 2002-2011; harvest averaged 0.6 deer per hunter or 1.6 deer per successful hunter. WAA 407 received less use with an average of 21 deer harvested; harvest averaged 0.3 deer per hunter or 1.1 deer per successful hunter.

After including predation in the deer model since wolves and bear are present in the Saddle Lakes WAAs, a demand of 190 deer equates to 8 percent of the historic habitat capability in WAA 406 (Table 58). Hunter demand equates to 12 percent of the existing habitat capability in WAA 406. A demand of 142 deer equates to 9 percent of the historic habitat capability in WAA 407. Demand equates to 21 percent of the existing habitat capability in WAA 407.

Table 58. Estimated Deer Demand as a Percent of Deer Habitat Capability[1]

		DHC adjusted for predation[1] (Hunter demand as % of DHC)						
		Historic	Existing \ Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
WAA 406	0-25 years	2,284 (8%)	1,613 (12%)	1,588 (12%)	1,603 (12%)	1,587 (12%)	1,582 (12%)	1,590 (12%)

	26-150 years		1,564 (12%)	1,533 (12%)	1,557 (12%)	1,530 (12%)	1,522 (12%)	1,536 (12%)
WAA 407	0-25 years	1,578 (9%)	669 (21%)	649 (22%)	657 (22%)	646 (22%)	638 (22%)	647 (22%)
	26-150 years		652 (22%)	626 (23%)	637 (22%)	621 (23%)	611 (23%)	623 (23%)
WAAs 406/407	0-25 years	3,861 (9%)	2,280 (15%)	2,237 (15%)	2,260 (15%)	2,233 (15%)	2,220 (15%)	2,237 (15%)
	26-150 years		2,215 (15%)	2,159 (15%)	2,193 (15%)	2,152 (15%)	2,133 (16%)	2,159 (15%)

1. Deer Habitat Capability (DHC) was reduced by 36% to account for predation per current direction. All harvest was modelled as clearcut and non-NFS lands were given zero value.

A deer population at carrying capacity should be able to support a hunter harvest of approximately 10 percent of the habitat capability that is sustainable and provides a reasonably high-level of hunter success (USDA 1997b, p. 3-596, USDA 2008c, pp. 3-428). Hunter success can be expected to decline when demand represents 10 to 20 percent of habitat capability, and if demand exceeds 20 percent of habitat capability, harvest of deer by hunters may be restricted, either directly through restrictions in seasons and bag limits, or indirectly through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates.

All alternatives would have less than 1 percent change initially and at stem exclusion in WAA 406. Demand would remain at approximately 12 percent of habitat capability under the current scenario, but this percentage could increase with the State road connection (see Access section below). Actual increase may be offset by already low deer populations in GMU 1A that are causing some hunters to hunt elsewhere (see Porter 2013a). Hunters in areas where demand is between 10 to 20 percent of habitat capability may experience moderate difficulty in obtaining deer. Hunter may have to spend more time and effort and/or success may decline.

All alternatives would have a 1 percent change initially in WAA 407. Demand would increase initially from 21 to 22 percent of habitat capability. Over the long-term, the proposed harvest would develop into stem exclusion and further reduce habitat capability. Assuming demand remains relatively stable, demand at stem exclusion would equal 22 to 23 percent of habitat capability within WAA 407. However, similar to WAA 406, demand may increase with increased access. Current and projected deer demand in WAA 407 is at the level (>20%) at which deer harvest may be restricted, either directly through restrictions in seasons and bag limits, or indirectly through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates. This appears to fit with the harvest survey data in that WAA 407 has a lower success rate than WAA 406. Based upon the 2002-2011 harvest data averages (Porter 2013b), 38 percent of all hunters were successful in WAA 406 whereas only 23 percent were successful in WAA 407. These numbers should be used with caution, however, since hunters may not hunt for a variety of reasons.

