United States Department of Agriculture

Wrangell Island Project

Draft Environmental Impact Statement

Forest Service
Alaska Region

Tongass National Forest
Wrangell RangerDistrict

R10-MB-634

May 2016

Acronyms

ACHP Advisory Council on Historic Preservation
ADEC Alaska Department of Environmental Conservation
ADF&G Alaska Department of Fish and Game
AMHT Alaska Mental Health Trust
ANCSA Alaska Native Claims Settlement Act
ANILCA Alaska National Interest Lands Conservation Act
APDES Alaska pollutant discharge elimination system
APE Area of potential effect
ATM Access and travel management
BMP Best management practice
CEQ Council on Environmental Quality
CFR Code of Federal Regulations
DEIS Draft environmental impact statement
DHC Deer habitat capability
DPS Distinct population segment
EFH Essential fish habitat
EIS Environmental impact statement
EPA Environmental Protection Agency
ESA Endangered Species Act
FACTS Forest activities tracking system
FAST-R Financial analysis spreadsheet tool – Residual value
FEIS Final environmental impact statement
FSH Forest Service handbook
FSM Forest Service manual
GIS Geographic information system
GMU Game management unit
GPS Global positioning system
HUC Hydrologic unit code
IDT Interdisciplinary team
IRA Inventoried roadless area
LUD Land use designation
MBF Thousand board feet
MIS Management indicator species
ML Maintenance level
MMBF Million board feet
NEPA National Environmental Policy Act
NFMA National Forest Management Act
NFS National Forest System
NHPA National Historic Preservation Act
NMFS National Marine Fisheries Service
NRIS Natural Resource Information System
OBML Objective maintenance level
OGR Old-growth reserve
OHV Off-highway vehicle
OPML Operational maintenance level
POG Productive old-growth
R10 Region 10 (Alaska Region of the Forest Service)
RAW Reasonable assurance of windfirmness
RMA Riparian management area
ROD Record of decision
ROS Recreation opportunity spectrum
SHPO State Historic Preservation Officer
SIO Scenic integrity objective
TTRA Tongass Timber Reform Act
USDA United States Department of Agriculture
USFWS United States Fish and Wildlife Service
VCU Value comparison unit
VPR Visual priority travel routes and use areas
WAA Wildlife analysis area

Cover Photo: Mill Basin, Wrangell Island. Photograph by Andrea Slusser

NOTE: Every effort is made to create documents that are accessible to individuals of all abilities; however, limitations with our word processing programs may prevent some parts of this document from being readable by computer-assisted reading devices. If you need assistance with this document, please contact the Wrangell Ranger District at (907) 874-2323.

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File Code: 1950
Date: May 24, 2016

Dear Planning Participant:

The Tongass National Forest is seeking public input on the Draft Environmental Impact Statement (DEIS), which proposes timber harvest and road construction on Wrangell Island. The Forest Service analyzed four action alternatives and a No Action Alternative. Alternative 2 is the Forest Service's Preferred Alternative at this time, which proposes the harvest of 65 million board feet (MMBF) on 5,309 acres and the construction of approximately 32 miles of road. All of the alternatives, however, will be considered in my decision.

It is important to note that this project is subject to the objection process pursuant to 36 CFR § 218 (March 27, 2013), and is not being authorized under the Healthy Forest Restoration Act (HFRA). Only individuals or entities (as defined by 36 CFR §218.2) who submit timely and specific written comments (as defined by 36 CFR §218.2) about this proposed project or activity during this or another public comment period established by the Responsible Official will be eligible to file an objection. Other eligibility requirements are defined by 36 CFR §218.25(a)(3) and include name, postal address, title of the project, and signature or other verification of identity upon request. Individual members of an entity must submit their own individual comments in order to have eligibility to object as an individual. A timely submission will be determined as outlined in 36 CFR §218.25(a)(4). It is the responsibility of the sender to ensure timely receipt of any comments submitted. Comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the Responsible Official to consider (36 CFR §218.2). Those who provide specific written comments during any designated opportunity for public comment in accordance with36 CFR §218.5 will be eligible to participate in the objection process. Issues raised in objections must be based on previously submitted timely, specific written comments regarding the proposed project unless new information arises after designated opportunities (36 CFR §218.7).

Comments on this proposed project will be accepted for 45 days beginning on the first day after the date of publication of the Notice of Availability (NOA) of the DEIS in the Federal Register. While a public notice will also be placed in the Ketchikan Daily News, and the Wrangell Sentinel, the publication date of the NOA in the Federal Register is the exclusive means for calculating the 45-day comment period for a proposed action documented in a DEIS.

The DEIS and associated road and unit cards are available for review online at http://www.fs.usda.gov/project/?project=34831. Paper copies are available at the Wrangell Ranger District and the Forest Supervisor's Office in Ketchikan. If you require a paper copy or a DVD, or need additional information, please contact Andrea Slusser, District NEPA Planner, at 907-874-2323 or send your request to: andreamslusser@fs.fed.us.

Specific written comments may be submitted via e-mail to comments-alaska-tongass-wrangell@fs.fed.us with 'Wrangell Island Project' in the subject line; or by fax to (907) 874-7595. Comments may also be mailed to: Robert Dalrymple, District Ranger, Wrangell Ranger District, PO Box 51, Wrangell, AK 99929, or hand-delivered to 525 Bennett Street, Wrangell, AK. The district office business hours are 8:00 a.m. to 4:30 p.m., Monday through Friday,

excluding holidays. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action and will become a matter of public record. Comments submitted anonymously will be accepted and considered, but those submitting anonymous comments will not be eligible for objection per 36 CFR §218.5.

Sincerely,

For M. EARL STEWART
Forest Supervisor
Tongass National Forest

Wrangell Island Project

Draft Environmental Impact Statement

United States Department of Agriculture

Lead Agency:	
	USDA Forest Service Tongass National Forest
Cooperating Agencies:	
	U.S. Fish and Wildlife Service Alaska Department of Natural Resources City and Borough of Wrangell
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	Andrea Slusser, NEPA Planner Wrangell Ranger District PO Box 51 Wrangell, Alaska 99929

Comments will be accepted for 45 days beginning on the first day after the date of publication of the DEIS Notice of Availability (NOA) in the Federal Register. Comments may be mailed to Andrea Slusser (address above) or submitted electronically to: comments-alaska-tongass-wrangell@fs.fed.us with "Wrangell Island Project" in the subject line.

Abstract

The Forest Service proposes to harvest timber, construct new roads and landings, recondition existing roads, and update some road access management decisions on Wrangell Island, Tongass National Forest, Alaska. The DEIS describes and analyzes in detail five alternatives that provide differing outputs and responses to issues identified for this project. Alternative 2 is the preferred alternative.

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Summary

Introduction

The Tongass National Forest has prepared this draft environmental impact statement (DEIS) to analyze the potential environmental impacts of a multi-year proposal involving timber harvest, road construction, and future road access management on Wrangell Island in Southeast Alaska. Proposed activities would take place on National Forest System (NFS) lands on the Wrangell Ranger District.

In compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations, this DEIS describes the purpose and need for the project and discloses the direct, indirect, and cumulative environmental impacts and any irreversible or irretrievable commitment of resources that would result from the proposed action and alternatives.

Location of the Project Area

Wrangell Island is part of the Alexander Archipelago and lies between Juneau and Ketchikan in Southeast Alaska. Wrangell Island is 134,306 acres and is part of the Wrangell Ranger District of the Tongass National Forest (Figure 1).

Why is this Project Important?

The forest products industry has been a vital part of Wrangell Island and the Southeast Alaska economy since the 1950s. Currently, the forest products industry in this area is in decline. Alaska timber mills contribute to local and regional economies by providing forest products and employment. The timber industry in Southeast Alaska includes large and small timber purchasers, mill operators, and value-added wood product industries that are dependent upon a reliable supply of sawtimber in the region and on Wrangell Island.

The Project Purpose and Need

The purpose of the Wrangell Island Project is to respond to the goals and objectives identified by the 2008 Tongass Land and Resource Management Plan (hereafter referred to as the “Forest Plan”) (USDA Forest Service 2008a) to guide timber management to support the local and regional economies of Southeast Alaska, while moving the Wrangell Island project area towards the desired future condition for all resources.

The underlying need for the Wrangell Island Project comes from the Forest Service’s obligation, subject to applicable law, to seek to provide a supply of timber from the Tongass National Forest that meets market demand annually and for the planning cycle, and to restore and improve forest resources to a condition where they provide increased benefits to society (Tongass Timber Reform Act, Section 101).

This project would contribute to the orderly flow of timber to large and small timber purchasers, mill operators, and value-added wood product industries in Southeast Alaska and benefit the local and regional economies of Wrangell and Southeast Alaska while also improving forest resource conditions. This project would help provide a reliable, long-term supply of “bridge” timber that would support local jobs and facilitate the industry transition to a sustainable wood product industry based on young-growth management on the Tongass National Forest.

The Proposed Action

The Forest Service is proposing a multi-year project involving timber harvest and associated road construction on Wrangell Island. The proposed action includes the harvest of timber from approximately 5,309 acres of forested land. The harvest would produce an estimated 65 million board feet (MMBF) of

sawtimber and utility wood that could be made available to industry. Timber harvest would occur with both even-aged (clearcut) and uneven-aged (partial cut) harvest using cable, helicopter and ground-based methods.

The timber harvest would require approximately 17.2 miles of National Forest System (NFS) road construction, 5.8 miles of reconditioning and approximately 14.9 miles of temporary road construction. Existing road systems and marine access facilities would also be used as needed to transport the timber.

All activities would be conducted in a manner conducive to moving resources towards their desired conditions described in the Forest Plan.

Decisions to Be Made

The Responsible Official of this project is the forest supervisor for the Tongass National Forest. After reviewing the analysis, public comments, and how well each alternative achieves the purpose and need, the Forest Supervisor will make a decision which will include:

1. The estimated timber volume to make available from the project, as well as the location, design, and scheduling of timber harvest, road construction and reconditioning, and silvicultural practices used;
2. Road management objectives on both proposed and existing roads which will define motorized access (road, trail and area restrictions and closures); and
3. Project design features, mitigation and monitoring requirements.

This decision will be documented in a Record of Decision.

Key Issues

Key issues are used to formulate and design alternatives to the proposed action, formulate project design features, and analyze significant effects. Key issues for the project have been identified through public and internal scoping.

The following key issues are addressed by the action alternatives.

Issue 1: Timber Supply and Timber Sale Economics

Issue statement: Both the timber supply and timber sale economics produced from national forest lands on Wrangell Island affect the stability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies during the transition to a sustainable supply of young-growth.

Issue 2: Wildlife Habitat

Issue Statement: Proposed timber harvest and roads, combined with past and reasonably foreseeable timber harvest, would affect old-growth habitat used by wildlife, particularly deer, wolves, and goshawks.

Issue 3: Scenic Quality

Issue Statement: Proposed timber harvest, combined with past and reasonably foreseeable timber harvest, would affect scenic integrity from visual priority travel routes and use areas identified in the Forest Plan, and in areas of particular scenic importance to the community of Wrangell.

Issue 4: Access Management

Issue Statement: Access management decisions for motorized road use will affect future public access for recreation and subsistence and access for agency administrative purposes.

Alternatives Considered in Detail

The Forest Service designed five alternatives for detailed analysis in this DEIS. These include the no action alternative, the proposed action, and three alternatives developed in response to key issues to provide a reasonable range of alternatives.

With the exception of Alternative 1, all are designed to achieve the purpose and need for the Wrangell Island Project. Maps of each alternative are provided in Chapter 2.

Alternative 1 – No Action

Alternative 1 is the "no-action" alternative because in this alternative, none of the proposed activities would occur.

NEPA requires the analysis of a no-action alternative in an environmental impact statement. It provides a baseline of existing conditions and trends, enabling the Responsible Official to compare the magnitude of environmental effects of the action alternatives. In this alternative, approved forest management activities not related to the proposed project can and would continue, and road management would be based on the existing access and travel management plan for Wrangell Island.

The Wrangell District Access and Travel Management Plan Decision Notice (ATM) deferred closure of some roads until the Wrangell Island EIS was complete (USDA Forest Service 2007b). Alternative 1 would fully implement the decision and close approximately 24.1 miles of existing National Forest System (NFS) road currently open to motorized use and 2.5 miles of existing NFS road would be decommissioned. Approximately 73 miles of existing NFS road would then be open for public use for motorized vehicles of all types.

Alternative 2 – Proposed Action

Alternative 2 is the project's proposed action, the initial project proposal developed by the Forest Service to address the purpose and need. The proposed action was published in the Federal Register on October 27, 2015 and is the alternative designed to provide the greatest supply of timber volume for the timber industry, while protecting scenic quality, old growth habitat and connectivity.

Alternative 2 proposes even-aged and uneven-aged timber harvest on suitable lands within a 10-year period, and new and temporary road construction. New roads would be closed and temporary roads would be decommissioned after project activities are completed, as directed by the existing access management plan. Alternative 2 would accomplish proposed activities according to Forest Plan land use designations and maintain current road management objectives.

Alternative 2 was designed to harvest timber in the roaded land base in development land use designations (LUDs; Timber Production and Modified Landscape). This alternative provides timber volume opportunities for both large and small sales outside of the 2001 Inventoried Roadless Areas (IRAs). This alternative addresses Issue 1 by providing the greatest timber volume from which to offer individual timber sales. It also addresses Issue 4 by providing the most motorized public access following harvest.

Timber Harvest: Alternative 2 would yield an estimated 65 MMBF of old-growth saw/utility timber volume from approximately 5,309 acres. Silvicultural prescriptions include approximately 3,528 acres of uneven-aged management (partial harvest) and 1,781 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are prescribed primarily to provide visual resource protection but also reduce effects to wildlife. No young-growth harvest is included in this alternative or any of the other alternatives, as no commercially viable young-growth timber is available.

Roads: Alternative 2 proposes construction of 17.2 miles of new NFS roads and 14.9 miles of temporary roads. It also proposes reconditioning 5.8 miles of existing NFS roads. All temporary roads would be decommissioned after harvest and firewood gathering are complete. Existing marine access facilities would be used.

Motorized Access Management: The motorized access management proposed in this alternative was developed through a collaborative process between the interdisciplinary team and the Wrangell Borough. The process identified the roads associated with the alternative that are the most important to the community for subsistence and recreation access. Then, the roads were evaluated based on resource protection needs and future maintenance costs. Alternative 2 proposes closing 16.1 miles of road to public motorized use and decommissioning 0.2 mile. Approximately 101 miles of NFS road would be available for public motorized access, of which 14 miles would be restricted to motorized trail use. These roads are shown on the Alternative 2 Access Management map (Figure 9).

Alternative 3

Alternative 3 is designed to address Issues 2 (Wildlife Habitat), 3 (Scenic Quality) and 4 (Access Management). In this alternative, the effect of timber harvest on scenic quality is reduced by applying less intensive harvest prescriptions and reducing the number of harvested acres overall.

Alternative 3 also maintains wildlife habitat and connectivity (Issue 2), and minimizes impacts to recreation while incorporating some economic considerations. It addresses Issue 4 by providing additional motorized public access following harvest.

Timber Harvest: Alternative 3 would yield an estimated 48.8 MMBF of old-growth saw/utility timber volume from approximately 3,184 acres. Silvicultural prescriptions include approximately 1,483 acres of uneven-aged management (partial harvest) and 1,701 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are primarily to provide visual resource protection but also reduce effects to wildlife. No young-growth harvest is included in this alternative.

Roads: Alternative 3 proposes construction of 15.8 miles of new NFS roads and 14.1 miles of temporary roads. It also proposes reconditioning 5.8 miles of existing NFS roads. All temporary roads would be decommissioned after harvest activities and firewood gathering are complete. Existing marine access facilities would be used.

Motorized Access Management: Alternative 3 proposes closing 16.3 miles of NFS road to public motorized use and decommissioning 0.2 mile of road. Approximately 99.2 miles of NFS road would then be open for public motorized access, 13.8 miles of which would be restricted to motorized trail use. These roads are shown on the Alternative 3 Access Management map (Figure 10).

Alternative 4

The objective of Alternative 4 is to maximize the economic value of the timber harvest from which to offer individual timber sales (Issue 1) while protecting scenic quality, old growth habitat and connectivity, and other resources as specified in the Forest Plan. This was done by selecting harvest units with least logging costs and road construction and minimizing helicopter yarding distances.

Alternative 4 would harvest timber in the roaded land base in development LUDs (Timber Production and Modified Landscape) and provide timber volume opportunities for both large and small sales outside of the 2001 IRAs using both even-aged and uneven-aged timber harvest in proximity to existing roads. Alternative 4 also addresses Issue 4 by providing motorized public access following harvest.

Timber Harvest: Alternative 4 would yield an estimated 51 MMBF of old-growth saw/utility timber volume from approximately 3,531 acres. Silvicultural prescriptions include about 1,738 acres of uneven-

aged management (partial harvest) and about 1,793 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are primarily to provide visual resource protection but also reduce effects to wildlife. No young-growth harvest is included in this alternative.

Roads: Alternative 4 proposes construction of 16.1 miles of new NFS roads and 16.2 miles of temporary roads. It also proposes reconditioning 5.4 miles of existing NFS roads. All temporary roads would be decommissioned after harvest activities and firewood gathering are complete. The existing marine access facilities would be used.

Motorized Access Management: Alternative 4 proposes closing 15.7 miles of NFS road to public motorized use and decommissioning 0.2 mile of road. Approximately 100 miles of NFS road would then be open for public motorized access, 13.6 miles of which would be restricted to motorized trail use. These roads are shown on the Alternative 4 Access Management map (Figure 11).

Alternative 5

The objective of Alternative 5 is to provide economic timber harvest while maintaining wildlife habitat (Issue 2). This alternative is similar to Alternative 3 in that it proposes less intensive harvest prescriptions than allowable under the Forest Plan and reduces the total acres of treatment. As a result, fewer acres of wildlife habitat would be affected, including elevational corridors, low elevation habitat and high-volume productive old-growth (POG) habitat. It also minimizes harvest activities in areas with higher specific wildlife values, such as including 500-foot buffers on streams that have brown bear feeding. This alternative also provides wildlife habitat connectivity by proposing fewer roads overall and closing all newly constructed roads following timber harvest activities, equating to a lower road density. This includes closing temporary roads immediately after harvest. These road closures are intended to reduce effects on wolves and would also reduce effects on deer and marten.

Timber Harvest: Alternative 5 would yield an estimated 42.8 MMBF of old-growth saw/utility timber volume from approximately 3,804 acres. Silvicultural prescriptions include about 2,868 acres of uneven-aged management and about 936 acres of even-aged management that would be achieved using conventional cable, shovel, and helicopter logging systems. No young-growth harvest is included in this alternative.

Roads: Alternative 5 proposes construction of 12.5 miles of new NFS roads and 9.1 miles of temporary roads. It also proposes reconditioning 4.1 miles of existing NFS roads. All temporary roads would be decommissioned after immediately after harvest activities are complete. The existing marine access facilities would be used.

Motorized access management: The ATM deferred closure of some roads until the Wrangell Island EIS is complete. Alternative 5 would fully implement the ATM and also close all newly constructed roads. Approximately 36.5 miles of road (existing and proposed) would be closed and 2.5 miles of existing road decommissioned. Approximately 73 miles of existing NFS road would be available for public use for motorized vehicles of all types. These roads are shown on the Alternative 5 Access Management map (Figure 12).

Comparison of Alternatives

This section compares outputs and provides a summary of the effects of implementing each alternative for the key issues.

Estimated Timber Production by Alternative

The following table shows the estimated timber volume that could be available in each alternative.

Table 1. Comparison of estimated timber volume (MMBF) and acres of harvest activity by alternative

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Total net sawlog volume (MMBF)	0	57.8	43.0	45.4	38
Total utility volume (MMBF)	0	7.3	5.8	5.7	4.8
Total net volume (MMBF)	0	65.1	48.8	51.1	42.8
Uneven-aged harvest (acres)	0	3,528	1,483	1,738	2,868
Even-aged harvest (acres)	0	1,781	1,701	1,793	936
Total acres	**0**	**5,309**	**3,184**	**3,531**	**3,804**

Proposed Road Construction and Management

All alternatives, except the no action, propose constructing new and temporary roads and reconditioning existing roads. Table 2 displays the miles of road construction and reconditioning and the cost of the road work. Table 3 shows miles of open and closed road. In all alternatives, all temporary roads would be decommissioned after project activities are complete.

Table 2. Proposed NFS road construction (miles and millions of dollars) on Wrangell Island

Activity	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Proposed NFS road construction (miles)	0	17.2	15.8	16.1	12.5
Proposed temporary road construction (miles)	0	14.9	14.1	16.2	9.1
Proposed road reconditioning (miles)	0	5.8	5.8	5.4	4.1
Estimated total road costs (in millions of dollars)	0	5.4	4.8	5.2	3.7

Table 3. Proposed access management (miles) for NFS roads on Wrangell Island

Access Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Open to all vehicles (miles)	73	86.7	85.4	86.3	72.8
Motorized trails (miles)	0	13.99	13.8	13.6	0
Closed to all vehicles (miles)	24.1	16.1	16.3	15.7	36.5
Decommissioned (miles)	2.5	0.2	0.2	0.2	2.5

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Chapter 1. Purpose and Need for Action

Introduction

The Tongass National Forest has prepared this draft environmental impact statement (DEIS) to analyze the potential environmental impacts of a multi-year proposal involving timber harvest, road construction, and future road access management on Wrangell Island in Southeast Alaska. Proposed activities would take place on National Forest System (NFS) lands on the Wrangell Ranger District.

In compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations, this DEIS describes the purpose and need for the project and discloses the direct, indirect, and cumulative environmental impacts and any irreversible or irretrievable commitment of resources that would result from the proposed action and alternatives.

Document Organization

This document was prepared following regulations provided in the Council of Environmental Quality's "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" and Forest Service directives. According to those regulations, this environmental impact statement is designed to be analytic rather than encyclopedic, discussing only briefly issues other than significant ones, and incorporating more detailed reports, regulations, and literature by reference. Detailed and supporting information can be found in the project record.

Chapter 1 – Purpose and Need for Action: This chapter explains the purpose and need for the proposed action, details public involvement activities conducted to date, and identifies the key issues driving the EIS analysis. This chapter also lists required federal and State permits, licenses and certifications needed to implement the project, as well as applicable laws and executive orders that pertain to the project.

Chapter 2 – Alternatives: This chapter describes the proposed action and alternatives, explains how alternatives were developed, compares alternatives by issues and effects, and explains alternatives considered but eliminated from detailed study.

Chapter 3 – Affected Environment and Environmental Consequences: This chapter describes the affected environment and evaluates the potential direct, indirect and cumulative environmental consequences of each of the alternatives on the existing conditions.

Chapter 4 –Lists and References: This chapter contains the list of preparers, DEIS distribution list, references and index.

Appendices: The appendices provide additional information to support analyses presented in the DEIS.

Location of the Project Area

Wrangell Island is part of the Alexander Archipelago and lies between Juneau and Ketchikan, in Southeast Alaska. The northern end of Wrangell Island lies at the mouth of the Stikine River, which is located on the North American mainland, and has long-standing cultural and economic value to the community of Wrangell. Wrangell Island is surrounded by Zimovia Strait, Ernest Sound, the Eastern Passage and Blake Channel (the latter two are collectively and locally referred to as the "backchannel"). Nearby islands include Woronkofski, Etolin and Zarembo. Of Wrangell Island's 134,306 acres, 112,936 are Tongass National Forest (Figure 1).

According to the 2010 Census, the City and Borough of Wrangell had a population of 2,369, with Alaska Natives comprising approximately 16 percent of the total (U.S. Census Bureau 2010). Wrangell's population increased by 22 percent between 1970 and 1990, and then decreased by 171 residents or 7 percent between 1990 and 2000. The population decreased by an estimated 79 residents or 3 percent from

2000 to 2010. Total estimated population was 2,406 in Wrangell in 2014 (Alaska Department of Labor 2015).

Why is this Project Important?

The forest products industry has been a vital part of Wrangell Island and the Southeast Alaska economy since the 1950s. Currently, the forest products industry in this area is in decline. Alaska timber mills contribute to local and regional economies by providing forest products and employment. The timber industry in Southeast Alaska includes large and small timber purchasers, mill operators, and value-added wood product industries that are dependent upon a reliable supply of sawtimber in the region and on Wrangell Island.

A project plan for the Wrangell Island Project was completed in April 2009. The Forest Supervisor for the Tongass reviewed the project plan and determined that the proposed project is feasible to prepare, that it will be consistent with the 2008 Tongass National Forest Land and Resource Management (also referred to in this document as the "Forest Plan"), and that further investment of resources and capital was warranted.

In 2010, the Alaska Regional Forester introduced the United States Department of Agriculture's (USDA) development of a strategy known as the Transition Framework program in a letter to the Members of the Tongass Futures Roundtable (USDA Forest Service 2010a). The purpose of the Transition Framework is to help Southeast Alaska diversify and strengthen its economy. The Forest Service, Rural Development, and Farm Service Agency and the U.S. Department of Commerce's Economic Development Administration are working with business industry leaders, other government agencies, tribes, and non-governmental organizations to help communities move to a more diversified economy by supporting job creation in renewable energy, forest restoration, timber, tourism, subsistence, fisheries, and mariculture. Key strategies for success are collaboration, innovation, access to capital, and strengthening community capacity.

In 2013, the Secretary of Agriculture directed the Forest Service to transition to a predominantly young-growth-based timber program over the next 10 to 15 years (USDA Office of the Secretary 2013). However, maintaining the existing industry during this time period will be essential.

Consequently, there is a need to transition from old-growth-based harvest to young-growth harvest. The rate at which this transition will occur is uncertain. The rate would depend on the level of industry investment and, under any scenario, would require a "bridge" strategy to continue to allow some old-growth harvest to sustain communities and jobs through this transition. A major step, following the example of successful mills in the lower 48, would be for industry in Southeast Alaska to retool its equipment to process smaller logs from younger trees. To do so, however, requires substantial investment over several years.

The Wrangell Island Project can contribute to providing "bridge" timber to sustain the current industry and jobs in communities, while opportunities are developed for Southeast Alaska young-growth. Therefore, an underlying need exists for a reliable economic supply of sawtimber for Southeast Alaska mills to help support the timber industry and employment through the transition years until the industry can switch to a stable supply of young-growth.

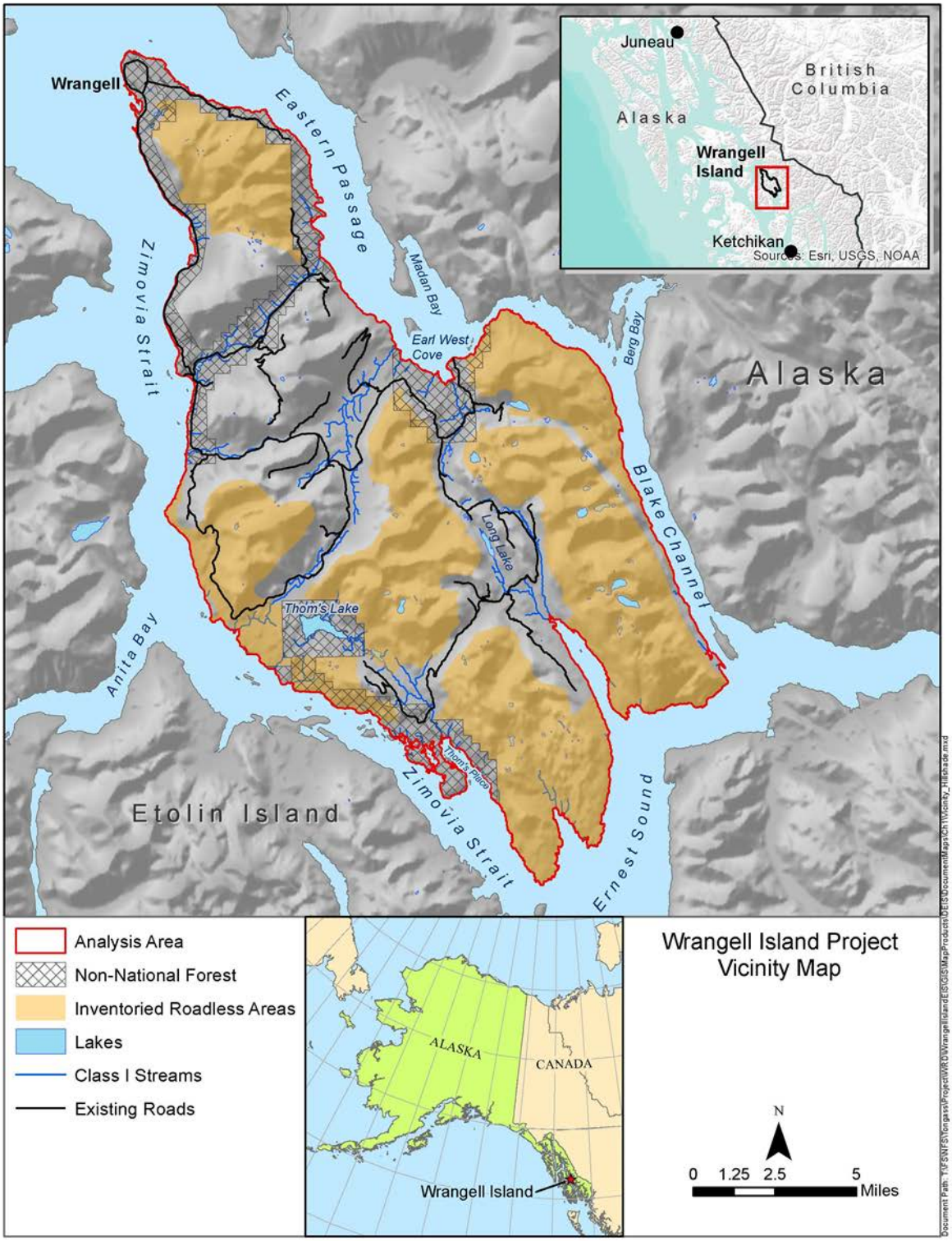

Figure 1. Wrangell Island Project vicinity map

The Project Purpose and Need

The purpose of the Wrangell Island Project is to respond to the goals and objectives identified by the 2008 Tongass Land and Resource Management Plan (hereafter referred to as the "Forest Plan") to guide timber management to support the local and regional economies of Southeast Alaska, while moving the Wrangell Island project area towards the desired future condition for all resources. Forest-wide multiple-use goals and objectives that apply to this project include, but are not limited to:

Timber—Goals and Objectives (USDA Forest Service 2008a, p. 2-7):

- Goal: Provide for the continuation of timber uses and resources by the timber industry and Alaska residents.
- Goal: Manage the timber resource for production of saw timber and other wood products from suitable forest lands made available for timber harvest, on an even-flow, long-term sustained yield basis and in an economically efficient manner.
- Objective: Seek to provide an economic timber supply sufficient to meet the annual market demand for Tongass National Forest timber, and the market demand for the planning cycle, up to a ceiling of [the Forest Plan's] allowable sale quantity (ASQ), which is 2.67 billion board feet in the first decade.
- Objective: Provide 2 to 3 years supply of volume under contract to local mills and then establish shelf volume [sale projects with completed NEPA and field work – ready to offer] to maintain flexibility and stability in the sale program.
- Objective: Review the timber sale program and work with State and other partners to implement changes that keep an "economic timber" perspective throughout the process and monitor the implementation of these reforms to ensure they are consistently employed across the Forest.

Local and Regional Economy—Goals and Objectives (USDA Forest Service 2008a, p. 2-5):

- Goal: Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.
- Objective: Support a wide range of natural resource employment opportunities within Southeast Alaska communities.

The underlying need for the Wrangell Island Project comes from the Forest Service's obligation, subject to applicable law, to seek to provide a supply of timber from the Tongass National Forest that meets market demand annually and for the planning cycle, and to restore and improve forest resources to a condition where they provide increased benefits to society (Tongass Timber Reform Act, Section 101).

This project would contribute to the orderly flow of timber to large and small timber purchasers, mill operators, and value-added wood product industries in Southeast Alaska and benefit the local and regional economies of Wrangell and Southeast Alaska while also improving forest resource conditions. This project would help provide a reliable, long-term supply of "bridge" timber that would support local jobs and facilitate the industry transition to a sustainable wood product industry based on young-growth management on the Tongass National Forest.

The Proposed Action

The Forest Service is proposing a multi-year project involving timber harvest and associated road construction on Wrangell Island. The proposed action includes the harvest of timber from approximately 5,309 acres of forested land. The harvest would produce an estimated 65 million board feet (MMBF) of sawtimber and utility wood that could be made available to industry. Timber harvest would occur with both even-aged (clearcut) and uneven-aged (partial cut) harvest using cable, helicopter and ground-based methods.

The timber harvest would require approximately 17.2 miles of National Forest System (NFS) road construction, 5.8 miles of reconditioning and approximately 14.9 miles of temporary road construction. Existing road systems and marine access facilities would also be used as needed to transport the timber.

All activities would be conducted in a manner conducive to moving resources towards their desired conditions described in the Forest Plan.

Relationship to the Forest Plan

The 2008 Forest Plan for the Tongass National Forest includes Forest-wide multiple-use desired conditions, goals, objectives, standards, guidelines, and land use designations to guide project planning; all of which are incorporated here by reference. Forest Plan Standards and Guidelines, which apply to all or most areas of the Tongass, are designed to protect forest resources and ensure consistent management across the Forest. Forest-wide standards and guidelines are used in conjunction with the additional standards and guidelines specific to each land use designation (LUD). See Chapter 4 of the Forest Plan for standards and guidelines.

The Forest Plan provides LUDs to guide management of NFS lands within the Tongass National Forest. Each designation provides direction on the types of activities, practices, and uses to be emphasized in specific areas. The Wrangell Island project area includes 20,962 acres of other land ownerships (16 percent) and five LUDs across 112,936 acres of NFS lands (84 percent of Wrangell Island) (Figure 2). Old-growth Habitat and Municipal Watershed LUDs are within the natural setting LUD group and therefore not suitable for timber harvest. Timber Production, Modified Landscape, and Scenic Viewshed are suitable for timber harvest and are referred to as development LUDs.

Decisions to be Made

The Responsible Official of this project is the Forest Supervisor for the Tongass National Forest. After reviewing the analysis, public comments, and how well each alternative achieves the purpose and need, the Forest Supervisor will make a decision which will include:

1. The estimated timber volume to make available from the project, as well as the location, design, and scheduling of timber harvest, road construction and reconditioning, and silvicultural practices used;
2. Road management objectives on both proposed and existing roads which will define motorized access (road, trail and area restrictions and closures); and
3. Project design features, mitigation and monitoring requirements.

If the decision is made to implement an alternative beyond approximately 5 years, the Forest Supervisor will determine if a review of resource effects is needed to supplement the analysis in this document before a timber sale contract is released for bid. If a review is needed, it may result in no change to implementation, a change analysis in the timber sale contract, or a revision of the EIS in accordance with the Forest Service Handbook (FSH 1909.15 Chapter 18).

Public and Agency Involvement

This project has included extensive public and agency involvement, through scoping letters, notices of intent in the Federal Register, public notices in the local news media, public meetings and consultation with the Wrangell Cooperative Association, a federally recognized tribe. Additionally, the project has been listed in the Tongass National Forest Schedule of Proposed Actions, and presentations were made to interested groups. In response to the District’s public outreach, 77 comment letters have been received regarding the project proposal. Detailed information on the public and agency involvement process is located in the project record.

Because of the interrelated goals and interests, the US Fish and Wildlife Service, the State of Alaska and the City and Borough of Wrangell became cooperating agencies on this project. Scoping results were shared with the cooperating agencies. Representatives from these agencies attended interdisciplinary team meetings, assisted in the development of alternatives and provided input to the analysis.

Stewardship Opportunities

Many ideas for restoration and enhancement projects – collectively referred to as "stewardship opportunities" – were identified during the public involvement process for the Wrangell Island Project. These opportunities, however, are beyond the scope of this project. It is important to document these ideas so they may be assessed in future collaborative planning efforts. Separate NEPA processes, including additional public involvement and analysis, would be required before any of these projects could move forward. Timber receipts from the Wrangell Island Project or other funding sources would pay for these projects. A summary of these stewardship opportunities is presented below.

Roads and Transportation

- Complete the north Wrangell loop road in cooperation with other land owners
- Bridge replacement and maintenance
- Replace or remove red pipes
- Tyee transmission line road access
- Fools Inlet ferry terminal
- Improve Pats Lake road and parking and picnic sites within Forest Service right-of-way easement
- Manage roadside vegetation to improve sight distance and safety
- Surfacing improvements to road accessing Middle Ridge recreation cabin
- Reopen road access south of Pats Cree

Recreation

- Upper Salamander campsite improvement
- Surface trail Salamander Ridge
- Reestablish snowmobile trail in Pats Creek Valley
- Old Hermit / Mt. Extreme snowmobile trail access
- Establish and implement vegetation management plans around recreation sites and key roadside viewpoints (includes hazard tree assessment and removal)
- Develop new dispersed recreation sites
- Island kayak route, pullout, and shelters, including Fools Inlet area
- Water trail concept with pullouts and shelters to circumnavigate island
- Earl West Marsh parking and recreation enhancement
- Picnic area and shelter at overlook on Earl West Cove
- Trail to Earl West marsh and kayak launch area
- Build roadside cabin in Thoms Creek Crossing campsite area
- Build roadside cabin at Fools Inlet road/trail
- Build cabin near Earl West
- Long Lake pond trail access and campsite improvement
- Long Lake and High Bush Lake access improvements
- Extend trail along Long Lake with shelter
- Improve dock at Long Lake
- Build a dock at Thoms lake
- Connect the Spur Road
- Improve Salamander Ridge trail
- Create a short, accessible trail to an old-growth stand of timber
- Extend other existing trails with possible forks and loops
- Cross-country ski trail off Pats Creek road or McCormack Creek road area
- Create a network system of ATV-preferred roads
- Create trail along ridge and to ridge overlooking the mill basin
- Create winter trail system Create trail to access national forest land above

Sowle's rock pit Create trail from over-grown road across from Nemo Campsite for subsistence berry-picking

- Create trail to fork off Rainbow Falls trail after first bridge, to other creek, and possibly looping back to main trail

Wildlife and Fisheries Habitat Improvement

- Pats Lake area restoration with State and partners
- Beach fringe thinning
- Pre-commercial thinning
- Invasive plant control
- Re-establish south shore road access to Highbush Lake for potential fisheries enhancement
- Small-scale fish habitat enhancement opportunities on fish streams across the island
- Lower Salamander bank protection and fish improvements
- Red pipe replacement
- Watershed enhancements

Past, Present and Reasonably Foreseeable Future Management Activities in the Project Area

The following table provides a summary of management activities within, or adjacent to, the project area. Individual resource analyses in Chapter 3 may reference this list.

Table 4. Summary of past, present and reasonably foreseeable management activities within or adjacent to the project area

Project Description	Agency/Jurisdiction	Resources Potentially Affected
Past		
Past timber harvest has occurred on approximately 6,800 acres of National Forest land within the analysis area, beginning in the early 1900s. These areas have regenerated into vigorous, predominately even-aged timber stands.	Tongass National Forest	Scenery Silviculture Soils Subsistence Wetlands Wildlife
There are approximately 100 miles of existing National Forest System roads within the analysis area. Of these, approximately 90 miles are open to the public for motorized travel. There are an estimated 34 miles of road in other land ownerships within the analysis area. This includes roads managed by the Alaska Department of Transportation, City and Borough of Wrangell, Alaska Mental Health Trust, and the Alaska Department of Natural Resources (Division of Forestry). The Alaska Mental Health Trust and the Division of Forestry both manage their roads as Closed (as defined by the Alaska Forest Resources and Practices Act).	Tongass National Forest	Access Management Invasive Plants Subsistence Wetlands Wildlife
The existing Tyee electrical transmission line provides power to Wrangell and Petersburg and traverses the analysis area for approximately 25.9 miles. The vegetation within the approximately 150-foot-wide corridor underneath the transmission line is regularly maintained where necessary, including where it is in close proximity to the ground and trees are present. The transmission line and corridor are visually evident in the landscape.	Tongass National Forest	Scenery Subsistence Wetlands Wildlife

Project Description	Agency/Jurisdiction	Resources Potentially Affected
Alaska Mental Health Trust Timber Sales Most of the AHMT land which was feasible to harvest was harvested in the 1990s along the Zimovia Highway. The most recent harvest (104 acres) occurred in 2014. The Wrangell Ranger District knows of no specific timber sales at this time.	Alaska Mental Health Trust	Subsistence Wildlife
Present		
The Roadside Decision Notice makes available up to 500 thousand board feet (MBF) of fuelwood and sawtimber per year in microsales as commercial salvage harvest of dead, dying, or blown down fuelwood and sawtimber from natural disturbance, and the minor harvest of green fuelwood and green sawtimber, depending on demand from the public and local operators. The first microsale from the Roadside project was sold in 2012 and in each subsequent year since an average of 4 microsales a year have been sold. Each year an average of 20 net MBF from an average of 2 acres have been harvested. The Wrangell Island analysis area includes harvest units that overlap the Roadside project, meaning that the Wrangell Island Project could potentially harvest areas also covered by the Roadside project.	Tongass National Forest	Aquatics Plants Silviculture Timber Economics/Timber Availability Wetlands
Reasonably foreseeable future		
Ongoing Pre-commercial Thinning. Approximately 4,000 acres have been thinned since the 1970s with an additional 1,250 acres anticipated over the next 10 years.	Tongass National Forest	Aquatics Plants, Sensitive and Rare Silviculture Wildlife
Alaska Mental Health Trust manages its land with an objective to produce revenue for the trust. Within the study area, AHMT has harvested, leased, or sold much of its land. The remaining land is slated to produce revenue at some point in the future. There is an annual land sale program for AMHT lands on Wrangell Island. The amount of land for sale is not determined until the offering is publicized. Typically, subdivision lots and small sized parcels are offered to the highest qualified bidder through a competitive land sale. The Wrangell Ranger District knows of no specific land sales at this time.	Alaska Mental Health Trust	Wildlife Invasive Plants
On June 30, 2015, an Agreement to Initiate was signed for a land exchange between the Forest Service and AMHT for multiple parcels across the Tongass National Forest. This proposal includes 1,105 acres of AMHT land within the analysis area to be transferred to the Forest Service. Newly acquired Forest Service land would be managed under the same Land Use Designation as adjacent National Forest land, which in this case would be the Scenic Viewshed Land Use Designation.	Tongass National Forest / State of Alaska	Wildlife

Project Description	Agency/Jurisdiction	Resources Potentially Affected
Southeast Alaska State Forest Plan. On February 29, 2016, the Commissioner of the Department of Natural Resources adopted the Southeast State Forest Management Plan. The plan will guide long-term active management of these forest lands and identifies the policies that will be followed. The establishment of the State forest is for timber management while also allowing other beneficial uses of public land and resources.	State of Alaska, Department of Forestry	Wetlands Wildlife
Division of Forestry, Five-year Schedule of Timber Sales (CY 2015-2019) Earl West Cove Area timber sale is located on the eastern coast of Wrangell Island. The timber sale is an estimated total volume of 12.5 MMBF of harvest from approximately 700 acres. An estimated 5 miles of road could be constructed for access in the harvest areas. The sale will be wholly on Southeast State Forest lands. It is currently scheduled for harvest in the 2019 calendar year.	State of Alaska, Department of Forestry	Access Management Aquatics Silviculture Timber Economics/Timber Availability Wetlands Wildlife
State Entitlement Land Selection from the Tongass National Forest The State of Alaska is still in the process of completing its entitlement selections from the Tongass National Forest, under Section 6(a) of the Alaska Statehood Act of 1959. The State has identified the 16,683 acre Thoms Creek parcel, near Thoms Lake/Thoms Place on Wrangell Island for selection (Sec. 22, 23, 24, 25, 26, 27 T65S R85E and Sec. 29, 30, 32 T65S R86E). The State has assigned Priority “C” ranking or a very low priority for conveyance ranking for this parcel but it continues to be State selected lands for the foreseeable future.	Tongass National Forest / State of Alaska	
The City and Borough of Wrangell is in the initial stages of planning development of the currently undeveloped 140-acre Institute Property near the 5-mile marker on Zimovia Highway for housing, health care and educational facilities. This property abuts the National Forest.	City and Borough of Wrangell	
The City and Borough of Wrangell have expressed interest in pursuing ownership and development of the privately owned former sawmill site, for industrial purposes, possibly including a timber processing facility. There are no firm proposals at this time.	City and Borough of Wrangell	

Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action and alternatives, providing opportunities during analysis to reduce adverse effects and compare trade-offs for the Responsible Official and public to understand. After reviewing all public comments and input received regarding the Wrangell Island Project, the interdisciplinary team (IDT) developed a list of issues to help shape the environmental analysis. These were categorized as either key issues, or other issues and concerns.

Key Issues

Key issues are used to formulate and design alternatives to the proposed action, formulate project design features, and analyze significant effects. Key issues for the project have been identified through public and internal scoping. Similar issues are combined where appropriate. Issues can arise from a variety of sources, including:

- Issues, concerns, and opportunities identified in the Forest Plan,
- Issues identified for similar projects (past actions),
- Current internal issues,
- Changes in public uses, attitudes, values, or perceptions,
- Issues raised by the public during scoping, and
- Comments from other government agencies.

Measures of the significance of an issue are based on the extent of the geographic distribution, the duration of the related effects, or the intensity of interest or resource conflict surrounding the issue. For an issue to be considered significant at the project level, it must be relevant to the specific project so that it can be appropriately addressed at the project level. Some issues have already been resolved through national level direction or analyzed at the Forest Plan level.

Once a significant issue is identified, measures are developed to analyze how each alternative responds to the issue. Measures are chosen that are quantitative (where possible), predictable, responsive to the issue, and linked to cause and effect relationships. These measures describe how the alternative affects the resource(s) at the heart of the issue (See Comparison of Alternatives and Table 9 in Chapter 2). Monitoring and mitigation of the anticipated environmental effects of the project are also designed to be responsive to key issues.

The following issues are addressed by the action alternatives.

Issue 1: Timber Supply and Timber Sale Economics

Issue statement: Both the timber supply and timber sale economics produced from national forest lands on Wrangell Island affect the stability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies during the transition to a sustainable supply of young-growth.

Most commenters expressing economic concerns cited the need to create well-paying local jobs and invigorate the local and regional timber economy in a sustainable manner; however, their ideas regarding what elements should be included in the proposed action to accomplish these goals varied considerably. Commenters suggested both large-volume sales (to attract large investors and create more service jobs) and small-volume sales (representing different demand calculations that incorporate factors beyond mill capacity and that would develop local value-added operations), as well as varying harvest unit prescriptions (i.e., clearcut versus partial cut). Some suggested including other economic support and recreation opportunities to make the project more economically viable. Many commenters also questioned the decision to exclude roadless areas from the harvest units, and requested the Forest Service reconsider and include these areas for a variety of reasons, including meeting the goals of the originally proposed 10-year sale and providing more access and economic benefits for the public.