Trends are not likely to change as a result of the Saddle Lakes project. Non-rural Ketchikan hunters are expected to harvest the majority of deer taken from WAAs 406 and 407. Therefore, reductions in habitat capability to support deer will lead to increased competition between rural and non-rural hunters for available resources. According to the 2013 ADF&G Deer Management Report, GMU 1A deer numbers are no longer meeting local hunter demands (Porter 2013a). With additional loss of habitat due to timber harvest, ADF&G expects to see long-term negative effects on deer numbers and hunter success in most areas near Ketchikan (Porter 2013a).

Demand may also increase with the road connection to Ketchikan. Use from Metlakatla may increase causing additional completion between rural subsistence users. Additional non-rural and non-resident hunters may hunt the area given the easy access to and from Ketchikan. If future restrictions are necessary due to increased demand and less deer, then Ketchikan and other non-rural hunters would be restricted first. If further restrictions become necessary, then a positive "customary and traditional use" determination could be made for Saxman and potentially Metlakatla restricting other subsistence.

Findings

Consistent with Section 810 of ANILCA, the Saddle Lakes project area was evaluated for potential effects on subsistence, as described above.

This evaluation concludes that the proposed timber harvest and associated activities, in conjunction with past projects may have a significant possibility of a significant restriction of subsistence deer use. The Saddle Lakes project would reduce the abundance and distribution of deer which could increase competition between users. Modelled habitat capability would be reduced by up to 8 percent from existing condition and up to 61 percent from historic condition. Hunter demand would be greater than 20 percent of habitat capability in WAA 407 and would be between 10 – 20 percent in WAA 406. In addition, hunting use patterns could change with the completion of the Ketchikan to Shelter Cove Road, increasing hunter demand and/or the amount of competition in the area. If necessary, sport hunting restrictions would occur first (primarily affecting Ketchikan residents), followed by selective subsistence reductions (e.g., more restrictive customary and traditional use determinations). See ANILCA Section 804 for additional details.

To be in compliance with ANILCA, and consistent with current Forest policy (FSH 2090.23), the following actions are required as a result of the finding of a significant possibility of a significant restriction:

a. The proposed action should be modified to remove the significant restriction finding; or
b. The process be stopped for that action and the action prohibited, or
c. After notifying the Regional Forester and requesting concurrence, proceed to Notice and Hearings (described below).

Notice and Hearings

If the responsible line officer decides to proceed, the official shall:

1. Give notice to the Alaska Department of Fish and Game (for wildlife and fisheries subsistence uses);
2. Give notice to the appropriate Subsistence Regional Advisory Councils and Local Fish and Game Advisory Committees (for wildlife and fisheries subsistence uses); and,
3. Give notice and hold a public hearing in the vicinity of the area involved.

Notice shall not be less than 30 days and may be extended. Notices in 1, 2, and 3, above may run concurrently.