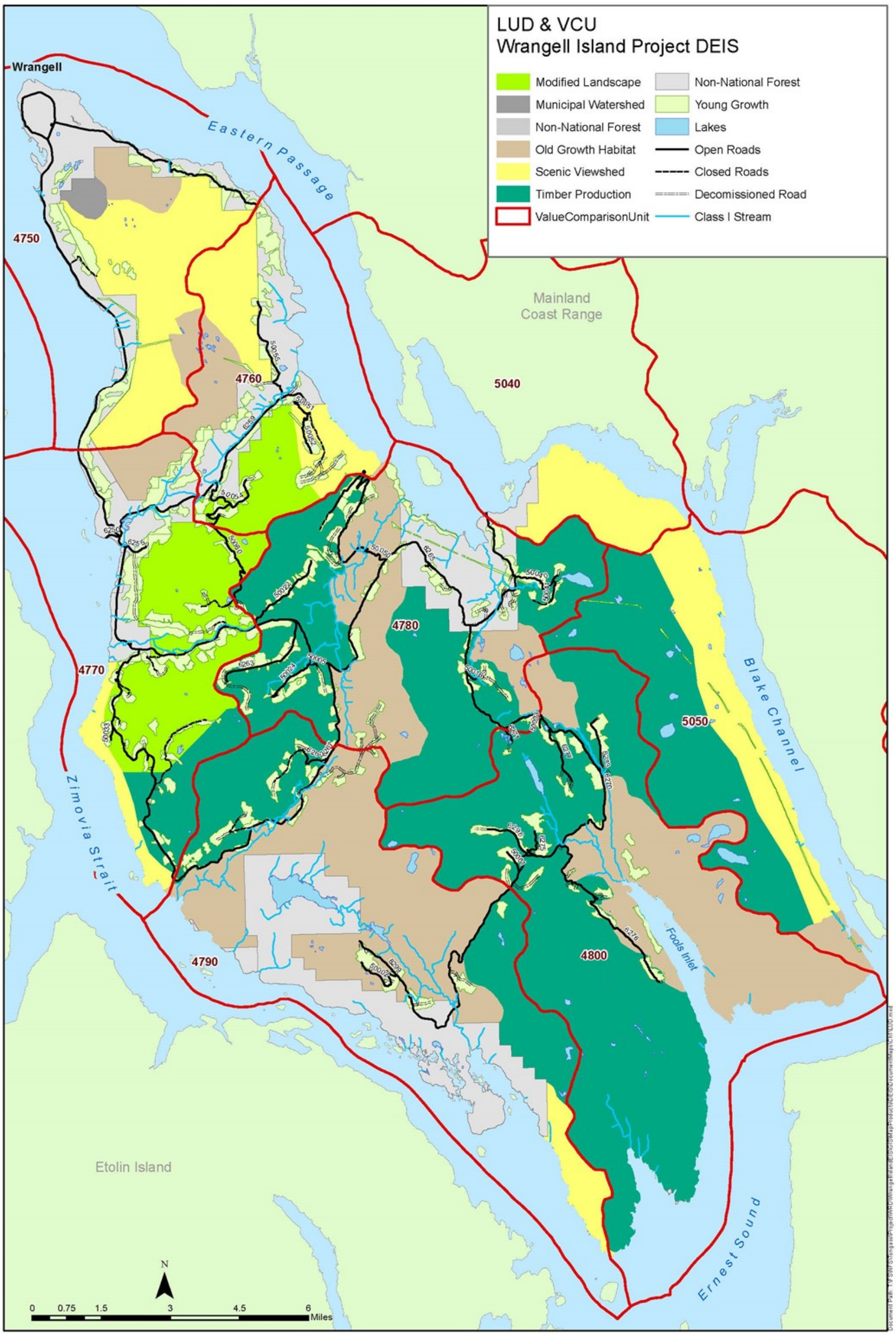

Figure 2. Map showing the location of the 5 land use designations (LUDs) and 8 value comparison units (VCUs) in the project area. Map also shows areas of young-growth

Issue 2: Wildlife Habitat

Issue Statement: Proposed timber harvest and roads, combined with past and reasonably foreseeable timber harvest, would affect old-growth habitat used by wildlife, particularly deer, wolves, and goshawks.

Many commenters expressed general concern that logging and road construction reduces biodiversity, imperils species, and destroys wildlife habitat. Commenters requested the DEIS discuss impacts to wildlife resources expected to occur as a result of the project.

Public and agency comments, as well as internal scoping, expressed concerns about project effects on wildlife in the project area, including biodiversity, species imperilment, and habitat. Commenters indicated past management activities on Wrangell Island have caused habitat fragmentation, and the proposed project presents impacts to wildlife species. Further, commenters suggested the Forest Service seek opportunities for manipulating forest structure and composition to improve wildlife habitat.

The project area includes low-elevation, old-growth habitat. Concern was noted relative to deer, wolves, bears, marten, goshawk, and other species. Of special concern are project effects on deer because of their importance to wolves and subsistence users. In particular, loss of deer habitat and increased competition due to additional road access were noted.

Commenters also made mention of impacts to subsistence use of wildlife. Because of its ease of access, the Wrangell Island project area is considered an important deer hunting area for the community of Wrangell. The cumulative effects on old-growth habitat associated with additional harvest, combined with past harvest and increasing road density were noted concerns.

Issue 3: Scenic Quality

Issue Statement: Proposed timber harvest, combined with past and reasonably foreseeable timber harvest, would affect scenic integrity from visual priority travel routes and use areas identified in the Forest Plan, and in areas of particular scenic importance to the community of Wrangell.

Concerns were raised regarding potential effects of proposed timber harvest to Visual Priority Travel Routes, and areas of high scenic integrity. Comments were expressed regarding visual evidence of logging on the island and advocated for protection of the viewshed along the back channel from the water, which is important to the Wrangell tourism industry. Individual respondents urged avoidance of the viewsheds along the back channel or eastern passage southeast of Earl West and to leave the long pristine stretches of timber untouched to maintain scenic integrity. Long Lake, Zimovia Strait and the area to the east of the old mill site, known locally as the mill basin area, were identified as areas of visual concern. Other comments noted removing trees can provide desirable views of the landscape.

Issue 4: Access Management

Issue Statement: Access management decisions for motorized road use will affect future public access for recreation and subsistence and access for agency administrative purposes.

Individual respondents offered support for creating more NFS roads and keeping temporary roads open longer for subsistence, firewood gathering, and recreation. Other respondents indicated the project should limit new roads, reduce density as a means of resolving wildlife or aquatic issues, protecting watersheds, or lowering maintenance costs.

Many respondents expressed concerns about the impacts of road construction on wildlife, fisheries, riparian and aquatic habitats, and watersheds, and about the impacts of reduced habitats and increased competition for subsistence resources.

Federal and State Permits and Authorizations

Prior to implementation of the project, the Forest Service would have to obtain various permits or authorizations from other Federal and State agencies. These include the following:

- **U.S. Environmental Protection Agency:** Review of the project's hazardous materials spill prevention control and countermeasure plan
- **State of Alaska, Department of Environmental Conservation:** Certification of Compliance with Alaska Water Quality Standards (401 Certification); Stormwater Discharge Permit/Alaska Pollutant Discharge Elimination System review under Section 402 of the Clean Water Act (402); Solid Waste Disposal Permit
- **State of Alaska, Department of Natural Resources:** Authorization for occupancy and use of tidelands and submerged lands
- State of Alaska, Department of Natural Resources and Alaska Mental Health Trust: Right-of-way authorizations
- **State Historic Preservation Officer (SHPO):** Concurrence on Forest Service historic property determination
- **State of Alaska, Department of Fish and Game:** Concurrence with Title 16 for activities in streams such as culvert installation.

Applicable Laws and Executive Orders

Shown below is a partial list of Federal laws and executive orders pertaining to project-specific planning and environmental analysis on Federal lands. While most pertain to all Federal lands, some of the laws are specific to Alaska. Disclosures and findings required by these laws and orders are contained in chapter 3 of this DEIS.

- Alaska Native Claims Settlement Act (ANCSA) of 1971
- Alaska National Interest Lands Conservation Act (ANILCA) of 1980 (as amended)
- Bald and Golden Eagle Protection Act of 1940 (as amended)
- Clean Air Act of 1970 (as amended);
- Clean Water Act (CWA) of 1977 (as amended)
- Endangered Species Act (ESA) of 1973 (as amended)
- Executive Order 11593 (Cultural Resources)
- Executive Order 11988 (Floodplains)
- Executive Order 11990 (Wetlands)
- Executive Order 12898 (Environmental Justice);
- Executive Order 12962 (Aquatic Systems and Recreational Fisheries)
- Executive Order 13007 (Indian Sacred Sites)
- Executive Order 13175 (Government-to-Government Consultation)
- Executive Order 13443 (Facilitation of Hunting Heritage and Wildlife Conservation)
- Magnuson-Stevens Fishery Conservation and Management Act of 1996
- Marine Mammal Protection Act of 1972;
- Migratory Bird Treaty Act of 1918 (as amended)
- National Environmental Policy Act (NEPA) of 1969 (as amended)
- National Forest Management Act (NFMA) of 1976 (as amended)
- National Historic Preservation Act (NHPA) of 1966 (as amended)
- Tongass Timber Reform Act (TTRA) of 1990

Availability of the Project Record

This analysis used the best information available. The project record contains detailed supporting material that documents the NEPA process and analysis from the beginning of the project to the publication of the final EIS (FEIS). The project record is available by request from the Wrangell Ranger District office in Wrangell, Alaska.

Map Disclaimer

All map products in this document are reproduced from geospatial information prepared by the Forest Service. Geographic Information System (GIS) data and product accuracy may vary. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. For more information, contact the Wrangell Ranger District.

Chapter 2. Alternatives

Introduction

This chapter describes and compares the alternatives developed to address the key issues identified in Chapter 1. The chapter includes a discussion of how the alternatives were developed, alternatives not brought forward for full analysis, and a description of each alternative considered in detail. Also included is a discussion of design features, mitigation measures and monitoring common to all action alternatives. The chapter concludes with maps of each alternative and an alternative comparison table.

A complete detailed discussion of the environmental effects of the alternatives are presented in Chapter 3 “Environment and Effects.”

At this time, Alternative 2 is identified as the Preferred Alternative. However, all the alternatives are viable and any one of them, or portions of them, could be selected by the Responsible Official.

Alternative Development

The available timber volume within the project area was analyzed in a logging system transportation plan which identified a possible pool of timber harvest units. This unit pool was screened for consistency with the Forest Plan and for economic feasibility to develop the proposed action. The proposed action was presented to the public during scoping to solicit public comment. Those comments were used to identity the key issues and alternatives to the proposed action to address those issues.

Alternatives Considered in Detail

The Forest Service designed five alternatives for detailed analysis in this DEIS. These include the no action alternative, the proposed action, and three alternatives developed in response to key issues to provide a reasonable range of alternatives.

With the exception of Alternative 1, all are designed to achieve the purpose and need for the Wrangell Island Project. Maps of each alternative are located at the end of this chapter.

Alternative 1 – No Action

Alternative 1 is the “no-action” alternative because in this alternative, no proposed activities would occur (Figure 3).

The no action alternative is required. It provides a baseline of existing conditions and trends, enabling the Responsible Official to compare the magnitude of environmental effects of the action alternatives. In this alternative, other approved forest management activities not related to the proposed project would continue. Road access management would fully implement the 2007 Wrangell Ranger District Access and Travel Management Plan decision (ATM) for Wrangell Island.

The ATM deferred closure of some roads until the Wrangell Island EIS is complete. If Alternative 1 is selected, then approximately 24.1 miles of NFS road currently open to motorized use would be closed, and 2.5 miles of existing NFS road would be decommissioned. Approximately 73 miles of existing NFS road would be open for public use for motorized vehicles of all types. These roads are shown on the Alternative 1 Access Management map (Figure 8).

Alternative 2 – Proposed Action

Alternative 2 is the proposed action. The alternative is designed to provide the greatest supply of timber volume for the timber industry, while maintaining scenic quality, old growth habitat and habitat connectivity as specified in the Forest Plan (Figure 4).

Alternative 2 proposes even-aged and uneven-aged timber harvest on suitable lands within a 10-year period, and new and temporary road construction. New roads would be closed and temporary roads would be decommissioned after project activities are completed, as directed by the existing access management plan. Alternative 2 would accomplish proposed activities according to Forest Plan land use designations and maintain current road management objectives.

Alternative 2 is designed to harvest timber in the roaded land base in development land use designations (LUDs; Timber Production and Modified Landscape). This alternative provides timber volume opportunities for both large and small sales outside of the 2001 Inventoried Roadless Areas (IRAs). This alternative proposes harvest in the Mill Basin and Thoms areas, as well as harvest adjacent to Long Lake. This alternative addresses Issue 1 by providing the greatest timber volume from which to offer individual timber sales. It also addresses Issue 4 by providing the most motorized public access following harvest.

Timber Harvest: Alternative 2 would produce an estimated 65 MMBF of old-growth saw/utility timber volume from approximately 5,309 acres. Silvicultural prescriptions include approximately 3,528 acres of uneven-aged management (partial harvest) and 1,781 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are designed to provide visual resource protection but also reduce negative effects to wildlife. No young-growth harvest is included in this alternative or any of the other alternatives, as no commercially viable young-growth timber is available.

Roads: Alternative 2 proposes construction of 17.2 miles of new NFS roads and 14.9 miles of temporary roads. It also proposes reconditioning 5.8 miles of existing NFS roads. All temporary roads would be decommissioned after harvest and firewood gathering activities are complete. Existing marine access facilities at Pats Landing and Earl West could be used.

Motorized Access Management: The motorized access management proposed in this alternative was developed through a collaborative process between the IDT and the Wrangell Borough. The process identified the roads associated with the alternative that are the most important to the community for subsistence and recreation access. Then, the roads were evaluated based on resource protection needs and future maintenance costs. Alternative 2 proposes closing 16.1 miles of road to public motorized use and decommissioning 0.2 mile. Approximately 101 miles of NFS road would be available for public motorized access, of which 14 miles would be restricted to motorized trail use. These roads are shown on the Alternative 2 Access Management map (Figure 9).

Alternative 3

Alternative 3 proposes even-aged and uneven-aged timber harvest and new and temporary road construction. Alternative 3 also proposes road management objectives which define public motorized access.

Alternative 3 was designed to harvest timber in the roaded land base in development LUDs (Timber Production and Modified Landscape) while maintaining scenic quality, old growth habitat and habitat connectivity as specified in the Forest Plan. This alternative provides timber volume opportunities for both large and small sales outside of the 2001 IRAs. Alternative 3 is designed to address Issues 2 (Wildlife Habitat), 3 (Scenic Quality) and 4 (Access Management). This alternative avoids harvest in the Mill Basin and adjacent to Long Lake. It proposes less harvest in the Fools Inlet area. In this alternative the effects of timber harvest on scenic quality are reduced by using more partial harvest prescriptions requiring at least two-thirds of the stand to remain, and harvesting fewer acres (Figure 5). Alternative 3 also maintains wildlife habitat and connectivity (Issue 2), and minimizes impacts to recreation while still incorporating some economic harvest opportunities. It addresses Issue 4 by providing additional motorized public access following harvest.

Timber Harvest: Alternative 3 would yield an estimated 48.8 MMBF of old-growth saw/utility timber volume from approximately 3,184 acres. Silvicultural prescriptions include approximately 1,483 acres of uneven-aged management (partial harvest) and 1,701 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are primarily to provide visual resource protection but also reduce effects to wildlife. No young-growth harvest is included in this alternative.

Roads: Alternative 3 proposes construction of 15.8 miles of new NFS roads and 14.1 miles of temporary roads. It also proposes reconditioning 5.8 miles of existing NFS roads. All temporary roads would be decommissioned after harvest operations and firewood gathering activities are complete. Existing marine access facilities at Pats Landing and Earl West could be used.

Motorized Access Management: The motorized access management proposed in this alternative was developed through a collaborative process between the IDT and the Wrangell Borough. The process identified the roads associated with the alternative that are the most important to the community for subsistence and recreation access. Then, the roads were evaluated based on resource protection needs and future maintenance costs. Alternative 3 proposes closing 16.3 miles of road to public motorized use and decommissioning 0.2 mile of road. Approximately 99.2 miles of NFS road would be open for public motorized access, 13.8 miles of which would be restricted to motorized trail use. These roads are shown on the Alternative 3 Access Management map (Figure 10).

Alternative 4

Alternative 4 was designed to harvest timber in the roaded land base in development LUDs (Timber Production and Modified Landscape). This alternative provides timber volume opportunities for both large and small sales outside of the 2001 IRAs. Alternative 4 proposes even-aged and uneven-aged timber harvest and new and temporary road construction. Alternative 4 also proposes road management objectives which define public motorized access.

The alternative was designed to maximize the economic value of the timber harvest from which to offer individual timber sales (Issue 1) while protecting scenic quality, old growth habitat and connectivity, and other resources as specified in the Forest Plan. This was done by proposing harvest units with the least logging costs and minimizing road construction and helicopter yarding distances (Figure 6). Alternative 4 minimizes helicopter harvest in the Mill Basin and Eastern Passage area. It emphasizes even-aged harvest over the more costly partial harvest.

Timber Harvest: Alternative 4 would yield an estimated 51 MMBF of old-growth saw/utility timber volume from approximately 3,531 acres. Silvicultural prescriptions include approximately 1,738 acres of uneven-aged management (partial harvest) and 1,793 acres of even-aged management (clearcut) that would be achieved using conventional cable, shovel, and helicopter logging systems. The partial harvest systems are primarily to provide visual resource protection but also reduce effects to wildlife. No young-growth harvest is included in this alternative.

Roads: Alternative 4 proposes construction of 16.1 miles of new NFS roads and 16.2 miles of temporary roads. It also proposes reconditioning 5.4 miles of existing NFS roads. All temporary roads would be decommissioned after harvest operations and firewood gathering activities are complete. The existing marine access facilities at Pats Landing and Earl West could be used.

Motorized Access Management: The motorized access management proposed in this alternative was developed through a collaborative process between the IDT and the Wrangell Borough. The process identified the roads associated with the alternative that are the most important to the community for subsistence and recreation access. Then, the roads were evaluated based on resource protection needs and future maintenance costs. Alternative 4 proposes closing 15.7 miles of road to public motorized use and decommissioning 0.2 mile of road. Approximately 100 miles of NFS road would be open for public

motorized access, 13.6 miles of which would be restricted to motorized trail use. These roads are shown on the Alternative 4 Access Management map (Figure 11).

Alternative 5

Alternative 5 is designed to harvest timber in the roaded land base in development LUDs (Timber Production and Modified Landscape). This alternative provides timber volume opportunities for both large and small sales outside of the 2001 IRAs. Alternative 5 proposes even-aged and uneven-aged timber harvest, and new and temporary road construction. Alternative 5 also proposes road management objectives which define public motorized access.

Alternative 5 is designed to provide timber harvest while protecting wildlife habitat to respond to Issue 2 (Wildlife Habitat). In this alternative, the effects of timber harvest on wildlife habitat are reduced by using more partial harvest prescriptions that require at least two-thirds of the stand to remain and reduce the number of acres harvested. As a result, fewer acres of wildlife habitat would be affected, including elevational corridors, low elevation habitat, and high productive old-growth (POG) habitat. It also minimizes harvest activities in areas with higher specific wildlife values such as 500-foot no harvest buffers on streams that have brown bear feeding (Figure 7). This alternative also provides wildlife habitat connectivity by proposing fewer roads overall and closing all newly constructed roads following timber harvest activities, to create a lower road density. These road closures are intended to reduce effects on wolves and would also reduce effects on deer and marten. This alternative avoids harvest in the Thoms Area and adjacent to Long Lake. It does propose partial harvest in the Mill Basin.

Timber Harvest: Alternative 5 would yield an estimated 42.8 MMBF of old-growth saw/utility timber volume. Silvicultural prescriptions include about 2,868 acres of uneven-aged management and about 936 acres of even-aged management that would be achieved using conventional cable, shovel, and helicopter logging systems. No young-growth harvest is included in this alternative.

Roads: Alternative 5 proposes construction of 12.5 miles of new NFS roads and 9.1 miles of temporary roads. It also proposes reconditioning 4.1 miles of existing NFS roads. All temporary roads would be decommissioned immediately after harvest activities are complete. Existing marine access facilities at Pats Landing and Ear West could be used.

Motorized access management: The ATM deferred closure of some roads until the Wrangell Island EIS is complete. Alternative 5 would fully implement the ATM and also close all newly constructed roads. Approximately 36.5 miles of road (existing and proposed) would be closed and 2.5 miles of existing road decommissioned. Approximately 73 miles of existing NFS road would be available for public use for motorized vehicles of all types. These roads are shown on the Alternative 5 Access Management map (Figure 12).

Project Design Features and Mitigation Measures for Action Alternatives

To reduce or avoid the overall impacts of this project, design features have been incorporated into the design of the harvest units for all action alternatives based on the application of the Forest Plan Standards and Guidelines and management prescriptions. The intent of these standards and guidelines are to help avoid, minimize, or mitigate possible adverse impacts due to project activities. Where applicable, these site-specific project design features are identified the unit and road cards.

Best Management Practices

Best management practices (BMPs) are methods, measures, or practices to directly or indirectly protect water quality, and abate or mitigate adverse water quality impacts while meeting other resource goals and objectives identified in FSH 2509.22, Region 10 Soil and Water Conservation Handbook. They are the result of collaboration between the Forest Service and the State of Alaska to identify practices to ensure

timber harvest activities minimize soil erosion and protect aquatic habitat to meet the requirements of the Clean Water Act. In addition to having the State-approved BMPs in place, the Forest Service issued National Core BMPs in 2012 (USDA Forest Service 2012).

BMPs are applied to all management activities including timber harvest and road construction, reconditioning, and maintenance.

Marine Access Facilities

The two existing marine access facilities, Pats and Earl West, are available to convey logs for saltwater transportation. These facilities are permitted with the State of Alaska and are designed to minimize impacts to soil, water quality and marine environment.

Landings

Landings constructed for conventional or helicopter logging systems would be located adjacent to existing or newly constructed roads near harvest locations. Existing landings and rock quarries would be used for log storage and helicopter support services when available.

Hazardous Materials

All activities with potential for spills of hazardous materials would comply with all State and federal permits and laws regarding hazardous materials storage and cleanup. They would also comply with BMPs and other requirements such as a Spill Prevention Control and Countermeasure Plan.

Streams

To retain stream channel characteristics, including riparian vegetation, all Class I and II streams will be protected by a no-harvest riparian management area (RMA) buffer of 100 feet or more, consistent with the Forest Plan. Class III streams would be protected by a minimum width, no-cut riparian buffer with a reasonable assurance of windfirmness. Class IV streams would be protected by directional timber felling and yarding away from stream channel. Units considered to have increased risk of windthrow would have reasonable assurance of windfirmness (RAW) buffers using RAW guidelines.

Silviculture

Where specified, uneven-aged management (partial harvest) would harvest a maximum of one-third of the stand leaving a minimum of two-thirds to provide for visual, wildlife, and other resource values.

Soils

Effects to soils would be minimized by utilizing existing roads, landings, and rock quarries for timber harvest activities when present. Where feasible, temporary road locations would take advantage of topography and minimize disruption of natural drainage patterns. Areas identified for shovel yarding generally only occur on slopes less than 35 percent and outside riparian management areas. Slash or puncheon mats would be used to protect soils by distributing the weight of the mechanized harvest equipment in exposed soil areas. The leading end of logs would be suspended during yarding operations, reducing the footprint of logs as they are dragged on the soil surface. Helicopter yarding would provide full suspension of logs. Fine organic matter and coarse woody debris from cull logs and breakage of tops and branches remaining on the ground would provide nutrient recycling.

Wildlife

In units designated for uneven-aged management (partial harvest), a maximum of one-third of the stand would be removed leaving a minimum of two-thirds to provide for wildlife values. The remaining stand would provide cavity-nesting habitat and other habitat values. In areas of uneven-aged management, standing snags, and snags felled for safety reasons, would be retained to provide wildlife habitat. Known

or suspected heron and raptor nests would be protected. A 600-foot wind firm buffer would be applied around all active nests. A minimum of 100 acres of POG would be provided around all known goshawk nests.

Wetlands

Roads would be located to avoid wetlands to the extent practicable. Drainage structures would be used in sufficient number to maintain natural hydrologic conditions. Ditching would be minimized to prevent excessive drainage. Ground-based logging systems would be required to place slash to float the equipment to minimize wetland disturbance.

Invasive Plants

Require rock material from existing quarries for construction of new roads to be inspected and documented as being free of any high priority invasive species; require erosion control material (such as seed mixes) to be certified as “weed-free” for the local ecosystem; and maintain crushed rock stockpiles and active quarries in a “weed-free” condition.

Develop a comprehensive invasive plant management approach prior to project implementation; focused treatment of small weed infestations in high value habitats (e.g., riparian, beach fringe) tiering to the 2013 Wrangell-Petersburg Integrated Weed Management Plan; eradication or control of any newly introduced invasive plant species prior to closing roads; prioritization for eradication or control of invasive plants on roads with low levels of existing infestations that act as a vector to high country or estuarine habitat.

Scenery

To reduce the visual impact of harvest areas, and where safety and operability concerns would permit, vertical structure containing both live and dead trees would be retained within timber harvest units and along unit edges to emulate natural openings. Unit boundaries would be shaped and feathered to reduce any unnaturally-shaped edges and hard edges that appear as artificial features on the landscape.

Monitoring

Project monitoring is used to determine how well specific design features or mitigation work in minimizing adverse impacts and achieving resource objectives. The project would be monitored during implementation to ensure that timber sale contract provisions and resource protection measures are followed.

Harvest activities would be monitored as part of timber sale contract administration. Harvest units would be monitored with regeneration surveys to ensure adequate stand regeneration as required by the National Forest Management Act. Project harvest units and roads would be incorporated into the Forest-wide BMP monitoring program.

Invasive plants would be monitored within the project area as part of the Wrangell District Invasive Plant management program.

Soil disturbance would be monitored through the Forest-wide BMP and soils monitoring programs.

Bark accumulation at the Pats Landing and Earl West marine access facilities would be monitored as required by the Alaska APDES Permit AKG700000 – Log Transfer Facilities in Alaska.

Project activities would be monitored to ensure that any previously unknown historical or cultural sites that are found would be adequately protected.

Roads and bridges associated with the project would be monitored as part of the Forest-wide roads and bridges inspection program.

Goshawk nests and suspected nest areas would continue to be monitored in accordance with Forest goshawk monitoring protocols.

Alternatives Considered But Eliminated From Detailed Study

Several alternatives were considered during the planning process, but eliminated from detailed study in the EIS. They are described briefly below, along with rationale for not considering them further.

Increase Available Timber Volume through Forest Plan Amendments

This alternative proposed project-specific Forest Plan amendments to modify some small and medium old-growth reserve (OGR) boundaries in order to provide a larger supply of timber volume. Removal of some visual priority route designations were also proposed to provide more timber volume.

This alternative was eliminated from further study because the Forest Plan itself is undergoing an amendment process. The uncertainty of the outcome of the Forest Plan Amendment warranted eliminating this alternative from consideration at this time.

Increase Wildlife Habitat Protections through Forest Plan Amendments

This alternative proposed project-specific Forest Plan amendments to allow for the modification of some small and medium OGR boundaries to provide additional wildlife habitat protections in these areas. Areas within deer winter range habitat were either excluded from harvest or only allowed for partial harvest.

This alternative was eliminated from further study because the Forest Plan itself is undergoing an amendment process. The uncertainty of the outcome of the Forest Plan Amendment warranted eliminating this alternative from consideration at this time.

Increase Available Timber Volume by Applying Minimal Nest and Stream Buffer Protections

This alternative proposed to minimize the nest protections by applying a standard horizontal radius, regardless of productive old-growth (POG), and to minimize stream buffer protections for Class III streams by applying only in areas required to meet best management practices. Based on the results of a preliminary analysis, this alternative was eliminated because it would not result in an amount of additional timber volume that would justify the minimal buffer protections and would not meet the intent of the Forest Plan Standards and Guidelines.

Increase Available Timber Volume by Proposing Harvest over a 30-year Harvest Period

This alternative proposed to provide timber volume from the project over a 30-year period by scheduling harvest units that would not currently meet the “green up” guidelines until adjacent harvested stands had adequately regenerated. This alternative was eliminated because the additional timber volume is similarly represented in other alternatives and there is too much uncertainty to warrant a 30-year project.

Include Timber Harvest within the 2001 Inventoried Roadless Area

This alternative proposed harvest within the 2001 Inventoried Roadless Areas to meet the initial project plan of 150 to 200 MMBF of timber volume. This alternative was eliminated because timber harvest and road construction are not allowed within the 2001 Inventoried Roadless Areas (IRAs).

Avoid Timber Harvest within the 2003 Forest Plan Inventoried Roadless Areas

This alternative proposed to exclude timber harvest and road construction within the 2003 Inventoried Roadless Areas identified in the Forest Plan, as well as in the 2001 Inventoried Roadless Areas. Excluding

timber harvest from both types of roadless areas would not provide sufficient timber volume to meet the purpose and need of this project.

Avoid Timber Harvest in Low Elevation Productive Old-Growth Areas

This alternative proposed to avoid timber harvest and road construction within areas of POG below 1,500-, 1,000-, and 800-foot elevations to protect wildlife habitat and winter range concerns. This alternative was eliminated because it is represented in the Alternative 5 design to reduce the effect of timber harvest on wildlife habitat.

Avoid Timber Harvest in McCormack Creek and Salamander Creek Watersheds

This alternative proposed to exclude timber harvest or road construction within McCormack Creek and Salamander Creek basins to address watershed-related concerns about the level of previous harvest in these areas. This alternative was eliminated because it is already addressed in Alternative 1.

No New Road Construction

This alternative proposed timber harvest with no new road construction which would limit timber harvest to only helicopter yarding or to areas along existing roads. This alternative was eliminated because it would not meet the purpose and need for timber volume, would be highly uneconomical due to the high costs of helicopter yarding, and because it does not develop any road infrastructure to support the transition to a future of sustainable young-growth management.

Comparison of Alternatives

This section compares outputs and provides a summary of the effects of implementing each alternative for the key issues.

Estimated Timber Production by Alternative

The following table shows the estimated timber volume that could be available in each alternative. Estimates are based on silvicultural stand examination information used with the Region 10 FAST-R timber sale financial efficiency model, version October 21, 2013, and are provided for comparison and analysis purposes only.

Table 5. Comparison of estimated timber volume (MMBF) by alternative

Volume (MMBF)	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Total net sawlog volume	0	57.8	43.0	45.4	38
Total utility volume	0	7.3	5.8	5.7	4.8
Total net volume (sawlog and utility)	0	65.1	48.8	51.1	42.8

Proposed Road Construction and Management

All alternatives, except the no action, propose constructing new and temporary roads and reconditioning existing roads. Table 6 displays the miles of road construction and reconditioning. Table 7 shows annual maintenance costs by alternative. All values are rounded estimates.

Table 6. Miles of road construction and reconditioning by alternative

Activity (miles)	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
New NFS construction	0	17.2	15.8	16.1	12.5
New temporary construction	0	14.9	14.1	16.2	9.1
Reconditioning of existing road	0	5.8	5.8	5.4	4.1

Table 7. Estimated total road costs by alternative

Cost	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Total (in millions of dollars)	0	5.4	4.8	5.2	3.7

The Wrangell Island Project proposes road management objectives which designate motorized vehicle use by vehicle class for each alternative. Alternatives 1 and 5 close all newly constructed roads to motorized access following completion of timber harvest activities. The remaining roads would be managed under the ATM decision.

Alternatives 2, 3, and 4 propose road management objectives which would designate some roads to remain open to motorized vehicle use after the completion of timber harvest operations. See Table 8 for access management under each alternative.

Table 8. Access management for NFS roads on Wrangell Island

Access Management	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Open to all vehicles					
Total new	0	5	3.8	4.7	0
Total existing	73	81.6	81.6	81.6	72.8
Total (new and existing)	**73**	**86.7**	**85.4**	**86.3**	**72.8**
Motorized trails					
Total new	0	5.97	5.7	5.6	0
Total existing	0	8.02	8.0	8.0	0
Total (new and existing)	**0**	**13.99**	**13.8**	**13.6**	**0**
Closed to all vehicles					
Total new	0	6.1	6.2	5.8	12.5
Total existing	24.1	10.0	10.1	10.0	24.1
Total (new and existing)	**24.1**	**16.1**	**16.3**	**15.7**	**36.5**
Decommissioned					
Total new	0	0	0	0	0
Total existing	2.5	0.2	0.2	0.2	2.5
Total (new and existing)	**2.5**	**0.2**	**0.2**	**0.2**	**2.5**

Table 9. Alternative comparison table

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Basic Project Data					
Timber Harvest (acres)	0	5,309	3,184	3,531	3,804
Volume of Harvest (MMBF)	0	65.1	48.8	51.1	42.8
Road construction (miles) (NFS road and temporary road construction)	0	32.1	29.9	35.4	21.6
ISSUE 1: TIMBER SUPPLY AND ECONOMICS					
Timber Volume			**Millions of Board Feet (MMBF)**		
Sawtimber	0	57.8	43.0	45.4	38.0
Utility	0	7.3	5.8	5.7	4.8
Total Net Volume	0	65.1	48.8	51.1	42.8
Logging System			**(Acres)**		
Cable	0	1,200	1,158	1,207	640
Shovel	0	703	587	720	411
Helicopter	0	3,408	1,440	1,604	2,754
Total Harvest Acres	0	5,309	3,184	3,531	3,804
Timber Volume by Species			**Millions of Board Feet (MMBF)**		
Sitka spruce	0	12,711	9,465	9,979	8,360
Hemlock	0	30,044	22,373	23,587	19,760
Western Redcedar	0	4,622	3,442	3,629	3,040
Alaska Yellow-cedar	0	10,400	7,744	8,165	6,840

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Financial Efficiency Analysis			**(Current Region 10 Export Policy)**		
Indicated Advertised Rate ($/thousand board feet (MBF) net removed)	0	($57.25)	($54.21)	($61.36)	($91.80)
Road Construction and Reconditioning Costs ($/MBF net removed)	$0.00	$83.20	$99.20	$102.40	$86.90
Logging Costs ($/MBF net removed)	0	$318.22	$293.38	$297.99	$349.36
Financial Efficiency Analysis			**(Domestic Processing)**		
Indicated Advertised Rate ($/MBF net removed)	0	($218.66)	($215.62)	($237.08)	($253.21)
Road Construction and Reconditioning Costs ($/MBF net removed)	0	$83.20	$99.20	$102.40	$86.90
Logging Costs ($/MBF net removed)	0	$318.22	$293.38	$297.99	$349.36
Employment			**Number of Annualized Jobs Supported**		
Total Jobs Estimated (Current Region 10 Policy)	0	252	187	198	166
Domestic Processing	0	303	226	238	199

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
ISSUE 2: WILDLIFE HABITAT					
Cumulative Change to *Deer* Habitat on All Land Ownerships[1]			**Percent Change From Historical Acres**		
Historical Deep Snow Winter Habitat (high-productivity old-growth (POG) ≤800' elevation on all aspects)	-33%	-34%	-34%	-34%	-33%
Historical Average Winter Habitat (POG ≤1,500' elevation)	-18%	-25%	-23%	-23%	-23%
Historical Non-winter Habitat (all habitats except older young-growth)	-4%	-4%	-4%	-4%	-4%
Cumulative Change in *Deer Model* Habitat Capability (DHC) on All Land Ownerships			**Percent Change in DHC Since 1954 (at stem exclusion)**		
1954 Theoretical Number of Deer	-17.0%	-23.0%	-21.0%	-22.0%	-21.0%
Effects on *Wolves* on All Land Ownerships			**Deer Density Compared to Historical Deer Density (deer/mi2 at stem exclusion)**		
Deer Model Deer Density – 1954 [1]	10.6	9.9	10.2	10.1	10.1
Cumulative Change to *Bear* Habitat on All Land Ownerships			**Percent Change From Historical Habitat**		
Historical POG Within 500 feet of Class I fish streams	-17%	-19%	-18%	-19%	-18%

[1] WAA 1903 is 134,307 acres, and current models show a deer density of 12.9 deer/mi2; 2

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cumulative Change to *American Marten* Habitat on All Land Ownerships					
Historical Winter Habitat – High-volume POG < 1500' in elevation	-34%	-41%	-39%	-40%	-39%
Historical Year-round Habitat – POG	-18%	-25%	-23%	-23%	-23%
Cumulative Change to *Goshawk* Habitat on All Land Ownerships[2]					
Historical Nesting Habitat by VCU – High-Volume POG	0-49%	0-60%	0-59%	0-60%	0-59%
Historical Foraging Habitat by VCU – All POG	0-29%	0-42%	0-40%	0-40%	0-40%
Cumulative Changes to High-Volume POG and all POG Habitat on All Land Ownerships					
High-volume POG	-32.0%	-40.0%	-37.0%	-37.0%	-38.0%
All POG	-15.0%	-22.0%	-19.0%	-20.0%	-20.0%
ISSUE 3: SCENERY					
Scenic Integrity Objectives met?	yes	yes	yes	yes	yes
Relative impact on scenery as a result of proposed timber harvest (lowest=1 to highest=5)	1	5	4	3	2

[2] VCUs 4750, 4760, 4770, 4780, 4790, 4900, 5040 and 5050

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Relative impact on scenery as a result of proposed road construction (lowest=1 to highest=5)	1	4	3	5	2
ISSUE 4: TRANSPORTATION					
Proposed NFS road construction (miles)	0	17.2	15.8	16.1	12.5
Proposed temporary road construction (miles)	0	14.9	14.1	16.2	9.1
Proposed road reconditioning (miles)	0	5.8	5.8	5.4	4.1
Estimated total road costs (in millions of dollars)	0	5.4	4.8	5.2	3.7
Road Designations, following Implementation (total, island-wide)					
Open to all vehicles (miles)	73	86.7	85.4	86.3	72.8
Motorized trails (miles)	0	13.99	13.8	13.6	0
Closed to all vehicles (miles)	24.1	16.1	16.3	15.7	36.5
Decommissioned (miles)	2.5	0.2	0.2	0.2	2.5
Temporary roads to be kept open for firewood gathering following harvest operations (approx. 2-3 years)	no	yes	yes	yes	no

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
AIR QUALITY AND CLIMATE CHANGE					
Contribute to the effects of or current rate of climate change, including carbon sequestration?	not likely	slight increase	slight increase	slight increase	slight increase
Contribute to Yellow-cedar decline?	not likely	not likely	not likely	not likely	not likely
Contribute to greenhouse gas emissions?	no	yes	yes	yes	yes
AQUATICS					
Proposed NFS Road stream crossings					
Class I	0	2	2	2	1
Class II	0	8	3	8	4
Class III	0	14	12	13	9
Proposed Temporary Road stream crossings					
Class I	0	0	0	0	0
Class II	0	2	1	2	1
Class III	0	12	11	13	10
CULTURAL RESOURCES					
Impacts to cultural resources?	no	no	no	no	no
ENVIRONMENTAL JUSTICE					
Disproportionately high or adverse impact on low-income or minority populations who use the project area?	no	no	no	no	no

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
INVENTORIED ROADLESS AREAS					
Impact on inventoried roadless areas?	no	no	no	no	no
PLANTS: SENSITIVE AND RARE					
Relative ranking of impact to sensitive plant habitat (1 = most impact, 5 = least impact)	5	1	3	2	4
Relative ranking of impact to rare plant habitat (1 = most impact, 5 = least impact)	5	1 (tie)	3	1 (tie)	4
PLANTS: INVASIVE					
Risk of spread of invasive species	Low	Moderate	Moderate	Moderate	Low
RECREATION					
Relative ranking of impacts to inventoried recreation sites on Wrangell Island, not including roads (1 = most impact, 5 = least impact)	5	1	3	2	4
SILVICULTURE					
Silvicultural system and harvest method					
Even-aged Management - Clearcut					
Cable/Shovel	0	1,713	1,633	1,725	868
Clearcut with reserves					
Cable/Shovel	0	68	68	68	68

Measure or Question	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Helicopter	0	0	0	0	0
Uneven-aged Management – Single tree selection (up to 33% removal)					
Shovel	0	119	43	134	114
Helicopter	0	3,410	1,440	1,604	2,754
Total Acres Harvested	0	5,309	3,184	3,531	3,804
SOILS					
Estimated acres of detrimental soil disturbance					
Yarding	0	95	84	91	54
Temporary Roads	0	81	77	88	49
Total acres	0	175	160	180	103
Estimated harvest acres and road miles on steep slopes					
Acres of harvest proposed on slopes over 72% (all harvest methods)	0	268	211	253	177
Miles of proposed road on slopes >67%	0	1.3	1.3	1.4	0.6
WETLANDS					
Acres of wetlands impacted by activity					
Harvest (acres)	0	1,740	1,056	1,112	1,230
Rock quarry (acres)	0	14	13	15	9
Road construction (acres)	0	78	74	81	51

Figure 3. Alternative 1 - Existing condition of the Wrangell Island project area

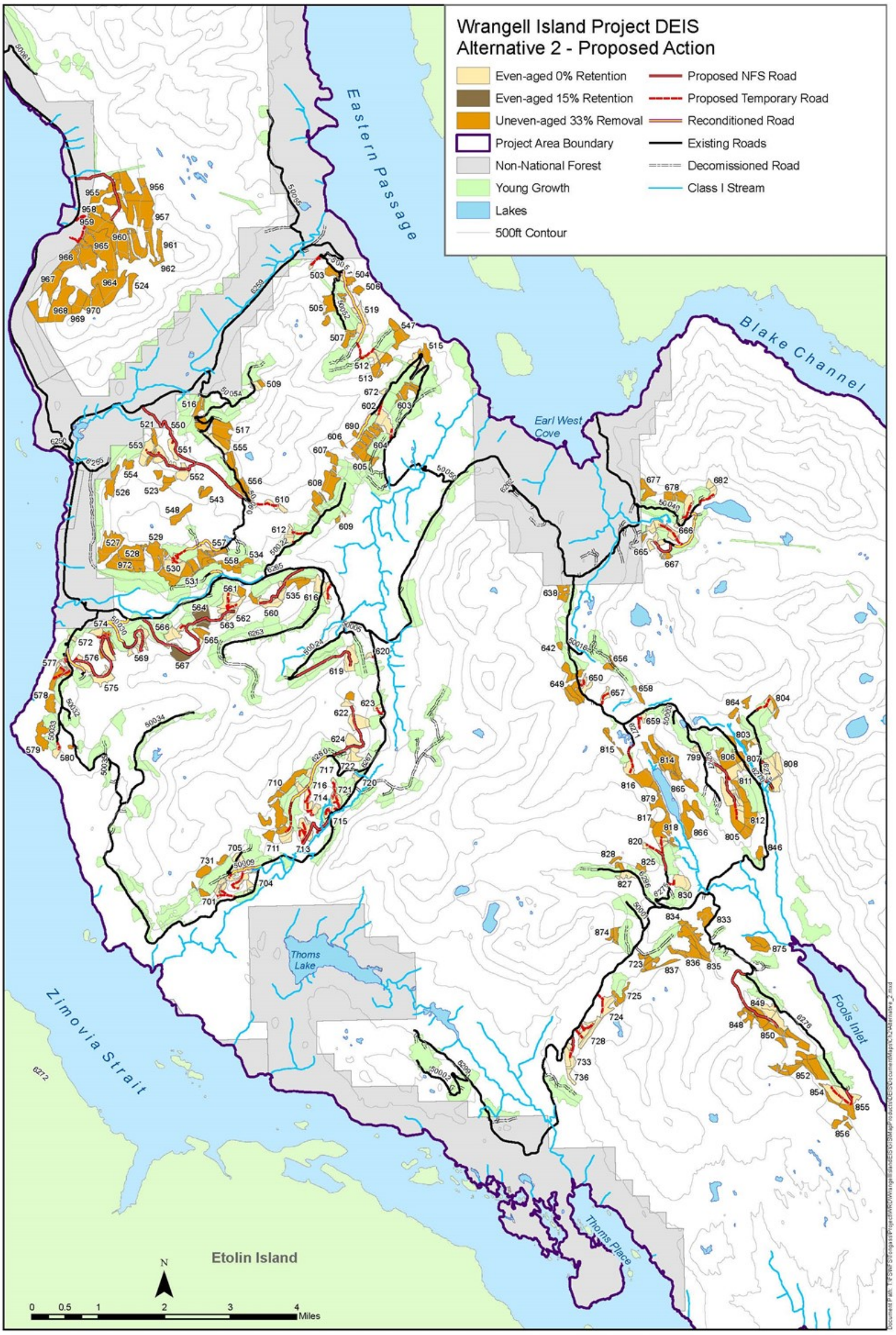

Figure 4. Alternative 2 - Proposed action for the Wrangell Island Project

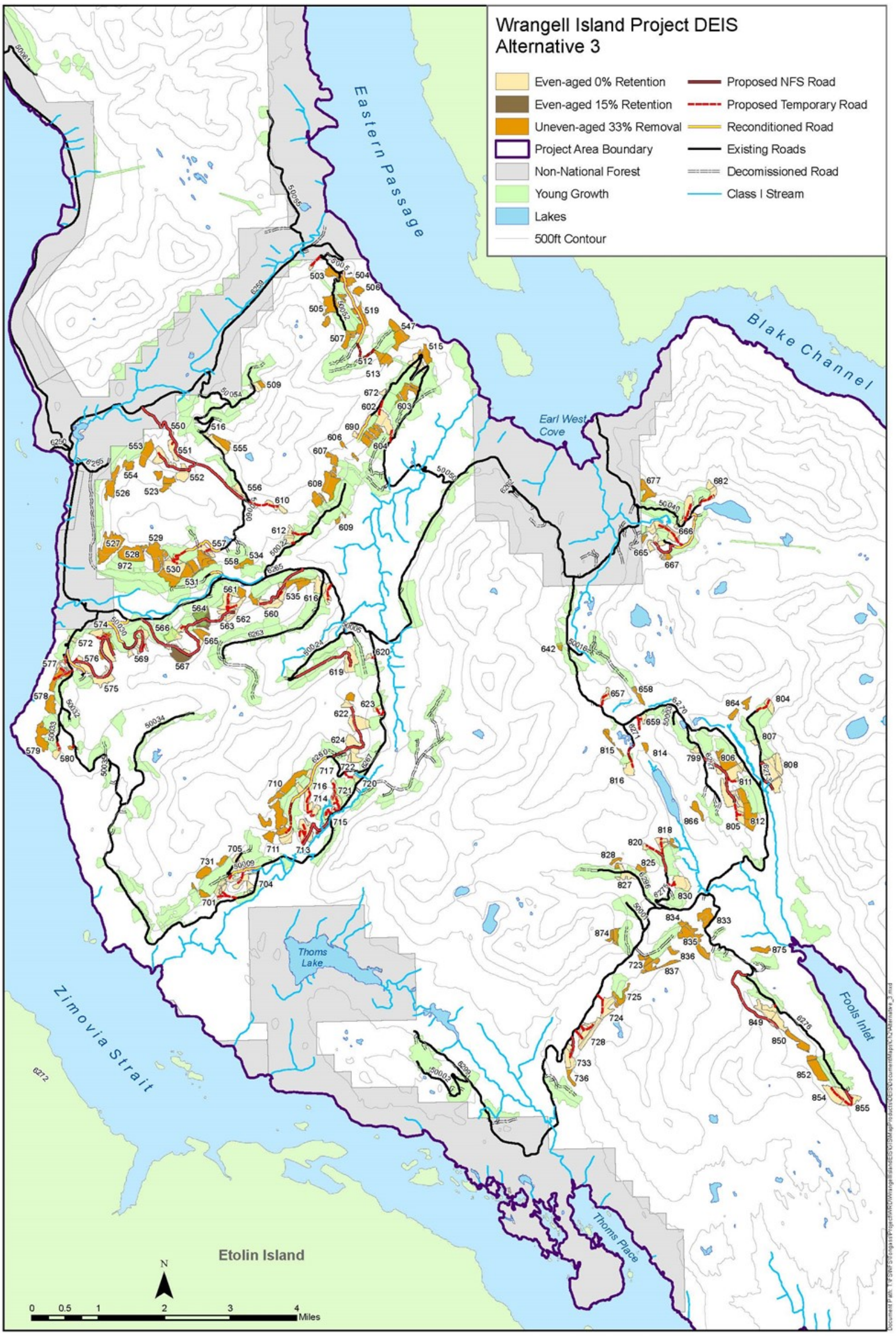

Figure 5. Alternative 3 for the Wrangell Island Project

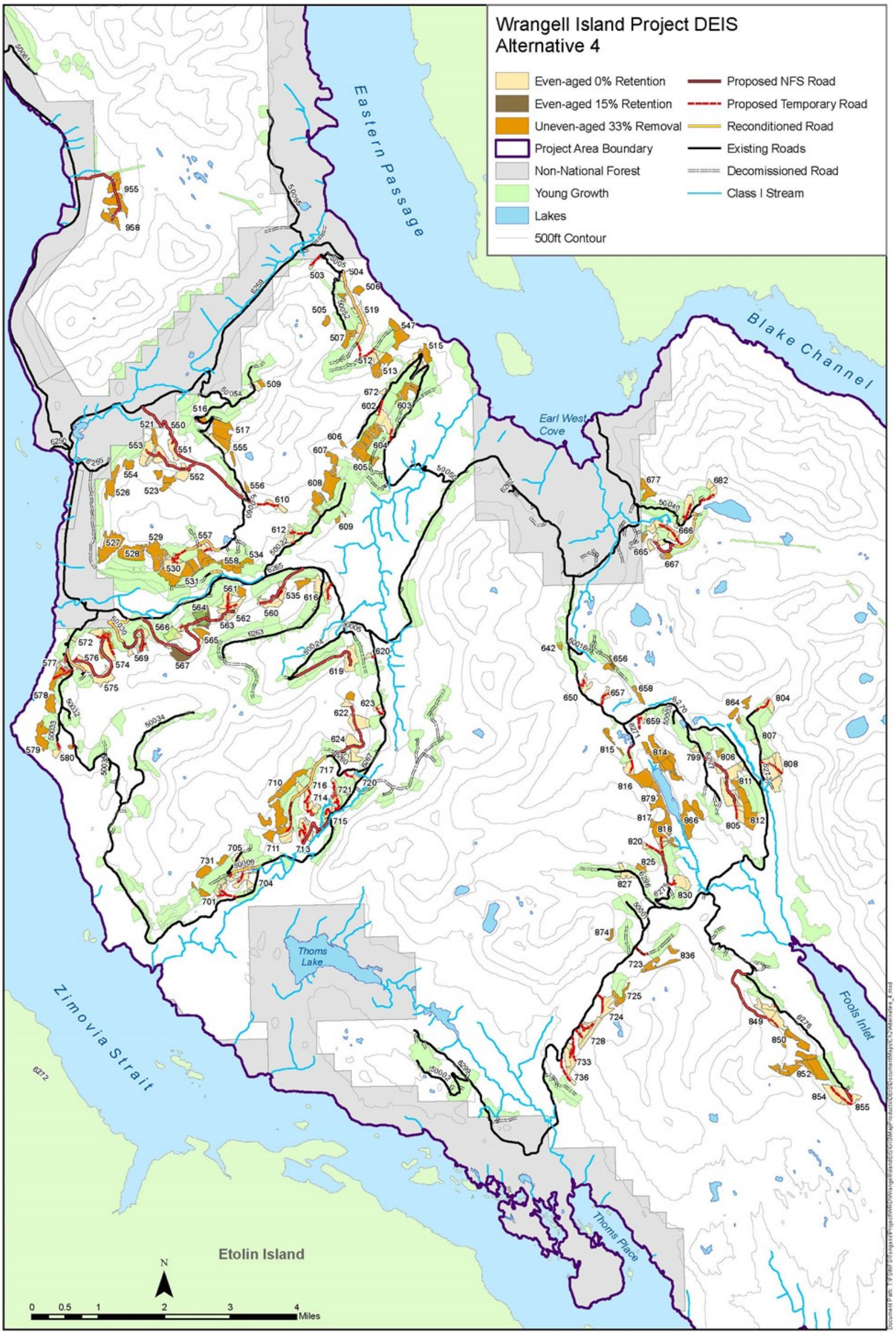

Figure 6. Alternative 4 for the Wrangell Island Project

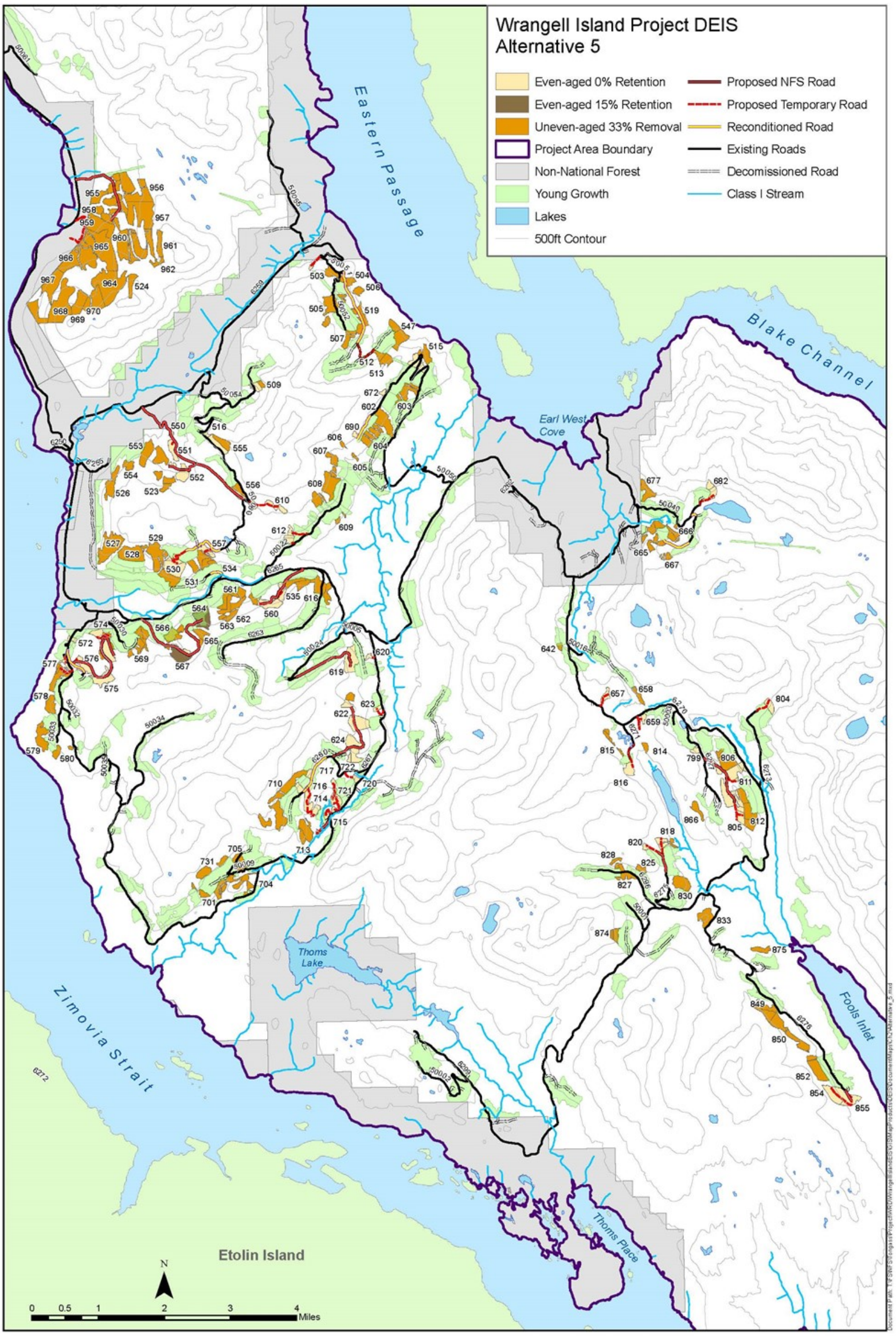

Figure 7. Alternative 5 for the Wrangell Island Project

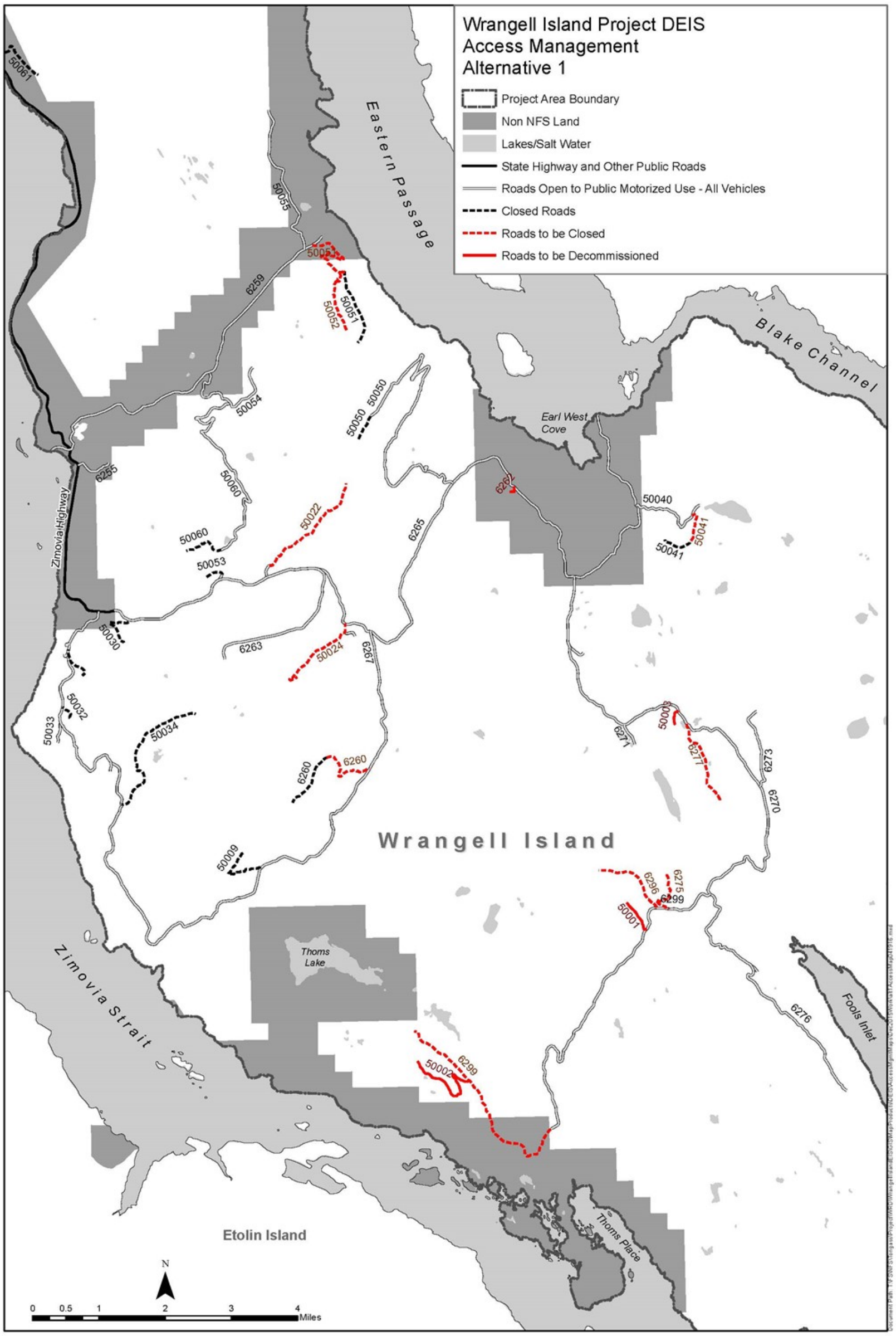

Figure 8. Access Management - Existing road access plan for Wrangell Island

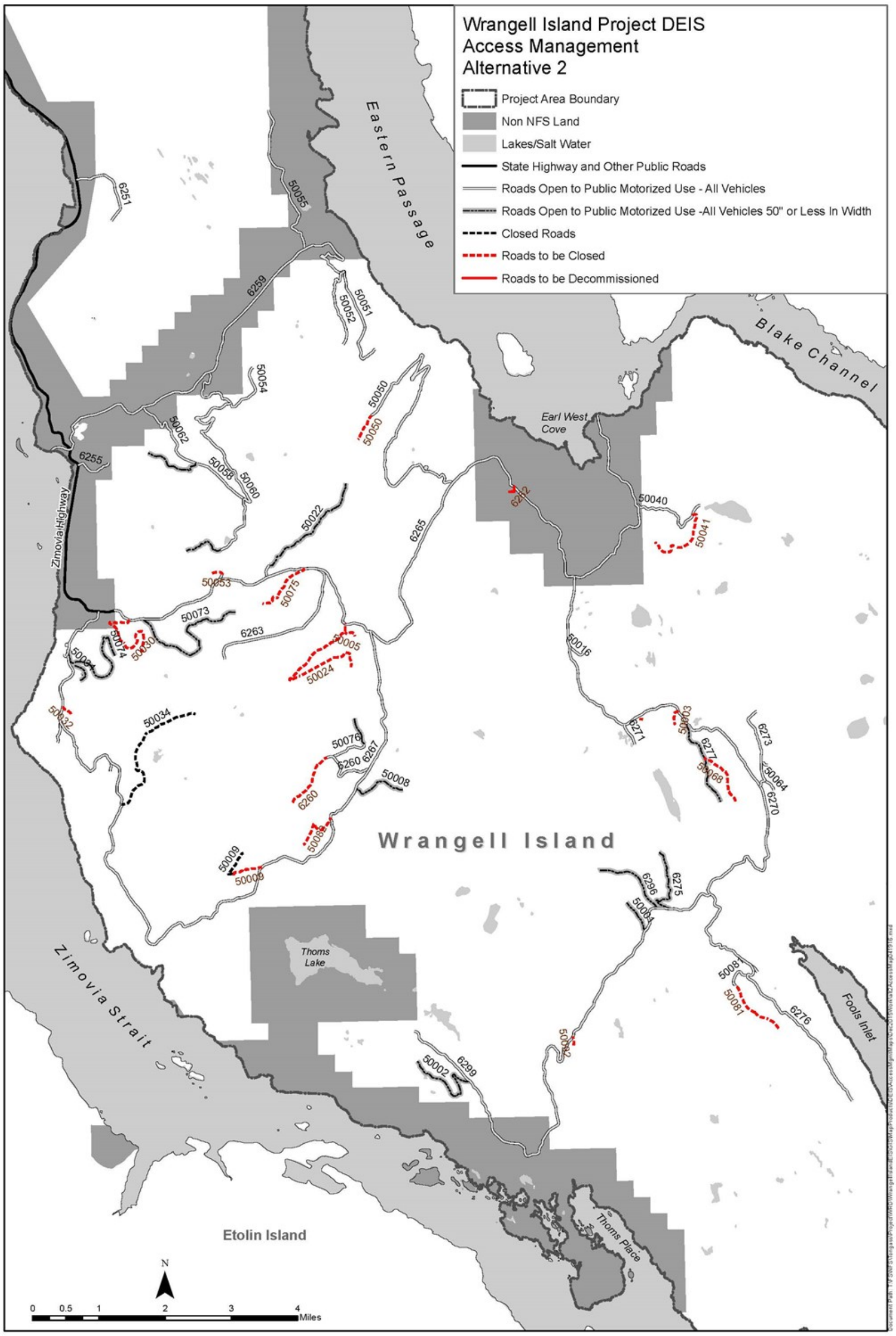

Figure 9. Access Management proposed for Alternative 2

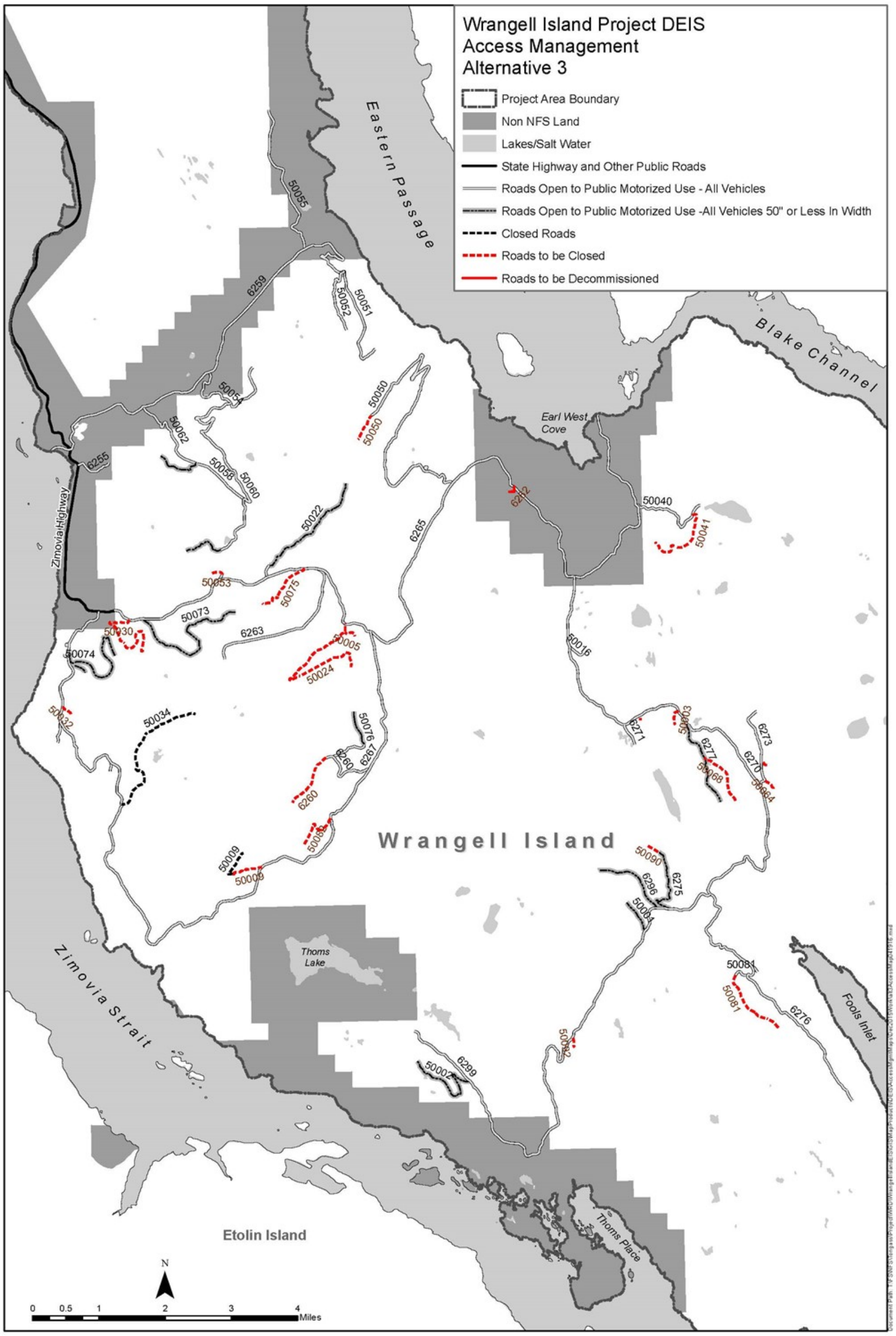

Figure 10. Access Management proposed for Alternative 3

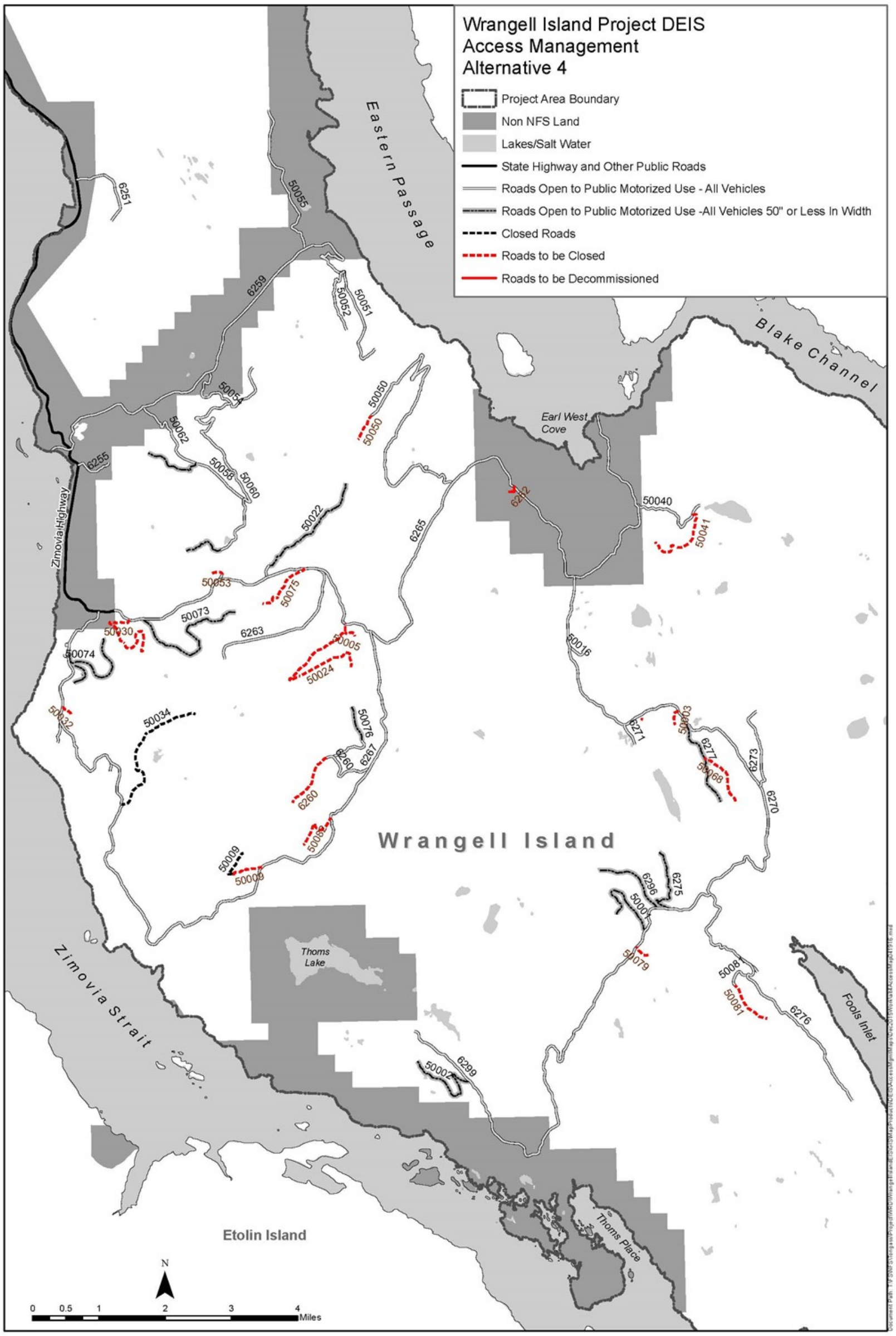

Figure 11. Access Management proposed for Alternative 4

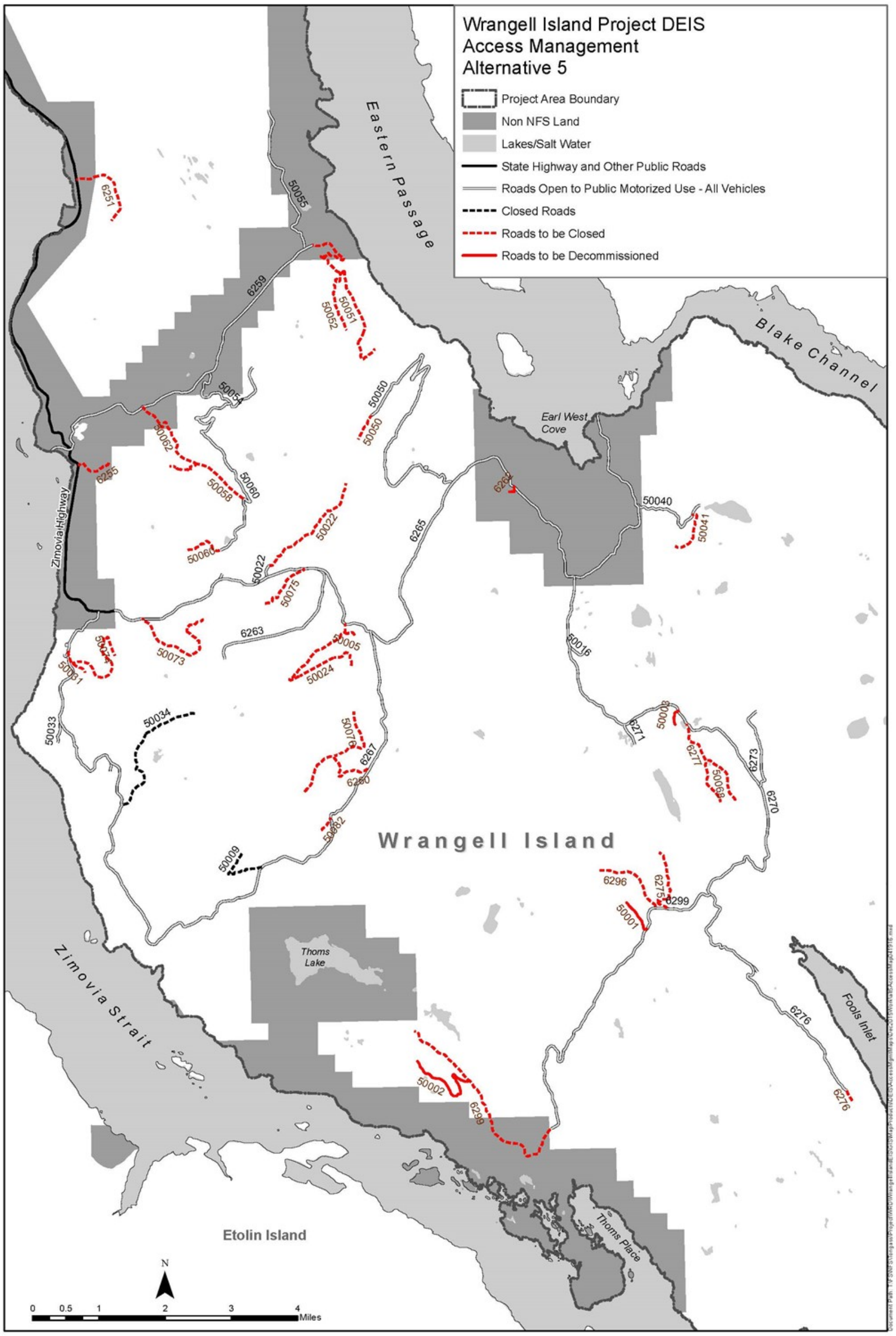

Figure 12. Access Management proposed for Alternative 5

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter describes the existing natural and physical environment of the Wrangell Island project area that may be affected by the alternatives under consideration (Affected Environment). These descriptions are followed by a discussion and analysis of the anticipated direct, indirect, and cumulative impacts of the alternatives under consideration (Environmental Consequences). The analysis in this DEIS focuses on the key issues that highlight significant effects or unintended consequences that may occur from the alternatives under consideration. These issues include effects to timber economics and timber availability, wildlife and subsistence use, and scenic integrity and recreational opportunities. Effects are quantified where possible, and qualitative discussions are also included. The analyses of potential impacts of the alternatives include implementation of applicable Forest Plan Standards and Guidelines, Forest Service best management practices, and recommended mitigation.

Discussions of resources and potential effects use existing information included in the Forest Plan, other project environmental analyses, project-specific resource reports, agency and scientific studies, and related information. Where applicable, such information is briefly summarized and incorporated by reference to minimize duplication. The project record includes all project-specific analysis information, including resource reports, literature cited, documentation of field investigations, and information resulting from public involvement efforts.

Location of the Project Area

The Wrangell Island ecosystem is a temperate rainforest interspersed with muskegs and influenced by a maritime climatic zone. The topography of Wrangell Island is generally steep and mountainous, with high mountain ridges bisected by broad valleys and creeks. Mountains reaching nearly 3,000 feet in elevation make up much of the island. Numerous small steep streams flow from mountain slopes, lakes, and muskegs throughout the island. Although many mountain streams coalesce in the valley bottoms, few are large enough to develop any substantial floodplains. Roughly half of the island is productive forest land, with the rest being wetlands, forested wetlands, and bogs that developed on poorly drained till underlying a layer of organic soils.

The City of Wrangell (population approximately 2,400) is located at the island's north end and is the largest community on Wrangell Island. Thoms Place, located on the southwest coast of Wrangell Island, is a small community with a summertime high population of about 22. Wrangell's economy was previously based on mining, timber harvesting, manufacturing, fishing, and seafood processing. However, tourism is now playing a larger role in Wrangell's economy, and the City and Borough of Wrangell are actively seeking diversification and economic growth.

Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the resources. Divisions vary by resource since the relationship of each resource to geographic conditions and zones varies. Land divisions important for the effects analysis are briefly described.

Land Use Designations

The Forest Plan uses land use designations (LUDs) to guide management of National Forest System (NFS) lands within the Tongass National Forest. The Wrangell Island project area includes five LUDs: Timber Production, Modified Landscape, and Old-Growth Habitat, Municipal Watersheds and Scenic Viewsheds (see Figure 2). Table 10 summarizes the management emphasis, and provides the amount and

percentage of acres for each LUD on Wrangell Island. Chapter 3 of the Forest Plan contains a more detailed description of each LUD.

Table 10. Land use designations (LUDs) on Wrangell Island

Land Use Designation	Description	Acres	Percentage of NFS land on Wrangell Island	Percentage of LUD within 2001 Roadless
Timber Production	Emphasis is sustained, long-term timber production. Timber harvest activities are located and designed to meet timber objectives. See Forest Plan pages 3-116 through 3-121.	52,579	46%	67%
Modified Landscape	Emphasis is sustained, long-term timber production while minimizing the visibility of development in the Foreground distance zone. Recognizes scenic values of forested lands as viewed from identified visual priority travel routes and use areas (Forest Plan, Appendix F) and provides for modifying timber harvest practices accordingly by reducing the effects to scenery. See Forest Plan pages 3-109 through 3-115.	9,992	9%	18%
Scenic Viewshed	Emphasis is sustained, long-term timber production while minimizing the visibility of developments. Recognizes scenic values of forested lands as viewed from identified visual priority travel routes and use areas (Forest Plan, Appendix F) and provides for modifying timber harvest practices accordingly. Emphasizes the scenic values to a greater degree than the Modified Landscape land use designation. See Forest Plan pages 3-101 through 3-108.	19,197	17%	74%
Old-growth Habitat	Emphasis is to maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources. Timber harvest for timber management objectives is not compatible with this designation. See Forest Plan pages 3-57 through 3-62.	30,929	27%	58%

Land Use Designation	Description	Acres	Percentage of NFS land on Wrangell Island	Percentage of LUD within 2001 Roadless
Municipal Watershed	Emphasis is to maintain these watersheds as municipal water supply reserves in a manner that meets provisions of the Safe Drinking Water Act and State of Alaska Drinking Water Regulations and Water Quality Standards, in accordance with Forest Service Manual (FSM) 2542 and 36 CFR §251.9. Timber production is not compatible with this designation, but administrative use of timber is allowed if the land use designation objectives are being met. See Forest Plan pages 3-51 through 3-56.	413	<1%	100%
	Total National Forest system lands	**113,110**		
	Total lands of other ownership	**21,196**		
		134,306		

Project Area

The project area is Wrangell Island itself and is about 134,306 acres in size. Included in the project area are 21,196 acres of non-NFS lands. Non-NFS lands on Wrangell Island are owned by the State of Alaska, Alaska Mental Health Trust Authority, Sealaska (tribal), the City and Borough of Wrangell, and private landowners.

Value Comparison Units

Value comparison units (VCUs) are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. Boundaries usually follow major watershed divides. The Wrangell Island project area encompasses VCUs 4750, 4760, 4770, 4780, 4790, 4800, 5040 and 5050 (Figure 2).

Game Management Units

Game management units (GMUs) are geographical areas defined by the Alaska Department of Fish and Game (ADF&G) to manage wildlife populations. Hunting and trapping regulations govern each unit. The Wrangell Island project area is located in GMU 3.

Wildlife Analysis Areas

Wildlife analysis areas (WAAs) are land divisions used by the ADF&G for wildlife analysis. The Wrangell Island project area as WAA 1903.

Watersheds

A watershed refers to the area that contributes water to a drainage or stream and to the portion of a forest in which all surface water drains to a common point. Watersheds can range from tens of acres that drain a single, small intermittent stream, to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams. The watersheds used for this analysis were delineated by the US Geological Survey according to a national hierarchy of hydrologic unit codes (HUC). In coastal areas, the ocean is considered the common point, so some of these units drain unconnected streams into the ocean.

Inventoried Roadless Areas

The 2001 Roadless Rule identified Inventoried Roadless Areas on National Forest lands and how they are to be managed. Timber harvest and road construction are not allowed within Roadless Areas. The 2001 Roadless Rule supersedes direction provided in the Forest Plan LUDs.

As a result of the rule, 67 percent of the land designated by the Forest Plan for timber production within the Wrangell Island project area, or 43 percent of all development LUD acres, are no longer available for timber harvest. Table 11 summarizes the percentage of acres within 2001 Roadless for each LUD on Wrangell Island.

There are six Inventoried Roadless Areas on Wrangell Island which comprise approximately 64 percent of the NFS land (71,926 acres) (Table 11 and Figure 13). These roadless areas are in a relatively natural state; however, there has been past timber harvest and road construction within the West Wrangell IRA.

The Wrangell Island Project does not propose timber harvest or road development activities in any 2001 Inventoried Roadless Areas.

Table 11. 2001 Inventoried Roadless Areas (IRAs) within the Wrangell Island project area

IRA Name	Area (acres)
Central Wrangell	13,394
East Wrangell	7,609
North Wrangell	8,089
South Wrangell	14,203
Southeast Wrangell	18,360
West Wrangell	10,271
Total	**71,926**

Biogeographic Province

This designation refers to 22 ecological subdivisions of Southeast Alaska identified by generally distinct ecological, physiogeographic, and biogeographic features (The Nature Conservancy). Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces. The Wrangell Island project area is located within biogeographical province called Wrangell/Etolin/Zarembo Complex. Effects of management at this scale are analyzed as part of the Forest Plan.

Ecological Subsection

Ecological subsections are mid-sized terrestrial ecosystems (10 to 1,000 mi^2). They further refine biogeographical provinces based on similar ecological characteristics (e.g., landforms, streams, vegetation, soils, and wetlands). The Wrangell Island project area is located within the Zimovia Strait Complex, Eastern Passage Complex and Berg Bay Complex Ecological Subsections (Nowacki et al. 2001).

Analyzing Effects

Environmental consequences are the resulting effects of implementing an alternative on the human environment. The EIS describes and provides the analysis of environmental effects of the proposed action and each alternative analyzed in detail. In this document, this is covered in the Chapter 3 "environmental consequences" section, which is devoted largely to a scientific analysis of the direct and indirect environmental effects of the proposed action and of each of the alternatives. The terms effects and impacts are used synonymously.

Figure 13. There are six Inventoried Roadless Areas on Wrangell Island which comprise approximately 64 percent of the NFS land

How the Effects of the Alternatives Were Evaluated

Within each issue and resource area, applicable direct and indirect effects were evaluated. Cumulative effects, unavoidable adverse effects, and resource commitments lost or unable to be reversed were also evaluated for all alternatives considered in this DEIS. These effects are defined as follows:

Direct effects – Those effects caused by the action and occur at the same time and in the same general location as the action.

Indirect effects – Effects that occur at a different time or in a different location than the action to which the effects are related.

Cumulative effects – Effects on the environment that result from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Interrelated projects are defined for the Wrangell Island Project DEIS as activities that could potentially interact with the alternatives being considered in a manner that could result in cumulative impacts. Interrelated projects have been grouped as past, present, and reasonably foreseeable future actions. See Appendix A – Reasons for Scheduling the Environmental Analysis of the Wrangell Island Project.

Unavoidable adverse effects – Effects that could occur as a result of implementing any of the action alternatives. Some of these effects would be short-term, while others would be long-term.

Irreversible commitments – Commitments that cannot be reversed, except in the extreme long-term. This term applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to factors, such as soil productivity, renewable only over long periods of time.

Irretrievable commitments – Commitments lost for a period of time. An example is trees that will not grow back on a road that is built and continuously maintained. The commitment is irretrievable rather than irreversible because if the road maintenance stops, then trees will eventually reoccupy the former road bed.

Available Information

Much of the Tongass National Forest resource data resides in an electronic database formatted for a geographic information system (GIS). The IDT resource specialists used GIS software (ESRI ArcMap) to assist in the analyses of these data. GIS data is available in tabular (numerical) and map formats. For this DEIS, all the maps, and most of the numerical analyses, are based on GIS resource data supported by field inventories.

Incomplete and Unavailable Information

The Council on Environmental Quality regulations provide direction on how to proceed with the preparation of a DEIS when information is incomplete or unavailable. None of the incomplete or unavailable information identified was critical to the impact analysis.

It should be noted that there is incomplete knowledge about many of the relationships and conditions of wildlife, fish, forests, climate change, jobs, and communities. The ecology, inventory, and management of a large forest area is a complex and developing science. The biology of fish and wildlife species prompts questions about population dynamics and habitat relationships; and the interaction of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well-established in the respective sciences for the deciding official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences. This analysis used the best information available.

Other Resources

Resources Not Present

The Forest geologist and the District soil scientist reviewed the proposed action and determined that karst and cave resources are not present in the Wrangell Island project area. Therefore, analysis of this resource is not carried forward in this DEIS.

Resources Likely to be Unaffected

Some resources in the project area are likely to remain unaffected by the Wrangell Island Project and are briefly discussed to the extent that measurable effects or differences between the alternatives are present. These resource sections follow the key issues.

- Air Quality and Climate Change
- Aquatics
- Cultural Resources
- Environmental Justice
- Plants: Sensitive and Rare
- Invasive Plants
- Recreation
- Silviculture
- Soils
- Wetlands

Issue 1: Timber Economics and Availability

Summary

The Wrangell Island Project is intended to provide a stable economic timber supply. In order to meet this objective, the project is designed to include sufficient units and volume to allow the Forest Service to adjust future timber sale offerings from the project area to meet fluctuating market conditions. The provision of a long-term stable and economic timber supply is intended to support local operators and encourage investment in the wood products industry as it transitions to include more young growth harvesting and restoration activities.

The Wrangell Island Project Timber Economics Resource Report provides an assessment of the current timber sale economics within the project area and the financial efficiency of implementing the proposed action and action alternatives. The analysis concentrates on the potential economic effects associated with old-growth timber harvest and road construction/reconditioning. The analyses utilize existing information from field surveys, spatial GIS data, financial analysis models, monitoring results, scientific literature, and other sources.

Affected Environment

Analysis Area

The NFS lands on Wrangell Island are used for the analysis area for determining the volume and the financial efficiency analysis since that is where the timber is located that the Forest Service can offer. Although timber from other land ownerships within the area may influence the value of the timber to some purchasers or units from other projects may be included in an offering, this is not incorporated into this analysis.

Also, this analysis is limited to a snapshot in time based on available information and does not speculate on timber market fluctuations. At the time of the appraisal, the value of the timber or costs may increase

or decrease. For cumulative effects analysis, the analysis area is considered to be the Tongass National Forest for the volume involved in the timber program.

The cumulative effects analysis area considers the entire Tongass National Forest, which combines the timber from various projects into the Tongass timber program. Contracts are usually not restricted to bidders from a distinct geographic area and can include bidders outside of Southeast Alaska, including bidders from the rest of the United States. In addition to the timber managed by the Forest Service, the State of Alaska (Division of Forestry (DOF), Alaska Mental Health Trust Authority (AMHTA), and the University of Alaska), and Alaska Native Corporations also support the Southeast Alaska timber industry.

Existing Condition

About 74,000 people live in towns, communities, and villages located on islands and coastal lands of Southeast Alaska (ADOL 2013). The Southeast Alaska region accounts for about 12 percent of the State's population and 6 percent of the land base. Federal lands comprise about 95 percent of Southeast Alaska, 80 percent within the Tongass National Forest. Most Southeast Alaska communities are island based, with very few road connections. These communities are mostly within or adjacent to the Tongass National Forest, and depend primarily on the Forest to provide natural resources associated with fishing, timber, mining, and tourism for employment. The Forest is also accessed for recreation and subsistence use. Appropriate management of the Forest's natural resources is, therefore, critically important for local communities and the overall regional economy. Loss of even a small number of jobs can force families to leave, destabilizing entire communities (Alexander et al. 2010).

Timber harvest has occurred in VCUs 4750, 4760, 4770, 4780, 4790, and 4800, and on State lands in the Pats Creek drainage and just south of Earl West. Past timber management activities on Wrangell Island began in the early- to mid-1950s using clearcut cable-yarding methods. Larger-scale clearcut logging began in the late 1970s and continued through about 1995, resulting in approximately 7,490 acres of clearcut harvest on NFS lands on Wrangell Island. Approximately 74 percent of the harvesting on NFS lands on Wrangell Island occurred in the 1980s and 1990s. (For more detailed information regarding past harvest in the analysis area, see the Silviculture and Vegetation Resource Report.) Currently, only minor harvest activities are occurring on either private or NFS lands on Wrangell Island. Two small sales known as the Backline Cable Timber Sale and Backline Helicopter are currently under contract. The first one is even-aged management harvest of approximately 267 total acres while the latter is 237 acres of uneven-aged management on NFS land in the analysis area. The survival of the existing timber industry is dependent on a predictable and adequate supply of timber.

Methods Used to Analyze Effects

Effects Analysis Indicators

The following indicators were used to measure potential effects of project activities on timber supply and timber sale economics resource:

- Total net volume of sawlog and utility (MMBF)
- Total net volume of sawlog (MMBF)
- Net sawlog volume by species (MMBF)
- Acres of harvest by logging system
- Acres of harvest by prescription
- Cost of logging, haul and roads per total sawlog timber volume available ($/net MBF[3])
- Indicated advertised value($/net MBF), using the FAST-R model
- Number of annualized jobs

[3] MBF = one thousand board feet

Environmental Consequences

Summary of Effects

A summary is provided below in Table 12. For detailed discussion, refer to the Wrangell Island Project Timber Economics Resource Report found in the project record.

Direct and Indirect Effects of the Alternatives

Alternative 1 – No Action

The no action alternative is required by Council of Environmental Quality (CEQ) Section 1502.14(d) to provide a baseline for comparing alternatives. It also responds to concerns and comments that there should be no harvest timber or road construction, though this would not meet the purpose and need.

Under the no action alternative no timber would be harvested; no roads would be constructed or reconstructed. Access management (Issue 4) would implement the existing management condition provided in the 2007 Access Travel Management Decision Notice (USDA Forest Service 2007b). Under Alternative 1, 24.1 miles of existing NFS road currently open to motorized use would be closed, 2.5 miles of existing NFS road would be decommissioned, and approximately 73 miles of existing NFS road would be available for public use for motorized vehicles of all types.

Alternative 2 – Proposed Action

The Proposed Action would supply the most timber volume (about 58 MMBF net sawlog) and direct annualized jobs (252 to 303) to meet the purpose and need for this project. This alternative has the second highest indicated advertised rate (negative $57.25 per MBF net sawlog for export and negative $218.66 per MBF net sawlog for domestic) relative to the other action alternatives.

This alternative has the second highest proportion (64 percent) of unit acres utilizing the most expensive yarding system, helicopter ($410 per MBF net sawlog) for partial harvest. In proportion to total volume, this alternative exhibits the lowest road cost per net MBF and constructs the second most miles of new roads for all alternatives.

This alternative is similar to Alternatives 3 and 4 in terms of the acres of shovel and cable yarding proposed. This alternative increases opportunity for partial harvest using helicopter over all the others; however, some cases may be better-suited for shovel or cable yarding.

Alternative 3

This alternative would supply the third greatest volume of timber (about 43 MMBF net sawlog) and direct annualized jobs (187 to 226) to meet the purpose and need for this project. This alternative has the highest indicated advertised rate (negative $54.21 per MBF net sawlog for export and negative $215.62 per MBF net sawlog for domestic) relative to the other action alternatives.

This alternative has the smallest proportion (45.2 percent) of unit acres utilizing the most expensive yarding system, helicopter ($410 per MBF net sawlog) for partial harvesting. In proportion to total volume, this alternative exhibits the highest road cost per net MBF and constructs the second fewest miles of new roads for all action alternatives.

This alternative is similar to Alternatives 2 and 4 in terms of the amount of shovel and cable yarding proposed. This alternative reduces costs thereby increasing economics.

Alternative 4

This alternative would supply the second greatest volume of timber (about 45 MMBF net sawlog) and direct annualized jobs (198 to 238) to meet the purpose and need for this project. This alternative has the third highest indicated advertised rate (negative $61.36 per MBF net sawlog for export and negative $237.08 per MBF net sawlog for domestic) relative to the other action alternatives.

This alternative has the second smallest proportion (45.4 percent) of unit acres utilizing the most expensive yarding system, helicopter ($423 per MBF net sawlog) for partial harvesting. In proportion to total volume, this alternative exhibits the second lowest road cost per net MBF and constructs the most miles of new roads for all action alternatives.

This alternative is similar to Alternatives 2 and 3 in terms of the amount of shovel and cable yarding proposed. This alternative strives to increase supply using helicopter yarding within units that are only suitable for helicopter.

Alternative 5

This alternative would supply the least volume of timber (about 38 MMBF net sawlog) and direct annualized jobs (166 to 199) to meet the purpose and need for this project. This alternative has the lowest indicated advertised rate (negative $91.80 per MBF net sawlog for export and negative $253.21 per MBF net sawlog for domestic) relative to the other action alternatives.

This alternative has the highest proportion (72 percent) of unit acres utilizing the most expensive yarding system, helicopter ($429 per MBF net sawlog) for partial harvesting. In proportion to total volume, this alternative exhibits the second highest road cost per net MBF and constructs the fewest miles of new roads for all action alternatives.

This alternative has the most helicopter harvest of all alternatives. In addition, it reduces the amount of shovel and cable harvest from the other three action alternatives.

Cumulative Effects

Indirect and cumulative effects are based on the ability of this project to contribute to the orderly flow of timber to large and small timber purchasers, mill operators, and value-added wood product industries in Southeast Alaska that are dependent upon the Forest's timber resources. Timber harvest under the action alternatives would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs.

Economic effects are analyzed in the 1997 Forest Plan FEIS, 2003 Forest Plan SEIS, 2008 Forest Plan Amendment FEIS and most recently in the analysis for the 2015 Forest Plan Amendment DEIS. Alternatives 2 through 5 would contribute to the timber–related economy of Southeast Alaska. Alternative 1 would not contribute to the timber–related economy and timber from other areas on the Tongass would have to be used to provide a supply.

Past timber harvest has occurred in VCUs 4750, 4760, 4770, 4780, 4790, and 4800, and on State lands in the Pats Creek drainage and just south of Earl West. Past timber management activities on Wrangell Island began in the early to mid-1950s using clearcut cable-yarding methods. Larger-scale clearcut logging began in the late 1970s and continued through about 1995, resulting in approximately 7,490 acres of clearcut harvest on NFS lands on Wrangell Island. Past harvest on Wrangell Island which are now non-National Forest lands is 3,286 acres. No future timber harvest is currently reasonably foreseeable on National Forest System lands. Considering the transition to young-growth timber, the young growth on Wrangell Island is too young and not commercial to be considered as reasonably foreseeable. Future foreseeable projects on non-National Forest lands includes the Earl West Timber sale scheduled for 2019 and for 12.5 MMBF.

This project contains a supply of old-growth "bridge" timber that could support local jobs and facilitate the industry transition to a sustainable wood product industry based on young-growth management on the Forest and throughout Southeast Alaska. Toward this end, the Forest Service is currently working to implement other large timber projects in Southeast Alaska. Other ongoing bridge timber projects include the Big Thorne Project on Prince of Wales Island with an estimated 133.9 MMBF of old-growth timber and also 15 MMBF of young-growth timber. Another bridge timber project includes the Saddle Lakes

Timber Sale near Ketchikan. In addition, the Kosciusko Vegetation Management and Watershed Improvement project may authorize the harvest of approximately 30.2 MMBF of young-growth timber to begin the transition to predominately young growth management.

Table 12. Alternative comparison of the measures and potential effects of project activities on the timber supply and timber sale economics resource

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres of Uneven Aged Harvest	0	3,528	1,483	1,738	2,868
Acres of Even Aged Harvest	0	1,781	1,701	1,793	936
Total Acres	0	5,309	3,184	3,531	3,804
Cable	0	1,200	1,158	1,207	640
Shovel	0	703	587	720	411
Helicopter	0	3,408	1,440	1,604	2,754
Total Acres	0	5,309	3,184	3,531	3,804
Sitka Spruce Volume (MBF)	0	12,711	9,465	9,979	8,360
Hemlock Volume (MBF)	0	30,044	22,373	23,587	19,760
Western Red Cedar Volume (MBF)	0	4,622	3,442	3,629	3,040
Alaska Yellow Cedar Volume (MBF)	0	10,400	7,744	8,165	6,840
Total Net Sawlog Volume (MBF)	0	57,777	43,025	45,360	37,999
Utility Volume (MBF)	0	7,280	5,770	5,715	4,788
Total Net Volume (MBF)	0	65,057	48,795	51,075	42,787
NFS Road Construction (miles)	0.0	17.2	15.8	16.1	12.5
Temporary Road Construction (miles)	0.0	14.9	14.1	16.2	9.1
Total Miles	0.0	32.1	29.9	35.4	21.6
Logging Cost ($/ net MBF) Stump to Truck	$0	$318.22	$293.38	$297.99	$349.36
Stump to Mill cost[1] ($/net MBF)	0	$532.70	$529.67	$536.80	$567.25
NFS Road Construction/Reconditioning Cost ($/net MBF)	0	$83.20	$99.20	$102.40	$86.90
Indicated Advertised Rate Current Export Policy[2] $/MBF	0	($57.25)	($54.21)	($61.36)	($91.80)
Indicated Advertised Rate 100% Domestic Processing[3] $/MBF		($218.66)	($215.62)	($237.08)	($253.21)

1 - Stump to mill costs includes cost of specified road construction/reconditioning.

2 - Current export policy allows 100 percent Alaska yellow-cedar export plus hemlock/spruce export equal to 50 percent total sale net sawlog volume.

3 - Assumes 100 percent Alaska domestic processing of hemlock/spruce/western red cedar; 100 percent export of Alaska yellow-cedar.

Source: N. Stearns FAST-R (December 2015 Output), Tongass GIS 2015

All economic analysis assumes Standard Profit and Risk (14 percent).

Issue 2: Wildlife Habitat

Introduction

Following the concerns described in Issue 2, this section will focus on the effects of old-growth timber harvest and road construction on wildlife habitat. For the purposes of this analysis, impacts to wildlife can fall into categories of direct, indirect and cumulative effects. Cumulative effects take into consideration the interaction of the proposed project and past treatments, as well as those in the reasonably foreseeable future (Table 4), over an estimated 5 years. These functions are introduced in the Affected Environment section and analyzed by species in the Environmental Effects section.

A full wildlife analysis was conducted, and more detailed information can be found in the Wildlife Resource Report. The Wildlife Resource 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 resources. The resource report focuses on Tongass National Forest management indicator species (MIS), Wrangell Island endemic species, and migratory birds that could utilize habitat in the proposed project area.