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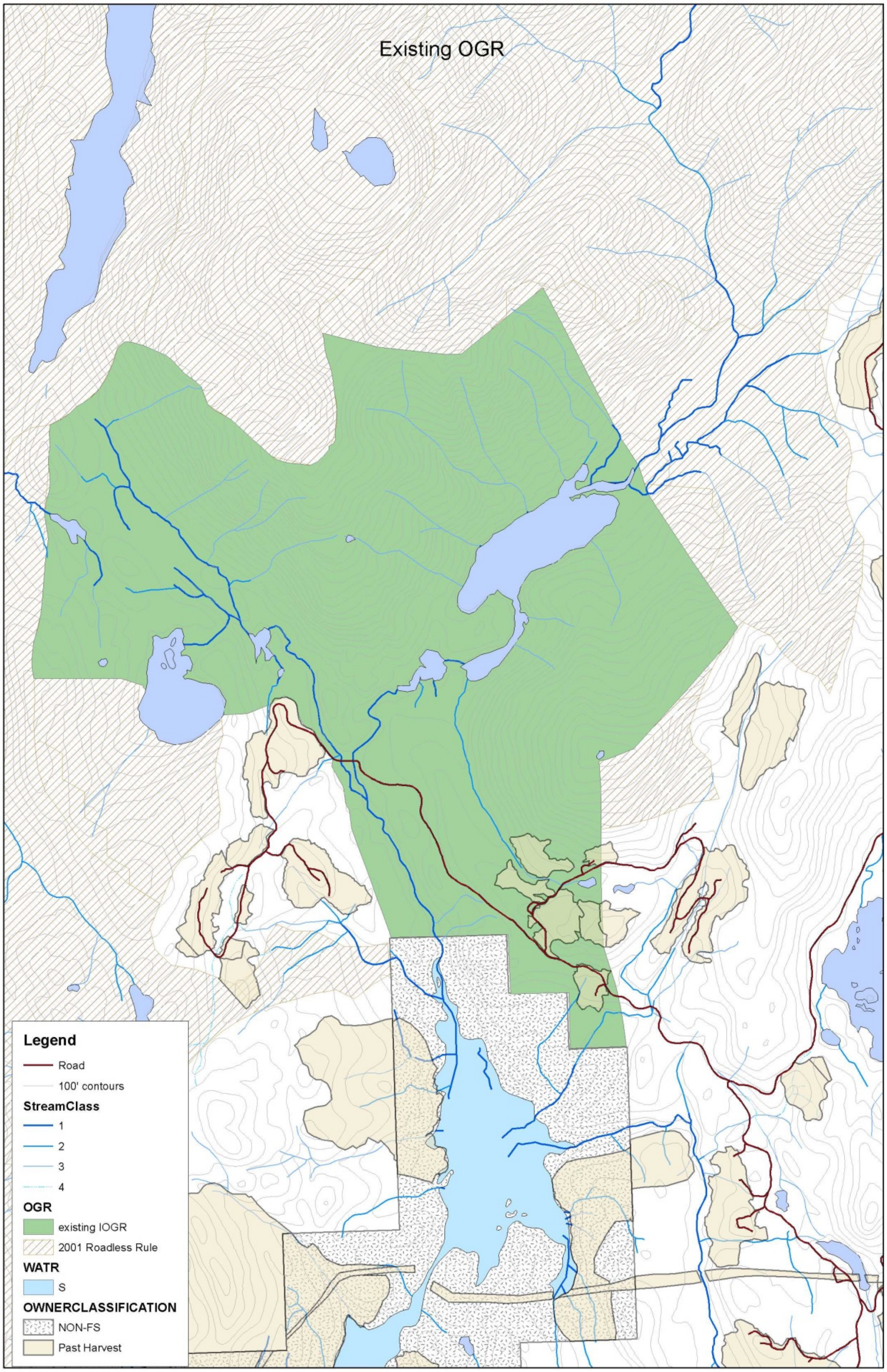
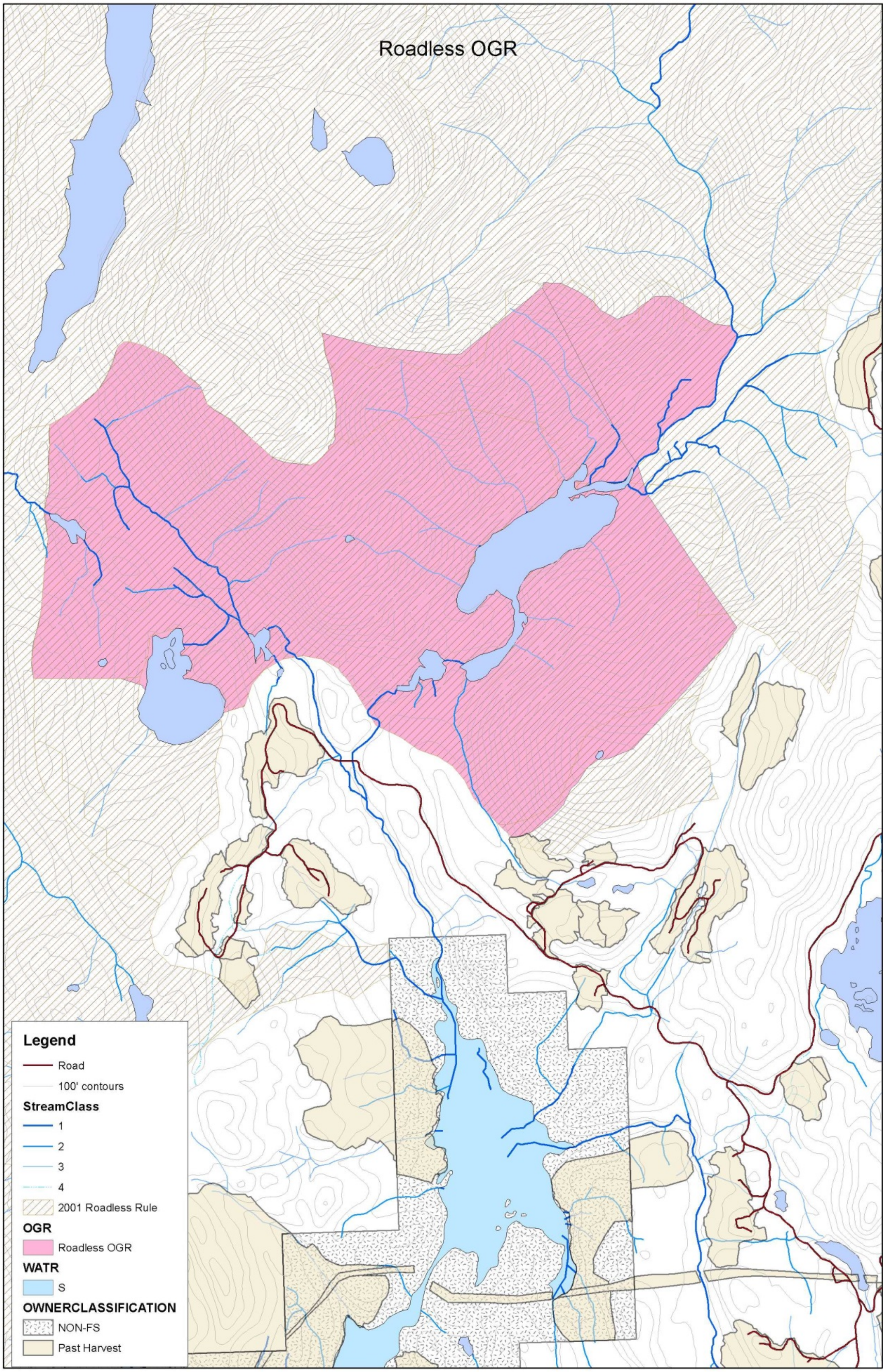