Table 13. List of threatened and endangered species, sensitive species, management indicator species and species of interest analyzed

Species name	Scientific name
Threatened and Endangered	
Humpback Whale	*Megaptera novaeangliae*
Steller Sea Lion (Western DPS)	*Eumetopias jubatus*
Forest Service Sensitive Species	
Yellow-billed Loon	*Gavia adamsii*
Steller Sea Lion (Eastern DPS)	*Eumetipias jubatus*
Queen Charlotte Goshawk	*Accipiter gentilis laingi*
Management Indicator Species	
Alexander Archipelago Wolf	*Canis lupis ligoni*
American Marten	*Martes Americana*
Bald Eagle	*Haliaeetus leucocephalus*
Black Bear	*Ursus americanus*
Brown Bear	*Ursus arctos horribilis*
Brown Creeper	*Certhia Americana*
Hairy Woodpecker	*Picoides villosus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Red Squirrel	*Tamiasciurus hudsonicus*
River Otter	*Lutra Canadensis*
Sitka Black-tailed Deer	*Odocoileus hemionus sitkensis*
Vancouver Canada Goose	*Branta Canadensis fulva*
Species of Interest	
Great Blue Heron	*Ardea Herodias*
Marbled Murrelet	*Brachyramphus mamoratus*
Southern Red-backed Vole	*Mvodes gapperi wrangeli*
Migratory birds	See the wildlife resource report for a complete list of species

Threatened and Endangered

Section 7 of the Endangered Species Act (ESA) of 1973 as amended (19 U.S.C. 1536 (c)) protects threatened and endangered species or their designated critical habitat. This document is prepared in accordance with those legal requirements and follows standards established in Forest Service Manual (FSM) direction (2672.42) and the Code of Federal Regulations (50 CFR §402.12). There are two ESA-listed species known to occur within the project vicinity: the humpback whale and Steller sea lion (Western distinct population segment (DPS)). All others were dropped from further analysis. There is no designated critical habitat for any threatened or endangered wildlife species on Wrangell Island.

Humpback whale (Megaptera novaeangliae)
Status: Endangered

Effect Determination: Not likely to adversely affect

Rationale: The Forest Plan Standard and Guidelines, Marine Mammal Protection Act (MMPA) and Endangered Species Act all have measures in place to reduce disturbance and the risk of collision with ocean vessels. All project activities would be conducted in accordance with Alaska Water Quality Standards for marine access facilities, which would limit the effects to water quality and exposure to potential oil/fuel spills.

Steller sea lion – Western Distinct Population Segments (Eumetopias jubatus)
Status: Threatened

Effect Determination: Not likely to adversely affect

Rationale: The Forest Plan Standard and Guidelines, MMPA and ESA all have measures in place to reduce disturbance and the risk of collision with water vessels. All project activities would be conducted in accordance with Alaska Water Quality Standards for marine access facilities, which would limit the effects to water quality and exposure to potential oil/fuel spills.

Forest Service Region 10 Sensitive Species

Sensitive species are species identified by the Regional Forester that may have viability concerns on National Forest System lands within the region. Viability concerns are evidenced by a significant current or predicted downward trend in population numbers, density, or habitat capability that will reduce a species' existing distribution (FSM 2670.5). The Alaska Region updated its list of sensitive species in 2009. The Forest Service Manual states that viable populations and habitats of these species will be maintained and distributed throughout their geographic range on National Forest System lands (FSM 2670.22). As part of the NEPA process, Forest Service activities are reviewed, through a BE, to determine their potential effect on sensitive species, and how impacts to these species should be minimized or avoided (FSM 2670.32). There were three sensitive species analyzed for the Wrangell Island Project: yellow-billed loon, Steller sea lion (Eastern DPS) and Queen Charlotte goshawk. All others were dropped from further analysis due to lack of habitat or occurrence in the project area.

Yellow-billed loon (Gavia adamsii)
Status: Forest Service Sensitive

Effect Determination: No effect

Rationale: The yellow-billed loon is considered a rare winter migrant that occurs at very low densities around the proposed project during the winter months when project activities would be limited to nonexistent. They are not known to nest or breed on Wrangell Island.

Steller sea lion – Eastern Distinct Population Segment (DPS) (Eumetopias jubatus)
Status: Forest Service Sensitive

Effects Determination: Not likely to adversely affect

Rationale: The Forest Plan Standard and Guidelines, Marine Mammal Protection Act and Endangered Species Act all have measures in place to reduce disturbance and the risk of collision with water vessels. All project activities would be conducted in accordance with Alaska Water Quality Standards for marine access facilities, which would limit the effects to water quality and exposure to potential oil/fuel spills.

Queen Charlotte goshawk (Accipiter gentilis laingi)

Status: Forest Service Sensitive

Effect Determination: 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.

Rationale: There would be noise and disturbance from project activities. Removal of productive old-growth (POG) would decrease available nesting and foraging habitat.

Other Special Status Species

Several species listed as threatened or endangered that occur in Alaska, including the Eskimo curlew, Aleutian tern, short-tailed albatross, spectacled eider, Steller's eider, northern sea otter, and polar bear, are not addressed in this document because the project area is outside of their known range. The Kittlitz's murrelet, a candidate for federal listing, is also not addressed because suitable habitat is not present on Wrangell Island. Therefore, the Wrangell Island Project would have no effect on these species, and they are not addressed further in this DEIS.

Several federally listed whales (blue, beluga, bowhead, Northern Pacific right, sei and sperm) and species of sea turtle (green, leatherback, loggerhead and olive ridley) have been incidentally observed in Southeast Alaska but are suspected to be uncommon in Southeast Alaska waters. The bearded, ringed, and spotted seals are candidates for federal listing, and are directly associated with sea-ice habitats not commonly observed in Southeast Alaska. Critical habitat has not been designated in waters surrounding the proposed project area for any of above-mentioned species. Therefore, the Wrangell Island Project would have no effect on these species, and they are not be further analyzed in this DEIS.

Because the Wrangell Island Project is not expected to affect the species named above and their habitats, they are not discussed further in this DEIS, however they are addressed in a separate Biological Assessment/Biological Evaluation for the Wrangell Island Project.

Management Indicator Species

Management indicator species (MIS) are used as indicators whose responses to land management activities can be used to predict the likely responses of other species with similar habitat requirements. In accordance with the 1982 planning regulations, 13 wildlife species were identified as MIS in the Forest Plan FEIS. Forest Service Manual 2621.3 requires that the effects of a proposed action to MIS be assessed and that the Forest Plan requirements, goals, and objectives for these species are met at the project level.

Management indicator species and other species of interest inhabiting old-growth forest were selected for detailed project analysis based on the potential for the Wrangell Island Project to impact their habitats (Table 15).

Other species, such as those endemic to the proposed project area, are also addressed in the wildlife resource report to meet FSM 2620.1 requirements to manage and maintain viable populations of existing native wildlife species. The Forest Service is also required to support the conservation of migratory birds by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts to migratory bird resources when conducting agency actions. The Forest Plan does not address the management of migratory birds specifically but includes standards and guidelines for seabirds, waterfowl, and shorebirds, as well as applicable direction under general habitat planning and coordination. These other species are listed in Table 15, with the

exception of mountain goat (*Oreamnos americanus*) which has not been documented in the project area and therefore will not be discussed further.

Additional background and supporting information comes from the 1997 Forest Plan FEIS, and the 1998 Wrangell Island Analysis Report (USDA Forest Service 1998). The wildlife resource report meets the requirements of the National Forest Management Act (NFMA) which requires that the Forest Service manage wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area and ensure that its actions do not contribute to trends toward federal listing of species. These documents are incorporated here by reference.

Migratory Birds

In a provisional checklist, at least 73 migratory bird species were noted as occurring on Wrangell Island or in the surrounding marine waters (USDA Forest Service 2001b). These species were recorded during the summer as probable breeders, or as migrants or overwintering birds. Two additional species, the red-tailed hawk (*Buteo jamaicensis*) and the northern hawk owl (*Surnia ulula*), were observed during field surveys on Wrangell Island in summer 2010. The list of 73 bird species known to occur on Wrangell Island is likely incomplete given that roughly 150 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.

Endemic Mammals

Based on specimen collection records and distribution information presented in MacDonald and Cook (2007), 26 mammalian species are known to occur on Wrangell Island. Because of the geographic isolation of the islands in the Alexander Archipelago and their possible role as refugia for terrestrial mammals during previous glaciations, mammalian endemism in the Alexander Archipelago continues to attract research attention (ISLES 2009; MacDonald and Cook 2007). For terrestrial mammals, one broad pattern has emerged: the proportion of endemics decreases from the outer islands in the archipelago eastward toward the inner islands nearer the mainland; this pattern is more pronounced in the southern part of the archipelago (MacDonald and Cook 2007). Consistent with this pattern, Wrangell Island currently is known to support only one endemic mammal, a subspecies of southern red-backed vole (*Myodes gapperi wrangeli*). This subspecies is known only from Wrangell, Sergief, and Etolin Islands (MacDonald and Cook 2007; Smith 2005).

Affected Environment

A representation of wildlife habitats on Wrangell Island was generated from the mapping of forest stands on the island, using the size-density model (SDM) (Caouette and DeGayner 2008, Krosse and O'Connor 2009). SDM categories are described in detail in the Forest Plan FEIS (pp. 3-139 through 3-142 and 3-231). For analyzing habitat for species in this document, size density classes are categorized as shown below. They are grouped this way to represent habitat utilized by species discussed in this document.

SD4H: Volume class 4 on hydric soils. Low productive older forests associated with wet, poorly drained land types. Canopy closure is variable. Trees are small, old, and defective. Stand volume is low.

SD4N: Volume class 4 on non-hydric soils, north aspect, or flat. Low to moderately productive older upland forests. Canopy characteristics are variable and patchy, with moderate canopy closure and relatively coarse canopy texture. Stand volume is low to moderate.

SD4S: Volume Class 4 on non-hydric soils, not north aspect, or flat. Highly productive younger upland forests. Stand volume is moderate, but increasing rapidly. Crown competition is high. Canopy characteristics tend to be uniform, with high canopy closure and fine canopy texture.

SD5H: Volume class 5 on hydric soils. Moderately productive older forests associated with wet, poorly drained land types. Canopy closure, texture, and structure tend to be variable and patchy. Stand volume and annual growth is also variable and patchy.

SD5N: Volume class 5 on non-hydric soils, north aspect, or flat. Moderately productive older upland forests. Stand volume is moderate to high. Canopy characteristics tend to be variable, with moderate canopy closure and coarse canopy texture.

SD5S: Volume class 5 on non-hydric soils, not north aspect, or flat. Highly productive upland forests. Stand volume is high. Canopy characteristics tend to be uniform, with moderate to high canopy closures.

SD67: Volume classes 6 and 7. Highly productive forests associated with riparian areas, alluvial fans, colluvial toe slopes, karst geology, and wind-protected uplands. Stand volume is high. Stand age can vary. Canopy closure is low to moderate and canopy texture is coarse.

Table 14. Size-density model habitat classifications

Habitat	Size Density Map Classes
POG	SD4H, SD4N, SD4S, SD5H, SD5N, SD5S, SD67
High-volume POG	SD5N, SD5S, SD67
Medium POG	SD4N, SD4S, SD5H
Low POG	SD4H
Forested muskeg	FM
Non-forested	NF
All young-growth	HS1, HS2, HS3,S1, S2, S3

Units of Measure

The following list shows the primary measurements used (i.e., units of measure) to assess the effects of proposed activities to wildlife and/or habitat at the wildlife analysis area (WAA 1903) spatial scale which includes all of Wrangell Island:

- Humpback whales, acoustic disturbance and habitat degradation that are associated with marine access facilities.
- Steller sea lion, harassment or displacement from human activities associated with marine access facilities and log raft towing.
- Yellow-billed loon, anthropogenic disturbances and marine contaminants.
- Goshawk, acres of POG and high-volume POG habitat
- Deer model output, run separately for NFS lands only (direct and indirect effects), and all land ownerships given current or zero value (cumulative effects)
- Percentage reduction in all classes of
    - Productive old-growth (POG) at all elevations
    - POG below 1,500 feet in elevation
    - POG below 800 feet in elevation
- Percentage reduction in high volume POG below 800 feet in elevation (marten and deep deer snow winter range habitat)
- Miles of open road at all elevations
- Road density (all roads) below 1,200 feet in elevation
- Patch size (acres) and number
- Total, high-volume, and large-tree productive POG acres by value comparison unit (VCU), wildlife analysis area (WAA), project area, and biogeographic province

- Connectivity/fragmentation (qualitative analysis of corridors; reduction of POG acres; patch size analysis)
- Deer habitat capability by WAA and biogeographic province in deer/mi^2
- Abundance and distribution of known wildlife subsistence resources

Methods Used to Analyze Effects

Table 15 shows the species analyzed in this document along with preferred habitat and how the units of measure apply to individuals and/or habitat.

Table 15. Wrangell Ranger District management indicator species (MIS), preferred habitat and units of measure

Species	Preferred Habitat	Project Level Indicator/Measurement
Humpback whale (*Megaptera novaeangliae*)	Temperate and tropical waters. Feed in highly productive fjords in SE AK.	National Forest management activities generally fall into categories of acoustic disturbance and habitat degradation that are associated with marine access facilities.
Steller sea lion (both east and west DPS) (*Eumetopias jubatus*)	Marine waters, primary abundance and distribution across the Gulf of Alaska and Aleutian Island	Harassment or displacement from human activities associated with marine access facilities and log raft towing.
Yellow-billed loon (*Gavia adamsii*)	In SE Alaska, marine waters during the nonbreeding season	Anthropogenic disturbances and marine contaminants.
Queen Charlotte goshawk (*Accipiter gentilis laingi*)	Nests primarily in high-value POG habitat and forages in non-productive forest types and second growth	Acres of POG and high-value POG habitat.
Alexander Archipelago wolf (*Canis lupus ligoni*)	Habitat generalist, POG provides habitat for prey	Deer/wolf interactions, fragmentation. Measured by deer/mi^2 and road density
American marten (*Martes americana)*	Represents POG and HPOG intercepts snow and provides cover and habitat for prey	Winter - acres of high-POG ≤1,500 feet; non-winter - all POG
Bald eagle (*Haliaeetus leucocephalus*)	Within 1,000 feet of shoreline	POG within beach/estuary buffer; disturbance
Black bear (*Ursus americanus*) and Brown bear (*Ursus arctos*)	Young-growth (<26 year old) and all types of old-growth POG and salmon streams	Denning habitat - acres of POG. Foraging - POG within 500 feet of anadromous fish streams and all habitats except stem exclusion.
Brown creeper (*Certhia americana*)	Snag dependent species, interior POG and prefers patch sizes >15 ac.	Edge habitat and acres of interior POG and number of patches
Hairy woodpecker (*Picoides villosus*)	Snag dependent species, represents high volume POG. Prefers patch sizes >500 ac.	Acres of high volume POG at all elevations and number of remaining of patch size requirement
Red-breasted sapsucker (*Sphyrapicus ruber*)	Snag dependent species, representing low-medium POG.	Acres of low- and medium-POG at all elevations, patch size
Red squirrel (*Tamiasciurus hudsonicus*)	POG or young growth greater than 40 years old and prefers patches of timber >30 ac.	Acres of POG and habitat patch size
River otter (*Lontra canadensis*)	Riparian and coastal POG habitat	POG within 500 feet of fish streams and within beach buffers

Species	Preferred Habitat	Project Level Indicator/Measurement
Sitka black-tailed deer (*Odocoileus hemionus sitkensis*)	Represents a variety of habitat at all elevations. Winter = low elevation POG that intercepts snow and provides cover (thermal and predation)	Habitat available in a deep snow winter - acres of high-POG ≤800 feet elevation; average winter habitat - acres of POG ≤1500 feet; acres summer habitat - includes all terrestrial habitats except stem exclusion forest. Measured by percent of historical condition total deer remaining
Vancouver Canada goose (*Branta canadensis fulva*)	Forested wetlands for nesting and brood rearing, occasionally nests in trees	Acres of forested muskeg, UF, and hydric POG (SD4H, SD5H)
Great blue heron (*Ardea herodias*)	Riparian and coastal POG habitat	Acres of POG within beach/estuary or lake buffers
Marbled murrelet (*Brachyramphus marmoratus*)	Coastal old-growth	Acres of high-POG (SD5N, 5S and 6/7) and within 5 miles of shore
Southern red-backed vole (*Myodes gapperi wrangeli*)	Endemic mammal; POG along with corridors and island connectivity is important to survival	Acres of POG, habitat connection corridors
Migratory forest birds	Old-growth forests	Acres of POG

Threatened and Endangered Species

Humpback Whale (Megaptera novaeangliae)

Humpback whales were federally listed as endangered in 1970 under the precursor to the ESA and have remained on the list of threatened and endangered species since the ESA was passed in 1973 (35 FR 8491 8498). Humpback whales were also afforded additional protection under the Marine Mammal Protection Act in 1972 under which they are considered “depleted” (NMFS 2013). In November 1991, the National Marine Fisheries Service (NMFS) published a recovery plan for humpback whales. Humpback whales are thought to be increasing throughout most of their range (NMFS 2013). No critical habitat has been designated for this species.

Humpbacks in southeast Alaska are part of the Central North Pacific stock – a relatively distinct population that winters near Hawaii and feeds in the waters of Southeast and Southcentral Alaska. They have a distinct seasonal pattern of occurrence in Southeast Alaska. Dahlheim et al. (2009) documented that humpback whale numbers increased throughout the year, with the fewest whales seen in the spring and more whales seen during the summer and fall. In Southeast Alaska, capture-recapture analyses using data from the 1980s and 1990s produced various minimal estimates of 400 to 1,000 humpbacks in the region, but more extensive analyses recently increased the estimate substantially to 2,883 to 6,414 whales over a broader area of Southeast Alaska, northern British Columbia, and waters offshore from the region (Allen and Angliss 2010).

National Forest management activities that could affect humpback whales generally fall into the categories of habitat degradation, acoustic disturbance, and potential for ship strike. Activities that could potential contribute to habitat degradation include: development and use of marine access facilities and their associated camps, movement of log rafts from marine access facilities to mills, and potential development of other docks and associated facilities for mining, recreation, or other Forest uses and activities.

Steller sea lion (Eastern and Western Distinct Population Segments) (Eumetopias jubatus)

The Steller sea lion was emergency-listed as threatened under the ESA in April 1990 by NMFS due to rapid population declines in the western portion of its range (55 FR 12645). In 1997 the NMFS designated two DPS (occurring west and east of 144 degrees west longitude, respectively). Due to persistent decline, the western DPS was reclassified as endangered. In November of 2013 the eastern DPS was delisted and is no longer on the threatened and endangered list, because they have been increasing at an average rate of approximately 3 percent per year, and was estimated to number between 45,000 and 56,000 animals. Critical habitat was designated in August 1993 (Federal Register 1993) consisting of breeding rookeries (sites where pups are born) and haulouts (sites where adults emerge from the water to rest) throughout the State, as well as marine waters within a 3,000-foot radius of those sites.

Steller sea lions in Alaska are year-round residents and are not known to make regular migrations, but they undertake seasonal movements in response to prey availability. The total eastern stock of the Steller sea lion was estimated to be at within the range of 45,095 to 55,832 sea lions with 20,793 sea lions counted from rookery and haulout trend sites in Southeast Alaska (Allen and Angliss 2010). Steller sea lions are sensitive to disturbance and harassment and displacement of sea lions from haulouts and rookeries by human activities such as boating, recreation, aircraft, marine access facilities, and log raft towing are concerns related to the long-term conservation of the sea lion in Southeast Alaska.

Sensitive Species

Yellow-billed loon (Gavia adamsii)

The yellow-billed loon was petitioned for listing under the ESA in 2004 by the Center for Biological Diversity (CBD 2004). In 2007, the U.S. Fish and Wildlife Service (USFWS) found the petition presented substantial information indicating that listing may be warranted, and a status review of the species was initiated (Federal Register 2007a). The yellow-billed loon was considered vulnerable due to a combination of low population size, low reproductive rate, and specific breeding habitat requirements (Earnst 2004). In 2009, the USFWS determined that listing the yellow-billed loon as a threatened or endangered species was warranted, but was precluded by other higher-priority listing actions (Federal Register 2009). Than on October 1, 2014 the USFWS released a 12-month finding not to list the yellow-billed loon as endangered or threatened.

In Alaska, the yellow-billed loon breeding is concentrated on the Seward Peninsula and the western and central portions of the Arctic Coastal Plain. The yellow-billed loon is considered a rare migrant and winter visitant, and casual summer visitant to Southeast Alaska (Heinl and Piston 2009). On wintering grounds in Southeast Alaska, yellow-billed loons are typically recorded at low densities, and Christmas Bird Count (CBC) data indicate the species is uncommon around Wrangell Island. Between 1992 and 2012, the yellow-billed loon was observed eleven times on Wrangell Islands CBCs winter count (1 to 7 individuals per count), for a total of 28 loons. The potential negative impacts on wildlife from anthropogenic disturbance such as: aircraft, ground vehicle traffic, housing facilities, oil production facilities, and noise are well recognized (Earnst 2004), but no relevant data is available on responses of yellow-billed loons to anthropogenic disturbances.

Queen Charlotte Goshawk (Accipiter gentilis laingi)

The Queen Charlotte goshawk is recognized as a distinct subspecies of the northern goshawk (*Accipiter gentilis*) that occurs only in coastal areas of British Columbia and in Southeast Alaska, and is identified as a species of concern throughout its range. It is also identified as a sensitive species by the Forest Service, Alaska Region (USDA Forest Service 2009a). In 2007, in response to a court-ordered remand on a petition to list the species, the USFWS updated a 1997 status review for the Queen Charlotte goshawk, and concluded that Alaska supports a DPS of this species though listing of this DPS was not warranted (USFWS 2007).

In Southeast Alaska, the northern goshawks inhabit forested lands but favor dense stands of conifer or deciduous old-growth for nesting and foraging habitat. Nest trees are typically located in Sitka spruce or western hemlock and in mature to old-growth forest types. In Alaska, goshawks generally occur in low densities. The most recent estimates of the goshawk populations range from 261 to 336 breeding pairs on the Tongass National Forest and 300 to 400 pairs across Southeast Alaska (Federal Register 2007). Research specific to Southeast Alaska concluded that goshawks are uncommon in this region and nesting densities are lower than other areas (Federal Register 2007). The major threat to goshawks is the loss of old growth habitat due to logging.

Management Indicator Species

Alexander Archipelago Wolf (Canis lupus ligoni)

The wolf was selected as a MIS because of population concerns in some areas of the Tongass National Forest. The standards and guidelines put forth by the Forest Plan as they pertain to the Alexander Archipelago wolf can be found on page 4-95. The Alexander Archipelago wolf (*Canis lupus ligoni*), a subspecies of the gray wolf found in Southeast Alaska, inhabits the mainland and the larger islands south of Frederick Sound (MacDonald and Cook 2007).

In August 2011, the U.S. Fish and Wildlife Service (USFWS) received a petition to list the subspecies as threatened or endangered, and to recognize Prince of Wales Island as a significant portion of its range (Center for Biological Diversity and Greenpeace 2011). The petition also requested that the USFWS consider Prince of Wales Island and adjacent islands (including Kosciusko, Tuxekan, Heceta, Suemez, Dall, and others proximate to Prince of Wales) a DPS based on unique genetic, physical, and ecological characteristics. On March 31, 2014 the USFWS released the following: “We, the U.S. Fish and Wildlife Service, announce a 90-day finding on a petition to list the Alexander Archipelago wolf (*Canis lupus ligoni*) as a threatened or endangered species and to designate critical habitat under the Endangered Species Act of 1973, as amended (Act). Based on our review, we find that the petition presents substantial scientific or commercial information indicating that listing the Alexander Archipelago wolf may be warranted. Therefore, with publication of this notice, we are notifying the public that when resources become available, we will be conducting a review of the status of the species to determine if listing the Alexander Archipelago wolf is warranted.” On January 5, 2015, the USFWS determined the Alexander Archipelago wolf does not warrant protection as an endangered or threatened species under the ESA. The decision came as a result from the Service’s 12-month finding on a petition from multiple groups to list the wolf.

Wolves in Southeast Alaska are generalists and use a wide variety of habitats but spend most of their time in productive and unproductive old-growth forests at low elevations (below 270 feet) (Person and Russell 2008). They are vulnerable to over-harvest which may limit dispersal, and thus the ability of wolves to recolonize territories that have been vacated by trapping and hunting or maintain genetic interchange between separate populations. The Forest Plan states that a road density of 0.7 to 1.0 mi/mi^2 or less may be necessary to reduce harvest-related mortality risk where locally unsustainable wolf mortality has been identified. Person et al. (1996) reported that wolf harvest increased twofold when total road density below 1,200 feet elevation exceeded 0.7 mi/mi^2. Wolf populations are also closely tied to prey abundance (Person et al. 1996). 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, Szepanski et al. 1999, Lowell 2012). For the Wrangell Island Project prey abundance (deer) and road densities were used to analyze affects.

American Marten (Martes americana)

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, and as an indicator of medium-sized old-growth reserves. Marten also are important furbearers on the Tongass, and

trapping provides an economic supplement to some residents in Southeast Alaska. Marten occur throughout most of the forested areas of Southeast Alaska, including both the mainland and the Alexander Archipelago. The marten native to Wrangell Island belong to the subspecies *M. a. americana* (Small et al. 2003). The Wrangell Island Project is within the Wrangell/Etolin Island Bio-geographic Province, which is considered a high-risk province for marten habitat. However, legacy standards and guidelines do not apply to any VCUs on Wrangell Island (USDA Forest Service WILD1.IV.D pp. 4-90 and 4-91).

ADF&G does not have population data for marten on Wrangell Island or within GMU 3. According to trapping data, populations appear to fluctuate yearly. An average of 16 marten/year (range 0-69) were trapped on Wrangell Island between 1992 and 2010 (ADF&G 2015). The harvest of 60 and 69 in 2011/2012 far exceeds any previous year trapping levels. There are currently no furbearer regulatory closures in response to the past nine decades of population decline in GMU 3; however, increased road densities associated with timber harvest activities have improved trappers' access to furbearers' habitat, reducing their refugia and making the animals increasingly vulnerable to overharvest (Lowell 2014). Regulatory mechanisms include licensing; setting season lengths, dates, and harvest limits; assigning trapper's exclusive rights to trapping areas; establishing refugia; and selective trapping of sexes.

The availability of good quality marten habitat is important and is defined in this report as POG (SD4H, SD4N, SD4S, SD5H, SD5N, SD5S and SD6/7), high-value POG (SD5N, 5S and 6/7) below 1,500 feet and below 800 feet in elevation. Studies of eight marten populations in Southeast Alaska conducted between 2001 and 2003 show that marten selected POG but also used some young-growth 26 to 40 years of age.

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle was selected as an MIS to represent species associated with beach, estuary fringe, and riparian habitats. Bald eagles typically nest in large trees in spruce-hemlock forest, and over 90 percent of the nests are within 500 feet of a saltwater beach. Nests are located within beach, estuary fringe, and riparian habitats. Since 1967, the USFWS has monitored, via aerial surveys, bald eagle populations along the North Pacific Coast from southern British Columbia to the Alaska Peninsula (Hodges 2011). In Southeast Alaska, the population increased until the 1980s, but since then has remained stable, with an adult population of approximately 13,000-26,000 birds (Hodges 2011).

Bald eagles are common year-round residents in Southeast Alaska, where they nest and winter in high numbers. The Tongass both historically and presently has supported the largest breeding population of bald eagles in the world. Currently, a stable population of approximately 25,000 adult birds is estimated to occur in Southeast Alaska (Jacobson and Hodges 1999), and more than 8,000 nest sites have been documented in the area (USDA Forest Service 2008b). The Bald and Golden Eagle Protection Act provides specific protections for bald eagles and their nests when timber-harvest activities are proposed, and all Forest Service projects must comply with 50 CFR §22.

Black and Brown Bears (Ursus americanus) and (Ursus arctos)

Black and brown bears were selected as MIS due to their economic value for hunting and recreational viewing. Due to similar habitat components and the fact that brown bears only occur on Wrangell Island in very small numbers, they were combined here for analysis.

Black bears (*Ursus americanus*) are present throughout the mainland and on the islands south of Frederick Sound. They use habitats from sea level to the alpine. Estuarine, riparian, and forested coastal habitats receive the highest use by black bears and appear to have the highest habitat values (USDA Forest Service 2008b, p. 3-233). The black bear is the most abundant bear in Alaska (Schoen and Peacock 2007), but little population information is available for Southeast Alaska including Wrangell Island.

Black bear hunters are required to obtain a harvest ticket prior to hunting; most non-residents hunt without a guide. Annual black bear harvest in GMU 3 has increased from 29 bears in 1973 to 309 bears in

2000 with over half of the bears harvested from nearby Kuiu Island (Lowell 2011a). Harvest by non-residents increased from less than 50 percent to 80 percent during the same timeframe. Recent harvest has ranged from 169 to 225 bears annually with the 169 black bears killed in during the 2009-2010 season, the lowest annual harvest since 1992 (Lowell 2011a). Non-residents continued to harvest roughly 80 percent of the bears. Reported black bear harvest on Wrangell Island is minor compared to Kuiu, although unreported harvest may occur. An average of 3.5 bears (range 1-10) were taken yearly between 1991 and 2014. On Wrangell Island, over 75 percent of the harvest was by resident hunters (ADF&G 2012).

Brown bears (*Ursus arctos*) mainly occur on the coastal mainland of Southeast Alaska, especially along major river systems and on the northern islands of the Alexander Archipelago between Icy Strait and Frederick Sound (MacDonald and Cook 2007; Schoen and Gende 2007). Brown bears occur on Wrangell Island in low densities with no population estimates currently available, but populations are believed to be stable (Lowell 2011b).

According to harvest data, brown bear hunting in GMU 3 is by registration permit with a bag limit of one bear every 4 years. GMU 3 has an annual harvest limit of no more than three bears annually. Primary threats to brown bears in GMU 3 would be the loss of habitat from clearcutting and increases in human caused mortality facilitated by increased road access (Lowell 2011b). Three brown bears have been harvested on Wrangell Island since 2005; the high proportion of female harvest is a management concern (ADF&G 2011).

In Alaska, both bears are associated with a variety of habitats from sea level to alpine. Estuaries, riparian areas, and old-growth forests have the highest value; young clearcuts, muskegs, small openings, and subalpine meadows provide high levels of forage (USDA Forest Service 2008b, pp. 2-233 and 3-235). For analysis, POG is used to represent bear denning habitat and POG within 500 feet of anadromous streams is used for critical foraging habitat.

Brown Creeper, Hairy Woodpecker, and Red-breasted Sapsucker

The red-breasted sapsucker, hairy woodpecker, and brown creeper were selected as MIS to represent old-growth associated and snag dependent species. Although no historical population estimates exist, it is likely that timber harvest and associated activities have reduced populations from current levels (Hejl et al. 2002). North American Breeding Bird Survey (BBS) data collected between 1988 and 2013 on a route specific to Wrangell Island (Zimovia Strait 03224). Over this period the brown creeper, hairy woodpecker, and red-breasted sapsucker occurrences have fluctuated on Wrangell Island (Sauer et al. 2015). However, statistically significant state-wide trends are not available for these species (Sauer et al. 2015). Due to similar habitat components and the fact that timber harvest will impact these birds in similar ways, they were combined for analysis. It will be noted where differences occur.

Brown Creeper (*Certhia americana*)

The brown creeper is an uncommon year-round resident that is widely distributed throughout Southeast Alaska and the Tongass National Forest (Heinl 2010). Although widespread, this species occurs primarily in old-growth and mature coniferous forests and can be difficult to detect and monitor due to its small size, cryptic coloration and 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. It is also unlikely that trend information from broad-scale surveys (e.g., BBSs and Christmas Bird Counts (CBCs)) can be used to determine if population fluctuations are due to habitat alterations or to other causes. Data from BBS indicates that abundance of brown creepers along the Zimovia Strait survey fluctuates with a high of 29 in 2005 and a low of 0 (6.3 individuals/year; Sauer et al. 2015). Counts from Wrangell Island CBCs from 1997 to 2011 ranged from 0 to 10 birds per survey year (0 to 0.18 birds/party hour; Audubon Society 2015), and in winter surveys conducted by Hughes (1985) on Admiralty Island, the density of brown creepers in stands of old-growth forest was 15 individuals/100 acres.

Hairy Woodpecker (*Picoides villosus*)

Hairy woodpeckers are an uncommon resident throughout Southeast Alaska that occur in relatively small numbers (Heinl 2010) and breed and overwinter on Wrangell Island (USDA Forest Service 2001b). According to the Zimovia Strait BBS route, hairy woodpeckers average 1.6/per year, with a high of 7 in 1997 and 98 (Sauer et al. 2015). Cotter (2007) estimated density of 0.1 birds per acre. According to Audubon CBC data, they have only been 4 times since 1992 (Audubon Society 2015). Hairy woodpeckers occupy mature, uneven-aged timber stands with many snags for foraging and nesting (Conner and Crawford 1974). They prefer habitats with high tree basal area, tall canopy, large diameter trees, and nest cavities that are high above the ground (Conner and Adkisson 1976). High-volume, old-growth forests receive more use in the Tongass National Forest than medium or low volume stands (Hughes 1985). Habitat patches greater than 500 acres are thought to provide optimal habitat (USDA Forest Service 2008b). Since data available from Southeast Alaska suggests that larger patch sizes are sought out by woodpeckers, high-POG (SD5N, SD5S, SD67) and patch size were used as the measurement criteria for analyzing effects.

Red-breasted Sapsucker (*Sphyrapicus ruber*)

The red-breasted sapsucker is considered an MIS in the Tongass for its role as a primary cavity excavator which depends on soft, decaying wood for its cavities. The species is widely distributed throughout Southeast Alaska forests during the spring, summer, and fall seasons. Northern populations are at least partially migratory and reduced abundances occur there during winter (Walters et al. 2002), with the remaining individuals occurring predominately at lower elevations (USDA Forest Service 2008b). Based on Wrangell Island CBCs, red-breasted sapsuckers are uncommon within the project area in the winter (Audubon Society 2015).

Approximately 32 percent of the global population of red-breasted sapsuckers breeds in Southeast Alaska (Kissling 2006). Data from BBSs indicate that Southeast Alaska has a high breeding density of red-breasted sapsuckers, with an average of approximately 9 individuals/year on the Zimovia Strait route, and a high of 37 individuals recorded in 2004 (Sauer et al. 2015). Only one BBS has been conducted on Wrangell Island, in 1984, and the data from this single survey is not useful in interpreting bird abundances or population trends. Studies indicate a preference for late-successional forests (greater than 200 years old) with higher densities of larger snags (Joy 2000, Kissling and Garton 2008, Dellasala et al. 1996).

The Forest Plan FEIS defines habitat for red-breasted sapsuckers as low to moderate volume old-growth forest habitat (low- and medium-POG classes SD4H, SD4N, SD4S, SD5H) in patches greater than 250 acres.

Red Squirrel (Tamiasciurus hudsonicus)

The red squirrel is considered an MIS on the Tongass because it is an important prey species for the northern goshawk and American marten. One of only 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). A breeding population occurs on Wrangell Island. There are no specific standards and guidelines specifically covering red squirrels in the Forest Plan. However, because they use cavities in trees for nesting and denning (USDA Forest Service 2008b, p. 3-239), red squirrels are covered under the Reserve Tree/Cavity-Nesting Habitat guidelines (USDA Forest Service 2008a, p. 4-91).

There is no harvest information available or conservation concerns for red squirrels. Under the current regulations, there is no harvest limit in the GMU3 and no closed season.

River Otter (Lontra canadensis)

The river otter was selected as an MIS because of its association with coastal and freshwater aquatic environments and the immediately adjacent (within 100 to 500 feet) upland habitats (USDA Forest Service 2008b, p. 3-233). There are no specific standards and guidelines put forth by the 2008 Forest Plan

specifically covering river otters. There is a strong association with aquatic habitats and susceptibility to pollution and habitat degradation, making river otter's good indicators of high water and environmental quality (Melquist et al. 2003).

ADF&G and the Federal Subsistence Board keep track of river otter harvest throughout Southeast Alaska. The ADF&G furbearer management report (Lowell 2013) provides information on GMU 3 furbearers with includes otters. No completed surveys or population data exist for Wrangell Island or GMU 3, but ADF&G believes that populations are currently abundant and stable in suitable habitat. Population levels are supported by information obtained from trappers and from mandatory sealing pelts, and there is currently no limit on the number of otter that can be harvested (Lowell 2013). Current trapping effort is moderate due to low-to-moderate fur prices and relatively high fuel costs. Weather has also had a profound influence on trapper effort. An average of 25 otters was harvested annually between 2006 and 2008; the average harvest increased to 41 between 2009 and 2011 in GMU 3, which is down from the 10-year average of 53 otter/year (Lowell 2013). Beach and stream side POG is used to represent river otter habitat.

Sitka Black-tailed Deer (Odocoileus hemionus)

The Sitka black-tailed deer was chosen as an MIS because it is the wildlife species that receives the highest hunting and subsistence use of all terrestrial species in Southeast Alaska, and it represents those species that use lower elevation POG habitat (below 800 feet) during the winter period (USDA Forest Service 2008b, p. 3-230). Standards and guidelines for Sitka black-tailed deer are on page 4-92 of the Forest Plan (USDA Forest Service 2008a).

Winter habitat and deer condition going into winter are considered the most important limiting factors for deer in Southeast Alaska (USDA Forest Service 2008b, 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. Annual variability in weather patterns and snowfall can have noticeable impacts on deer distribution, population density, and hunter accessibility (McCoy et al. 2009). 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 at approximately 3.9 inches (Hanley 1984, Kirchhoff and Schoen 1987, Parker et al. 1999). The second is when deer sink in the snow beyond front knee height (approximately 9.8 to 11.8 inches) 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, therefore, snow deeper than 9.8 to 11.8 inches should be considered "deep snow" (Hanley et al. 1986, White et al. 2009). See Figure 14 for a map showing deep snow habitat on Wrangell Island.

There are no reliable population estimates for deer populations in GMU 3, which includes Wrangell Island, but deer populations within this area have exhibited extreme historical fluctuations. According to ADF&G decline in unit-wide harvest actually reflects deer population decline in GMU 3 (Lowell 2013). Severe weather is responsible for most declines, but predation by wolves and bears have extended the duration of the declines (Lowell 2013). Brinkman et al. (2011) identified a 30 percent decline in deer abundance during their 3-year study on nearby Prince of Wales Island, which they attributed to the 3 consecutive severe winters. Deer populations on most islands in GMU 3 have declined since 2004 and are thought to be well-below carrying capacity.

Vancouver Canada Goose (Branta canadensis fulva)

The Vancouver Canada goose is considered an MIS on the Tongass because of its association with forested wetland habitats, and because nesting and brood-rearing could be affected by various forest-management activities. There are specific standards and guidelines put forth by the 2008 Forest Plan

specifically covering Canada geese (WILD1 XII B, p. 4-94). However, because of their association with coastal and freshwater aquatic environments, Vancouver Canada geese management guidelines in the 2008 Forest Plan are covered under beach and estuary fringe (USDA Forest Service 2008a, pp. 4-4 to 4-5), riparian areas (USDA Forest Service 2008a, pp. 4-50 to 4-54, and D-1 to D-20) and waterfowl and shorebird habitats (USDA Forest Service 2008a, pp. 4-93 to 4-94).

The Vancouver subspecies is found almost exclusively in Southeast Alaska and British Columbia with the breeding range in Alaska extending from 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). They are considered common, permanent residents throughout the Tongass National Forest. There is an estimated resident population of 10,000 Vancouver Canada geese in Southeast Alaska (USDA Forest Service 2008b, p. 3-241). Up to 25,000 individuals have been observed along marine shorelines during winter (Hodges et al. 2008). The total population is estimated at 87,000 geese. Data from CBCs specific to Wrangell Island between 1991and 2015 show that Canada geese were observed on thirteen annual winter counts, with an average of 68 geese per count (Audubon Society 2015). Hydric-POG and other unproductive land were used to analyze goose habitat.

Other Species of Interest

Great Blue Heron (Ardea Herodias fannini)

The great blue heron is a species of concern and is considered in this analysis because of its association with forested wetland habitats. Management activities such as timber harvest could affect great blue heron nesting and brood-rearing habitat. There are specific standards and guidelines set forth by the 2008 Forest Plan specifically covering great blue heron rookeries (USDA Forest Service 2008a, WILD1 XIII, p. 4-94).

Great blue herons in Southeast Alaska primarily use near-shore marine waters and freshwater habitats for foraging on fish and invertebrates. Shallow, slow-moving water is preferred. Less frequently, they may use open upland habitats for foraging on small mammals. In Southeast Alaska, herons nest as single pairs and in small colonies in coastal habitats. During breeding, great blue herons are particularly susceptible to disturbance at rookeries. At some colonies, predation by bald eagles on eggs, nestlings, and fledglings can be a major cause of nest failure (Vennesland and Butler 2004). 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. Great blue herons are thought to utilize forested muskeg and non-forest beach and freshwater habitats for foraging, and POG forests associated with hydric soils and stream drainages for nesting, the quantitative impact indicator for habitat loss/alteration for great blue herons will include the areal coverage (acres) of those habitats (1,000-foot beach buffer and 100 feet around all lakes).

Figure 14. Deep snow deer habitat; areas of refugia for deer during times of deep snow

Marbled Murrelet (Brachyramphus marmoratus)

Marbled murrelets are widely distributed across marine waters in Southeast Alaska. They spend the majority of their lives at sea, but travel inland up to 50 miles to nest in old-growth forest stands (Piatt et al. 2007). Marbled murrelets typically nest on mossy-limbed branches of large, mature coniferous trees within stands of structurally complex, coastal high-volume old-growth forest (DeGange 1996). However, on some treeless islands in Southeast Alaska marbled murrelets lay eggs on bare talus slopes in mountainous areas (Piatt et al. 2007). Nests can be very difficult to find but are protected with 600-foot radius, no-cut buffer under Forest Plan standard and guidelines (USDA Forest Service 2008a). 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, Piatt and Naslund 1995), but come onshore for nesting (Hobson 1990). Throughout much of their summer range, murrelets are often observed within 3.1 mi of the shore in water less than 131 feet deep (Day et al. 2003).

In March 2006, a status review for the marbled murrelet was initiated by the USFWS for the northern part of the species range to support ESA deliberations over the listing of the species as threatened in the southern part of its range (California, Oregon, and Washington; Piatt et al. 2007). Genetic analysis conducted as part of the review identified three DPS: one in the central and western Aleutian Islands; one ranging from the eastern Aleutians to northern California; and one in central California.

Although marbled murrelets are common in the marine waters surrounding Wrangell Island, no nests were found during numerous field reconnaissance trips, and no birds were observed flying inland from adjacent coastal waters. All POG was used represent their habitat for this analysis.

Endemic

Southern Red-backed Vole (Myodes gapperi wrangeli)

Endemic species are distinct, unique species with a restricted area or range. 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. There are roughly 24 mammal species or subspecies considered endemic to Southeast Alaska (Smith et al. 2005). Mammal surveys on the Tongass have resulted in the documentation of new distributions, new species. 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). Within Southeast Alaska, roughly 20 percent of known mammal species and subspecies have been described as endemic to the region. 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 (http://msb.unm.edu/isles/). The southern red-backed vole (*Myodes gapperi wrangeli*) is the only endemic small mammal identified on Wrangell Island; that also occurs on nearby Sergief Island (MacDonald and Cook 2007).

Information about Wrangell Island red-backed voles comes from Smith and Nichols (2004) and the related Smith et al. (2005) on Wrangell Island. They tested the association with old-growth specifically for the Wrangell Island red-backed vole. Muskegs and scrub forest (non-productive POG) supported the fewest voles and Smith and Nichols felt it was unlikely that these habitats supported breeding populations. 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). Density of small snags (4 to 19 inch diameter at breast height) and percentage of conifer seedlings were negatively associated with population density as was high moss cover in the spring (Smith et al. 2005).

The ISLES project conducted small mammal trapping on Wrangell Island in 2009 and caught 74 southern red-backed voles. The data from this study can be found in the Arctos online database along with the trap locations. In total eight different species were trapped in 169 captures with a total effort of 1,865 trap nights. In general, southern red-backed voles occur across much of northern North America and are a

common resident of later successional, moist forest habitats (Runck and Cook 2005). The highest densities and highest reproductive rates are often found in old-growth forest (Smith et al. 2005). Because densities and reproductive rates were highest in POG forest and questions remain on young growth, all POG was selected (forest types SD67, SD5S, SD5N, SD5H, SD4S, SD4N, and SD4H) as the measurement criteria for Wrangell Island red-backed voles.

Migratory Birds

Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of 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 Forest Service 2008b, p. 3-244).

Although a comprehensive list of the bird species occurring in Southeast Alaska or on Wrangell Island has not yet been published, an authoritative list of species occurring in the Ketchikan area (Revillagigedo Island) has been prepared (Heinl and Piston 2009). This list likely is representative of the Alexander Archipelago region and especially of the southern islands in the archipelago including Wrangell. Neotropical migratory birds (referred to as migratory birds) are far ranging species that require a diversity of habitats for foraging, breeding, and wintering. Many of the 295 species of birds that occur regularly in Alaska are migratory, some coming from as far away as Central or South America to their nesting, breeding, and rearing grounds in Alaska. Approximately 236 species of birds occur regularly in Southeast Alaska. Roughly 160 species are known or suspected to breed in Southeast Alaska (Armstrong 1995). The number of breeding species on Wrangell Island may be fewer than 70, but this is not currently known.

Twenty bird species are identified as species of concern in Southeast Alaska by the Boreal Partners in Flight program (BPIF 1999, USDA Forest Service 2008b, pp. 3-247 and 3-248, Table 3.10). Another 24 species were selected from the USFWS's birds of conservation concern (BCR 5) that can occur in Southeast Alaska (USFWS 2008). Seventeen of these species are linked to coniferous forest and could be affected by the proposed timber harvest on Wrangell Island. Refer to the USDA Forest Service FEIS pages 3-244 through 3-248 for additional information on migratory bird species.

Environmental Consequences

For a more in-depth analysis of effects by alternative to the wildlife species outlined below, see the wildlife resources report.

Humpback Whale

Direct/Indirect effects

The action alternatives will authorize harvest of 43 to 65 MMBF of timber, but this will not modify marine or estuarine habitat. No new marine access facilities or other dock facilities will be constructed under any of the action alternatives. Operation of all marine access facilities and similar facilities require U.S. Army Corps of Engineer, U.S. Environmental Protection Agency, and State of Alaska tidelands permits. The permitting process requires that marine access facility operation maintain water quality in the specific facility locations and that marine circulation and flushing are maintained. Bark deposition and water quality at existing marine access facilities are in compliance with permit requirements and are not expected to exceed thresholds as a result of this project. Strict adherence to water quality standards and hazardous material containment and spill guidelines will limit the potential for contamination from associated marine access facilities. Likewise, stream monitoring has not shown any significant detrimental impacts from sedimentation caused by previous logging, and Forest Plan Standards and

Guidelines for riparian management will be applied. Therefore, effects to humpback whales or their prey are expected to be minor.

It has been demonstrated that increases in human activity and background noise can alter habitats of marine animals and potentially mask communications for species that rely on sound to mate, feed, avoid predators, and navigate (Ellison et al. 2011). Acoustic disturbance sources include all types of marine vessels and low-flying aircraft. Whale response to noise varies and is correlated to size, behavior, and composition of the whales at the time of disturbance (USDA Forest Service 2008a, Appendix F). Ellison et al., 2011 state that “There is compelling evidence that factors other than received sound level, including the activity state of animals exposed to different sounds, the nature and novelty of a sound, and spatial relations between sound source and receiving animals (i.e., the exposure context) strongly affect the probability of a behavioral response. Responses have ranged from leaving or avoiding feeding and nursery areas to becoming habituated to vessel traffic and its noise. Habituation, however, may cause humpbacks to be more vulnerable to vessel strikes (USDA Forest Service 2008a).

All helicopter yarding is land to land under all action alternatives; none of the helicopter units are near the shore. Therefore, acoustic disturbance from helicopters should be minor to non-existent.

The potential for ship strikes is expected to be minor and discountable because all permitted watercraft are required to follow MMPA regulations and stay at least 100 yards from any marine mammal. Direct pursuit of whales by boats and frequent changes in boat speed and direction appear to elicit avoidance behaviors more frequently than other types of boat traffic. Tug boats towing log barges maintain relatively slow, constant speeds and direction. Ships of this type are less likely to lead to ship strikes (Jensen et al. 2010). Forest-wide standards and guidelines direct the Forest Service to ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act, Endangered Species Act, and NMFS regulations for approaching whales, dolphins, and porpoise. "Taking" of whales is prohibited; "taking" includes harassing or pursuing, or attempting any such activity (FP WILD4.B p. 4-99). The daily volume of boat traffic from the project is not expected to be distinguishable from baseline conditions.

Cumulative effects

The proposed project has the potential to result in a minor increase in vessel traffic occurring irregularly over a number of years. This would contribute to the existing level of noise and disturbance and the potential for oil or fuel spills and collisions associated with vessel activity in the vicinity of the marine access facilities to which humpback whales could be exposed., There may be cumulative effects when combined with past, present or reasonable foreseeable future activities. Activities within the analysis area that have affected humpback whales and are cumulative with the proposed project: include any project that utilized the existing marine access facilities on Wrangell Island, the Roadside EA can allow up 500 MBF of timber harvest per year which may or may not go through the marine access facility, and all future harvest completed by other land owners (Alaska Mental Health Trust and Alaska Department of Natural Resources). These activities have all increased acoustic levels and vessel traffic.

It is assumed that other vessel activity would abide by MMPA and NMFS guidelines for speed and approaching marine mammals which would reduce the likelihood of disturbance and collisions. Therefore, the action alternatives when taken together with other past, present, and reasonably foreseeable activities in the marine environment in the vicinity of the marine access facilities would only have a minor cumulative effect to humpback whales.

Steller Sea Lion (both Eastern and Western Distinct Population Segments)

Direct/Indirect effects

National Forest management activities that could have an effect on Steller sea lions are generally associated with the development and use of marine access facilities, increased marine activities, and

activities that alter stream habitat that flows into marine environments. Harassment or displacement of sea lions from preferred habitats by human activities such as boating, recreation, aircraft, log transfer facilities, and log raft towing, was identified as a concern with regard to long-term conservation in the Biological Assessment conducted for the Forest Plan (USDA Forest Service 2008c, p. F-12). The NMFS has identified similar threats in the 2008 updated recovery plan for Steller sea lions, but acknowledged that there was not enough information to quantify effects. The Wrangell Island Project occurs within the Steller sea lion eastern distinct population segment (DPS); therefore, analysis is limited to that stock although incidental occurrence of western DPS individuals may occur. Temporary movements from areas of disturbance have been documented and rookeries subject to repeated disturbance may be permanently abandoned. However, because of lack of information, it is not possible to quantify these threats (NMFS 2008). NMFS goes on to state that the potential threat from increased human disturbance highlights the need to keep regulatory mechanisms such as the MMPA in place to protect sea lions. NMFS has yet to develop a post-delisting monitoring plan which would include, among other criteria, monitoring the frequency and severity of Steller sea lion-human interactions in ports and harbors and the impacts of recreational and commercial viewing operations.

Implementation of the action alternatives could have a minor effect on Steller sea lion individuals through an incidental disturbance from barging or the rafting logs but travel routes will not be near any critical habitat or any major haul-outs. Long-term effects are not anticipated due to past history of the area. Similar to the humpback whales analysis, none of the activities will degrade the marine environment due to regulatory controls and acoustic disturbance will be temporary and indistinguishable from baseline conditions. Forest Plan Standards and Guidelines are in place to direct the Forest Service to prevent and/or reduce potential harassment of sea lions due to activities carried out by or under the jurisdiction of the Forest Service. Forest Service funded, permitted, or authorized activities must be conducted in a manner consistent with the requirements, consultations, or advice received from the appropriate regulatory agencies for the Marine Mammal Protection Act, Endangered Species Act, and NMFS guidelines for approaching seals and sea lions. "Taking" of sea lions is prohibited; "taking" includes harassing or pursuing, or attempting any such activity. Therefore, any potential effects to Steller sea lions (eastern or western stock) would be minor immeasurable.

Cumulative effects

Because the proposed project has the potential to result in a minor disturbance to Steller sea lion individuals, there would be cumulative effects when combined with past, present or reasonable foreseeable future activities. Activities within the analysis area that have affected Steller sea lions and are cumulative with the proposed project: include any project that utilized the existing marine access facilities on Wrangell Island, the Roadside Decision Notice allows up 500 MBF of timber harvest per year which may or may not go through the marine access facility, and all future harvest completed by other land owners (Alaska Mental Health Trust and Alaska Department of Natural Resources). These activities have all increased acoustic levels and vessel traffic.

It is assumed that all vessels would continue to abide by MMPA and NMFS guidelines for speed and approaching marine mammals which would reduce the likelihood of disturbance and collisions. Therefore, the action alternatives when taken together with other past, present, and reasonably foreseeable activities in the marine environment in the vicinity of the marine access facilities could have a minor cumulative effect on Steller sea lions individuals.

Yellow-billed Loon

Direct/Indirect effects

The yellow-billed loon is a rare winter migrant which occurs at low densities around Wrangell Island. There are no known nesting sites on the Tongass National Forest. Alternative 2, 3, 4, and 5 have the potential to increase in vessel activity at the existing marine access facilities, however, vessel activity

would not measurably effect yellow-billed loons. General Forest Plan direction for seabirds and shorebird habitats apply to this species (USDA Forest Service 2008a, pp. 4-93 to 94) and direction for the protection of beach, estuary and riparian habitats maintain some habitat for this species. Depending upon weather, the proposed project is likely to have reduced or no activity during times when loons may be present. Therefore, effects of the project to yellow-billed loons would be negligible.

Cumulative effects

Because there were no measurable direct and indirect effects to yellow-billed loon individuals or their habitat, there would be no cumulative effects when combined with past, present and reasonably foreseeable activities.

Queen Charlotte Goshawk

Direct/Indirect effects

Under all the action alternatives there may be adverse impacts to individuals, but these effects are not likely to result in a loss of viability on Wrangell Island nor cause a trend toward federal listing. The Wrangell Island Project has the potential to directly affect goshawks through activities that create noise or disturbance of adults or young, resulting in the temporary displacement of individual birds, removal of active nests, nest abandonment, habitat loss and fragmentation. There are no known goshawk nests within any of the proposed harvest units; therefore, none of the alternatives would directly impact known actively nesting birds but potential habitat would be removed and fragmented. Goshawks are year-round residents in the project area; therefore, timber harvest and associated activities could disturb or temporarily displace birds during the non-breeding season. Indirect effects of the Wrangell Island Project include the reduction of perching, foraging (POG), and potential nesting habitat (high-value POG).

Impacts to goshawks are assessed in terms of the reduction in total POG, which provides general habitat requirements especially foraging and high-value POG (SD 5N, 5S & 6/7) represents optimal nesting habitat due to the presence of large-trees and snags. Reductions in forest cover, and the subsequent progression of forest succession of second-growth stands, also have the potential to affect the abundance and availability of prey. This may cause goshawks to increase their breeding home range size in order to gather sufficient prey to raise young (McClaren 2004). Additionally, if timber harvest reduces the proportion of the landbase consisting of POG and mature second-growth forest to below 50 percent, this could result in portions of the landscape becoming marginal or unsuitable for goshawks. Therefore, alternatives that harvest the most POG and reduce the proportion of the landscape consisting of mature high-value POG, would be expected to have the greatest effect on goshawks. All action alternatives would maintain at least 91 percent of the existing total POG within National Forest System (NFS) lands in WAA 1903 and maintain a minimum of 88 percent high-value POG (Table 16 and Table 17). At the VCU scale the most impacted VCU is 4750 maintaining a minimum of 82 percent of foraging habitat and 74 percent of optimal nesting habitat.

Alternative 2 would harvest the most total POG (foraging habitat and nesting habitat) (4,553 acres), followed by Alternatives 5 (3,268 acres), 4 (3,023 acres), and 3 (2,740 acres; Table 16). Within the project area VCUs, the amount of POG remaining on NFS land would range from 82 to 100 percent under all action alternatives (Table 16). VCUs 4750 and 4770 would have the greatest impacts.

Table 16. Total acres of POG harvested by VCU or WAA for each alternative (NFS lands only)

VCU / WAA	2015	Alt 2		Alt 3		Alt 4		Alt 5	
	Existing acres of POG	Acres harvested	% of POG left	Acres harvested	% of POG left	Acres harvested	% of POG left	Acres harvested	% of POG left
4750	4,886	902	82	0	100	74	98	901	82
4760	3,550	318	91	228	94	245	93	228	94
4770	5,868	1,071	82	904	85	932	84	872	85
4780	7,708	689	91	531	93	576	93	516	93
4790	9,508	459	95	459	95	459	95	315	97
4800	13,361	1,114	92	618	95	738	94	436	97
5040	1,778	0	100	0	100	0	100	0	100
5050	5,746	0	100	0	100	0	100	0	100
WAA 1903	52,405	4,553	91	2,740	95	3,023	94	3,268	94

Table 17. Total acres of high-value POG harvested by VCU or WAA for each alternative (NFS lands only)

VCU / WAA	Existing acres of high-value POG (2015)	Alt 2		Alt 3		Alt 4		Alt 5	
		Acres harvested	% of POG left	Acres harvested	% of POG left	Acres harvested	% of POG left	Acres harvested	% of POG left
4750	1,862	485	74	0	100	27	99	478	74
4760	1,463	172	88	122	92	147	90	122	92
4770	2,687	614	77	562	79	591	78	538	80
4780	2,638	282	89	235	92	237	91	235	91
4790	3,092	219	93	219	94	219	93	127	96
4800	4,501	503	89	267	94	394	91	156	97
5040	1,073	0	100	0	100	0	100	0	100
5050	2,036	0	100	0	100	0	100	0	100
WAA 1903	19,351	2,275	88	1,406	93	1,615	92	1,655	91

Alternative 2 would also harvest the most high-value POG (nesting habitat) at approximately 2,275 acres, followed by Alternative 5 (1,655acres), Alternative 4 (1,615 acres), and Alternative 3 (1,406 acres; Table 17). Within the project area VCUs, the amount of existing high-value POG remaining would range from 74 to 100 percent under all action alternatives. The greatest effect would be in VCU 4570.

Under all action alternatives, the project area as a whole would continue to provide goshawk foraging and nesting habitat, by maintaining at least 88 percent of the land base in POG and mature forest habitat (Table 16 and Table 17).

The action alternatives would result in a reduction in suitable nesting and foraging habitat for goshawks through the removal of POG forest habitat. Under all alternatives there would be no direct impact to any known nesting area. However, timber harvest will remove potential nesting habitat, which could alter the distribution of nesting goshawks (resulting in more widely spaced nesting territories) on Wrangell Island as the landscape becomes more fragmented around potential nest sites. Reductions in forest cover, and the

subsequent progression of forest succession in second-growth stands, also have the potential to affect the abundance and availability of prey, benefitting some prey species while adversely affecting others. This may cause goshawks foraging on Wrangell Island to increase their breeding home range size in order to gather sufficient prey to raise young, resulting in increased energy expenditure and potentially decreased fitness (McClaren 2004; Bloxton 2002).

The extent of such effects depends in part on the amount of tree retention in resulting forested stands. An uneven-age prescription, which leaves a proportion of the trees standing in the harvest unit, would maintain some habitat value for goshawks following harvest, provided that the trees with branches adequate to support goshawk perching are retained (USFWS 2007). Widen (1997) concluded that fragmentation of mature forest patches reduced goshawk hunting opportunities where remaining patches were surrounded by young-growth forests; therefore, uneven-aged harvest also may reduce the effects of fragmentation by retaining more structure adjacent to unharvested stands. In contrast, even-aged harvest (e.g., clearcuts), which may involve the felling of all trees in a unit, provides poor quality habitat for goshawks immediately following timber harvest and marginal habitat for a few decades near the end of each rotation. Thus, the inclusion of uneven-aged harvest may lessen the effects to goshawks. Of the action alternatives, Alternative 5 includes the most uneven-aged harvest (75 percent of harvest, 2,868 acres), followed by Alternatives 2 (66 percent, 3,528 acres), Alternative 4 (49 percent, 1,738 acres), and Alternative 3 (47 percent, 1,484 acres). Therefore, implementation of the action alternatives would not directly affect goshawk individuals, but would indirectly affect nesting and foraging habitat.

Cumulative effects

In addition to effects to goshawk individuals and their habitat from all of the action alternatives, there would also be cumulative effects when combined with past, present or reasonable foreseeable future activities. Past activities on Wrangell Island that have affected potential goshawk habitat and are cumulative with this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles) and property development on non-NFS land. Activities that has improved habitat include pre-commercial thinning which have improved approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. One possible benefit is the Alaska Mental Health Trust (AMHT) land exchange where the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and of little value to this POG associated species.

Timber harvest since 1954 has increased fragmentation of productive forest habitat and reduced the amount of high-quality habitat on Wrangell Island. Taking all land ownerships into account, 85 percent of the original total POG and 78 percent of the original high-volume POG remain on Wrangell Island (existing condition) (Table 18). Within individual VCUs, the amount of original total POG ranges from 60 to 100 percent, and the amount of original high-value POG ranges from 40 to 100 percent. Ongoing and future timber harvest on NFS and State lands, such as ongoing harvest cleared by the Roadside EA and the 700 acres proposed for harvest around Earl West, as well as private lands, would result in additional fragmentation loss of old-growth forest habitat and be cumulative with the proposed action.

Table 18. Original (1954) POG and high-value POG (HPOG) remaining by VCU and WAA (all land ownerships)

	1954		Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
VCU / WAA	Historical POG	Historical HPOG	% of 1954 POG Remaining	% of 1954 HPOG Remaining	% of 1954 POG Remaining	% of 1954 HPOG Remaining	% of 1954 POG Remaining	% of 1954 HPOG Remaining	% of 1954 POG Remaining	% of 1954 HPOG Remaining	% of 1954 POG Remaining	% of 1954 HPOG Remaining
4750	6,159	2,915	84	69	70	52	84	69	83	68	70	53
4760	5,038	2,849	71	52	65	46	66	48	66	47	66	48
4770	8,404	5,282	71	51	58	40	60	41	60	40	60	41
4780	11,905	5,802	76	53	71	48	72	49	72	49	72	49
4790	12,179	5,034	90	76	86	72	86	72	86	72	88	74
4800	14,499	5,638	92	80	84	71	88	75	87	73	89	77
5040	2,125	1,406	100	100	100	100	100	100	100	100	100	100
5050	5,856	2,145	98	95	98	95	98	95	98	95	98	95
WAA 1903	66,165	31,072	85	68	78	60	81	63	80	63	80	62

Foraging goshawks could be temporarily disturbed or displaced by timber harvest activities associated with the Wrangell Island Project; similar disturbance also has the potential to occur in association with future projects such as timber harvest on non-NFS land, future State of Alaska transportation and utility construction. These disturbances are considered to have low incremental effects when combined with past, present and reasonably foreseeable future projects.

Alternative 1 would not contribute to cumulative effects to goshawks as no action would be undertaken. Under Alternative 1 (existing condition) WAA 1903 would maintain 85 percent of the original (1954) total POG, and 68 percent of the original high-volume POG.

All of the action alternatives in combination with past, present, and foreseeable future timber harvest would result in an additional cumulative reduction of potential goshawk habitat on Wrangell Island (Table 18). Within the project area WAA 1903, Alternative 2 would maintain 78 percent of the original total POG and 60 percent of the original high-volume POG. Alternative 3 would maintain 81 percent of the original total POG and 63 percent of the original high-volume POG within the project area WAA. Alternative 4 would maintain 80 percent of the original total POG and 63 percent of the original high-volume POG within the project area WAA. Alternative 5 would maintain 80 percent of the original total POG and 62 percent of the original high-volume POG within the project area WAA.

Cumulative reductions in nesting and foraging habitat on Wrangell Island could result in the local expansion of individual goshawk home ranges, potentially leading to a reduction in breeding density. Effects would be greatest under Alternative 2. However, given that goshawks are highly mobile and that breeding density is currently low on the Tongass National Forest, the effects of the Wrangell Island Project in combination with past, present, and foreseeable activities would result in effects to goshawks on Wrangell Island. Wrangell Island would continue to provide suitable habitat and the Queen Charlotte goshawk would continue to persist at current levels.

Alexander Archipelago Wolf

Direct/Indirect effects

Wolf individuals would be directly affected by activities that create noise or disturbance which could result in displacement. There are no known den sites within the proposed project area but wolves do occur on Wrangell Island. For more on wolf standards and guidelines see the 2008 Forest Plan (p. 4-95).

Indirect effects of the Wrangell Island Project may include the reduction of wolves and their prey base (deer) with the increased human access along project roads. It is assumed that a decline in the deer population would likely result in a decline in the wolf population (USDA Forest Service 2008b, p. 3-381). Therefore, impacts to wolves are assessed in terms of the reduction in deer habitat capability (based on habitat capability model outputs in terms of theoretical deer density). Note that this density does not represent actual population numbers but represents the functioning of the predator-prey system dynamic. Model methods are based on recent direction provided by the Forest Service and include:

- For the project-related indirect effects analysis, deer habitat capability by WAA (including only NFS lands) was divided by the total square miles of NFS lands (all elevations included, but with acres above 1,200 feet elevation receiving a zero value) in the WAA.
- For the cumulative effects analysis, deer habitat capability from all land ownerships (NFS and non-NFS lands) was divided by the total square miles of all land ownerships (all elevations included, but habitats on non-NFS land and land above 1,200 feet elevation receiving a zero value) in the WAA.

Timber harvest would decrease carrying capacity for deer over the long-term due to reductions in the quality of available winter range. Current deer habitat capability on Wrangell Island (WAA 1903) is below the Forest Plan guideline of 18 deer/mi^2, which suggests that the project could result insufficient numbers

of deer to sustain wolves and human hunting (See existing modeled deer densities). Deer model calculations show that there would be an estimated decline of approximately 0.3 deer/mi^2 across Wrangell Island (WAA 1903) from current levels due to existing young growth stands entering stem exclusion. Alternative 2 would have greatest impact on deer density but it would maintain 12.3 deer/mi^2 1 year post-implementation and 11.7 at stem exclusion (Table 19).

Table 19. Deer density (deer/mi^2) estimates for each alternative compared to the current (2015) condition on NFS lands in WAA 1903

Deer Density	Alt 1 (existing condition)	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	15.3	--	--	--	--
Current (2015)	12.9	--	--	--	--
1 yr. post implementation	12.9	12.3	12.5	12.5	12.5
At stem exclusion (2042)	12.6	11.7	12.0	12.0	12.0

All action alternatives involve road construction which can increase the risk of hunting and trapping mortality through increased human access. Some impacts can be mitigated through road closures (USDA Forest Service 2007a); open roads would be expected to have a greater effect than roads that are closed either through storage or decommissioning following their use (Person and Russell 2008). However, Person and Logan (2012) modeled the effects of such closures and found them to have little influence on mortality risk. Under all action alternatives, there is a slightly different configuration of NFS roads to be constructed and/or closed (See the Issue 4: Access Management section for more details).

Existing total road densities in WAA 1903 are at the upper end of the Forest Plan recommendation of 0.7 to 1.0 where road access and associated human-caused wolf mortality is a concern. Harvest rates may increase under alternatives that increase the total road density on Wrangell Island (open and closed roads). Therefore, all action alternatives would have a direct and indirect effect to wolf individuals and their habitat. Road densities below 1,200 feet on NFS lands only would be above the 0.7 to 1 mi/mi^2 guideline for all the action alternatives. Alternatives 2 to 4 would increase road densities to 1.3 mi/mi^2 (Table 20).

Table 20. Road miles (mi) and density (mi/mi^2) below 1,200 feet on NFS lands by alternative and road status

Road status	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2
Open	73.9	0.74	83.1	0.83	81.8	0.82	82.7	0.83	73.9	0.74
Closed	24.2	0.24	45.7	0.46	44.3	0.44	45.9	0.46	39.4	0.39
Total	98.1	0.98	128.8	1.3	126.1	1.3	128.6	1.3	113.5	1.1

NFS land below 1,200 feet 99.55 mi^2
Open = objective maintenance level (ML) 2 through 4
Closed = objective ML 1 + decommissioned

Cumulative Effects

Because there would be direct/indirect effects to wolves from all action alternatives, there would be cumulative effects when considering past, present, or reasonably foreseeable future activities (Table 4). Commercial timber harvest has occurred on the Tongass National Forest since 1954 and as a result has reduced habitat capability for deer in GMU 3 through the removal of POG. All action alternatives would

result in additional reduction of deer habitat capability, contributing to similar effects associated with ongoing and future timber harvest across all ownerships.

Activities on Wrangell Island that have affected wolf habitat and/or prey and are cumulative with this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat for the primary prey (deer) include pre-commercial thinning which has improved the forage on approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. One other possible benefit is the AMHT land exchange. NFS lands would increase by approximately 1,105 acres, but the majority of this land has already been harvested so any deer habitat benefits would be minimal at this time.

Cumulatively these impacts may have the potential to result in localized declines in the deer population, and therefore wolves also because deer is their primary prey. The historical and current theoretical deer densities on Wrangell Island have never supported 18 deer/mi^2, and the model shows even further decline with increased harvest. Alternative 2 would have greatest impact on deer density where it would be reduced to 10.4 deer/mi^2 1 year post-implementation and 9.9 deer/mi^2 at stem exclusion (Table 21).

Table 21. Cumulative effects to deer density (deer/mi^2) on all land ownerships in WAA 1903 by alternative

Timeframe	Alt 1 (existing condition)	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	12.9	--	--	--	--
Current (2015)	10.9	--	--	--	--
1 yr. post implementation	10.9	10.4	10.6	10.5	10.5
At stem exclusion (2042)	10.6	9.9	10.2	10.1	10.1

However, wolves are highly mobile within their territories and adjacent islands with higher deer densities would continue to support wolves on the Wrangell Ranger District. Within the biogeographic province, only one WAA currently meets or exceeds the 18 deer/mi^2 habitat capability, and that is Zarembo Island. The current road densities on all land ownerships below 1,200 feet on Wrangell Island are above the guideline and are expected to increase among the different alternatives. All action alternatives would put Wrangell Island above the 1.0 mi/mi^2 road density which could lead to an increase in human caused wolf mortality. Alternatives 2 to 4 would increase road densities to 1.5 mi/mi^2 (Table 22).

Table 22. Cumulative road density below 1,200 feet (mi/mi^2) on all land ownerships by alternative

Road status	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2	mi	mi/mi^2
Open	127.1	0.95	136.3	1.0	135	1.0	135.9	1.0	127.1	0.95
Closed	46.4	0.35	67.9	0.51	66.5	0.50	68.1	0.51	62.4	0.47
Total	173.5	1.3	204.2	1.5	201.5	1.5	204	1.5	189.5	1.42

Roads include all NFS and non-NFS roads existing, motorized trails, city, State, closed and decommissioned below 1,200 feet
Square feet of all land ownerships below 1,200 feet on Wrangell Island = 133.51mi^2

There could be cumulative effects on wolves or their prey when past, present and reasonable foreseeable future projects are combined with the implementation of the Wrangell Island Project; however, wolves would continue to persist on Wrangell Island.

American Marten

All action alternatives would have moderate direct and indirect effects to marten individuals and/or habitat. Two primary activities have been identified as affecting marten habitat: timber harvest below 1,500 feet (especially in high volume POG forest) and increases in open motorized access. Alternatives that result in the greatest reduction in primary habitat would be expected to have the greatest effects to marten.

Direct /Indirect Effects

Marten individuals would be directly affected through disturbance from harvest activities, which could result in displacement or adversely affecting young. Through the removal of forest cover and old-growth ecosystem features such as decadent live trees and snags (POG), timber harvest would reduce the vertical and horizontal structural complexity important to marten in relation to prey access, denning and resting sites, escape from predation, and thermoregulation (Flynn and Schumacher 2001). Marten would see the greatest reduction in habitat under Alternative 2 which would reduce habitat by 7 to 12 percent depending on habitat type (Table 23).

Table 23. Existing acres of POG, HPOG and percent reduction from existing by alternative in WAA 1903 on NFS land only

	Existing Condition (2015)		Alt 2		Alt 3		Alt 4		Alt 5	
Elevation	**POG**	**HPOG**	**POG**	**HPOG**	**POG**	**HPOG**	**POG**	**HPOG**	**POG**	**HPOG**
NFS lands at all elevations	52,405	19,351	9	12	5	7	6	8	4	9
NFS lands below 1,500 ft. elevation	41,060	16,943	10	12	6	8	7	9	7	8
NFS lands below 800 ft. elevation	22,164	9,261	7	9	4	5	5	6	5	5

Forest fragmentation resulting from timber harvest may also alter patterns of occupancy by marten (Chapin et al. 1998). Table 24 shows that as POG is reduced across Wrangell Island it becomes more fragmented (broken up into small patches).

Table 24. Number of historical and current POG patches, compared to POG patches for the action alternatives (NFS land only)

Patch Size (acres)	Historical (1954)	Current (2015)	Alt 2	Alt 3	Alt 4	Alt 5
15-50	55	60	83	68	75	72
50-100	9	12	18	17	18	17
100-250	8	13	18	17	18	19
250-500	5	7	8	8	7	7
500-1000	1	0	4	4	4	4
1000+	4	6	7	6	6	6
Total Acres	**59,017**	**51,596**	**46,634**	**48,594**	**48,315**	**48,085**

Research has shown a negative linear relationship between clearcut logging and marten densities (Flynn 1991). Clearcut logging directly affects marten habitat and can reduce the connectivity of POG across the project area. Clearcut harvest would also reduce canopy cover, the amount of coarse woody debris, the availability of denning and resting sites, habitat for prey species, and marten hunting efficiency. It would also create 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). Clearcuts and forest openings also reduce forest cover exposing martens to much higher snow accumulations and predation risks (Schoen et.al. 2007). Marten are thought to avoid both young and older clearcuts in the winter (Flynn and Schumacher 2001). Table 25 displays marten habitat acres harvested by alternative.

Table 25. Acres of marten habitat harvested by alternative

Habitat	Alt 2	Alt 3	Alt 4	Alt 5
NFS land (all elevations)				
POG	4,553	2,740	3,023	3,268
High-volume POG	2,275	1,405	1,614	1,655
NFS land below 1,500 feet				
POG	3,969	2,489	2,757	2,769
High-volume POG	2,025	1,280	1,480	1,427
NFS land below 800 feet				
POG	1,624	965	1,112	1,085
High-volume POG	797	440	574	490

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 neither selected for or against units that had been partial cut as long as canopy cover remained greater than 30 percent and structure was maintained. Table 26 displays even and uneven–aged management of high-volume POG marten habitat acres which are the most important, especially during the winter. Partial harvest prescription that would still maintain 67 percent of the stand volume and impact may not be as severe. This is especially true for Alternative 5 where 75 percent of total harvest is UA33.

The Marten Scientific Panel (USDA Forest Service 1997b, Appendix N) concluded that clearcut silviculture prescriptions 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 that could be permanent and result in limited interaction between populations. They defined the spatial scale of a gap to be one vacant marten territory every 1 to 3 mi^2 (640 to 1,920 acres) in size. These gaps were in areas in which habitat capability had been reduced to the point that reproductively successful marten populations may no longer exist (USDA Forest Service 1997a, pp. 3-396 and 3-397). The consequence of a gap would be some measure of reduced gene flow within the population: 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.

Table 26. Acres of marten high-volume POG (HPOG) habitat harvested by even and uneven management

Habitat and silvicultural prescription	Alt 2	Alt 3	Alt 4	Alt 5
NFS land - all elevations				
Clearcut	658	623	669	278
UA33	1,618	782	945	1,377
Total	2,275	1,405	1,614	1,655
NFS land below 1,500 feet				
Clearcut	645	607	657	261
UA33	1,380	674	824	1,166
Total	2,025	1,280	1,480	1,427
NFS land below 800 feet				
Clearcut	293	270	295	78
UA33	504	170	279	412
Total	797	440	574	490

Cumulative Effects – Action Alternatives

Because there would be direct/indirect effects from all action alternatives to marten individuals and their habitat, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities with the implementation of this project. Past activities on Wrangell Island that have affected martin habitat include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Ongoing or foreseeable timber harvest projects on NFS and State lands such as harvest cleared by the Roadside EA and 700 acres proposed for harvest near Earl West Cove, as well as harvest on private lands would contribute similar effects and further reduce marten POG habitat and high-volume POG habitat. One possible benefit is the AMHT land exchange. NFS lands would gain approximately 1,105 acres, however, the majority of this land has already been harvested so there would be no gain in current habitat. Approximately 85 percent of the original (1954) POG habitat remains within the project area WAA (Table 27). Alternative 2 would have the greatest impact on marten habitat where critical winter habitat which is deep snow marten habitat (high-value POG below 800 feet elevation) only maintain 60 percent of the original 1954 historical acres (Table 27).

The project area has an extensive road system and new roads associated with the proposed action as well as other forest management projects that would contribute to potential issues associated with human access and over-exploitation of marten along the road system. However, implementation of the Wrangell Ranger District Access and Travel Management Plan (ATM) would close or store roads in Alternatives 2 and 5, which could mitigate some trapping effects. Project total road densities would not exceed 0.69 mi/mi^2 for all land and all elevation WAA 1903 (all ownerships). There is no road density standard and guideline for marten under the Forest Plan but is important when examining roadless refugia (Flynn et al. 2004). The existing roadless refugia (roadless areas, unroaded old-growth reserves (OGRs) and other matrix lands) within the project area would be maintained under all action alternatives. Therefore, implementation of all action alternatives would have cumulative effects to martins or their habitat when combined with past, present and reasonable foreseeable future projects with the implementation of the Wrangell Island Project. Although there are effects to martins, they would still continue to persist on Wrangell Island.

Table 27. Acres of historical marten habitat, POG/high-value POG (HPOG), and the percent remaining by alternative within WAA 1903 for all land ownerships

Elevation	Historical (1954) acres	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	POG / HPOG	POG	HPOG	POG	HPOG	POG	HPOG	POG	HPOG	POG	HPOG
All lands at all elevations	66,165 / 31,072	85	68	78	60	81	63	80	63	80	62
All lands below 1,500 ft. elevation	54,554 / 28,401	82	66	75	59	77	61	77	60	77	61
All lands below 800 ft. elevation	32,629 / 17,734	78	60	73	56	75	58	74	57	74	58

Bald Eagle

All action alternatives have been grouped because any effects associated with timber harvest under the action alternative would affect bald eagles in similar ways.

Direct/Indirect Effects

Timber harvest and associated activities would create noise and disturbance (e.g., helicopter logging) and have the potential to result in minor, temporary negligible direct/indirect effect to individual birds. As required by the Forest Plan, all alternatives would be conducted in accordance with the Bald and Golden Eagle Protection Act, including maintaining appropriate distances from active bald eagle nests. Helicopter flight paths that would avoid disturbance to bald eagle nests based on Bald and Golden Eagle Protection Act requirements will be identified for the final unit pool as appropriate. There is no timber harvest within the beach/estuary or stream buffers.

The Forest Plan also requires that bald eagle nest sites be managed in accordance with the USFWS guidelines. These guidelines restrict activities that are consistent with current bald eagle use, a 660-foot radius around active bald eagle nest trees between March 1 and August 31. There are also seasonal timing and activity restrictions for repeated helicopter flights within a 1,000 feet of active nests and for road blasting or rock crushing activities within 0.5 mile of active nests. These requirements will be implemented if active nests areas located in or adjacent to proposed activities. Currently all known bald eagle nest sites within the project area fall within the established 1,000-foot beach fringe buffer; therefore, Forest Plan standard and guidelines for bald eagles are currently being met.

Cumulative Effects

Because there would be negligible direct/indirect effects to bald eagle individuals or their habitat under all action alternatives, there would be no cumulative effects of past, present or reasonably foreseeable future activities combined with the implementation of the proposed project. All project activities would be implemented in accordance with the Bald and Golden Eagle Protection Act. It is assumed that ongoing and foreseeable actions in the project area would also be conducted accordingly. Thus, the Wrangell Island Project, in combination with ongoing and foreseeable activities, would have negligible cumulative effects to bald eagles or their habitat.

Black and Brown Bears

Direct/Indirect Effects

Timber harvest has the potential to adversely affect bears through activities that create a disturbance, the removal of habitat and increased mortality through increased road access. There are no known dens that have been located within any of the proposed harvest units. Preferred habitats by bears, which include coastal, estuarine, and riparian areas, are protected by the Forest Plan conservation strategy. These areas support salmon which are an important component to a bear's diet. Therefore, none of the alternatives are expected to significantly affect the highest quality black or brown bear habitats. All activities near Class I salmon streams, will follow the mandatory Forest Plan Standards and Guidelines. Additionally, reductions in deer habitat capability resulting from timber harvest could reduce fawn productivity, and therefore the prey base for bears in the spring. However, due to the variety of food consumed by bears and the short-term availability of fawns as a food source, it is unlikely that this will have a substantial effect to the black or brown bear populations. Currently on NFS lands on Wrangell Island there are approximately 52,405 acres of denning habitat and 3,678 acres of foraging stream habitat (Table 28). Alternative 2 would have the greatest reduction in bear denning habitat at 9 percent.

Table 28. Existing acres of bear habitat (NFS lands) in WAA 1903 and percent reduction from existing condition

Habitat type	Historical condition (1954)	Existing condition (2015)	% remaining from original	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Denning habitat[1]	59,478	52,405	88	0	9	5	6	6
Foraging habitat[2]	112,139	108,537	97	0	5	3	3	3
Foraging within 500 feet of Class I streams	4,124	3,678	89	0	3	1	2	1

1 - Denning habitat includes all POG at all elevations

2 - Foraging habitat includes all habitats except older young-growth, lakes and water

Timber harvest would have a beneficial impact by increasing forage availability over the short-term in the resulting early-successional plant communities. However, this food source typically lasts about 25 years post-logging in association with canopy closure. Over the long-term, timber harvest would decrease habitat suitability for bears, due to the reduced understory forage in young-growth stands as they enter the stem exclusion stage and loss of denning habitat in upland areas (e.g., large woody structures such as hollow logs and hollow living trees; Davies et al. 2012). At the WAA scale, it can be expected that habitat capability for bears would decline as harvested stands move into stem exclusion. Over time, this reduction in foraging habitat may result in a decrease in the bear population (Rogers 1976).

Roads associated with timber harvest may indirectly increase the susceptibility of bears to be over-harvested with an increase in access. Although there is no road density standard and guideline for bears, it can be assumed that an increase in open roads, particularly in open habitats such as clearcuts, muskegs, and alpine areas where bears forage and easier to see, increases the potential for human-bear interactions. The amount of road access, quantified in terms of the amount of road construction and reconditioning proposed under each alternative, is representative of the potential for over-hunting (USDA Forest Service 2008b). For more information on road densities, see the full wildlife report.

Cumulative Effects

Because there would be direct/indirect effects to both brown and black bears from all the action alternatives, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Activities on Wrangell Island that have affected bear habitat and prey and would cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. One other possible benefit is the AMHT land exchange through which NFS lands would gain approximately 1,105 acres, but the majority of this land has already been harvested so the benefit would be a gain in short-term foraging habitat. POG harvest under the action alternatives would reduce the original (1954) POG remaining within the project area WAA 1903 (Table 29). This would contribute to similar effects resulting from ongoing and foreseeable harvest on NFS, State lands, such as harvest cleared by the Roadside EA and 700 acres of harvest planned near Earl West Cove, as well as harvest on private land. After timber harvest there would be a short-term (about 25 years) increase in the forage availability for bears, which may result in short-term population growth. However, over the long-term (25 to 150 years), as the forest canopy fills, forage species would be reduced and thus reduce carrying capacity for bears. Alternative 2 would maintain approximately 78 percent of historical POG habitat (Table 29).

Table 29. Historical and existing acres of bear habitat and percent remaining by alternative (all land ownerships) in WAA 1903

Habitat type	Historical condition (1954)	Existing condition (2015)	% remaining	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Denning habitat[1]	66,292	56,166	85	100	78	81	80	80
Foraging habitat[2]	132,837	127,442	96	100	92	94	93	93
Foraging within 500 feet of Class I streams	5,219	4,318	83	100	81	82	81	82

1 - Denning habitat includes all POG at all elevations

2 - Foraging habitat includes all habitats except older young-growth, lakes and saltwater

Young-growth stands generally lack large hollow trees and root masses important for denning, though these features would be protected in harvested stands to some extent on NFS lands under the Forest Plan. Ongoing and future thinning of young-growth stands on NFS lands would improve habitat conditions for bears over the short-term by increasing the period during which forage is available and over the long-term promote the development of larger trees which could provide suitable den sites.

Road building associated with past timber harvest on Wrangell Island has resulted in high road densities for a Southeast Alaskan island. Cumulative total road densities on all land ownerships would increase under Alternatives 2, 3 and 4 and be reduced in Alternatives 1 and 5. Increased harvest of bears due to human access along roads would be greatest under Alternative 2 because 100.6 miles (includes motorized trails) would remain open following project implementation. All temporary roads would be closed upon project completion. Other timber harvest projects on NFS and State lands that involve road construction also have the potential to result in cumulative road-related effects to bears. Projected total road densities (all land ownerships) would be between 0.88 to 1.07 mi/mi^2 in WAA 1903 (all of Wrangell Island). Therefore, implementation of all action alternatives would have cumulative effects to both brown and

black bears or their habitat when combined with past, present and reasonable foreseeable future projects with the implementation of the Wrangell Island Project. Although there are effects to bears they would still continue to persist on Wrangell Island.

Brown Creeper, Hairy Woodpecker, and Red-breasted Sapsucker

Direct/Indirect Effects

Timber harvest and associated activities under all action alternatives have the potential to disturb nesting adults and young, remove nests, reduce habitat availability, or cause nest abandonment. Because these species are year-round residents, timber harvest activities could also displace birds during the non-breeding season.

Direct effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper would also result from the removal of nesting and foraging habitat (POG forest). These species rely on structural components (e.g., large diameter trees, snags) of the old-growth forest ecosystem for nesting and foraging. Red-breasted sapsuckers are most closely associated with low-volume old-growth; whereas hairy woodpeckers and brown creepers are associated with high-volume and large-tree, respectively. All harvest prescriptions and methods would reduce the number of large trees; however, uneven-aged harvest would retain some structural components suitable for these species. It is assumed that alternatives that prescribe the most even aged harvest of POG would have greater effects to these species. Table 30 displays existing and reduction of habitat by alternative. Alternative 2 would remove the greatest amount of habitat - 1 to 12 percent of existing condition. Table 30 displays historical, existing and percent remaining by alternative.

Table 30. Acres of POG (high, medium, low) and nonproductive lands - historical, existing, amount of harvest and percent remaining by alternative (NFS land)

Volstrata	Historical condition (1954)	Existing condition (2015) (% remaining from historical)	Alt 2 Harvest (% reduction from existing)	Alt 3 Harvest (% reduction from existing)	Alt 4 Harvest (% reduction from existing)	Alt 5 Harvest (% reduction from existing)
High (5N, 5S and 6/7)	26,554	19,351 (73)	2,275 (12)	1,405 (7)	1,614 (8)	1,655 (9)
Medium (4N, 4S and 5H)	--	21,218 (--)	1,442 (7)	806 (4)	856 (4)	1,014 (5)
Low (4H)	--	11,836 (--)	837 (7)	528 (4)	553 (4)	599 (5)
Non-productive lands[1]	--	52,494 (--)	718 (1)	425 (1)	486 (1)	502 (1)

1- Non-Productive Lands: Size Density shows the Volume Strata to be “Non-Productive Lands” for between 12 percent and 15 percent of the acres in the proposed alternative harvest units. This is partially caused by inaccurate Cover Type polygon delineation and, more substantially, caused by a lack of attribute data in Cover Type. When attribute fields in Cover Type contain no data (<NULL>) for FPROD (Forest Productivity), SSIZEC (Stand Size Class), or VOLC (Volume Class), then the VEG_CODE (Vegetation Code) field in Size Density gets populated with a value of “Unknown Forested Data.” For these same features, the VOLSTRATA (Volume Strata) field of Size Density is calculated to be “Non-Productive Lands.”

Indirect effects to these species would be associated with fragmentation and the reduction in POG patch sizes acres (Table 31). Fragmentation reduces the amount and effectiveness of interior forest habitat by creating habitat edges along which there may be increased rates of nest predation by avian predators (Kissling and Garton 2008). Alternatives that result in the greatest increase in the number of patches in the

smallest size classes, and result in the greatest decrease in acres of interior forest, would be expected to have greater effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper. At the VCU scale, VCU 4750 POG habitat could be 18 percent in Alternatives 2 and 5 (Table 31).

Table 31. Effects on brown creepers, hairy woodpeckers and red-breasted sapsuckers by alternative, as represented by the reduction of acres of POG habitat on Wrangell Island (NFS lands only)

VCU / WAA	Acres of historical condition (1954)	Alt 1 (Acres of existing condition) (% remaining from historical)	Alt 2 (% reduction from existing)	Alt 3 (% reduction from existing)	Alt 4 (% reduction from existing)	Alt 5 (% reduction from existing)
4750	5,114	4,886 (96)	902 (18)	0 (0)	74 (2)	901 (18)
4760	4,212	3,550 (84)	318 (9)	228 (6)	245 (7)	228 (6)
4770	7,424	5,868 (79)	1,071 (18)	904 (15)	932 (6)	872 (15)
4780	9,964	7,708 (77)	689 (9)	531 (7)	576 (7)	516 (7)
4790	10,639	9,508 (89)	459 (5)	459 (5)	459 (5)	315 (3)
4800	14,496	13,361 (92)	1,114 (8)	618 (5)	738 (6)	436 (3)
5040	1,778	1,778 (100)	0 (0)	0 (0)	0 (0)	0 (0)
5050	5,881	5,746 (98)	0 (0)	0 (0)	0 (0)	0 (0)
WAA 1903	59,478	52,405 (88)	4,553 (9)	2,740 (5)	3,023 (6)	3,268 (6)

Cumulative Effects

Past timber harvest has reduced the amount of foraging and nesting habitat available in the project area for the red-breasted sapsucker, hairy woodpecker, and brown creeper. Fragmentation resulting from past timber harvest has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions. All of the action alternatives would contribute to these effects. Other activities on Wrangell Island that have affected potential brown creeper, hairy woodpecker and red-breasted sapsucker and are cumulative with this project include: road/trail construction (100 miles), installation of utility corridors (26 miles) and property development on non-NFS land. An activity that has improved habitat by encouraging tree growth includes pre-commercial thinning approximately 4,000 acres since the 1970s. There are an additional 1,250 acres planned over the next 10 years. One other possible benefit is the AMHT land exchange where there would be a gain of approximately 1,105 acres of NFS land, but the majority of this land has already been harvested and would be of little value to these POG associated species.

Ongoing and foreseeable timber harvest on NFS lands, including harvest cleared by the Roadside EA, micro-sales and free use, and the planned harvest of 700 acres of State land around Earl West Cove, would result in additional habitat loss and associated fragmentation. Young-growth treatments on NFS lands may provide additional foraging opportunities for cavity nesters through the increase in downed

wood and decaying debris. Restoration activities that involve thinning would have similar effects. At the VCU scale, VCU 4770 would only maintain 58 percent of the historical POG under Alternative 2 (Table 32). Despite having cumulative impacts under all alternatives, the Forest Plan conservation strategy would maintain habitats for the brown creeper, hairy woodpecker and red-breasted sapsucker.

Table 32. Effects on brown creepers, hairy woodpeckers and red-breasted sapsuckers by alternative, as represented by acres of remaining POG habitat on all land ownerships on Wrangell Island

VCU / WAA	Historical condition (1954)	Alt 1 (existing condition) (% remaining of historical)	Alt 2 (% remaining of historical)	Alt 3 (% remaining of historical)	Alt 4 (% remaining of historical)	Alt 5 (% remaining of historical)
4750	6,159	5,203 (84)	902 (70)	0 (84)	74 (83)	901 (70)
4760	5,038	3,572 (71)	318 (65)	228 (66)	245 (66)	228 (66)
4770	8,404	5,942 (71)	1,071 (58)	904 (60)	932 (60)	872 (60)
4780	11,905	9,101 (76)	689 (71)	531 (72)	576 (72)	516 (72)
4790	12,179	10,991 (90)	459 (86)	459 (86)	459 (86)	315 (88)
4800	14,499	13,364 (92)	1,114 (84)	618 (88)	738 (87)	436 (89)
5040	2,125	2,121 (100)	0 (100)	0 (100)	0 (100)	0 (100)
5050	5,856	5,751 (98)	0 (98)	0 (98)	0 (98)	0 (98)
WAA 1903	66,165	56,045 (85)	4,553 (78)	2,740 (81)	3,023 (80)	3,268 (80)

Red Squirrel

Direct/Indirect Effects

Direct effects to red squirrels can result from disturbances that adversely affect individuals or young including removing active nests. Squirrels are year-round residents and would be disturbed and displaced by harvest activities. Indirect effects result from the reduction of nesting, foraging, and caching habitat. The greatest threat to red squirrels is the loss of large cone producing trees and nest sites. Clearcutting directly impacts red squirrels by reducing the number of seed producing trees, nest sites, removing canopy and escape routes. The removal large amounts of POG habitat will likely have the greatest impacts to red squirrels. It can take up to 40 years for regenerating trees to be able to produce cones. At the WAA scale, POG habitat would be reduced by 5 to 9 percent (Table 32).

Cumulative Effects

Because there would be direct/indirect effects to red squirrels from all action alternatives, there would be cumulative effects when combined with past present or reasonably foreseeable future activities. Other activities on Wrangell Island that have affected potential red squirrel nesting and foraging habitat and are cumulative with this project include: timber harvest (6,800 acres), road/trail construction (100 miles), installation of utility corridors (26 miles) and property development on non-NFS land. One possible benefit is the AMHT land exchange. NFS lands would gain approximately 1,105 acres, but the majority of

this land has already been harvested and currently would be of little value to these POG associated species.

Past timber harvest has reduced the amount of red squirrel denning, nesting, and foraging habitat available on Wrangell Island. Fragmentation resulting from past timber harvest and POG removal activities has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions. All of the proposed action alternatives would contribute to these effects. Ongoing and foreseeable timber harvest on NFS lands and State lands, such as those cleared by the Roadside EA and 700 acres of planned harvest near Earl West Cove, would result in additional habitat loss and associated fragmentation. The cumulative reduction in POG and connectivity within the matrix would result in negative impacts to red squirrel populations. Impacts would be greatest in VCUs where there has already had substantial timber harvest, and where large young-growth stands or large clearcuts (greater than 0.6 mile across) are already present, which may act as barriers to red squirrel movements.

Young-growth treatments on NFS lands and restoration projects that involve thinning would improve habitat quality for red squirrels by creating structural conditions in young-growth stands that are conducive to red squirrel dispersal. At the WAA scale POG habitat would be maintained at 78 to 85 percent of historical habitat. Although there are cumulative effects to red squirrels they would still continue to persist on Wrangell Island.

River Otter

Direct/Indirect Effects

With the implementation of Forest Plan Standards and Guidelines for the beach and estuary fringe, lake buffers, and stream buffers, as well as best management practices (BMPs) for maintaining water quality, all of the action alternatives would be expected to have negligible effects to river otters. There would be 3 to 4 percent reduction of otter habitat on NFS lands through the action alternatives (Table 33). Preferred river otter habitat, which includes old-growth forest immediately adjacent to coastal and fresh water aquatic environments (1,000-foot beach buffer and Class I and II streams), are protected by Forest Plan Standards and Guidelines and would not be affected by this project. The OGR and Scenic Viewshed LUD designations also protect shoreline habitats. Therefore, adverse effects to this species are negligible under all action alternatives.

Table 33. Acres of POG harvested within 500 feet of Class I and II streams in WAA 1903 and percent reduction by alternative (NFS lands)

Historical condition (1954)	Existing condition (2015) (% remaining)	Alt 2 harvest (% remaining)	Alt 3 harvest (% remaining)	Alt 4 harvest (% remaining)	Alt 5 harvest (% remaining)
10,045	9,134 (91)	334 (4)	243 (3)	348 (4)	237 (3)

Cumulative Effects

Because there would be negligible direct/indirect adverse effects to river otters with the implementation of all action alternatives, there would be no cumulative effects when combined with past, present and reasonable foreseeable future projects. All alternatives would follow standards and guidelines that protect important river otter habitat such as maintaining the beach and estuary fringe, lake buffers, and stream buffers, as well as BMPs for maintaining water quality. There would be 20 to 21 percent reduction of POG habitat from historical 1954 condition within 500 feet of Class I streams (Table 34) but with a minimum of 100-foot buffer. Therefore, any effect from the action alternatives would be minor and have a negligible contribution to effects (adverse or beneficial) to river otters. Ongoing and foreseeable timber harvest, young-growth treatments, and restoration activities on NFS lands would be subject to the same

standards and guidelines, minimizing effects to river otter habitat. Any young-growth treatments on NFS lands in riparian, beach, and estuary habits would improve habitat quality for river otters, as would restoration activities in the project area, particularly those focused on riparian and in-stream habitat improvement but no such projects are scheduled in the reasonably foreseeable future.