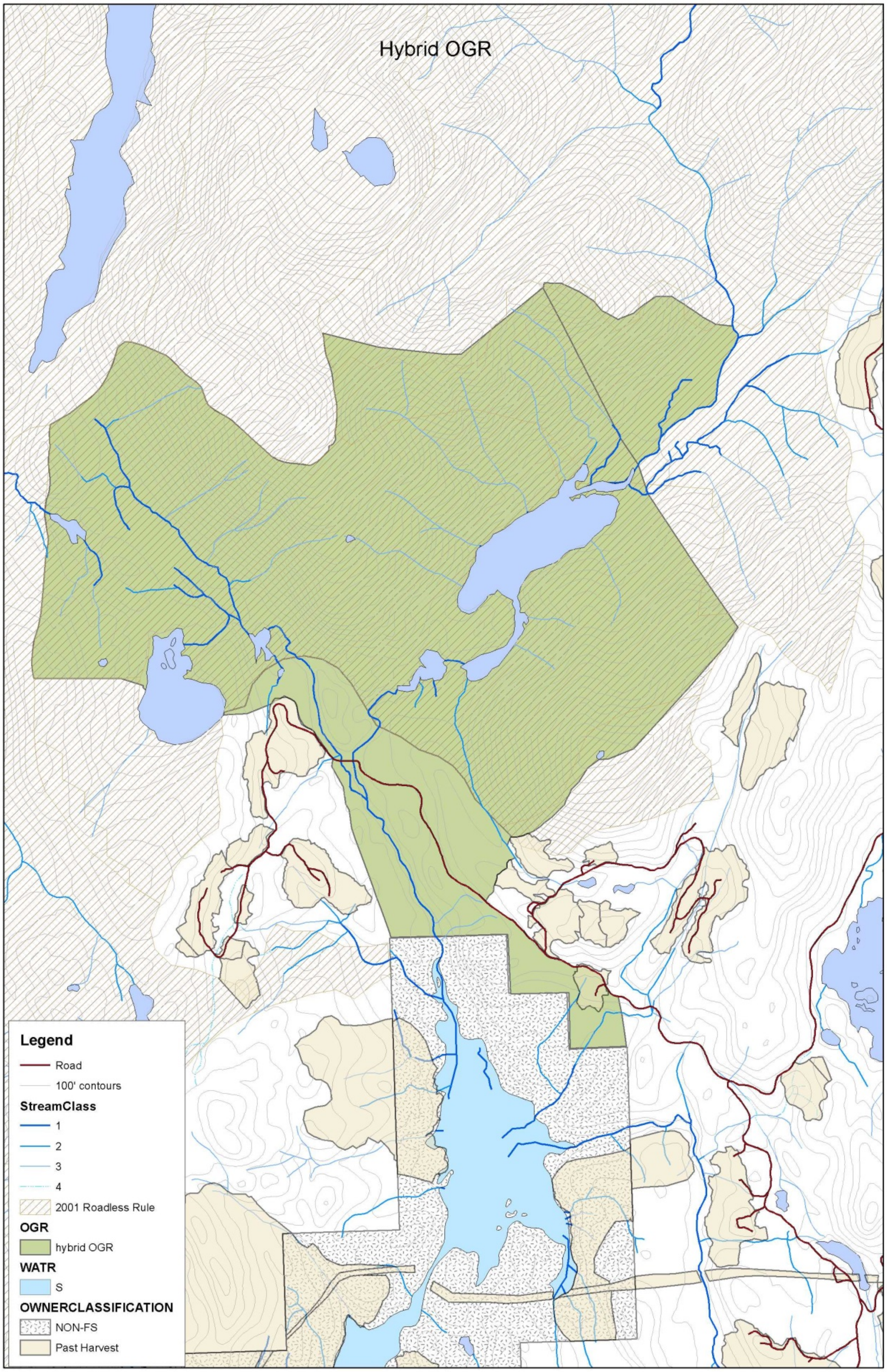
APPENDIX A