Table 34. POG harvested within 500 feet of Class I and II streams (all lands) in WAA 1903. Also shows percent of historical POG remaining for each alternative

Historical 1954	Existing 2015 (% remaining)	Alt 2 (% remaining)	Alt 3 (% remaining)	Alt 4 (% remaining)	Alt 5 (% remaining)
12,063	9,986 (84)	334 (80)	243 (81)	348 (80)	237 (81)

Sitka Black-tailed Deer

Direct/Indirect Effects

All of the action alternatives would reduce POG habitat, therefore reducing deer habitat capability (Table 35). Effects would be realized immediately after project completion (2016), but more so at stem exclusion (2042), as forest succession progress. Under all alternatives, this would occur to some extent due to natural succession of previously harvested stands. Over the long-term, reductions in habitat capability could reduce carrying capacity, or the number of deer an area is capable of supporting given the available resources. This could lead to a decline in the deer population, particularly following severe winters, if the demand for resources (e.g., food or habitat) exceeds that which is available. Uneven-aged harvest prescriptions would lessen reductions in habitat capabilities as both some cover and forage would be maintained in harvested stands. Uneven-aged management can take 50 years to recover as compared to 150 with some even-aged management. 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). Likewise, reductions in deer habitat capability over the long-term may reduce the access to and availability of deer to subsistence hunters. Alternative 2 would have greatest reduction deer habitat capability of 9 percent at stem exclusion (Table 35).

Table 35. Deer habitat capability (DHC) (measured from theoretical number of deer) and percent of current DHC reduced by alternative in WAA 1903 on NFS lands only

Deer Habitat Capability	Alt 1 (existing condition)	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	2,678	--	--	--	--
Current (2015)	2,264 (85%)	--	--	--	--
One year post implementation (2016)	2,216 (98%)	2,160 (5%)	2,198 (3%)	2,187 (3%)	2,193 (3%)
Stem exclusion (2042)	2,215 (98%)	2,053 (9%)	2,114 (7%)	2,098 (7%)	2,105 (7%)

Timber harvest under all of the alternatives would decrease the amount of available average snow and deep snow winter habitat, and to a much less extent the non-winter habitat (Table 36). This could alter the distribution of these habitats on the landscape resulting in concentrated deer use of these areas (Schoen and Kirchoff 1984), although they are already patchily distributed in the project area. Resident deer that concentrate use within remnant patches of low-elevation forested habitat may be more prone to increased

predation pressure or may resort to using lower quality habitats (McNay and Vollner 1995, B.C. Ministry of Forests 1996). Such effects may indirectly affect the migratory deer population. Timber harvest would also increase foraging habitat over the short-term in summer and low-snow winters, but could also reduce overall the amount of habitat (through POG reduction). Loss of non-winter habitat could reduce the ability of deer to withstand harsh winter conditions if not enough forage is available for deer to build fat reserves. Currently on NFS land there are 1,802 acres of deep snow habitat, 41,060 acres of average snow habitat, and 108,538 acres of non-winter habitat (Table 36). Alternative 2 would have the greatest effect on average snow habitat by reducing it 10 percent. All other alternatives would have similar effects deer habitat (Table 36).

Table 36. Acres of harvest of deep snow, average snow, and non-winter habitat for deer (NFS lands only). Also includes percent reduction from current acres

Habitat	Historical (1954) acres	Current (2015) acres	% of Historical	Alt 2	Alt 3	Alt 4	Alt 5
Deep snow[1]	2,655	1,802	68	58 3%	47 3%	54 3%	24 1%
Average snow[2]	47,871	41,060	86	3,970 10%	2,489 6%	2,757 7%	2,769 7%
Non-winter[3]	112,140	108,538	97	289 1%	300 1%	299 1%	286 1%

1 - High volume POG (SD 5S, 5N, and 6/7) on south-facing slopes

2 - All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, and 6/7) at or below 1,500 feet elevation

3 - Spring/summer/fall habitat; all POG, non-productive OG, non-forested, muskeg, and alpine at all elevations

Cumulative Effects

Because there would be direct/indirect effects to individual deer and their habitat from all action alternatives, there would be cumulative effects when combined with past, present or reasonably foreseeable future activities. Other activities on Wrangell Island that have affected deer habitat and are cumulative with this project include: past timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. Stands entering stem exclusion would continue into the future but be alleviated through thinning. One other possible benefit is the AMHT land exchange. NFS lands would gain approximately 1,105 acres, but the majority of the land has already been harvested and would be of little value other than possible foraging habitat.

Past harvest activities have reduced deer habitat capability on all land ownerships within WAA 1903 (Table 37). Additional harvest on Wrangell Island, such as the 700 acres that would occur as part of the Earl West Cove harvest or as cleared by the Roadside EA, would further reduce deer habitat capability; however, micro-sales and free use have a negligible effect on deer habitat capability because they do not result in substantial stand modification. Deer habitat capability would be maintain 77 percent of historical condition under Alternative 2, all other Alternative would affect deer habitat capability similarly (Table 37).

Table 37. Deer habitat capability (measured as theoretical number of deer) and percent remaining of historical (1954). Numbers are for all lands in WAA 1903

Deer habitat capability	Alt 1 (existing condition)	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	2,678	--	--	--	--
Current (2015)	2,264 (85%)	--	--	--	--
One year post implementation (2016)	2,216 (85%)	2,160 (81%)	2,198 (82%)	2,187 (82%)	2,193 (82%)
Stem exclusion (2042)	2,215 (83%)	2,053 (77%)	2,114 (79%)	2,098 (78%)	2,105 (79%)

Average snow, deep snow, and non-winter habitat have also been reduced by past harvest and would be further reduced from historical condition by all action alternatives. Cumulative reductions in deep snow and average snow winter habitat would be reduced under all action alternatives (Table 38). Currently all land in WAA 1903 would maintain 67 percent of the historical deep snow habitat, 82 percent of the average snow habitat and 96 percent of the non-winter habitat (Table 38). Therefore, implementation of the proposed project would increase habitat fragmentation, human disturbance, and cause a loss of habitat when combined with past, present, and reasonably foreseeable future harvest. Although there would be effects on Wrangell Island, deer would continue to persist at current levels.

Table 38. Deep snow, average snow, and non-winter habitat for deer in WAA 1903 (all lands) and acres harvested, percent remaining from historical condition

Habitat	Historical condition (1954) acres	Current condition (2015) acres	% remaining of historical	Alt 2	Alt 3	Alt 4	Alt 5
Deep snow[1]	3,333	2,247	67	58 66%	47 66%	54 66%	24 67%
Average snow[2]	54,675	44,812	82	3,970 75%	2,489 77%	2,757 77%	2,767 77%
Non-winter[3]	133,396	127,997	96	296 96%	300 96%	299 96%	286 96%

1 - High volume POG (SD 5S, 5N, and 6/7) on south facing slopes

2 - All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, and 6/7) at or below 1,500 feet elevation.

3 - Spring/summer/fall habitat; all POG, non-productive OG, non-forested, muskeg at all elevations

Vancouver Canada Goose

Direct/Indirect Effects

There would be negligible direct and indirect effects to Vancouver Canada Geese as a result of implementing the proposed action alternatives. Timber harvest and associated activities would have the potential to affect Vancouver Canada geese through noise and but any adverse effects would be short-term and negligible. The Vancouver Canada goose nests and rears its broods in coastal forested habitats near water sources and winters along marine waters. These geese have been known to utilize both forested and non-forested wetlands. Timber harvest would affect this species through the removal of forested wetlands, but because of poor timber quality at these sites any effects are expected to be minimal. Habitat for Vancouver Canada geese on NFS lands would be reduced by 4 to 7 percent through the action alternatives (Table 39). Forest Plan Standards and Guidelines would maintain habitats in beach/estuary buffers,

riparian and lake buffers. Additional protection of wetlands and areas of concentrated waterfowl use is also provided for under the waterfowl and shorebird habitat standards and guidelines although there are no such areas identified in the project area. Conversion of these stands to young growth would be expected to lower the ability of this habitat to support Vancouver Canada geese. It is assumed that alternatives that harvest the most forested wetlands would have the greatest effects to Vancouver Canada geese.

Table 39. Vancouver goose habitat harvested by alternative and percent reduction from existing condition (NFS lands only)

Habitat	Existing (2015)	Alt 2	Alt 3	Alt 4	Alt 5
Hydric POG (SD4H)	11,836	7%	4%	4%	5%
Other unproductive lands[1]	52,494	1%	1%	1%	1%

1 - Other unproductive lands = forested muskeg, non-forested and unproductive forest

Cumulative Effects

Because there would be negligible adverse direct/indirect effects to Vancouver Canadian geese with the implementation of any of the action alternatives, there would be no cumulative effects when combined with past, present and reasonable foreseeable future projects. Alternative 2 would have the greatest impact, but approximately 93 percent of habitat would remain from 1954 historical conditions (Table 40). There are standards and guidelines in place that protect important Vancouver Canada goose habitat, such as maintaining the beach and estuary fringe, lake buffers, and stream buffers, as well as BMPs for maintaining water quality. Furthermore, timber harvest in Vancouver Canada goose habitat has generally been minimal because these sites are fairly unproductive for timber harvest. Therefore all action alternatives would have negligible effects on Vancouver Canada geese. Ongoing and foreseeable timber harvest, young-growth treatments, and restoration activities on NFS lands would be subject to the same standards and guidelines, minimizing effects to Vancouver Canada goose habitat.

Table 40. Historical acres of Vancouver goose habitat and percent remaining (all lands) by alternative

Habitat	Historical condition (1954)	Alt 2	Alt 3	Alt 4	Alt 5
Hydric POG (4H and 5H)	12,809 acres	93	96	96	95
Other unproductive lands[1]	64,060 acres	99	99	99	99

1 - Other unproductive lands = forested muskeg, non-forested and unproductive forest

Great Blue Heron

Direct/Indirect Effects

There would be negligible direct and indirect effects to great blue heron individuals or their habitat from all proposed action alternatives. Timber harvest and associated activities would have the potential to affect great blue heron through noise and disturbance, but all potential disturbances are expected to short-term and negligible. This species utilizes both forested and un-forested wetlands. Approximately 97 percent of the historical 1954 habitat remains on NFS lands within WAA 1903 (Table 41). Timber harvest could affect this species through the removal of forested wetlands, but no harvest activities are scheduled to occur within the 1000-foot beach buffer or 100 feet of any lake. The great blue heron usually nest

within 3km of coastal foraging areas and rears its broods in coastal forested habitats. There are Forest Plan Standards and Guidelines that maintain habitats in beach and estuary buffers and riparian, lake, stream and nest buffers. Protection of wetlands and areas of concentrated waterfowl use is also provided for under the waterfowl and shorebird habitat standards and guidelines, though there are no such areas identified in the project area. Conversion of these stands to young growth would be expected to lower the ability of this habitat to support great blue heron. It is assumed that alternatives where logging activity would have the most impact is when mature timber is in close proximity to prime foraging habitat. There are known heron rookeries on Wrangell Island that are currently protected and would remain so with a 600-foot buffer. Harvest activities adjacent to rookeries should be deferred until after the breeding season (March 1 to July 31).

Cumulative Effects

Because there would be negligible cumulative adverse effects to great blue heron individuals and/or their habitat with the implementation of all action alternatives, there would be no cumulative effects when combined with past, present and reasonable foreseeable future projects. Currently 89 percent of the historical 1954 habitat remains on Wrangell Island (all ownerships). Also, the Forest Service standards and guidelines in place that protect important habitat such as maintaining the beach and estuary fringe, lake buffers, and nest buffers (on NFS lands only). Furthermore, forested habitat used for nesting, which would not be impacted from harvest activities, nor is it the limiting factor affecting great blue herons. Timber harvest has generally had negligible effects because these sites are fairly unproductive for timber harvest. Therefore, all action alternatives would only have negligible effects on great blue herons or their habitat. Ongoing and foreseeable timber harvest, young-growth treatments, and restoration activities on NFS lands would be subject to the same standards and guidelines, minimizing effects to great blue heron habitat.

Table 41. Great blue heron habitat (1,000-foot beach buffer and 100-foot lake buffer) on NFS lands in WAA 1903

Historical condition (1954)	Existing condition (2015)	% remaining from historical condition
All land ownerships		
6,642 acres	5,916 acres	89
NFS lands only		
5,229 acres	5,067 acres	97

Marbled Murrelet

Direct/Indirect Effects

Timber harvest and associated activities would have direct/indirect effect on marbled murrelets through noise, disturbance, and the removal of potential nesting habitat. Although no murrelets were observed during field surveys, but they are common in marine waters surrounding Wrangell Island.

Direct impacts from logging on murrelet nesting habitat can be assumed because clearcut logging combined with a short (100-year) timber rotation cycles will permanently reduce potential murrelet nesting habitat on Wrangell Island. In Southeast Alaska trees in younger forests are much smaller and lack the large branches and epiphyte growth required for successful nesting sites (Cotter and Kirchhoff 2007).

Effects to POG forests resulting from all the action alternatives are summarized in the table below (Table 42). Effects would be greatest under Alternative 2, where the Wrangell Island Project would reduce habitat by approximately 5 to 9 percent of the existing POG habitat on Forest Service lands within WAA 1903.

Table 42. Acres and percent reduction of POG habitat (NFS lands only) in WAA 1903 by alternative

Historical condition (1954)	Alt 1 (existing condition[1]) (% remaining from historical)	Alt 2 (% reduction from existing)	Alt 3 (% reduction from existing)	Alt 4 (% reduction from existing)	Alt 5 (% reduction from existing)
59,478	52,168 (88)	4,553 (9)	2,740 (5)	3,023 (6)	3,268 (6)

1 - Existing condition is 2015

Cumulative Effects

Because there would be direct/indirect effects to marbled murrelets, there would be cumulative adverse effects with the implementation of all action alternatives when combined with past, present and reasonably foreseeable future projects. Activities on Wrangell Island that have affected marbled murrelet potential nesting habitat and are cumulative with this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. One possible benefit is the AMHT land exchange where the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and of little value to this POG associated species.

There are standards and guidelines in place that would protect nests if any were discovered. Cumulative effects to murrelet habitat in the project area is described in Table 43. The Wrangell Island Project in combination with past, present, and foreseeable projects would increase the number of habitat patches across the landscape, which are smaller and thus result in a greater fragmented landscape. The percent of habitat remaining upon project completion is approximately 78 to 81 percent of the historical 1954 condition on all land ownerships on Wrangell Island (Table 43). Therefore, all action alternatives may result in local declines of marbled murrelet population due to the reduced availability of potential nesting habitat. Implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past present and reasonably foreseeable would allow for the continued persistence of marbled murrelets on Wrangell Island.

Table 43. Acres harvested and percentage of remaining historical POG habitat on all lands on Wrangell Island in WAA 1903

Historical condition (1954)	Alt 1 (existing condition[1]) (% remaining of historical)	Alt 2 (% remaining of historical)	Alt 3 (% remaining of historical)	Alt 4 (% remaining of historical)	Alt 5 (% remaining of historical)
66,165	56,045 (85)	4,553 (78)	2,740 (81)	3,023 (80)	3268 (80)

1- Existing condition is 2015

Southern Red-backed Vole

Direct/Indirect Effects

There would be direct/indirect effects to Southern red-backed voles as a result of implementing the proposed action alternatives. Timber harvest would directly affect the southern red-backed vole through habitat loss (all POG), and by altering the distribution of habitats across the landscape. This may inhibit the ability of individuals to move between patches of suitable habitat, and therefore may further limit the distribution of a population or reduce genetic interchange between subpopulations. Alternatives that harvest the most POG would result in the greatest increase in the number of smaller POG patches on the landscape and would be expected to have the greatest effect to the southern red-backed vole.

Effects to POG forests resulting from all alternatives are described above in Table 42. Effects would be greatest under Alternative 2, where the Wrangell Island Project would reduce approximately 5 to 9 percent of the existing POG habitat on NFS land. Therefore all action alternatives that remove POG habitat would have minimal effect on red-backed voles which could lead to population declines and reduced genetic interchange because of habitat fragmentation.

Cumulative Effects

Because there would be direct/indirect effects to southern red-backed voles, there would be cumulative adverse effects with the implementation of all the action alternatives. Activities on Wrangell Island that have affected red-backed vole habitat and are cumulative with this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. One possible benefit is the AMHT land exchange where the Forest Service would gain approximately 1,105 acre, but the majority of this land has already been harvested and of little value to this POG associated species.

Timber harvest proposed under the action alternatives would further reduce and fragment POG habitat. Cumulative effects to POG and patch size in the project area by alternative is described in Table 43. The Wrangell Island Project in combination with past, present, and foreseeable projects would result in a reduction in habitat, patch size acres, which would all lead to a more fragmented landscape. Wrangell Island would maintain approximately 78 to 81 percent of 1954 POG levels. Therefore, all action alternatives may result in local declines in red-backed vole population due to the reduced availability nesting habitat. Therefore, implementation of the proposed action alternatives will increase habitat fragmentation, human disturbance, and cause a loss of habitat, when combined with past, present, and reasonably foreseeable future projects. Although there would be effects on Southern red-backed vole habitat, they should continue to exist on Wrangell Island at current levels.

Migratory Birds

Direct/Indirect Effects

There would be direct/indirect effects to migratory bird as a result of implementing the proposed action alternatives. Direct effects to migratory birds would result from disturbance, nest abandonment or removal, and loss of habitat. For species that are year-round residents, timber harvest (POG removal) and associated activities (road building) have the potential to disturb and displace birds during the non-breeding season. Indirect effects would result from the reduction of perching, foraging, and potential nesting habitat and the increase in habitat fragmentation. After timber harvest there would be a short-term increase in the habitat for species associated with early successional habitats and forest edges, which may result in short-term population growth for these species. However, extended local reductions in available habitat for both early and late successional species would be expected as forest succession progresses.

Habitat fragmentation can strongly influence bird community composition, and bird distribution has been identified as a major cause of population declines of breeding migratory songbirds (Kissling and Garton 2008). Reduction in patch size would reduce the effectiveness of interior forest habitat and increase the potential for nest predation and nest parasitism for some species, which can ultimately reduce reproductive success (Robinson et al. 1995). Migratory birds would be most susceptible to impacts from harvest activities occurring in suitable habitat during the nesting/fledging period, which generally begins in mid-April and ends about mid-July, when young birds have fledged.

Species most likely to be affected are those that nest in hemlock/Sitka spruce forests and those that utilize POG forests. The magnitude of effects will vary depending on bird species, amount of harvest, and the season in which harvest activities occur. Species that would be impacted include the western screech-owl, rufous hummingbird, red-breasted sapsucker, Pacific-slope flycatcher, Steller’s jay, northwestern crow, chestnut-backed chickadee, golden-crowned kinglet, varied thrush, Townsend's warbler, blackpoll

warbler, northern goshawk, purple finch, dusky grouse, Vaux's swift, Hammonds flycatcher, olive-sided flycatcher, bald eagle, Western wood-pewee, and marbled murrelet. Species that utilize early successional or shrub habitats such as McGillivray's warbler, golden-crowned sparrow, golden-crowned kinglet, purple finch, and varied thrush 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 other species that could occur on Wrangell Island but are associated with habitat types other than spruce/hemlock/cedar would be negligible to non-existent. Therefore, this discussion focuses on old-growth associated species. Alternatives that harvest the most POG and result in greater increases in the number of POG patches on the landscape would be expected to have greater effects to these migratory bird species (Table 42). The amount of POG harvest proposed under each Alternative will be used to measure the extent of potential effects. Through all the action alternatives there would be approximately 5 to 9 percent reduction in POG habitat on Forest Service land Wrangell, with the greatest being Alternative 2.

Effects to migratory birds can be minimized by altering the season of activity, retaining snags, maintaining the integrity of breeding sites, considering key winter and migration areas, and minimizing pollution or detrimental alteration of habitats (USDA Forest Service 2008b). Under all alternatives, migratory bird habitat would be maintained by the Forest Plan conservation strategy.

Cumulative Effects

Because there would be direct/indirect effects to migratory bird individuals and/or habitat from all action alternatives, there would be cumulative effects when combined with past, present or reasonably foreseeable future activities. Other activities on Wrangell Island that have affected deer habitat and are cumulative with this project include: past timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. One possible benefit is the AMHT land exchange where the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and of little value to this POG associated species.

Past timber harvest in the project area has removed migratory bird habitat or reduced its suitability through fragmentation (and associated edge effects such as predation). All action alternatives would further contribute to the loss and fragmentation of migratory bird habitat. The total amount of POG habitat remaining at project completion would be approximately 78 to 81 percent of historical 1954 condition (Table 43). Alternative 2 would harvest the most POG of all action alternatives and thus cause the greatest impact to migratory individuals and their habitat; however, 48,873 acres of migratory bird habitat is currently being maintained on Wrangell Island through the Forest Plan conservation strategy (OGR, RMAs and beach fringe). Therefore, implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past present and reasonably foreseeable future projects. Although there would be impacts to migratory bird habitat, they should continue to exist on Wrangell Island at current levels.

Issue 3: Scenic Quality

Scenery is defined as the general appearance of a place, general appearance of a landscape, or features of a landscape (USDA Forest Service 1995). Scenery is a resource of the Tongass National Forest much like recreation, timber, or wildlife. As a resource, it represents the attributes, characteristics, and features of landscapes that provide varying responses from and varying degrees of benefits to humans (USDA Forest Service 1995). For many visitors and those who experience the Tongass National Forest there is an expectation that the Forest provides visually appealing scenery, especially in areas along the Alaska Marine Highway, tour ship and small boat routes, State highways, and NFS roads, and from popular recreation places (USDA Forest Service 2008a, p. 2-6), with the objective of maintaining scenic integrity based upon land use objectives.

The scenic integrity of Wrangell Island would be affected by timber harvest activities and road development. The intent of this analysis is to disclose to what extent the proposed activities in each alternative would affect scenic integrity objectives adopted for land areas within the Forest Plan. Scenic integrity objectives are a measure of the degree of alteration to the landscape and generally coincide with management objectives for specific land use designations.

Complete analysis is available in the Scenery Resource Report located in the Wrangell Island EIS project record.

Affected Environment

Analysis Area and Methods of Assessment

The scenery analysis area for direct, indirect, and cumulative effects is Wrangell Island and sub-sections of the project area represented within value comparison units (VCUs) 4750, 4760, 4770, 4780, 4790, and 4800. Value comparison units 5040 and 5050 along Blake Channel along the eastern shoreline of Wrangell Island would have no proposed development. VCUs are a useful land area component from a comparative aspect in that they have a commonality in observation of a specific landscape area from multiple viewpoints and generally consist of a single LUD with common resource objectives. Also considered in this analysis is scenery guidance from the Forest Plan, which outlines levels of concern for scenic effect found in the Scenery Standards and Guidelines (USDA Forest Service 2008a, pp. 4-56 to 4-63), in addition to visual priority travel routes and use areas (VPRs) (USDA Forest Service 2008c, pp. F-1 to F-24). Also incorporated as a basis of scenic assessment is the Scenery Management System (SMS), which provides a framework for integrating scenery management principles into all levels of Forest Service planning. The SMS is described in Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook #701 (USDA Forest Service 1995).

Integral to the assessment of scenic effects within the project area are Visual Priority Routes (VPRs). Locations viewed from any observation point from any VPR incorporate scenic attributes to assess the visibility and effect of development upon landscape. The assessment begins with the distance from which the activity is observed, defined as a Distance Zone (Table 44). When viewed from VPRs, distance zones to the point of observation include Foreground (point of the observer up to 0.5 mile), Middleground (0.5 mile to 3-5 miles), and Background (beyond 5 miles, but less than 15 miles), and Seldom Seen (landscapes deemed least affected by change and not visible from VPRs). By combining distance zone and LUDs, scenic integrity objectives (SIOs) are derived (USDA Forest Service 2008a, p. 4-57). LUDs proposed for development for the Wrangell Island Project include, Scenic Viewshed (USDA Forest Service 2008a, p. 3-101), Modified Landscape (USDA Forest Service 2008a, p. 3-109), and Timber Production (USDA Forest Service 2008a, p. 3-116).

Table 44. Acres by distance zone for Wrangell Island

Distance Zone	Acres
Foreground	10,638
Middleground	66,363
Background	1,929
Seldom Seen	33,112
Total NFS	**112,041**

Non-NFS land acres are not inventoried. About 223 acres are non-attributed in GIS coded as non-NFS lands, saltwater, or non-attributed which is insignificant to this analysis as the acres are unaffected by this project.

SIOs are used to define the visual appearance as a result of management and the degree to which the landscape must be retained intact, or can be perceived as modified by alterations by human activities

(Table 45). The long-term future scenic condition for each area is set as a scenic integrity level that defines maximum levels of visual impact desirable from human alterations to the natural landscape character. Associated with each objective is a set of recommended scenery standards and guidelines that include harvest unit size ranges and method of treatment. These recommendations are guidelines that roughly define how much modification can occur and still achieve the desired SIO. Each objective makes recommendations for each distance zone and the period of time to meet the adopted SIO (USDA Forest Service 2008a, pp. 4-57 to 4-59). Visual depictions of SIO criteria can also be found in the Forest Plan (USDA Forest Service 2008a, pp. 4-61 to 4-63).

The following are classifications of scenic integrity objectives.

- High: The characteristic landscape appears intact. Deviations may be present but must repeat form, line, color, texture, and pattern common to the landscape character so completely and at such a scale that they are not evident. Under this condition the Forest visitor would not notice change.
- Moderate: The landscape appears slightly altered. Noticeable deviations are visually subordinate to the character. Under this condition the appearance timber harvest activities would be evident but the natural characteristics of the forest would be predominant.
- Low: The landscape appears moderately altered. Deviations may be dominant, but are shaped to borrow from the natural landform and other visual dominance elements (line, form, texture, color) and are subordinate to the characteristic landscape when viewed as background. Under this condition timber harvest very noticeable with some characteristics of a natural forest being retained.
- Very Low: Deviations are dominant, but borrow from the natural terrain and other elements common to the characteristic landscape. Under this condition timber harvest activities would be highly evident with few characteristics of a natural forest being retained.

The High SIO is adopted under the Forest Plan include areas surrounding Fools Inlet, the shoreline of Blake Channel, the vicinity of Earl West Marsh, the Upper and Lower Salamander Creek drainage, the lands adjacent to Thoms Place State Marine Park, the shoreline at Nemo Point, and portions of north Wrangell Island. The High SIO is also designated within the Old-growth Habitat and Municipal Watershed LUDs which are excluded from development for this project.

Moderate SIO areas consist of the Foreground along the northwest segment of the Nemo-Skip Loop Road (6267) and associated recreation use areas, the Foreground along Middle Ridge Road (50060) and the Foreground along a segment of McCormack Creek Road (6265) between Nemo-Skip Loop and Garnet Road (50022).

Low SIO areas consist of the remaining areas of north Wrangell Island, the north side of Salamander Ridge to the west of Middle Road (50060), the remaining Foreground of Nemo-Skip Loop Road (6267), lands adjacent Upper Salamander Campsite and Highbush Lake, the Foreground of Fools Inlet Road (6270), a portion of the Foreground Thoms Creek Road (6299), a portion of the Middleground along Blake Inlet, and smaller tracts near Thoms Point and Fools Inlet.

Very Low SIO areas consist of the alpine and Seldom Seen defined distance zone areas between Fools Inlet and Blake Channel, Fools Inlet and Thoms Place, alpine settings around Long Lake, the mountainous area to the north of the southern extent of Nemo-Skip Loop Road (6267), the southern slope of Salamander Ridge, and isolated locations in the northeastern part of the island.

Table 45. Scenic integrity objectives for NFS lands on Wrangell Island

Scenic integrity objective	Acres
High	34,571
Moderate	10,589
Low	34,455
Very Low	31,948
Total NFS	**111,563**

Non-NFS acres are not inventoried. About 700 acres are non-attributed in GIS coded as non-NFS land, saltwater, or non-attributed which is insignificant to this analysis as the acres are unaffected by this project.

Existing Condition

The landscape in the north portion of Wrangell Island has significant visible alteration to the landscape with the predominant modifications due previous timber management and associated roads development, as well as management occurring on portions of State and private lands. The majority of this change has occurred along the shoreline. The central portion of Wrangell Island has been highly modified, and as a result, the network of forest system roads, recreation areas, and previous timber harvest activities visually dominate the landscape. The southwest and eastern portions of the island are generally unaltered in appearance. Previously harvested areas continue to regenerate and contribute to a matrix of varying stages of vegetation regrowth ranging from areas of recent harvest to areas appearing fully natural. Remote alpine or inaccessible locations off the road system are intact or appear to be intact with no or very little visual change. Areas adjacent to Blake Channel remain unnoticeable to change with the exception of the Tyee power transmission line bordering the waterway.

Desired Condition

The desired condition for the scenery resource on Wrangell Island is defined by the LUDs identified in the Forest Plan. Each land use designation has varying degrees of acceptable scenic alteration based upon the goals and objectives corresponding to a level of scenic quality to be maintained.

A primary goal of the Scenic Viewshed LUD is to provide a sustained yield of timber and a mix of resource activities while minimizing the visibility of developments as seen from visual priority travel routes and use areas. The desired condition is for forest visitors to generally experience a mostly natural appearing landscape as viewed from these locations. Those areas screened from view of visual priority travel routes and use areas may be heavily modified by timber harvest.

In areas designated as Modified Landscape, a primary goal is to provide a sustained timber yield and a mix of resource activities while minimizing the visibility of developments in the Foreground distance zone. The desired condition is for forest visitors using visual priority travel routes and use areas to view a somewhat modified landscape, where management activities in the visual Foreground will be subordinate to the characteristic landscape but may dominate the landscape in the Middle and Background distance zones.

For locations designated for Timber Production, a primary goal is to maintain and promote wood production from suitable forest lands, providing a continuous supply of wood, seeking a timber based objective. The desired condition is for management activities to generally dominate most seen areas. Timber harvest would occur in a mix of age classes from young stands to trees of harvestable age, often in 40 to 100 acres in size. Forest visitors would view a landscape modified by change in most areas beyond the Foreground distance zone.

Old-growth Habitat LUD would maintain forested areas in their associated natural ecological processes to provide habitat for associated resources. The desired scenic condition would seek to sustain an environment where development is unnoticeable to Tongass National Forest visitors.

Effects Analysis Indicators (Units of Measure)

The following indicators were used to measure the potential effects of project alternatives to scenery.

Table 46. Issues and indicators for the scenery resource

Resource Issues	Issue Indicators
Direct and indirect effects of timber harvest.	Forest Plan scenic integrity objectives (SIOs) achieved.
Cumulative effect of timber harvest.	Total allowable visual disturbance by visual comparison unit (VCU).
Changes to areas of scenic importance expressed in public scoping.	Timber harvest within Foreground distance zone by alternative. Acres of harvest by scenic integrity objective (SIO). Acres of land use designation (LUD) by alternative.

The issue indicators used to determine the direct and indirect effects of proposed activities on the scenery resource include the expected SIO achieved by the activity relative to those adopted in the existing Forest Plan (2008). The cumulative effects for the scenery resource are expressed as the percentage of total visual disturbance past, present, and future within a value comparison unit relative to the total suitable timber acres. Landscapes designated for timber production would have a greater acceptable change over time. For the purpose of this project analysis, previously harvest units older than 30 to 35 years are considered visually recovered to a natural appearing condition and are not included in the cumulative effects analysis. The resulting unit of measure and consequence would be represented by the acres of Foreground distance zone, acres of harvest by SIO, and acres of harvest by LUD.

Factors contributing to the visual magnitude associated with timber harvest include: the size, shape, type of treatment, slope and aspect, distance at which it is observed, time of day and lighting conditions, prevailing weather, and vegetation composition of the surrounding landscape. For the Wrangell Island Project, design measures to minimize scenic effects include:

- Deferral of timber harvest;
- Removal of trees by helicopter and shovel methods;
- Modifying unit size and/or shape;
- Method of harvest treatment; and
- Retention of timber within harvest units utilized as vegetative screening.

In areas where road construction or reconditioning is proposed, final design of rock quarry development would be reviewed by an interdisciplinary team to include a landscape architect prior to implementation.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

There would be no direct, indirect, or cumulative effects upon the scenery resource associated with this project under Alternative 1 as no development is proposed. Existing previously approved NEPA activities such as small sales, commercial or pre-commercial thinning, and road maintenance would continue, resulting in scenic effects documented for those projects. This alternative defers timber harvest and would maintain the existing scenic condition (See Figure 15). Young-growth stands within the project area would continue to grow to a more mature forest.

Alternative 2 - Proposed Action

All alternatives would meet the SIOs adopted by the Forest Plan. The resulting future condition would be representative of the goals and objectives of the adopted by the LUDs identified in the Forest Plan or achieve a higher scenic integrity than adopted.

Alternative 2 is the proposed action, and has the greatest amount of harvest acres of all the alternatives. As with all action alternatives, the effect upon scenery would be reduced by the amount of uneven-aged management (single tree or group selection) proposed. Timber harvest would be evident along the Nemo-Skip Loop Road in the Foreground distance zone and nearly identical to all other action alternatives. Within areas of Scenic Viewshed LUD (Zimovia Strait, Nemo Point, and the Back Channel north of Earl West Cove) proposed in Alternatives 2, 3, and 5, timber harvest would be only slightly visible meeting the designated SIO of Moderate (See Figure 16, Figure 17, Figure 18 and Figure 19). The partial harvest proposed by helicopter removal adjacent to Long Lake in Alternatives 2 and 4, and Highbush Lake (Alternatives 2, 3, 4, and 5) would be slightly evident in achieving the High to Moderate SIO which is designated as a Low to Very Low SIO. The scenic effects of the proposed road up into the Mill Basin also proposed in Alternatives 2 and 4 would be reduced by a buffer zone of full timber retention on the downhill side of the road and partial harvest by helicopter outside of the road prism. Timber harvest visible from all other VPRs not mentioned above fully meet the adopted SIOs.

Alternative 3

This alternative responds primarily to Issue 3 by minimizing even-aged harvest potentially visible within the most visually sensitive viewsheds in the project area. It does this by proposing helicopter partial harvest only, and no harvest and road construction up to the Mill Basin which would be potentially visible from Zimovia Strait. Overall, Alternative 3 is designed to reduce the scenic effects of timber harvest by applying less intensive harvest prescriptions (from the scenery perspective) than allowable under the Forest Plan.

Scattered clearcut harvest along the Nemo-Skip Loop Road**,** designated within Modified Landscape and Timber Production LUDs, would incorporate portions of the Foreground distance which is adopted as a Moderate to Low SIO, similar to all other action alternatives. Timber harvest units would be small in size, proportional to the desired SIO and partially screened by non-harvested foreground vegetation and landforms. Other harvest of scenic concern within the Timber Production LUD includes clearcut harvest within proximity to Highbush Lake which would achieve a higher scenic integrity than the designated Low to Very Low SIOs. As with Alternative 5, minimal harvest would occur in areas surrounding Long Lake. No timber harvest is proposed within VCU 4750. Timber harvest from all other VPRs not mentioned above fully meet the adopted SIOs.

Alternative 4

Alternative 4 would meet the scenic integrity objectives in the Forest Plan for all identified VPRs. In the Timber Production LUD slightly more timber harvest is proposed than in Alternatives 2, 3, and 5, with the scenic effect being reduced by a mixture of even-aged and uneven-aged management. Timber harvest proposed adjacent to Long and Highbush Lakes would achieve a higher degree of scenic integrity than the adopted SIOs of Low to Very Low. The effect to areas within the Scenic Viewshed LUDs would be similar to Alternatives 2 and 5. As with Alternative 3, no timber harvest or road construction is proposed up to the Mill Basin. Timber harvest from all other VPRs, not mentioned above, fully meet the adopted SIOs.

Alternative 5

Alternative 5 would meet the SIOs adopted by the Forest Plan, and proposes the least amount of timber harvest for the action alternatives. The effects within the Scenic Viewshed LUD would be similar to Alternatives 2 and 4. As with Alternative 3, no timber harvest would occur in areas adjacent to Long Lake. Timber harvest from all other VPRs, not mentioned above, fully meet the adopted SIOs.

Comparison of Alternatives

Table 47 presents acres of timber harvest within each scenic integrity objective classification by alternative. Acres of timber harvest are separated by even-aged management (clearcut) and uneven-aged management (partial harvest). Even-aged management includes timber harvest with no stand structure remaining (clearcut) or a clearcut with reserves with approximately 15 percent of the stand structure remaining (CR15). Uneven-aged management is based on single-tree or group selection with approximately 67 percent of the stand structure remaining and identified as UA33. To account for the benefit of stand retention to scenery, only the actual acres harvested are represented. Alternatives 2, 3 and 4 propose similar amounts of timber harvest by volume and treatment, but the effects upon scenery vary. Alternative 3 lessens the effects by deferring harvest in VCU 4750. This alternative addresses concerns defined in Issue 3. Effects to scenery in Alternative 5 are reduced due to the application of less intensive harvest prescriptions and the reduction of total acres of treatment.

Table 47. Proposed acres of even-aged and uneven-aged timber harvest by alternative and scenic integrity objective

	Alt 2			Alt 3			Alt 4			Alt 5		
SIO	**EA**	**CR15**	**UA33**	**EA**	**CR15**	**UA33**	**EA**	**CR15**	**UA33**	**EA**	**CR15**	**UA33**
High	5	0	87	5	0	12	5	0	22	1	0	87
Moderate	357	35	419	363	35	108	357	35	137	219	35	400
Low	1,245	21	583	1,200	21	318	1,258	21	372	601	21	386
Very Low	105	1	184	65	1	52	105	1	41	47	1	59
Total	**1,781**	**57**	**1,273**	**1,633**	**57**	**490**	**1,725**	**57**	**572**	**868**	**57**	**932**

Table 48 presents the miles of new road construction and existing road reconditioning by SIO for each alternative. Alternatives 2, 3, and 5 would be similar in effect for miles of new road construction and existing road reconditioning. Alternative 4 has the greatest effect due to miles of new road construction and existing road reconditioning. Roads generally are not a scenic concern in locations of Low and Very Low scenic integrity as their appearance diminishes in a relatively short period of time (less than 35 years), and are within the degree of scenic effect allowed for those scenic objectives. In areas of high and moderate scenic integrity, design and stand retention may be used to lessen effects.

Table 48. Miles road construction (new) and existing road reconditioning (rec) by alternative and scenic integrity objective (SIO)

	Alt 2		Alt 3		Alt 4		Alt 5	
SIO	**New**	**Rec**	**New**	**Rec**	**New**	**Rec**	**New**	**Rec**
High	0.3	0	0.1	0	0.6	0	0.3	0
Moderate	9.9	2.3	9.4	2.3	10.1	2.3	7.3	1.8
Low	21.8	2.6	21.4	2.6	22.5	2.1	12.7	1.6
Very Low	2.4	0.7	2.4	0.7	2.3	2.3	2.3	1.6
Total Miles	**34.4**	**5.6**	**33.3**	**5.6**	**35.6**	**5.2**	**22.6**	**5.0**

Cumulative Effects

Cumulative effects analysis for the Wrangell Island Project considered the overall scenic effect expected as a result of past, present, and reasonably foreseeable future development listed in Table 4 (Chapter 1). These effects include timber harvest, roads, rock quarries, landings, and other management activities. Previous development on Wrangell Island has modified the scenic environment of many areas from a

natural appearing condition to a condition where some landscapes appear heavily altered. The cumulative effect of timber harvest incorporating adjacent non-NFS lands was considered, resulting in the proposed helicopter removal by individual tree and group selection methods in these locations. The effects of past timber harvest continue to lessen over time, and will result in a more natural-appearing forest in the reasonably foreseeable future.

As described in Appendix B of the Forest Plan FEIS (USDA Forest Service 2008c, p. B-23), the "percent allowable visual disturbance" represents an indicator of scenery cumulative effects modeled as scenic consequences of timber harvest in order to achieve a desired scenic integrity objective. The visual disturbance percentages are rough estimates intended to depict the possible level of disturbance one may encounter when viewing the landscape from certain areas. Allowable visual disturbance percentages vary by the land use designation objectives and scenic integrity objectives to be maintained over the period of harvest rotation. Using this model, it was assumed within the Timber Production LUD that up to 50 percent of suitable lands within areas of very low scenic integrity may be under development at one time. For areas of high scenic integrity, this percentage would be much lower at 8 to 10 percent. This is calculated by adding the past, present, and reasonably foreseeable harvest acres and dividing by the total suitable acres within the VCU.

Table 49 and Table 50 present the cumulative visual disturbance acres and percentage of cumulative timber harvest. For Alternative 1, this includes only past harvest less than 35 years old. For Alternatives 2, 3, 4, and 5, this includes past harvest less than 35 years old and proposed timber harvest acres. While the past harvest includes harvest between 1980 and 2016, young-growth stands greater than 35 years old are considered to be visually recovered. Therefore, only young-growth stands less than 35 years old were included as a past effect. Because uneven-aged management is considered a partial removal of an individual stand, only that percentage of harvest is considered as a cumulative effect.

Table 49. Post-1980 young-growth and proposed timber harvest acres by VCU and alternative

VCU	Alt 2		Alt 3		Alt 4		Alt 5	
	Post-1980	Proposed Harvest	Post-1980	Proposed Harvest	Post-1980	Proposed Harvest	Post-1980	Proposed Harvest
4750	85	345	85	0	85	27	85	345
4760	609	160	609	94	609	134	609	94
4770	1,090	758	1,090	689	1,090	712	1,090	553
4780	2,195	525	2,195	525	2,195	481	2,195	340
4790	1,131	429	1,131	429	1,131	429	1,131	208
4800	1,196	718	1,196	718	1,196	520	1,196	333
5040	0	0	0	0	0	0	0	0
5050	104	0	104	0	104	0	104	0

Table excludes land ownership other than National Forest. Uneven-aged harvest acres are reduced by the amount of retention.

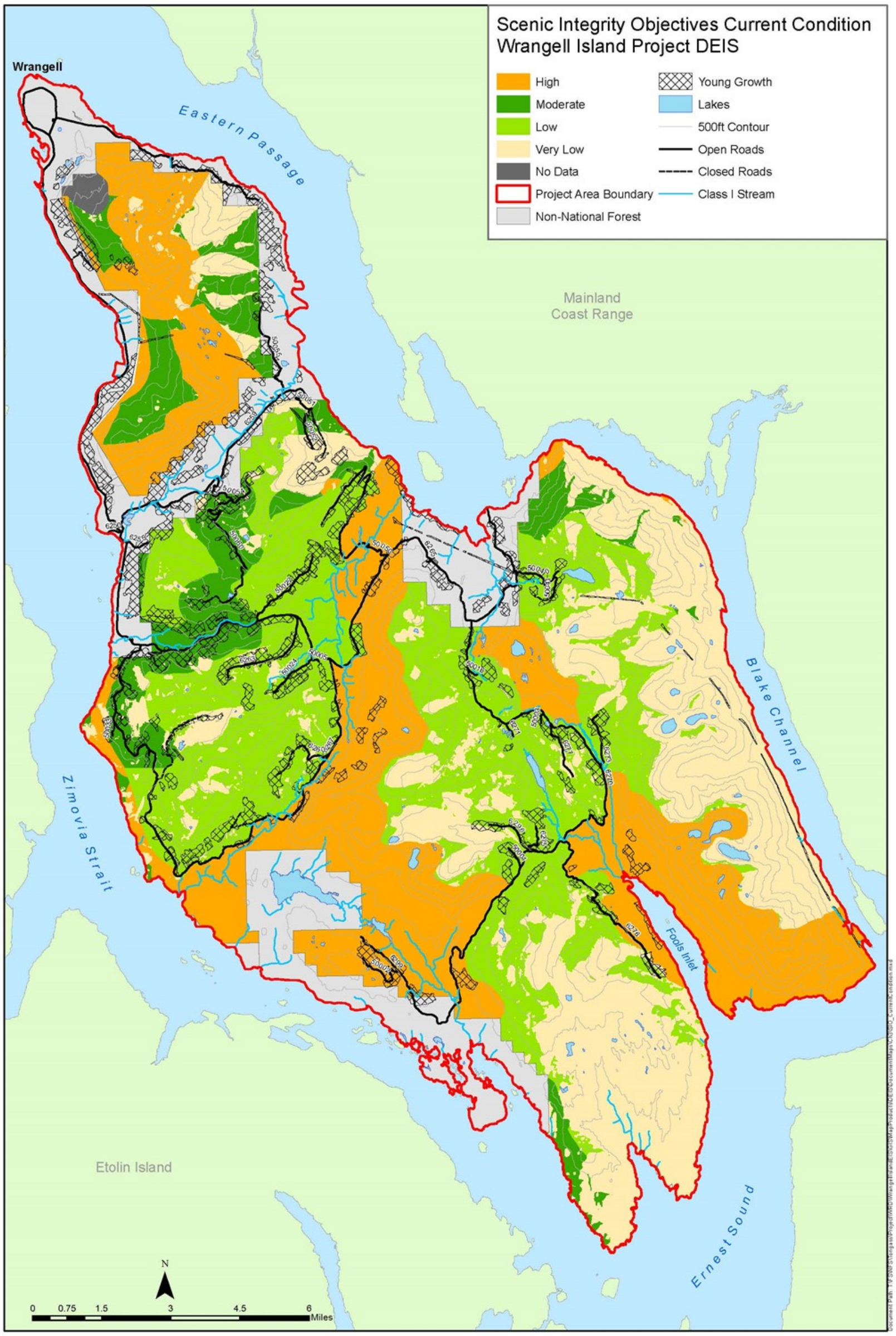

Figure 15. Current condition (Alternative 1) for Scenery Integrity Objectives (SIOs)

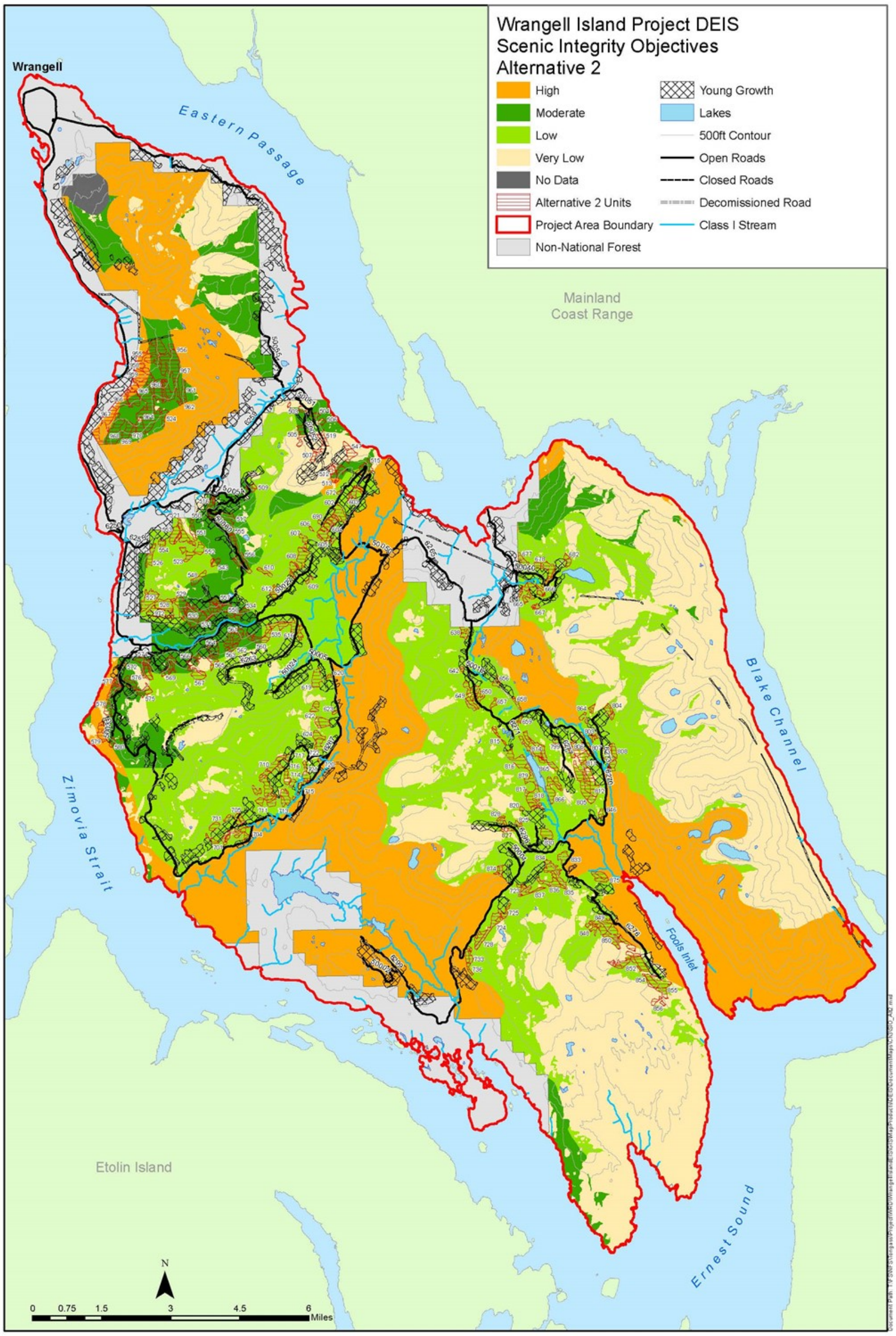

Figure 16. Scenery Integrity Objectives (SIOs) for Alternative 2 (Proposed Action)

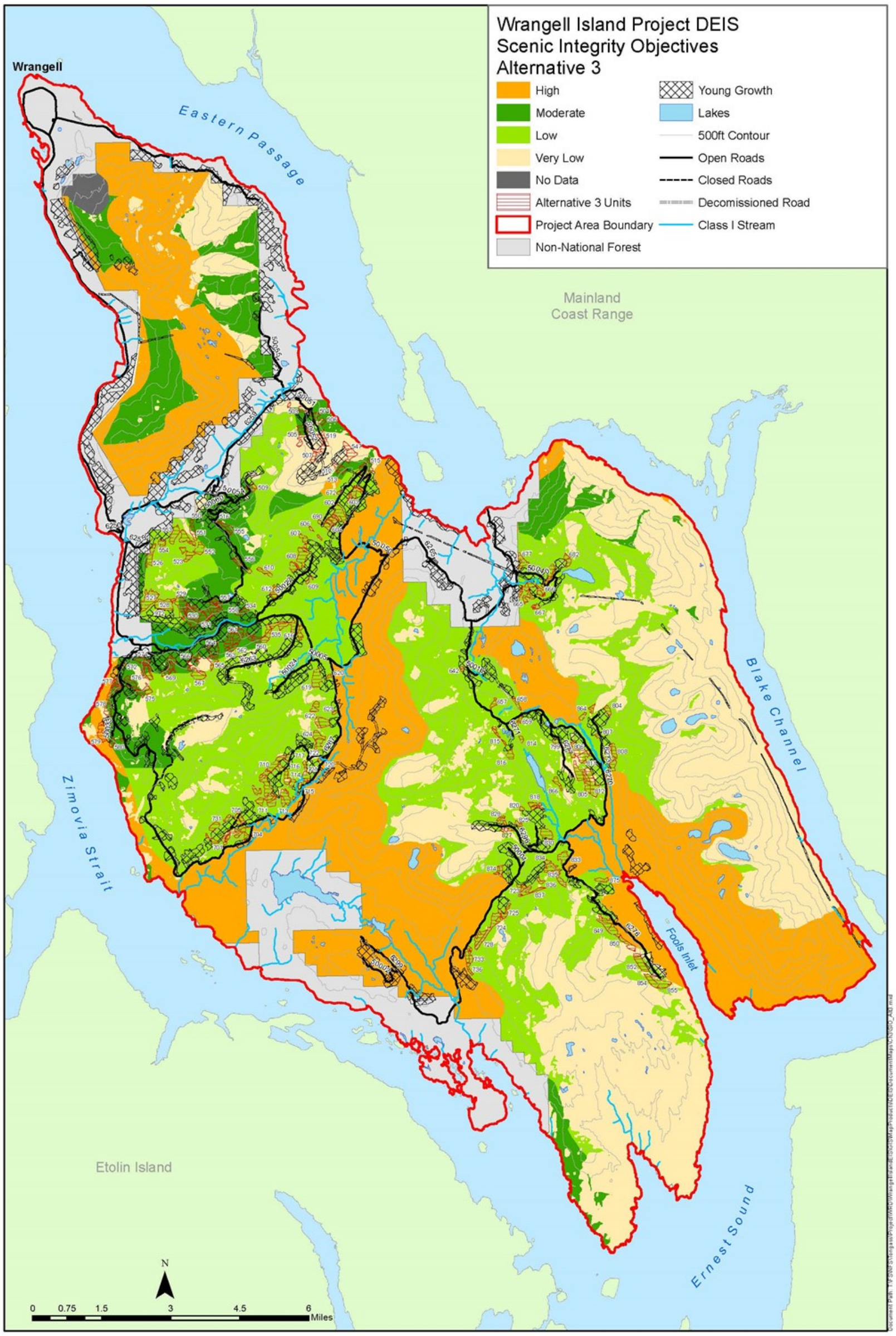

Figure 17. Scenery Integrity Objectives (SIOs) for Alternative 3

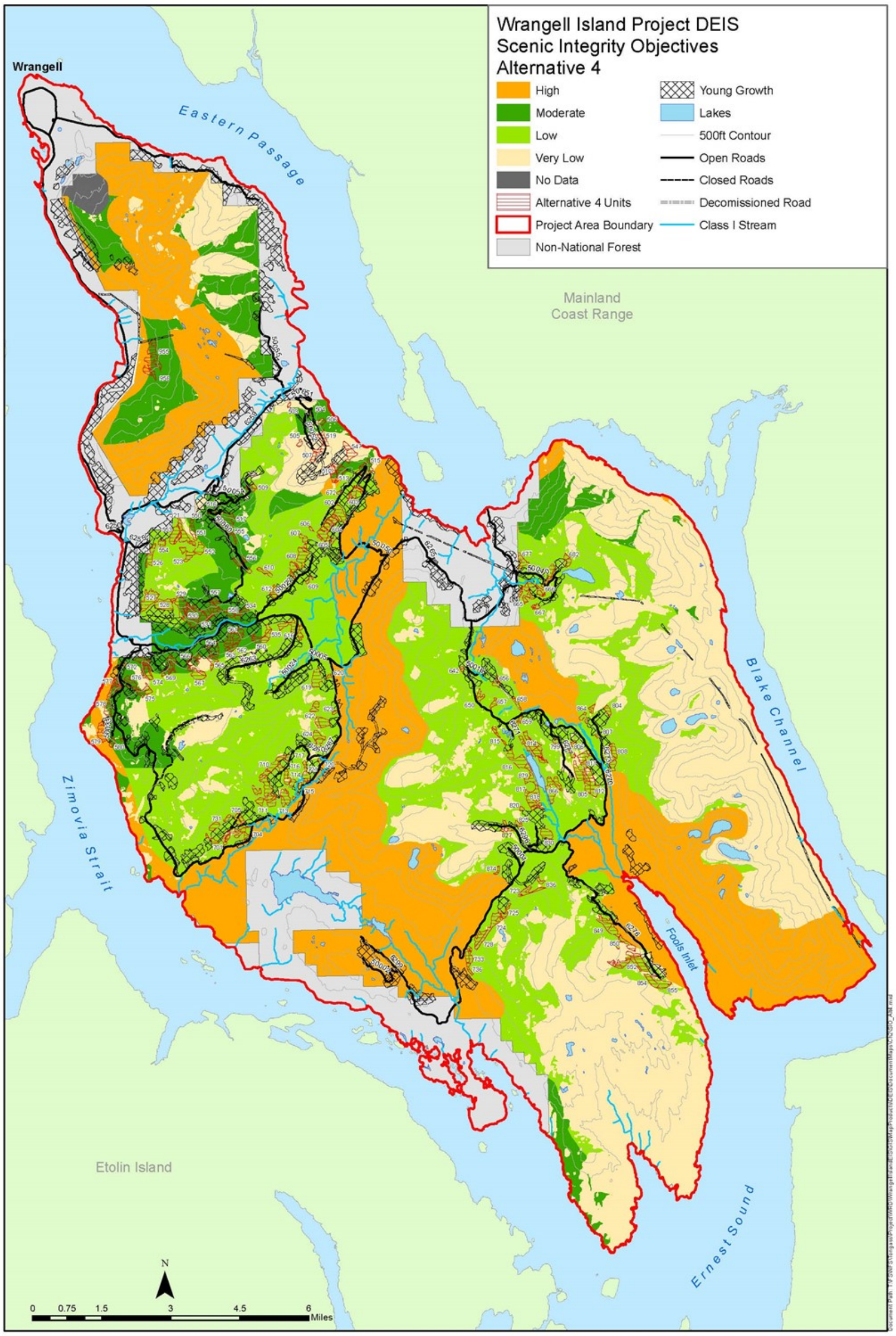

Figure 18. Scenery Integrity Objectives (SIOs) for Alternative 4

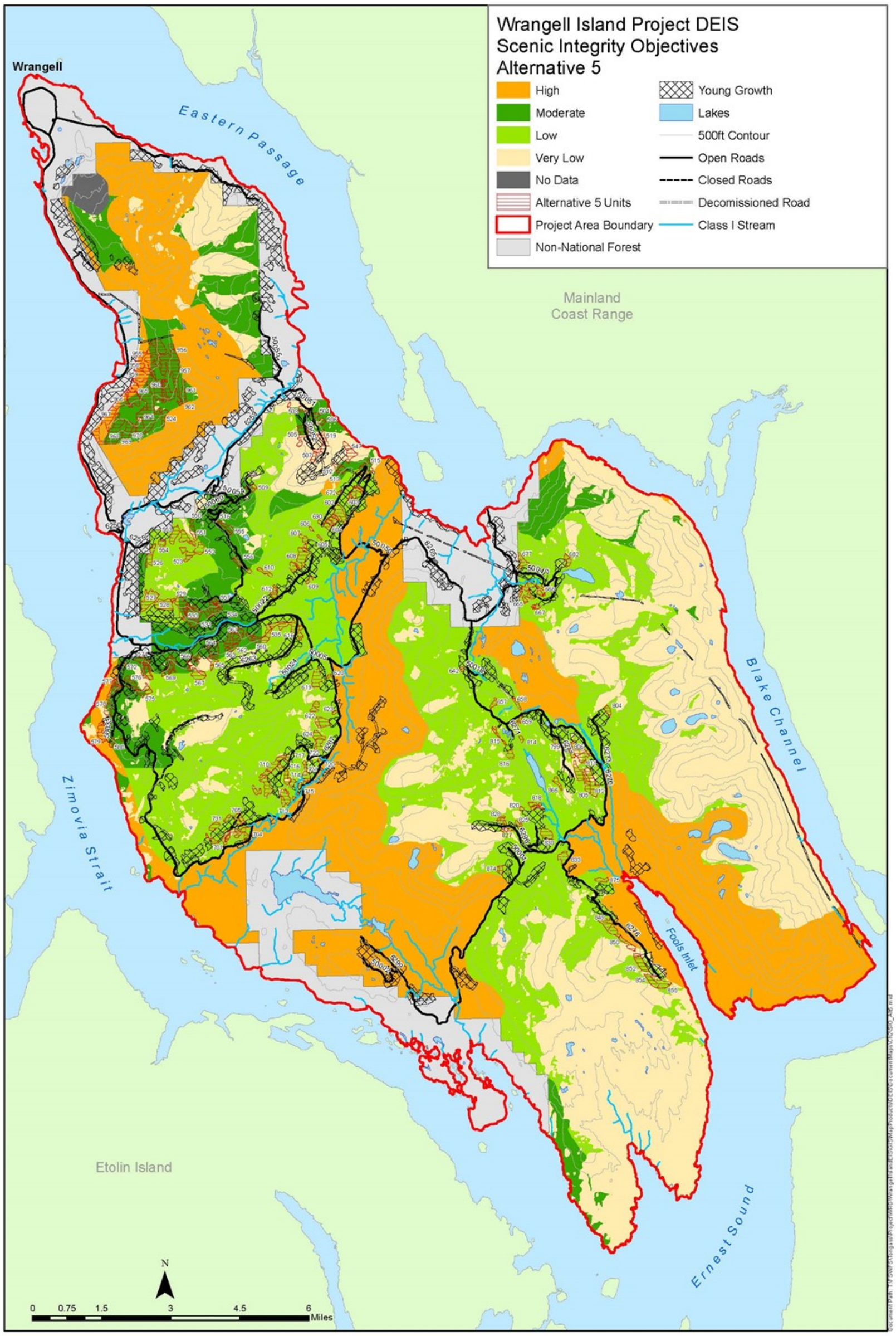

Figure 19. Scenery Integrity Objectives (SIOs) for Alternative 5

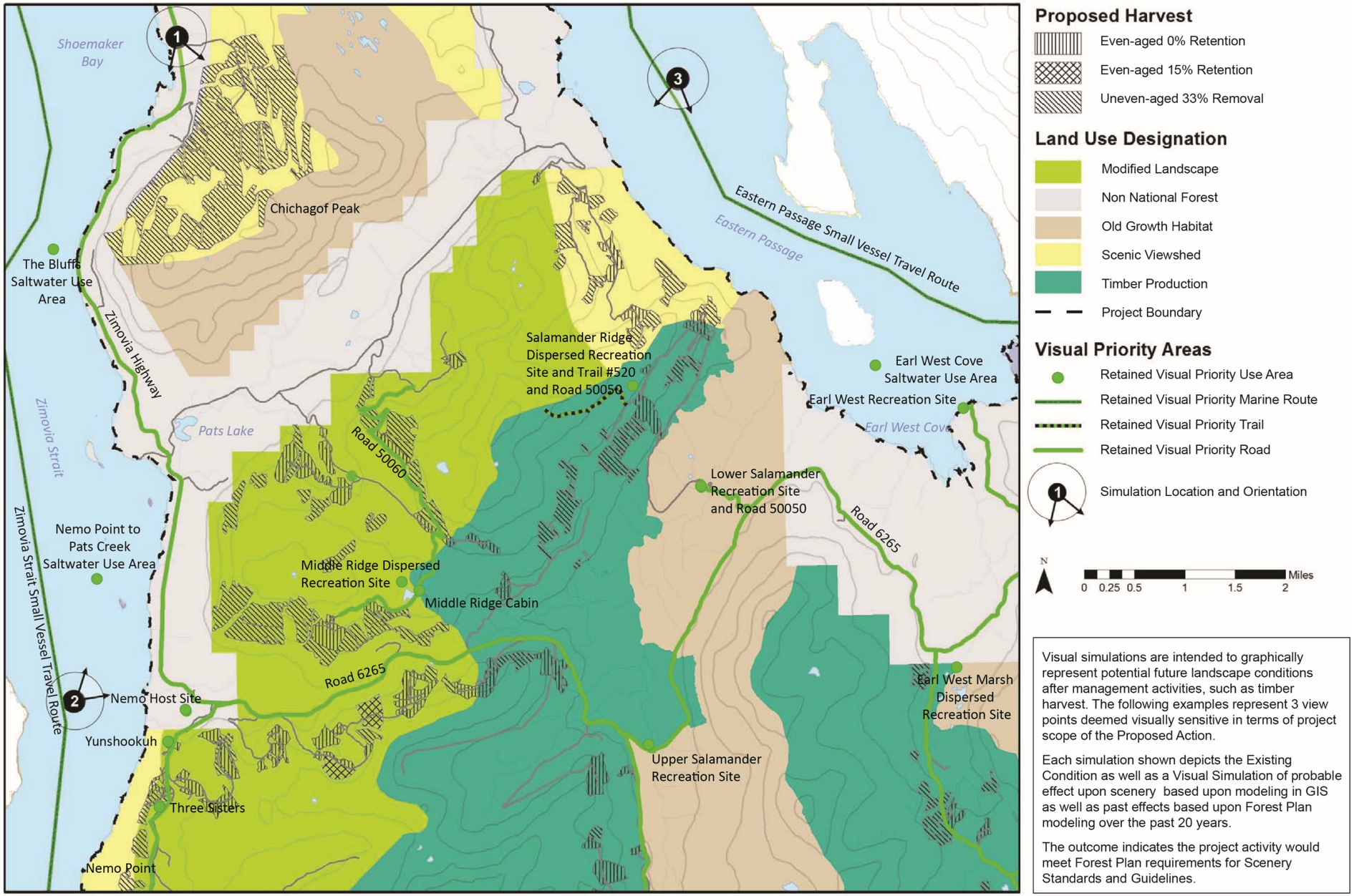

Figure 20. Visual simulation viewpoint map. The numbers (1, 2 and 3) on the map correspond to the photographs on the following pages

Figure 21. Viewpoint #1. Zimovia Highway at Shoemaker Bay looking south. Existing condition.

Figure 22. Simulation of uneven-aged management, 33 percent removal, as seen from Viewpoint #1

Figure 23. Viewpoint #2. Zimovia Strait looking northeast toward Pats Lake. Existing Condition

Figure 24. Simulation of uneven-aged management, 33 percent removal, as seen from Viewpoint #2

Figure 25. Viewpoint #3. Eastern Passage looking southward toward Salamander Ridge. Existing Condition

Figure 26. Simulation of uneven-aged management, 33 percent removal, as seen from Viewpoint #3

Table 50. Post-1980 young-growth and proposed timber harvest on NFS land by VCU expressed as a percentage of cumulative visual disturbance

VCU	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
4750	1%	13%	1%	2%	13%
4760	8%	10%	9%	10%	9%
4770	9%	25%	15%	15%	14%
4780	10%	13%	13%	14%	13%
4790	5%	8%	8%	5%	7%
4800	3%	6%	5%	5%	5%
5040	0%	0%	0%	0%	0%
5050	<1%	<1%	<1%	<1%	<1%

Uneven-aged harvest acres are reduced by the amount of retention.

The effects of timber harvest on scenery would be greatest immediately following implementation. Green tree retention in the harvested areas, such as remaining stand structure for uneven-aged management, legacy trees for wildlife, visual buffers, riparian buffers, and other locations of stand retention would reduce the overall contrast of new growth with the surrounding forest. Within 5 years after harvest, the color contrast with adjacent forested areas would be reduced as vegetation would begin to grow and transition in color from brown to light green. From 5 to 20 years after tree removal, established young trees would reach a height of approximately 15 to 30 feet and further reduce the color contrast with adjacent forested areas. After 50 years, the emerging forest within the harvested area would continue to grow. Although this emerging forested area will still be a lighter green in color than mature or old-growth forest, the color contrast at this point would be less. Textural differences will be apparent because young-growth stands are more uniform in appearance, predominantly in locations of clearcut treatment. Edge lines forming harvest boundaries would become less apparent over time especially those units having straight line. At 80 years after harvest, regrowth vegetation would achieve nearly 75 percent of its rotation height. At 100 to 120 years, the stand would reach the height and appearance where the past harvest would no longer be evident.

Assuming implementation of the Forest Plan, harvest of all suitable timber lands on Wrangell Island would continue transitioning toward the applicable desired condition. The landscape would be characterized by a mixture of stands ranging in various stages of development. Age classes of these stands would include recently harvested, emerging seedlings, stands of young-growth composed of pole sized trees, and eventual development into mature young-growth and old-growth stands. The appearance of the activities associated with timber harvest within the Timber Production LUD would present a landscape highly modified by the effect of timber harvest. To a lesser degree, the effects of timber harvest within the Modified Landscape and Scenic Viewshed LUDs would appear less altered to almost unnoticeable in areas using helicopter removal to achieve uneven-aged management. Landscapes within non-development LUDs would remain unchanged from a natural appearing forest environment.

Visual Simulations in Locations of Visual Sensitivity

Visual simulations are intended to graphically represent potentially future landscape conditions after management activities, such as timber harvest. The following examples represent 3 viewpoints deemed visually sensitive in terms of project scope of the proposed action. Each simulation depicts the existing scenic condition, as well as a probable effect of proposed timber harvest based upon modeling in GIS. It should be noted that the areas with 66 percent retention show minimal visible impact. The outcome indicates the project activity would meet Forest Plan requirements for scenery standards and guidelines.

Issue 4: Access Management

The transportation resource considers the potential effects of the new construction and reconditioning of roads used to access the proposed harvest units. It also considers the status of these roads after timber harvest, to be open or closed, as well as the maintenance costs of these proposed road designations. Roads can provide access for recreation and subsistence gathering purposes to the public. Roads also have the potential to affect fish habitat, soils, and water quality by increasing erosion and landslide potential, changing recreation settings and opportunities, altering scenery, and increasing legal and illegal wildlife harvest. Roads also have the potential to affect logging system feasibility, silviculture economics, and the long-term viability of economical and sustainable forest management. The complete analysis, based on Forest Plan Standards and Guidelines for transportation, is available in the transportation resource analysis report located in the project record. The analysis utilizes existing information from recent field surveys, spatial GIS data, monitoring results, and scientific literature.

National Forest System (NFS) roads are constructed to provide access to National Forest System lands and are intended to be maintained for the long-term. Most of these roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads.

Affected Environment

Analysis Area

The analysis area for the transportation system is Wrangell Island. There are no roads extending from within the project area and terminating outside the project area.

Existing Condition

For Wrangell Island, the demand for new roads has primarily been for access to timber resources. The maintenance and reconditioning requirements of the existing system depend mainly on the volume of timber hauled and, to a lesser extent, on recreation use. The amount of future road construction is anticipated to be determined by the need to access timber resources. All roads discussed in this analysis area were originally built for logging and the associated administration, though incidental recreational and subsistence use, including firewood gathering, occurs throughout the area.

To facilitate the understanding of road terminology, a road may be classified as NFS road, temporary, or an unauthorized road.

National Forest System (NFS) Road

“A forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county, or other local public road authority.” NFS roads are generally required to provide long-term or intermittent motor vehicle access. These roads receive constant or intermittent use depending upon the timing of the timber harvest(s) and other activities. NFS roads form the primary transportation network in the project area.

When a NFS road is not needed in the short-term but future use is anticipated, it is placed in storage. Road storage is intended to be the primary maintenance strategy on intermittent use roads during their closure cycle. Road storage is defined in FSH 5409.17 as “the process/action of closing a road to vehicle traffic and placing it in a condition that requires minimum maintenance to protect the environment and preserve the facility for future use.” Roads in storage are left in a self-maintaining state in order to use more road maintenance funds on the open drivable roads. Maintenance Level 1, closure and basic custodial maintenance, is assigned.

Temporary road or trail

“A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail, and that is not included in a forest transportation

atlas." Temporary roads are intended for short-term use and maintained for a limited time usually to access a timber harvest unit.

Temporary roads are decommissioned after a timber harvest. Road decommissioning activities result in the stabilization and restoration of unneeded roads to a more natural state. The term "decommissioned roads" generally refers to temporary roads constructed for timber harvests that have had stream courses restored, culverts removed, waterbars added where needed, and cut and fill slopes re-vegetated.

Unauthorized Road or Trail

"A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas." These include unplanned roads and off-road vehicle tracks that have not been designated and managed as roads or trails. Roads that are no longer under permit or authorization and have not been decommissioned are also considered unauthorized.

Road Maintenance and Reconditioning

Road maintenance consists of superficial periodic repairs to the existing road surface, brushing, cleaning, and repairing drainage features. These tasks are performed to keep the roads in a safe and useful condition for which they were designed and to minimize potential adverse effects to other resources. Repairs may be accomplished as annual maintenance. Road reconditioning is heavier maintenance of an existing NFS road, such as culvert replacement, surface rock replacement and subgrade repair.

Maintenance levels (ML) that are assigned to NFS roads depend on the intended road use and suitability for various types of vehicles. These levels range between ML 1 (closed), ML 2 (suitable for high-clearance vehicles), ML 3 (suitable for passenger vehicles, rough surface), ML 4 (suitable for passenger vehicles, smooth surface), and ML 5 (suitable for passenger cars, dust free, possibly paved).

Maintenance and reconditioning of existing NFS roads is an ongoing process that occurs on a periodic basis. Normally this type of work is determined to fit the category of routine repair and maintenance of roads that do not individually or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded. This work is done through separate service contracts to reduce the backlog of deferred maintenance, recondition roads to comply with best management practices, and maintain the existing infrastructure for National Forest management activities. The maintenance and reconditioning of NFS roads in the project area may occur before, during, and after this project analysis. Any effects from ongoing road maintenance and reconditioning work are included in the cumulative effects analysis for this project.

The maintenance of NFS roads is dynamic in the sense that roads are given both an operational maintenance level (OPML) and an objective maintenance level (OBML). The purpose of maintenance levels is to define the level of service provided by, and maintenance required for, a specific road or road segment. Roads are often built and operated at a higher maintenance level during project implementation than they are afterwards.

The OPML is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. It reflects the current condition and the ability to drive on the NFS roads on Wrangell Island. The OBML is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The OBML may be the same as, or higher or lower than, the OPML.

The current conditions of roads in the Wrangell Island project area are displayed in Table 51.

Table 51. Miles of existing roads, Wrangell Island project area

Route Status / System	National Forest system road OPML	National Forest system road OBML	Other public roads	TMP - temporary	NOT - not needed	Total miles
NFSR maintenance level						
1 - Basic custodial care (closed)	9.41	24.1				
2 - High clearance vehicles	27.84	32.52				
3 - Suitable for passenger cars	62.13	40.28				
4 - Moderate degree of user comfort	0.15	0.15				
D - Decommission		2.48				
Total existing system miles	**99.53**	**99.53**	**21.32**	**0**	**0**	**120.85**
Existing decommissioned miles	6.92			22.11	0.78	**29.81**
Non-routed system	0	0	12.7	20.79	0	**33.49**
Total non-system existing miles	**6.92**	**0**	**12.7**	**42.9**	**0.78**	**63.3**

Marine Access Facilities and Log Transfer Facilities

A marine access facility is an area used by humans to transfer items from land to saltwater or vice versa, that contains structures such as a mooring buoy, dock, marine access facility, boat ramp, or a combination of these. A log transfer facility is used to transfer logs and timber products from land-based transportation forms to water-based transportation forms (or vice-versa). These facilities are often used for the movement of equipment needed for logging and road construction or reconditioning.

There are three existing marine access facilities on Wrangell Island: Pats Creek, Earl West Cove (Venus Point), and at the site of the former Silver Bay mill in Shoemaker Bay (private property). All three marine access facilities are viable options for a timber purchaser to move logs off the Wrangell Island road system.

Pats Creek

The Pats Creek marine access facility is located at approximately mile 11 on the Zimovia Highway (State Highway 16) and consists of a barge loading and unloading ramp, a log-staging area, and a log transfer facility. The marine access facility is a single level, concrete block bulkhead with an approximately 0.5-acre log-staging area attached to it.

The Alaska Department of Environmental Conservation (ADEC) issued authorization AKG-70-0024 under Alaska Pollutant Discharge Elimination System General Permit AKG-70-1000 allowing for the discharge of bark and wood debris associated with in-water log transfer and log storage. This authorization was due to expire on November 30, 2013, but has been administratively extended.

The last benthic dive survey associated with the Pats Creek Tideland Lease was completed in October 2000. The bark accumulation was determined to be 0.33 acres of continuous debris and 0.16 acres of discontinuous debris, which is within the requirements of the permit.

Earl West Cove

The Venus marine access facility, commonly known as Earl West, is located at the terminal end of NFS road 6265. Earl West consists of a log transfer facility, log-staging area, and a barge and equipment loading and unloading ramp. The marine access facility is a low angle, concrete reinforced ramp with steel rails with an approximately 0.5-acre log-staging area.

The ADEC issued authorization AKG-70-0060 under Alaska Pollutant Discharge Elimination System General Permit AKG-70-1000 allowing for the discharge of bark and wood debris associated with in-water log transfer and log storage. This authorization was due to expire on November 30, 2013, but has been administratively extended.

The last benthic dive survey associated with the Earl West Tideland Lease was completed in June 2001. The bark accumulation was determined to be 0.1 acre of continuous debris and 0.1 acre of discontinuous debris, which is within the requirements of the permit.

Silver Bay Mill

The former Silver Bay mill is located at approximately mile 5.5 on the Zimovia Highway (State Highway 16) and consists of a large sort yard and a marine access facility. The marine access facility consists of a bulkhead where a crane can be used to transfer logs. Additionally, there is a low angle ramp were logs can be delivered by vehicle directly into the water.

The mill site is privately owned and the mill itself has been out of operation for several years. It is currently unknown if there are permits for the marine access facility or if there are any recent benthic dive surveys.

Minerals and Geology

There are no existing mining claims on Wrangell Island.

Table 52. Existing bridges, Wrangell Island project area

Road Number	Milepost	Status	Length (feet)	Bridge Type	Year Built	Condition
50016	0.250	Disposed	58	Log Stringer	1982	Unknown
50022	0.195	Existing - Inactive	60	Sawn Timber	1982	Satisfactory
50050	0.635	Existing - Active	88	Glulam	1988	Good
50055	0.700	Existing - Active	60	Sawn Timber	2004	Good
6260	0.967	Disposed	35	Log Stringer	Unknown	Poor
6260	1.013	Disposed	30	Log Stringer	1980	Serious
6260	1.229	Disposed	37	Log Stringer	1980	Critical
6265	0.815	Existing - Active	30	Sawn Timber	1982	Good
6265	5.270	Existing - Active	55	Sawn Timber	1989	Good
6265	10.645	Existing - Active	62	Sawn Timber	1988	Satisfactory
6265	11.994	Existing - Active	66	Sawn Timber	1980	Satisfactory
6265	14.575	Existing - Active	Unknown	Unknown	Unknown	Fair
6270	1.621	Existing - Active	51	Glulam	1982	Good
6270	2.33	Existing – Active	61	Glulam	1982	Satisfactory
6270	8.054	Existing – Active	61	Glulam	1982	Fair
6270	8.282	Existing – Active	81	Glulam	1982	Fair
6270	9.032	Existing – Active	61	Glulam	1982	Fair
6270	9.092	Existing – Active	81	Glulam	1982	Good
6273	0.097	Existing – Active	68	Glulam	1986	Good
6299	0.967	Existing – Active	61	Glulam	1982	Poor
6299	5.525	Existing – Active	71	Steel	1982	Satisfactory

Note: Bridge data summarized from USFS INFRA data

Rock Quarries

There are numerous rock quarries throughout the project area. Existing quarries are typically limited to 5 acres. More details regarding rock quarries can be found in the Transportation Resource Report located in the project record.

Bridges

Table 52 displays all existing and disposed National Forest System bridges on Wrangell Island.

Table 53. National Forest System road fish stream culverts on Wrangell Island

Road Number	Milepost	Stream Class	Structure Category	Road Number	Milepost	Stream Class	Structure Category
6270	8.904	II	Gray	50050	1.965	II	Red
6267	8.935	I	Gray	6259	2.334	I	Red
6267	9.318	I	Gray	6259	2.403	II	Red
50055	0.031	II	Red	6265	2.414	II	Red
50054	0.033	II	Red	6265	2.515	II	Red
50054	0.063	II	Red	6299	2.544	II	Red
50054	0.086	II	Red	6299	2.577	II	Red
6250	0.150	II	Red	6259	2.782	II	Red
50054	0.178	II	Red	6259	2.787	II	Red
6265	0.313	II	Red	6259	4.077	II	Red
6260	0.352	II	Red	6267	4.138	II	Red
50050	0.538	II	Red	6259	5.104	II	Red
6270	0.624	II	Red	6259	5.203	II	Red
6259	0.647	I	Red	6259	5.254	II	Red
6265	0.711	II	Red	6267	7.625	II	Red
6265	0.718	II	Red	6265	8.089	II	Red
50050	0.765	I	Red	6299	8.339	II	Red
6265	0.767	II	Red	6265	9.365	II	Red
6270	1.017	II	Red	6267	11.441	II	Red
50040	1.292	II	Red	6265	12.434	II	Red
50050	1.691	II	Red	6265	2.524	II	Red

Fish Stream Crossings

Most Class I and Class II fish stream crossing culverts for NFS roads on Wrangell Island have been surveyed and categorized as green, gray or red. There are 42 known fish stream crossing culverts currently categorized as red or gray on Wrangell Island. Additional discussion involving Class I and Class II streams are addressed in the Aquatics section of this chapter. The Tongass National Forest developed juvenile fish passage evaluation criteria matrix with an interagency group of professionals. The evaluation matrix stratifies culverts by type, and establishes criteria thresholds for culvert gradient, stream channel constriction, debris blockages, and vertical barrier (or perch) at the culvert outlet. Culvert categories are as follows (USDA Forest Service 2012):

- Green Category: conditions have a high certainty of meeting adult and juvenile fish passage requirements at all desired stream flows.

- Gray Category: conditions are such that additional and more detailed analysis is required to determine their juvenile fish passage ability.
- Red Category: conditions that have a high certainty of not providing juvenile fish passage at all desired stream flows.

Table 53 shows the number of crossings for each existing road within the project area (See aquatics resource report for a detailed list).

Road System Management

Road System Management provides road and access management in a tiered travel analysis process. The 2003 Tongass Forest-wide Roads Analysis provided management for the higher standard (Maintenance Levels 3, 4, and 5) category roads. The existing lower standard roads (Maintenance Levels 1 and 2) within the analysis area are currently managed under the 2007 Wrangell District Access and Travel Management Plan (ATM) decision. That decision identified but deferred road closures pending the record of decision for the Wrangell Island Project.

Road management for the Wrangell District is prescribed in the forest road atlas which serves as the forest development road system plan. The road atlas contains the road management objectives for NFS roads. The road management objectives define the motorized access for each NFS road. Access management for the NFS roads is implemented through the Motorized Vehicle Use Map (MVUM) which designates roads for motor vehicle use by vehicle class under 36 CFR §212.51. The MVUM is reviewed and published annually.

The Wrangell Island Project analysis includes the road management for the existing NFS roads and any proposed NFS roads needed to access timber for the Wrangell Island Project area. The Decision for this project includes public access travel management decisions. The existing road management objectives are summarized in Table 51. Each alternative proposes a travel access management proposal is provided under each alternative.

Methods Used to Analyze Effects

This analysis utilizes existing information from recent field surveys, spatial GIS data, monitoring results, and scientific literature. Information sources for transportation analysis include the transportation GIS records which house the spatial data for road locations. An inventory of road attributes for NFS roads is maintained in a national database. A complete list of road attributes and definitions of these attributes is located in the project record.

Road miles presented in the effects analysis are under the jurisdiction of the Forest Service unless stated otherwise. Refer to Table 51 for the most current records of road miles across other ownerships and jurisdictions.

Proposed new road construction routes were routed by transportation specialists and field reviewed by resource specialists during 2010 through 2012. Specific comments and concerns along with site-specific mitigation measures and design features are discussed in the respective resource reports and in the road cards for NFS roads or the unit cards for temporary roads. The analysis method for road location and field review does not vary by alternative; rather the roads are included or excluded by alternative based on the design criteria of each alternative.

Units of Measure for Timber Sale Roads

The following units of measure were used to measure potential effects of project activities and for comparing alternatives:

- Miles of NFS road constructed
- Miles of temporary road construction
- Miles of NFS road reconditioning

- Total cost of NFS and temporary road construction and NFS road reconditioning.
- Total road cost per net thousand board feet of sawlog and utility volume harvested ($/net MBF)

Overview of Issues Addressed

Access management decisions for motorized road use will affect future public access for recreation and subsistence and for agency administrative purposes.

Some commenters offered support for creating more NFS roads and keeping roads open longer for subsistence, firewood gathering, and recreation. Other commenters indicated that the project should limit new road construction to provide added resource protection and to minimize overall maintenance costs. Commenters requested that road development, closures, maintenance levels, and management objectives be analyzed.

36 CFR §212.55(a) provides direction and criteria for designation of NFS roads on NFS lands. The Responsible Official shall consider effects on NFS natural and cultural resources, public safety, provision of recreational opportunities, access needs, conflicts among uses, the need for maintenance and administration of roads, and availability of resources for that maintenance and administration.

Access Management Issue Indicators

The following units of measure were used to compare alternatives.

- Miles of NFS roads designated as open to all vehicles
- Miles of NFS roads designated as motorized trails
- Miles of NFS roads designated as closed to all vehicles
- Miles of NFS roads designated to be decommissioned
- Change in anticipated future road maintenance costs (percent)

Environmental Consequences

Summary of Effects

Alternatives 2, 3, 4 and 5 all propose varying amounts of timber harvest and, subsequently, varying amounts of road construction. Alternatives 1 and 5 share the similar road access and travel management objectives, which are based on the decision for the existing road management objectives for Wrangell Island. Alternatives 2, 3, and 4 incorporate changes to some road access and travel management objectives to reflect the public needs identified through project scoping. Refer to the transportation resource report for a detailed list of road management objectives by alternative. The effects of road construction, road reconditioning, and road access management decisions on other resources are discussed in their respective resource sections and reports. Site-specific design criteria can be found on road cards and unit cards, located on the project webpage (http://www.fs.usda.gov/project/?project=34831).

Short-term effects to access and travel management are anticipated as a result from conflicts that may occur during project implementation where hunters, loggers, and log trucks are using the roads simultaneously during the fall deer season. Long-term effects to access and travel management, following the completion of silvicultural activities, would vary by alternative.

New road construction and reconditioning may cause a timber sale to be uneconomical if there is not enough volume to amortize these road costs. To offset this effect, in terms of road costs and efficiencies, sufficient volume must be harvested. Additionally, it is more economical to offer a single, larger timber sale versus multiple, smaller timber sales spread over time, to minimize the cost of opening and closing roads with each harvest entry.

Table 54. Proposed and existing road miles

Road Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Proposed NFS - New construction	0.0	17.2	15.8	16.1	12.5
Existing NFS[1]	97.1	99.5	99.5	99.5	97.1
Total NFS - after implementation	**97.1**	**116.7**	**115.3**	**115.6**	**109.5**
Proposed temp - new construction	0.0	14.9	14.1	16.2	9.1
Existing decommissioned[2,3]	50.6	47.05	47.81	47.76	47.95
Total decommissioned - after implementation	**50.6**	**61.9**	**61.9**	**64.0**	**57.1**
Total proposed road construction	0.0	32.1	29.8	32.3	21.6
Road reconditioning (maintenance of closed roads)	**0.0**	**5.8**	**5.8**	**5.4**	**4.1**

1 Miles are based on Objective Maintenance Level (ML)

2 Existing miles vary to account for miles being converted to NFS or reused as Temporary

3 Existing Decommissioned = decommissioned NFS + Temporary + Not Needed (refer to Table 51).

Roads Proposed

Table 54 summarizes the miles of proposed road construction and existing road miles for both NFS roads and temporary roads. Temporary roads are decommissioned after their period of use has expired; they will not be open and drivable and are not counted as part of the NFS roads network. Temporary roads are not needed for future access and are typically constructed to a lower design standard than system roads resulting in a lower construction cost. Under Alternatives 1 and 5 temporary roads will not provide the public access to firewood after the timber harvest is complete. Alternatives 2, 3, and 4 would provide limited access to firewood gathering for up to 2 years after harvest operations have concluded, if the temporary roads can be satisfactorily storm-proofed with drivable water bars. NFS roads may remain open until silvicultural activities are completed, depending on the road management objective of the alternative.

Table 55, displays the units of measure to describe and compare the access and road management issue. The effects of these units of measure can be found the respective resource reports.

Alternatives 1 and 5 are essentially the same when comparing issue units of measure of access and travel management. All proposed NFS construction in Alternatives 5 would be closed to all motorized vehicles. This is based on the amount of roads determined to be open and accessible in the ATM decision (USDA Forest Service 2007b).

Alternatives 2, 3, and 4 are similar when comparing the issue units of measure for access and travel management. The road management objectives are based on the recommendations of the interdisciplinary team of resource specialists. These recommendations did not vary alternative to alternative, rather specific roads, or various lengths of a road, were needed for timber access.

Table 55. Proposed road designations by alternative

Road Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
NFS roads designated as open to all vehicles (ML2 - ML5)					
Proposed roads	0	5.06	3.8	4.7	0
Existing roads	73.0	81.6	81.6	81.6	72.8
Total	**73.0**	**86.7**	**85.4**	**86.3**	**72.8**
NFS roads designated as motorized trails (ML1, OHV)					
Proposed roads	0	5.97	5.7	5.6	0
Existing roads	0	8.02	8.0	8.0	0
Total	**0**	**13.99**	**13.8**	**13.6**	**0**
NFS roads designated to be closed to all vehicles (ML1)					
Proposed roads	0	6.1	6.2	5.8	12.5
Existing roads	24.1	10.0	10.1	10.0	24.1
Total	**24.1**	**16.1**	**16.3**	**15.7**	**36.5**
NFS roads designated to be decommissioned					
Proposed roads	0	0	0	0	0
Existing roads	2.5	0.2	0.2	0.2	2.5
Total	**2.5**	**0.2**	**0.2**	**0.2**	**2.5**
Change in annual road maintenance costs					
Total	**-19%**	**-4%**	**-5%**	**-4%**	**-19%**

Road Costs

Estimated costs for construction of roads are shown in Table 56. Road development costs are based upon regional average costs for constructing roads in Southeast Alaska. Costs are applied based upon an average cost per mile for different classifications of road construction and reconditioning with an additional cost per stream crossing. Refer to the Transportation Resource Report for a more in-depth discussion of road costs and calculations.

Table 56 displays the sum total of road costs per alternative, as well as the relationship between road costs and volume harvested.

Table 56. Estimated transportation costs and efficiencies

Road Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
NFS construction	$0	$3,286,605	$2,764,613	$2,852,732	$2,456,296
NFS reconditioning	$0	$17,280	$17,280	$16,050	$12,180
Temporary construction	$0	$2,109,977	$2,059,399	$2,363,041	$1,251,484
Estimated total road costs	**$0**	**$5,413,862**	**$4,841,292**	**$5,231,822**	**$3,719,960**
Net MBF harvested (sawlog and utility) (net MBF)	0	65,057	48,795	51,075	42,787
Total road costs per net MBF ($/net MBF)	**$0**	**$83.2**	**$99.2**	**$102.4**	**$86.9**

Note - Costs are estimated by road, but are not exact values; these values are presented to provide a relative comparison between the alternatives. All costs are subject to change.

Direct and Indirect Effects of the Alternatives

Effects Common to all Action Alternatives

Each action alternative proposes varying amounts of timber harvest to meet different management objectives and, subsequently, varying amounts of road construction. The effects of new road construction, road reconditioning, and access and travel management decisions on resources are discussed in their respective resource sections and reports. Site-specific resource concerns and design criteria are discussed in the road and unit cards.

Road miles and cost

All newly constructed roads would extend from the existing road system. All temporary roads would be decommissioned. Any closures or decommissioning of NFS roads would occur following the completion of timber harvest and associated silvicultural management activities.

Existing and newly developed rock would be needed for new road construction and reconditioning. Approximately each 2 miles of new road construction would require a rock source. Though existing quarries would be used where feasible, most new road construction would require the development of new quarries. Newly developed quarries would be located adjacent to newly constructed roads and resource protections identified in the Forest Plan will be met prior to development.

For all newly constructed roads crossing fish streams, designed structures would be used to provide fish passage. These structure types may include bridges, log culverts, or metal culverts which would be specifically designed to allow for adequate fish passage. These structures would be removed from all temporary roads following the completion of timber harvest. These structures may remain in place on NFS roads depending on the road management objectives.

New road construction and reconditioning may cause a timber sale to be uneconomical if there is not enough volume to amortize these road costs. To offset this effect, in terms of road costs and efficiencies, sufficient volume must be harvested. Additionally, it is more economical to offer a single, larger timber sale versus multiple, smaller timber sales spread over time to minimize the cost of opening and closing or decommissioned roads with each harvest entry.

Cable and shovel yarding methods require the added cost of new road construction and road recondition to gain access to harvest units. These road costs are offset by the minimal logging costs achieved by these methods. Additionally, the value of these road improvements can be realized through improved future economics for timber harvest and associate silvicultural management activities, and the ability to achieve Forest Plan desired conditions for the development land use designations.

Compared to conventional logging methods, helicopter yarding requires minimal new road construction and road reconditioning to gain access to harvest units. Within industry, helicopter yarding is typically only used in areas where the use of cable or shovel yarding is limited due to prohibitively high road costs or for environmental protection measures. This is primarily due to the harvest method’s high cost of yarding and because of their need of access for perpetual stand management. Where new road construction opportunities exist and helicopter yarding is being utilized rather than other conventional yarding methods, the remaining volume would likely not support the future cost of new road construction to access the unit.

Access and Travel Management

Alternatives 1 and 5 share the similar road access and travel management objectives, which are based on the existing ATM decision for Wrangell Island. Alternatives 2, 3, and 4 incorporate changes to some road access and travel management objectives to reflect the public needs identified through project scoping. Refer to the transportation resource report of the complete list of road management objectives.

Short-term effects to access and travel management are anticipated as a result from conflicts that may occur during project implementation where hunters, loggers, and log trucks are using the roads simultaneously during the fall deer season. Long-term effects to access and travel management, following the completion of silvicultural activities, would vary by alternative.

Alternative 1 – No Action

Road miles and cost

Under Alternative 1, no new road construction or reconditioning would occur as a result of this project. There would be no additional road costs incurred by this alternative.

The Forest Plan's transportation goal is to "Develop and manage roads and utility systems to support resource management activities; recognize the potential for future development of major Transportation and Utility Systems." Alternative 1 proposes no new development of roads. This alternative would forfeit any opportunity to develop or enhance the current road system. It would also not develop the road system required to move the forest toward its desired silvicultural condition.

Access and Travel Management

All NFS roads would be managed as directed by the Forest Plan, road management objectives, and previous NEPA decisions. A decision to implement this alternative would not impact projects that are already planned or currently being implemented.

No changes would be made to the road management objectives for existing roads. The ATM decision for roads on Wrangell Island would be fully implemented, and as resources and funding become available, the roads would be stored or decommissioned to match the currently assigned OBML. This would be a reduction in the estimated annual maintenance costs of 19 percent.

Alternative 2 – Proposed Action

Road miles and costs

Alternative 2 proposes construction of 17.2 miles of NFS road, 14.9 miles of temporary road, and the reconditioning of 5.8 miles of existing NFS roads.

Future harvest along these roads is a possibility, as well as future road extensions. Future opportunities for economical road construction would be limited due to this alternative's high proportion of helicopter logging and partial cutting since the remaining volume would likely not support future road development. Approximately 3,408 acres, or 64 percent of the total proposed harvest acres, are proposed for helicopter. This is the greatest number of acres proposed as helicopter and is the greatest in proportion to the total acres.

Of the four action alternatives, this alternative proposes the second highest amount of new road construction, although comparable to Alternative 4 (Table 55). This alternative also ranks the greatest in transportation development costs; however, at $83.2/net MBF, this alternative ranked the most efficient in road costs (Table 56). The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative.

Access and Travel Management

To address the access and travel management issue while meeting the overall alternative objectives, this alternative was designed to incorporate the road designation recommendations by the interdisciplinary team and the City and Borough of Wrangell.

Of the 17.2 miles of new NFS roads, 6.1 miles would be closed to all vehicles, 6.0 miles would be closed yet dual-designated as motorized trails, and 5.1 miles would remain open to all vehicles. Approximately 0.2 mile of NFS roads are designated to be decommissioned. The 86.7 miles of NFS roads designated to be open would reduce the estimated annual maintenance costs by 4 percent from what is currently open

and drivable; however, this would be a 19 percent increase in maintenance costs based on the ATM objective maintenance levels.

Alternative 3

Road miles and costs

Alternative 3 proposes construction of 15.8 miles of NFS road, 14.1 miles of temporary road, and the reconditioning of 5.8 miles of existing NFS roads.

Future harvest along these roads is a possibility, as well as future road extensions. Future opportunities for economical road construction will be limited due to this alternative's high proportion of helicopter logging and partial cutting since the remaining volume would likely not support future road development. Approximately 1,440 acres, or 45 percent of the total proposed harvest acres, are proposed for helicopter. This is the fewest number of acres proposed as helicopter and is tied for the least in proportion to the total acres.

Of the four action alternatives, this alternative proposes the second lowest amount of new road construction, but is comparable to Alternatives 2 and 4 (See Table 55). This alternative also ranks as the second lowest in transportation development costs; however, at $99.2/net MBF, this alternative ranked the second least-efficient in road costs (Table 56). The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative.

Access and Travel Management

To address the access and travel management issue while meeting the overall alternative objectives, this alternative was designed to incorporate the road designation recommendations identified by the interdisciplinary team.

Of the 15.8 miles of new NFS roads, 6.2 miles would be closed to all vehicles, 5.7 miles would be closed yet dual-designated as motorized trails, and 3.8 miles would remain open to all vehicles. About 0.2 mile of NFS roads would be designated for decommission. The 85.4 miles of NFS roads designated open would reduce the estimated annual maintenance costs by 5 percent from what is currently open and drivable; however, this would be a 17 percent increase in maintenance costs based on the ATM objective maintenance levels.

Alternative 4

Road miles and costs

Alternative 4 proposes construction of 16.1 miles of NFS road, 16.2 miles of temporary road, and the reconditioning of 5.4 miles of existing NFS roads.

Future harvest along these roads is a possibility, as well as future road extensions. Future opportunities for economical road construction will be limited due to this alternative's high proportion of helicopter logging and partial cutting since the remaining volume would likely not support future road development. About 1,604 acres, or 45 percent of the total proposed harvest acres, are proposed for helicopter. This is the second lowest number of acres proposed as helicopter and the second highest in proportion to the total acres, although this is comparable to Alternative 3.

Of the four action alternatives, this alternative proposes the greatest amount of new road construction (Table 55). This alternative also ranks the second highest in transportation development costs; however, at $102.4/net MBF, this alternative ranked as the least-efficient in road costs (Table 56).The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative.