VCU 7470

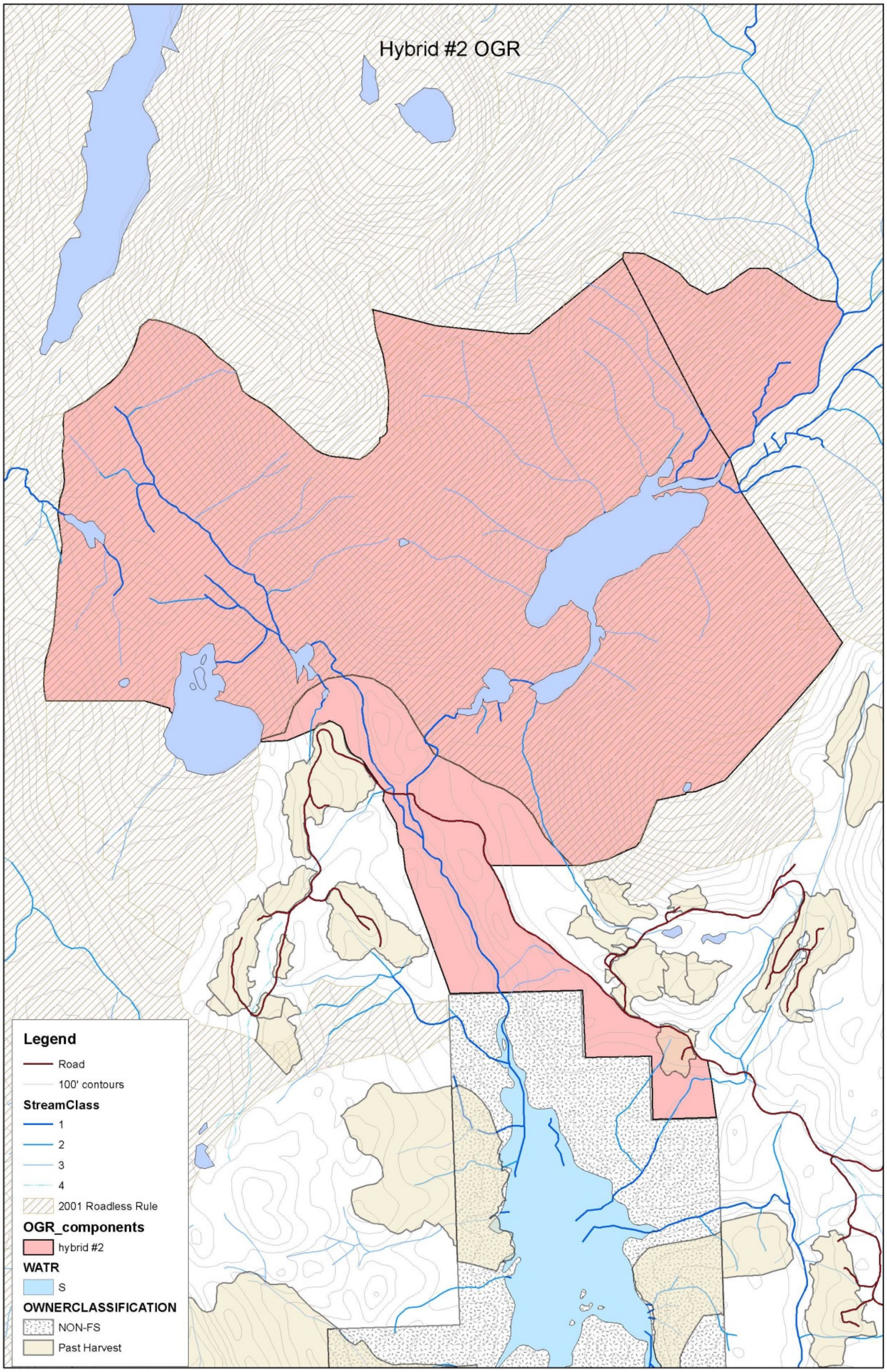
Small OGR Maps


Existing OGR
Legend
Road
100' contours
StreamClass
1
2
3
4
OGR
existing IOGR
2001 Roadless Rule
WATR
S
OWNERCLASSIFICATION
NON-FS
Past Harvest


Roadless OGR
Legend
Road
100' contours
StreamClass
1
2
3
4
2001 Roadless Rule
OGR
Roadless OGR
WATR
S
OWNERCLASSIFICATION
NON-FS
Past Harvest



Hybrid OGR
Legend
Road
100' contours
StreamClass
1
2
3
4
2001 Roadless Rule
OGR
hybrid OGR
WATR
S
OWNERCLASSIFICATION
NON-FS
Past Harvest



Hybrid #2 OGR
Legend
Road
100' contours
StreamClass
1
2
3
4
2001 Roadless Rule
OGR_components
hybrid #2
WATR
S
OWNERCLASSIFICATION
NON-FS
Past Harvest

Appendix B. POG tables by Alt.

	Historic NFS Acres VCUs 7460/7470/7530	Current NFS Acres VCUs	% Change	Historic NFS Acres WAA 406/407	Current NFS Acres WAAs	% Change
High-POG ≤800' elev.	18,366	9,904	-46%	26,984	17,193	-36%
High-POG ≤1500' elev.	28,340	17,018	-40%	45,655	32,032	-30%
POG ≤1500' elevation	41,529	30,207	-27%	69,974	56,351	-19%
High-POG	31,213	19,711	-37%	52,033	37,851	-27%
Moderate-POG	11,407	11,407	0%	22,464	22,463	<1%
Low-POG	3,711	3,711	0%	6,613	6,613	0%
POG	46,331	34,829	-18%	81,110	66,928	-17%
Interior POG[1]	23,186	7,960	-66%	36,858	18,824	-49%
Large Tree POG-SD67	unknown	1,927	??	unknown	5,998	