Access and Travel Management

To address the access and travel management issue while meeting the overall alternative objectives, this alternative was designed to incorporate the road designation recommendations identified by the interdisciplinary team of resource specialists.

Of the 16.1 miles of new NFS roads, 5.8 miles would be closed to all vehicles, 5.6 miles would be closed yet dual-designated as motorized trails, and 4.7 miles would remain open to all vehicles. About 0.2 mile of NFS roads would be designated for decommission. The 86.3 miles of NFS roads designated to be open would reduce the estimated annual maintenance costs by 4 percent from what is currently open and drivable; however, this would be an 18 percent increase in maintenance costs based on the ATM objective maintenance levels.

Alternative 5

Road miles and costs

Alternative 5 proposes construction of 12.5 miles of NFS road, 9.1 miles of temporary road, and the reconditioning of 4.1 miles of existing NFS roads.

Future harvest along these roads is a possibility, as well as future road extensions. Future opportunities for economical road construction would be limited due to this alternative's high proportion of helicopter logging and partial cutting since the remaining volume would likely not support future road development. Approximately 2,754 acres, or 72 percent of the total proposed harvest acres, is proposed for helicopter. This is the second greatest number of acres proposed as helicopter and the greatest in proportion to the total acres.

Of the four action alternatives, this alternative proposes the least amount of new road construction (Table 55). This alternative ranks the lowest in transportation development costs; however, at $86.9/net MBF, this alternative ranked the second most-efficient in road costs (Table 56).The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative.

Access and Travel Management

To address the access and travel management issue while meeting the overall alternative objectives, this alternative was designed to be consistent with the existing ATM decision within the project area.

All new and reconditioned NFS roads would be closed and none of these closed roads would be dual-designated as motorized trails. About 2.5 miles of NFS roads would be designated for decommission. The remaining 72.8 miles of NFS roads designated to be open would reduce the estimated annual maintenance costs by 19 percent from what is currently open and drivable. This would be at the levels set by the ATM objective maintenance levels.

Cumulative Effects

The cumulative effects analysis area boundary for the transportation system is Wrangell Island. There are no roads extending from within the project area and terminating outside the project area.

Alternative 1

Cumulative effects of past timber harvests and other development activities have resulted in a total of 97.1 miles of NFS roads and 50.6 miles of decommissioned roads (See Table 54).

The proposed Alaska Division of Forestry timber sale would add approximately 4.4 miles of roads and the recent Alaska Mental Health Trust Authority timber sale has added approximately 0.6 mile of roads.

The proposed Alaska Mental Health Trust Authority land exchange would increase the miles of roads under the jurisdiction of the Forest Service by approximately 1 mile. The Alaska Mental Health Trust (AMHT) generally manages their roads as closed (as defined by the Alaska Forest Resources and

Practices Act) with structures and fills removed from waterways. Should the exchange occur, the approximately 1 mile of road would likely be managed to a decommissioned temporary road. The exchange would not affect road maintenance budgets or motorized access.

Alternative 2

Cumulative effects of past and proposed timber harvest would result in a total of 116.7 miles of NFS roads and 61.9 miles of decommissioned roads within the Wrangell Island project area. This is the second greatest cumulative amount of NFS and temporary road created by an alternative, though comparable to Alternatives 3 and 4.

Additionally, the proposed Alaska Division of Forestry timber sale would add approximately 4.4 miles of roads and the recent Alaska Mental Health Trust Authority timber sale has added approximately 0.6 miles of roads.

The proposed Alaska Mental Health Trust Authority land exchange would increase the miles of roads under the jurisdiction of the Forest Service by approximately 1 mile. The AMHT generally manages their roads as closed (as defined by the Alaska Forest Resources and Practices Act) with structures and fills removed from waterways. Should the exchange occur, the approximately 1 mile of road would likely be managed to a decommissioned temporary road. The exchange would not affect road maintenance budgets or motorized access.

Alternative 3

Cumulative effects of past and proposed timber harvest would result in a total of 115.3 miles of NFS roads and 61.9 miles of decommissioned roads within the Wrangell Island project area. This is the second least cumulative amount of NFS and temporary road created by an alternative, but is comparable to Alternatives 2 and 4.

Additionally, the proposed Alaska Division of Forestry timber sale would add approximately 4.4 miles of roads and the recent Alaska Mental Health Trust Authority timber sale has added approximately 0.6 mile of roads.

The proposed Alaska Mental Health Trust Authority land exchange would increase the miles of roads under the jurisdiction of the Forest Service by approximately 1 mile. The AMHT generally manages their roads as closed (as defined by the Alaska Forest Resources and Practices Act) with structures and fills removed from waterways. Should the exchange occur, the approximately 1 mile of road would likely be managed to a decommissioned temporary road. The exchange would not affect road maintenance budgets or motorized access.

Alternative 4

Cumulative effects of past and proposed timber harvest would result in a total of 115.6 miles of NFS roads and 64 miles of decommissioned roads within the Wrangell Island project area. This is the greatest cumulative amount of NFS and temporary road created by an alternative.

Additionally, the proposed Alaska Division of Forestry timber sale would add approximately 4.4 miles of roads and the recent Alaska Mental Health Trust Authority timber sale has added approximately 0.6 mile of roads.

The proposed Alaska Mental Health Trust Authority land exchange would increase the miles of roads under the jurisdiction of the Forest Service by approximately 1 mile. The AMHT generally manages their roads as closed (as defined by the Alaska Forest Resources and Practices Act) with structures and fills removed from waterways. Should the exchange occur, the approximately 1 mile of road would likely be managed to a decommissioned temporary road. The exchange would not affect road maintenance budgets or motorized access.

Alternative 5

Cumulative effects of past and proposed timber harvest would result in a total of 109.5 miles of NFS roads and 57.1 miles of decommissioned roads within the Wrangell Island project area. This is the lowest cumulative amount of NFS and temporary road created by an alternative.

Additionally, the proposed Alaska Division of Forestry timber sale would add approximately 4.4 miles of roads and the recent Alaska Mental Health Trust Authority timber sale has added approximately 0.6 mile of roads.

The proposed Alaska Mental Health Trust Authority land exchange would increase the miles of roads under the jurisdiction of the Forest Service by approximately 1 mile. The AMHT generally manages their roads as closed (as defined by the Alaska Forest Resources and Practices Act) with structures and fills removed from waterways. Should the exchange occur, the approximately 1 mile of road would likely be managed to a decommissioned temporary road. The exchange would not affect road maintenance budgets or motorized access.

Other Resources Concerns

Air Quality and Climate Change

This section describes the general air quality conditions expected in the Wrangell Island project area and information available about climate change in Southeast Alaska. Climate change and air pollution are related issues that have largely been separated in research and politics. It is generally accepted that greenhouse gas (GHGs) emissions are impacting the Earth's climate by warming the surface and the atmosphere, thus affecting rainfall, glacier and sea ice retreat, and sea level, among other factors (Ramananthan and Feng 2009). Many of the traditional air pollutants and GHGs have common sources and may interact physically and chemically in the atmosphere causing a variety of environmental impacts on the local, regional and global scales (Bytnerowicz et al. 2007).

Affected Environment

Air Quality

Air quality on the Tongass National Forest and in Southeast Alaska is generally very good. The prevailing winds off the Pacific Ocean, the relatively low levels of industrial development, the small size of human population centers, and the low frequency of large-scale wildland fire smoke emissions all contribute to the maintenance of clean air in the region. However, localized air pollution from sources such as mining operations, marine vessels and cruise ships, wood-burning stoves, vehicle exhaust, diesel power and asphalt plants, incinerators, and unpaved roads can contribute to deterioration of air quality at various scales (temporal and spatial) that could impact sensitive receptors on the Tongass National Forest.

Designated sensitive receptors of air quality impacts are lichens (Dillman et al. 2007; USDA Forest Service 2008a). Lichens, especially canopy epiphytes, are particularly sensitive to pollution and climate because they obtain their water and nutrients directly from the atmosphere and lack membranes that are able to limit pollutant uptake. As a result, lichen communities are very responsive to shifts in moisture and temperature (McCune and Geiser 2009).

Under the Forest Plan, the goal of air resource management is to maintain the current excellent air resource condition to protect the Forest's ecosystems. To help resource managers evaluate the level of impacts of on- and off-Forest air pollution on sensitive receptors, the Forest Service established a network of permanent biomonitoring plots in 1989. In these plots, lichens are sampled every 8 to 10 years for contaminant concentrations. Locally relevant thresholds were developed for the Forest from pristine areas (Dillman et al. 2007) so local or regional emissions may be identified by lichen thallus pollutant concentration levels above the established background. Regular monitoring allows resource managers to

compile trend data on contaminants (some of which are criteria pollutants or similar species such as nitrogen for nitrogen dioxide, sulfur for sulfur dioxide and lead).

Additionally, the air quality objective under the current Forest Plan is to attain national and State ambient air quality standards forest-wide. To determine if national and State ambient air quality standards are being met in the region, an annual review of Environmental Protection Agency (EPA) and Alaska Department of Environmental (ADEC) Quality reports is conducted at the Forest level. Currently there is no non-attainment area in the vicinity of the project area.

Climate Change

Climate fundamentally shapes our surroundings. Climate is extremely important to local ecosystems as well as human health and infrastructure since temperature, precipitation, winds, and meteorological events (e.g., the timing of the first and last frost, the beginning and end of a rainy season, or a severe storm causing flooding) all influence the distribution of water, soils, plants, and wildlife across the globe. Significant, lasting change to existing weather patterns is commonly called “climate change.”

The term “greenhouse gasses” (GHGs) refers to a variety of gases in the Earth’s atmosphere that react with sunlight in a way that influence global air temperature. GHGs are a function of air quality and include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EO 13514). These GHGs are typically reported in units of carbon dioxide equivalent (CO_2e).

Long-term climate trends and decadal climate cycles have always occurred in Southeast Alaska, influencing air temperature and precipitation (Neal et al. 2002). There is a growing body of literature on the topic of climate change and likely effects on aquatic and terrestrial ecosystems of the Tongass National Forest (e.g., Bryant et al. 2004, Hodgkins 2009, Hood and Berner 2009, Haufler et al. 2010, Wolken et al. 2011, Hennon et al. 2012).

Changing Climate

The Tongass National Forest is a matrix of forests, wetlands, alpine meadows, ice, and rock. Climate change impacts these landscapes in different and potentially unanticipated ways. The Forest’s role in the global carbon cycle is thought to be significant, equal to about 8 percent of the carbon stored in all forests in the lower 48 (D’Amore and Edwards 2013).

The U.S. Global Change Research Program (2009) reported Alaska has experienced a 3.4 degree Fahrenheit rise in average annual temperatures over the past 50 years with an increase in winter temperatures of 6.4 degrees Fahrenheit. Temperatures are expected to continue to rise. These increases in temperature have led to other related changes to climate, such as an increase in snow-free days and shifts in precipitation. Snow-free days have increased across Alaska by an average of 10 days. According to Hennon et al. (2012), the forests of coastal Alaska are expected to experience the largest twenty-first century increase in frost-free days anywhere in North America (Meehl et al. 2004) as the winter climate moves across the snow–rain threshold (Hennon et al. 2012).

According to Haufler et al. (2010), anticipated climate change impacts to NFS lands and the lands of other ownerships on the Tongass National Forest include changing sea levels, increased ocean temperatures and changing circulation patterns, increased ocean acidification, increased storm intensities, changes to stream temperatures and flows, loss of glaciers, changes to wetlands, forest temperature and precipitation changes, and increases in invasive species. Climate change has been linked to increases in GHGs, with the primary factor being the rise in CO_2 levels (Haufler et al. 2010).

Yellow-cedar Decline

As discussed by Haufler et al. (2010), forest temperature and precipitation changes have an impact on NFS lands. In Southeast Alaska, these changes have been associated with a declining Alaska yellow-cedar (*Callitropsis nootkatensis*) distribution, henceforth referred to as yellow-cedar. Although distribution of

yellow-cedar has been undergoing change over the last century, scientists are indicating that these distribution changes are increasing due to decreasing snow pack related to climate change (Hennon and Shaw 1997, Beier et al. 2008, Hennon et al. 2016).

For more detail on yellow-cedar decline, see the section entitled, Forest Health and Natural Disturbance in the Silviculture section of this chapter.

Carbon Sequestration

Forest ecosystems represent the largest terrestrial carbon sink on Earth, such that the United Nations Framework Convention on Climate Change (see United Nations Framework Convention on Climate Change website) has recognized their management as an effective strategy for offsetting GHG emissions (Wilson et al. 2013). Although much of the attention on the forest carbon sequestration strategy in the United States has been on the role of private lands, public forests in the United States represent approximately 20 percent of the U.S. timberland area and also hold a significantly large share (30 percent) of the U.S. timber volume. With such a large standing timber inventory, these forested lands have considerable impact on the U.S. forest carbon balance (Depro et al. 2007).

Sequestration refers to the storage of carbon to reduce atmospheric carbon (CO_2) and mitigates the effects of climate change. For the purposes of federal land managers, biological sequestration occurs when atmospheric carbon is absorbed and stored by plants or soils. Biological sequestration is the net increase of carbon stored within a parcel of land over time, while the net decrease is considered an emission. In other words, a standing forest that exists today is not, in and of itself, considered sequestration, but any additional carbon that is stored within that forest as it grows over time would be considered sequestration.

Forests absorb carbon dioxide and sequester and store carbon over time until growth slows down considerably at maturity. Older trees sequester carbon through new growth at a declining rate, but retain pools of stored carbon until they burn or decay as they decline, die or are harvested. Actively growing forests turn water, sunlight and atmospheric carbon dioxide into solid carbon and oxygen and continue to store significant amounts of carbon when they are old. Carbon is continuously cycled among these storage pools and between forest ecosystems and the atmosphere as a result of biological processes in forests (e.g., photosynthesis, respiration, growth, mortality, decomposition, and disturbances such as fires or pest outbreaks) and anthropogenic activities (e.g., harvesting, thinning, clearing, and replanting). Because the carbon sequestration system consists of multiple pools, the fluxes between them, and numerous processes, it is important to consider forest carbon as a complete system, rather than just focusing on one pool or process. For example, if you were to just consider carbon fixed by growing trees through photosynthesis, you might assume that young forests are desirable because they sequester carbon faster than old forests. However, it is also important to consider the importance of carbon stored in older forests, both in live and dead biomass pools (Oregon Forest Resources Institute 2013).

The Tongass National Forest, like most forests, is considered a carbon sink (i.e., it stores more carbon in its systems than is released by natural processes). Cool conditions inhibit decomposition, slowing the rate of biomass breakdown and carbon release. Decaying plant matter is incorporated into the system's soil profile, where it accumulates and may reside indefinitely. As a result, mature forests generally store considerable amounts of carbon on the forest floor. As such, a critical ecosystem service sustained by the forest is carbon sequestration (i.e., the removal of carbon dioxide from the atmosphere and keeping that carbon inactive by storing it in live or dead biomass as well as organic soil matter).

In 2012, the Forest Inventory and Analysis (FIA) program made numerous carbon storage estimates available via online tools (see FIA Forest Carbon Estimation website) and prepared the first national assessment of the biomass and carbon attributes of down woody material (USDA Forest Service 2015). Table 57 shows the total carbon storage on the Tongass National Forest.

Table 57. Total carbon storage in the Tongass National Forest

State	Total Forest Carbon (million metric tons)					
	Live aboveground	Live belowground	Dead wood	Floor litter	Soils (organic)	Total
Alaska (Southeast only)	386	86	142	207	385	1,206

Source: FIA Current data as of 15 Jul 2013. Standard Tables of Forest Carbon Stock Estimates by State (Forest Inventory and Analysis National Program website).

Greenhouse Gasses

Climate change due to GHGs is a global phenomenon, so the spatial context for this discussion is the global climate.

The most important GHGs directly emitted by humans include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several other fluorine-containing halogenated substances. Naturally occurring GHGs include water vapor, CO_2, CH_4, N_2O, and ozone (O_3). Although these GHGs occur naturally in the atmosphere, human activities have changed their atmospheric concentrations. Atmospheric CO_2 concentration has increased from a pre-industrial value of 280 ppm to more than 390 ppm today, mostly due to carbon emissions from fossil-fuel burning and deforestation. GHGs trap heat and make the planet warmer.

The primary sources of GHG emissions in the Wrangell Island project area are from transportation emissions (from seaplane flights, ferry/cruise ship activity, and vehicle travel) and emissions from fuel combustion associated with the community of Wrangell.

Environmental Consequences

Climate Change and Carbon Sequestration

Alternative 1

Direct, Indirect and Cumulative Effects

Alternative 1 would likely result in a similar rate of climate change as the current condition, and would therefore have little or no effect on the rate of climate change in the Wrangell Island project area. The rate of carbon sequestration would likely remain at current levels for several years. However, for the purpose of this analysis, it is assumed that in the short term, “that harvesting forests with high biomass and planting new forest reduces overall C stocks more in the near term than if the forest were retained, even counting the C storage in harvested wood products” (Vose et al. 2012). It is conceivable however that the total carbon sequestration would be slightly higher under the No Action Alternative (at an unquantifiable level) considering a longer period of time (100 years) without harvest, assuming an annual increase in carbon sequestration (Depro et al. 2007) in absence of major natural disturbance (e.g., wildfire).

Alternative 1 is not expected to affect the current rate of climate change or carbon sequestration and thus would not add to the past, present, or reasonably foreseeable factors related to climate change.

Alternatives 2, 3, 4 and 5

Effects Common to All Action Alternatives

For all action alternatives, road construction activities, timber harvest operations, and administration of all operations by use of service vehicles throughout the life of the project would result in emissions of greenhouse gases. These activities involve removing vegetation, grading and re-contouring the ground surface, hardening the road, potential extraction of materials such as gravel, soil, and rock from on-island material sources, and constructing bridges all of which require fuel-burning construction machinery, an increase in construction-related vehicle traffic for a 3 to 10 year period. These construction actions would

increase CO_2e emissions due to fuel combustion from construction equipment and the vehicles of construction crews.

Although the nature of the effects would be the same for all action alternatives, the magnitude of effects would differ somewhat by alternative. This environmental impact statement only evaluates the change in CO_2e emissions produced by the action alternatives as compared to the no action alternative when assessing project effects to climate. This qualitative approach also matches federal protocol (CEQ 2014) in using CO_2e as the single assessed metric to encompass all greenhouse gas emissions.

The effects of project activities on regional changes in climate, in carbon sequestration and on the natural regeneration of yellow-cedar would be evaluated qualitatively for all action alternatives.

Direct, Indirect and Cumulative Effects

The following sub-sections qualitatively assess the potential impact of the action alternatives in general on carbon sequestering and climate change, but do not attempt to calculate quantifiable impact values.

Overall, under the action alternatives, the rate of climate change and carbon sequestration would likely continue at the current rate for several years. Based on the literature review presented in the Climate Change Resource Report (Howle and Krosse 2014), it is uncertain whether the rate of carbon sequestration would be higher or lower under no action compared with the action alternatives; however, it is possible that the rate of carbon sequestering would be slightly higher under the no action alternative (at an unquantifiable level). As Depro et al. (2007) found with longer periods of time (100 years) with no harvest, there would be an annual increase in carbon sequestration.

Yellow-cedar regeneration

Alternative 1

Direct, Indirect and Cumulative Effects

Alternative 1 would likely result in the same rate of yellow-cedar decline and current rates of regeneration, or at least would not have an effect on the rates of regeneration and/or decline. Since these factors are directly related to seasonal snow pack (loss of snow cover at lower elevations) and thawing cycles in late winter, a no-action alternative would have no direct, indirect, or cumulative effects on overall yellow-cedar decline and/or regeneration.

Alternatives 2, 3, 4 and 5

Direct, Indirect and Cumulative Effects

All action alternatives would likely result in the same rate of yellow-cedar decline and current rates of regeneration, or at least would not have an effect on the rates of regeneration and/or decline.

Greenhouse Gas Emissions

Alternative 1

Direct, Indirect and Cumulative Effects

Alternative 1 results in no construction-related CO_2e emissions because no Forest Service construction or harvest operations would take place. However, CO_2e would continue to be produced in the Wrangell area annually as a result of existing vehicle, aviation, and ferry/cruise ship emissions. Therefore, GHGs emissions are likely to remain the same as current conditions under Alternative 1.

Alternatives 2, 3, 4 and 5

Direct, Indirect and Cumulative Effects

During timber sale operations, fuel combustion associated with harvesting timber would result in CO_2e emissions. Additionally, the distance vehicles travel to and from the harvest units, regardless of the

location, would increase, during the life of the sale. Both of these changes would increase CO_2e emissions through additional fuel consumption.

For all action alternatives, construction activities—removing vegetation; grading and re-contouring the ground surface; hardening the roads; potential extraction of materials such as gravel, soil, and rock from on-island material sources, constructing bridges and operation of timber harvest machinery (yarders, shovels, loaders, log trucks) would require fuel-burning construction machinery, an increase in construction-related vehicle traffic, and two to three seasons of construction in addition to a 3 to 10 year timber harvest operation over the life of the sale. These construction actions would increase CO_2e emissions due to fuel combustion from construction equipment and the vehicles of construction crews.

The CO_2e emissions from construction were assessed qualitatively for all alternatives based on the duration and type of construction activity that would occur. The relative amounts of GHGs for each action alternative is proportional to the amount of road construction and harvest operations. Therefore, Alternative 2 would have the highest anticipated GHGs, followed by Alternatives 4, 3 and 5 which would have slightly lower levels.

Conclusion

Overall, the effects of this project on climate change and air quality would be negligible. The Air Quality and Climate Change Resource Report in the project record contains a more detailed discussion of the environmental effects of climate change and air quality from the activities identified for the Wrangell Island Project.

Although important on a global scale, it is estimated that the forests of the Tongass represent approximately only one-quarter of one percent of the stored carbon in forests worldwide (USDA Forest Service 2008b, p. 3-19). Therefore, it is reasonable to conclude that small, if even measurable, changes in carbon sequestration, greenhouse gasses, and yellow-cedar decline under any of the action alternatives would not be a relevant factor for choosing among alternatives. Additionally, as described above and in the Forest Plan, the task of understanding all the factors that influence climate change contains substantial uncertainty and for these reasons is not essential to a reasoned choice among alternatives.

None of the action alternatives are thought to measurably contribute to the cumulative effects on climate change.

Aquatics

This section focuses on sedimentation, streamflow, and stream temperature, as well as fish habitat. These are the principal areas of hydrology and fisheries that may be impacted by timber harvest and road construction activities. Road construction and use, as well as stream crossings are primary sources of sediment into streams. Timber harvest may adversely affect peak streamflows and therefore, fish habitat. Water quality can be affected by timber harvest through sedimentation caused by increased traffic on the road system and harvest practices such as cable yarding and shovel loading. Increased water temperatures can be caused by removal of trees (which shade streams). For more detail on aquatics analysis and fisheries please see the Aquatics Resources Report in the project record.

Methods

Watersheds are identified, delineated, and characterized using a combination of field data and the Tongass GIS library. Stream channels are categorized according to the Tongass National Forest Channel Type User Guide (USDA Forest Service 1992), which is the foundation upon which aquatic habitat management prescriptions are developed.

Climate conditions and precipitation values in project-area watersheds were determined using the Alaska Climate Research Center website (http://climate.gi.alaska.edu/). GIS is used to summarize location,

climate, geology, hydrology, stream density, road density, harvest history, landslide inventory, and disturbance regimes including erosion and mass movement hazard. District-wide road condition surveys were used in conjunction with GIS to determine number of stream crossings, number of red fish crossings, and streams requiring additional information or field verification. Field surveys were conducted to verify fish presence or absence, fish species, stream class and channel type, and to map streams in the proposed harvest units and surrounding areas within project area watersheds using Global Positioning System (GPS). Stream classes are determined using both fish presence and stream channel characteristics. Relative changes in stream gradient, flow, pool quality and frequency and barriers to upstream movement are used to determine extent of fish habitat upstream of the last fish detection. Fish presence or absence is verified using a backpack electrofisher or minnow traps, depending on site conditions. This information is combined with the limited available water quality and fish distribution data for an overall watershed characterization.

Effects for the watersheds are estimated using quantifiable surrogates for actual effects (e.g., stream crossings are a measure for increased sediment) as supported by the literature cited. The following units of measure were used to evaluate current watershed condition, the effects of the proposal, and to compare alternatives:

- Changed streamflow: Percent change based on Grant et al. (2008)
- Increased sediment: Percentage of basin comprised of roads (from acres of existing and proposed new road construction), and number of existing and new Class I and II stream crossings

In the past, the Tongass National Forest used an analytical threshold of 20 percent cumulative basin harvest to predict potentially detectable peak flow increases. This harvest level was roughly based on a review of relevant studies in the Pacific Northwest and was only used for effects analyses; it was not a management threshold or Forest Plan standard and guideline for limiting watershed harvest. The publication of Grant et al. (2008), a synthesis of relevant studies in western Washington and Oregon, represents the state of the science on this topic and is now the primary citation supporting effects analysis in the Tongass National Forest (for more detail, please refer to the Aquatics Resource Report, available in the project record).

Multiple harvest methods would be implemented in this project. The two primary methods would be clearcut (even-aged management) and UA33. The UA33 is an uneven-aged managed stand with 33 percent basal area removal. CR15 is a clearcut with 15 percent basal area retention and was calculated as clearcut acreage. Watershed acres for analysis via the Grant et al. (2008) method was calculated by using 100 percent of the clearcut and CR15 acreage, and 33 percent of the UA33 acreage.

Forest harvest and watershed condition are an evolving condition. Past activity on the watershed influence current conditions. Forest harvest is a particularly dynamic activity with harvest occurring since the 1950s. In order to quantify the effects, a conservative estimate of 30 years is used for the time necessary for hydrologic recovery, referring to the decreasing impact of forest practices through time as a result of vegetation regrowth (Moore and Wondzell 2005). Full hydrologic recovery in the absence of roads is expected to require between 10 and 30 years in the Pacific Northwest (Hicks et al. 1991; Jones 2000; Moore and Wondzell 2005). For the cumulative effects analysis, forest harvest since 1985 was used.

Analysis Area

Watersheds

A watershed is an area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream or channel, or frontal watersheds that drain to the ocean. The boundary of a watershed is based on the drainage divides, which take into account both hydrologic and geomorphic processes. Hydrologic unit codes (HUCs) are unique identifiers used in a standardized watershed classification system developed by federal agencies (USGS and NRCS 2013). This resource analysis has

been conducted using the 7th level, which is the smallest delineation in the HUC system. There are sixty-two 7th level watersheds on Wrangell Island. Twenty-four of them are affected by the proposed actions. The resources analysis has been limited to these watersheds. Table 58 lists the watersheds in this analysis with the alternatives in which they are included, watershed size and ownership. Figure 27 shows the 7th level watersheds for Wrangell Island. Trout Unlimited has identified VCU 4790 as one of the Tongass 77 watersheds. Wrangell Island Project may affect 3 watersheds of the 9 within VCU 4790. The effected watersheds are footnoted in the table below.

Table 58. Seventh level HUC watersheds analyzed for the proposed Wrangell Island Project

7th Level HUC Watershed	Alternative	Acres	Acres NFS	Acres Non-NFS	Percent NFS
19010209010102	2,3,5	1,629	1,622	6	99.6
19010209010202	3,5	2,317	2,040	276	88.0
19010209010303	2,3,4,5	4,704	2,967	1,737	63.0
19010209010304	2,3,4,5	1,178	1,178	0	100
19010209010403	2,3,5	880	785	96	89.2
19010209020506[1]	3,4	6,151	6,022	129	97.9
19010209020512	2,4	1,010	923	87	91.4
19010209070102[1]	2,3,4	2,706	2,695	11	99.6
Fools Inlet-Frontal Ernest Sound-A	2,4	1,970	1,970	0	100
Kunk Creek-Frontal Zimovia Strait-C	4,5	2,844	1,782	1,062	62.7
Kunk Creek-Frontal Zimovia Strait-D	2,3,4,5	834	300	534	36.0
Kunk Creek-Frontal Zimovia Strait-E	2,3,4,5	1,991	1,919	72	96.4
Long Lake	3,4	6,183	6,101	82	98.7
Lower Fools Creek-A	3,5	931	931	0	100
Lower Salamander Creek	2,3,4,5	4,141	4,113	28	99.3
McCormack Creek	2,3,4,5	2,885	2,589	296	89.7
Pat Creek	2,3,4,5	4,597	3,085	1,511	67.1
Upper Earl West Creek	2,3,4,5	2,950	2,937	12	99.6
Upper Fools Creek	2,3,4,5	4,919	4,910	8	99.8
Upper Salamander Creek	2,3,4,5	5,689	5,680	9	99.8
Wrangell Island-Frntl Eastern Passage-C	2,3,4,5	443	443	1	100
Wrangell Island-Frntl Eastern Passage-D	2,3,4,5	728	601	128	82.6
Lower Earl West Creek	3	4,741	3,425	1,316	72.2
Lower Thoms Creek[1]	3	3,282	2,608	674	79.5

1 Part of VCU 4790

Affected Environment

Current Conditions

Stream habitat is determined by mapping and classifying streams within the project area according to process group and channel type. The abundant Class I and Class II habitat in the form of streams and lakes indicates high fisheries value within the project area. Streams on the Tongass National Forest are also classified by habitat value classes from I to IV indicating levels of habitat use by fish populations and are

delineated according to the criteria described in the Aquatic Habitat Management Handbook (USDA Forest Service 2001a). See Figure 27 for mapped Class I, II and III streams.

- Class I - Streams and lakes with anadromous or adfluvial fish or fish habitat; or high quality resident fish waters, or habitat above fish migration barriers known to be reasonable enhancement opportunities for anadromous fish.
- Class II - Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradient (can also include streams with a 0 to 6 percent gradient) where no anadromous fish occur, and otherwise not meeting Class I criteria.
- Class III – Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability. For streams less than 30 percent gradient, special care is needed to determine if resident fish are present.
- Class IV - Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have immediate influence on downstream water quality or fish habitat capability. Class IV streams do not have the characteristics of Class I, II, or III streams, and have a bankfull width of at least 1 foot.
- Non-streams: Rills and other watercourses, generally intermittent and less than 1 foot in bankfull width, little or no incision into the surrounding hillslope, and with little or no evidence of scour.

Table 59. Stream classes and stream density within project watersheds

7th Level Watershed	Total Stream Miles	Stream Density	Class I	Class II	Class III	Class IV
19010209010102	16.1	6.4	1.2	3.6	6.3	5
19010209010202	17.6	4.9	1.7	2.8	7.7	5.4
19010209010303	33.1	4.5	5.8	3.4	17	6.9
19010209010304	11.8	6.6	0	0	5.1	6.7
19010209010403	1.8	1.3	0	0	1.8	0
19010209020506	34.8	3.6	8.9	6.1	11.4	8.4
19010209020512	3.7	2.3	0.5	0.8	2.2	0.2
19010209070102	25.1	6.0	0.5	6.6	11.4	6.6
Fools Inlet-Frontal Ernest Sound-A	10	3.2	0	1.8	6.5	1.7
Kunk Creek-Frontal Zimovia Strait-C	13.1	3.0	0.2	3.1	6.5	3.3
Kunk Creek-Frontal Zimovia Strait-E	7.6	2.5	0.3	0.9	1.3	5.1
Long Lake	32.9	3.4	4.8	10.4	7.1	10.6
Lower Earl West Creek	15.8	2.1	4.6	2.6	6.6	2
Lower Fools Creek-A	4.3	2.9	0.4	0.4	2.2	1.3
Lower Salamander Creek	39.2	6.0	7.2	5.2	13.2	13.6
Lower Thoms Creek	12.2	2.4	6.9	2	2.7	0.6
McCormack Creek	25	5.5	4.3	2.2	8.9	9.6
Pats Creek	24.4	3.4	5.1	1.9	12.7	4.7
Upper Earl West Creek	16.9	3.7	0.8	6	2.3	7.8
Upper Fools Creek	22.9	3.0	5.1	7.2	5.3	5.3
Upper Salamander Creek	19.5	2.2	8.2	3.2	5.3	2.8
Wrangell Island-Frontal Eastern Passage-C	2.8	4.0	0	0	2.8	0
Wrangell Island-Frontal Eastern Passage-D	9.2	8.4	0	0.1	3.4	5.7

Table 59 provides stream miles by class for each of the watersheds within the project area. Seven of the HUC 7 watersheds have more than 5 miles of Class I stream habitat.

Timber harvest can change streamflow by altering the collection and storage of water, thus altering the amount and timing of water delivery to the stream. Reductions in canopy interception and plant transpiration rates resulting from harvest can increase annual water yield as well as peak flows in small streams (Jones and Grant 1996). Rates of timber harvest in the project area have varied among watersheds since the 1950s, but were generally higher in the 1980s and 1990s when the Wrangell Island road system was expanded. Recent evidence supports the theory that increases in peak flows are only detectable in relatively small flows with a return period of 6 years or less in rain dominated and transitional snow zone watersheds, such as the watersheds analyzed in the project area (Grant et al. 2008). Table 60 summarizes harvest acres from 1985 to present, of the watersheds which have had prior timber harvest within the project area. Unit 19010209010304 has the highest cumulative harvest at 18 percent, followed by McCormack Creek at 15.5 percent.

Table 60. Summary of past timber harvest acres in watersheds (not including road clearings)

7th level HUC watershed	Watershed type	Acres	% past harvest	Harvest since 1985
19010209010202	Rain	2,317	8.8	203
19010209020506	Rain	6,152	3.0	188
19010209020512	Rain	1,010	0.4	4
19010209070102	Rain	2,706	1.1	30
Fools Inlet-Frontal Ernest Sound-A	Rain	1,983	4.2	84
Kunk Creek-Frontal Zimovia Strait-C	Rain	2,850	12.9	366
Long Lake	Rain	6,184	7.9	488
Lower Earl West Creek	Rain	4,744	1.6	75
Lower Fools Creek-A	Rain	931	11.0	102
Lower Thoms Creek	Rain	3,282	11.1	366
Upper Earl West Creek	Rain	2,950	1.0	31
Upper Fools Creek	Rain	4,919	7.8	383
19010209010102	TSZ	1,629	7.0	114
19010209010303	TSZ	4,705	6.4	302
19010209010304	TSZ	1,178	18.0	212
19010209020403	TSZ	3,237	1.3	41
Kunk Creek-Frontal Zimovia Strait-C	TSZ	2,850	12.9	366
Kunk Creek-Frontal Zimovia Strait-D	TSZ	835	0.7	6
Kunk Creek-Frontal Zimovia Strait-E	TSZ	1,996	12.5	250
Lower Salamander Creek	TSZ	4,143	13.7	565
McCormack Creek	TSZ	2,886	15.5	447
Pat Creek	TSZ	4,598	3.8	175
Upper Salamander Creek	TSZ	5,690	9.5	537
Wrangell Island-Frontal Eastern Passage-C	TSZ	456	0	0
Wrangell Island-Frontal Eastern Passage-D	TSZ	733	7.3	53

Grant et al. (2008) parses study results into hydrologic zones of rain-dominated, snow-dominated, and the transient snow zone that lies between them. The transient snow zone (TSZ) is likely the most sensitive to timber harvest effects because rain-on-snow events are common in this zone. Openings created by timber harvest increase snowpack exposure to rainfall that results in rapid snowmelt and increased peak flows. Stream discharge within Southeast Alaska is predominantly controlled by rainfall events, with peak discharges occurring during fall and winter storms (Jones and Fahl 1994). No active or historical stream gages exist within the project area. Evaluation of the data from nearby streamflow gages suggests that project area streamflow is likely influenced by spring snowmelt and winter rain-on- snow events. For the Wrangell Island Project an elevation of 1,000 feet was used to establish snow cover based on snow survey data. Each watershed was evaluated for percentage of harvest over 1,000 feet. If the watershed had harvest at or above the threshold elevation, it was evaluated as a transient rain watershed. Those not meeting that criteria were evaluated as rain dominated watersheds. The area did not have any areas that met the designation of snow dominated. Table 60 lists the designation of each of the watersheds in the project area.

Table 61. Existing roads by project area watersheds

7th level HUC watershed	Total road miles	% Basin area as roads	Total road density
19010209010102	4.2	1.2	1.6
19010209010202	4.4	0.9	1.2
19010209010303	10.8	1.1	1.5
19010209010304	2.7	1.1	1.5
19010209010403	0	0	0
19010209020506	12.2	1.0	1.3
19010209020512	0.6	0.3	0.4
19010209070102	1.9	0.3	0.5
Fools Inlet-Frontal Ernest Sound-A	1.2	0.3	0.4
Kunk Creek-Frontal Zimovia Strait-C	7.9	1.3	1.8
Kunk Creek-Frontal Zimovia Strait-D	3.9	2.3	3.0
Kunk Creek-Frontal Zimovia Strait-E	4.8	1.2	1.5
Long Lake	9.8	0.8	1.0
Lower Earl West Creek	6.9	0.7	0.9
Lower Fools Creek-A	2.1	1.1	1.5
Lower Salamander Creek	11.8	1.4	1.8
Lower Thoms Creek	6.7	1.0	1.3
McCormack Creek	9.1	1.5	2.0
Pat Creek	11.2	1.2	1.6
Upper Earl West Creek	2.5	0.4	0.6
Upper Fools Creek	5.8	0.6	0.8
Upper Salamander Creek	12.4	1.1	1.4
Wrangell Island-Frontal Eastern Passage-C	0.1	0.1	0.1
Wrangell Island-Frontal Eastern Passage-D	2.4	1.6	2.1

Road construction has been shown to affect runoff generation; potentially altering the timing and volume of water delivery to streams (Wemple et al. 1996). There are currently approximately 130 miles of roads

in project area watersheds. A statistical relationship between fine streambed sediment and watershed disturbance has been reported in Southeast Alaska studies (Ross 2013). Table 61 lists the existing road densities for each watershed. Three of the watersheds have existing road densities exceeding 2.0 mi/mi^2 but only one exceeds the 2.0 percent basin area value used by Grant et al. (2008) for differentiating peak flow effects within the watershed.

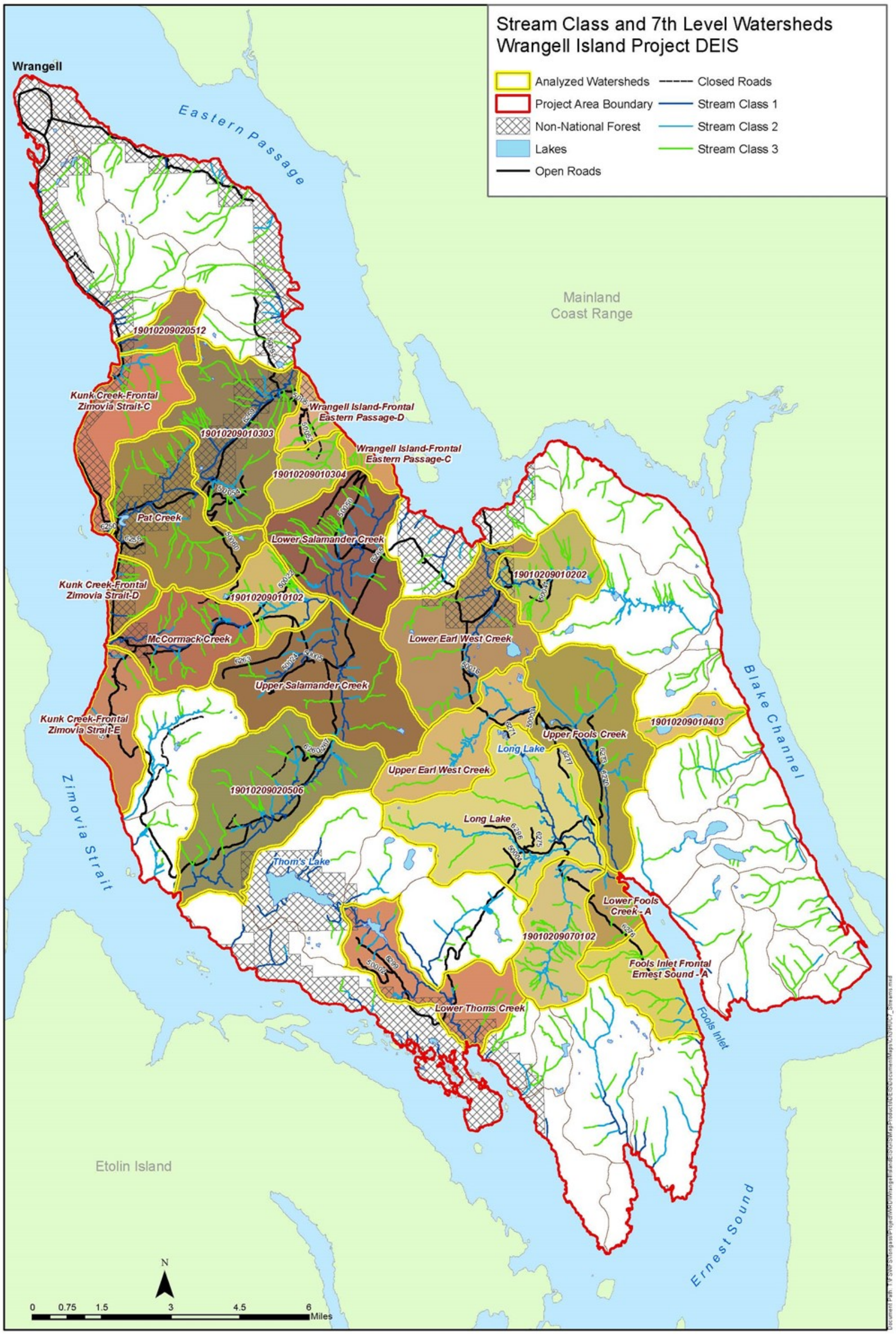

Figure 27. Stream class and 7th level HUC watersheds for Wrangell Island

Removal of riparian vegetation and the resultant increase in solar radiation can lead to increased stream temperatures (Beschta et al. 2000). The Alaska Water Quality Standards for "growth and propagation of fish…" are "may not exceed 20 degrees C at any time," and are specifically 15 degrees for migration and rearing areas, and 13 degrees for spawning areas (ADEC 2008). See the Aquatics Resource Report for further discussion on stream temperature in managed and unmanaged watersheds. Forest Plan Standards and Guidelines provide for the protection of riparian buffers on all fish-bearing and Class III streams through designation of Riparian Management Areas (RMAs). RMAs are designed to protect riparian zone interactions between streams, floodplains, riparian wetlands and uplands (Paustian 2004). Prior to passage of the Tongass Timber Reform Act (TTRA) in 1990, timber harvest in RMAs occurred in all project area watersheds (Table 62). The largest harvest of riparian area is Kunk Creek-Frontal Zimovia Strait-D with 43.2 percent, followed by Kunk Creek-Frontal Zimovia Strait-E with 23.6 percent.

Table 62. Riparian area with historical riparian harvest

7th level watershed	Total RMA acres	Harvested RMA acres	Harvested RMA percent
19010209010102	199.8	21.3	10.7
19010209010202	190.8	22.9	12
19010209010303	438.8	66.3	15.1
19010209010304	43.7	7.1	16.2
19010209010403	16.6		
19010209020506	548	58.1	10.6
19010209020512	59.7	1	1.7
19010209070102	319.2	2.4	0.8
Fools Inlet-Frontal Ernest Sound-A	102.1	7	6.9
Kunk Creek-Frontal Zimovia Strait-C	153.5	19.8	12.9
Kunk Creek-Frontal Zimovia Strait-D	55.6	24	43.2
Kunk Creek-Frontal Zimovia Strait-E	47.8	11.3	23.6
Long Lake	548.7	6.3	1.1
Lower Earl West Creek	290.5	4.4	1.5
Lower Fools Creek-A	55.6	6.7	12.1
Lower Salamander Creek	545	45.3	8.3
Lower Thoms Creek	369.1	17.8	4.8
McCormack Creek	269.8	61	22.6
Pats Creek	344.1	74	21.5
Upper Earl West Creek	185.8	1.1	0.6
Upper Fools Creek	417	0.7	0.2
Upper Salamander Creek	398.8	11.5	2.9
Wrangell Island-Frontal Eastern Passage-C	28.6	0	0
Wrangell Island-Frontal Eastern Passage-D	34.8	6.1	17.5

Environmental Consequences

Comparison of Alternatives Effects

Analysis to determine probable changes in peak stream flow were conducted in all project watersheds by the method outlined in Grant et al. (2008). Twelve of the watersheds were determined to be rain dominated and the analysis showed that none would result in a detectable change. In contrast, of the 12 TSZ watersheds for Wrangell, 9 watersheds met the threshold for changes in peak flow. Table 63 shows the TSZ watersheds with the predicted peak flow change by alternative. Peak flows determine the structure and dimensions of streams. Large scale increases or decreases change habitat values and usability of the stream by aquatic organisms. Large increases in flow also effect infrastructure such as culverts, roads and bridges.

Table 63. Transient watersheds peak flow percentage change

7th level watershed	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
McCormack Creek	15.5	18.6	18.9	18.9	17.9
Kunk Creek-Frontal Zimovia Strait-D	0.7	15.6	15.9	15.9	15.9
19010209010102	7.0	21.7	16.8	16.7	15.9
Kunk Creek-Frontal Zimovia Strait-E	12.5	18.3	17.2	17.2	11.8
Wrangell Island-Frontal Eastern Passage-D	7.3	16.3	16.2	6.8	16.2
Pats Creek	3.8	16.3	16.0	16.1	8.0
Lower Salamander Creek	13.7	7.2	6.8	6.9	10.7
19010209010304	18.0	6.9	6.6	7.4	11.9
Upper Salamander Creek	9.4	6.7	6.6	6.6	9.4
19010209010303	6.4	6.5	6.1	6.2	8.1
19010209020403	18.0	6.5	7.0	7.1	6.4
Wrangell Island-Frontal Eastern Passage-C	0.00	10.3	7.1	6.8	7.1

Each of the proposed action alternatives relies on the existing road system and expansions to the NFS roads, and all would require the construction of temporary roads. New NFS roads and temporary roads would be built in all proposed alternatives, resulting in increases in the percentage of each basin comprised of roads (Table 64).

All action alternatives would increase the number of crossings on Class I, Class II and Class III streams (Table 65). Risk of sediment delivery to streams is higher at road crossings, reflecting the potential for culverts to become plugged with sediment and debris. All temporary roads would be decommissioned following harvest activities and after a period during which firewood gathering may be permitted. Decommissioning roads will decrease the potential for sediment delivery to streams from the failure of drainage structures. The risk of sediment introduction to streams can be reduced by limiting the number of stream crossings, storm-proofing roads closed to motor vehicles, maintaining open NFS roads, and implementing Forest Plan Standards and Guidelines, and best management practices (BMPs). Road cards located on the project webpage (http://www.fs.usda.gov/project/?project=34831) describe road management objectives, construction timing restrictions, and the locations of all new stream crossings on new NFS roads.

Table 64. Proposed road construction in project area watersheds (percent increase)

7th level watershed	Alt 2	Alt 3	Alt 4	Alt 5
19010209010102	0.64	0.68	0.69	0.65
19010209010202	0.45	0.45	0.45	0.08
19010209010303	0.04	0.03	0.03	0.03
19010209010304	0.28	0.28	0.28	0.28
19010209020403	0.23	0.23	0.33	0
19010209020506	0.53	0.51	0.52	0.27
19010209020512	0.45	0	0.45	0.45
19010209070102	0.2	0.2	0.2	0
Fools Inlet-Frontal Ernest Sound-A	0.25	0.25	0.25	0.25
Kunk Creek-Frontal Zimovia Strait-C	0.3	0	0.12	0.3
Kunk Creek-Frontal Zimovia Strait-E	0.73	0.72	0.71	0.59
Long Lake	0.26	0.25	0.29	0.23
Lower Earl West Creek	0.02	0	0.02	0
Lower Fools Creek-A	0.4	0.4	0.4	0
Lower Salamander Creek	0.07	0.07	0.07	0
Lower Thoms Creek	0	0	0.03	0
McCormack Creek	1.13	1.18	1.18	0.7
Pats Creek	0.49	0.45	0.48	0.41
Upper Earl West Creek	0.1	0.1	0.1	0.1
Upper Fools Creek	0.13	0.15	0.12	0.11
Upper Salamander Creek	0.24	0.24	0.24	0.22

Table 65. New NFS and temporary road crossings by alternative

	NFS roads				Temporary roads			
	Class I	Class II	Class III	Class IV	Class I	Class II	Class III	Class IV
Alt 2	2	8	14	8	0	2	12	24
Alt 3	2	3	12	9	0	1	11	22
Alt 4	2	8	13	8	0	2	13	25
Alt 5	1	4	9	6	0	1	10	20

Effects by Alternative

A list of past, current and future management activities may be found in Table 4 in Chapter 1. The effects of land exchanges would be negligible on aquatic resources. Timber sales would have impacts as described in earlier analysis. The projects that may have impacts on watersheds within the project area and were considered in the cumulative effects analysis are the Roadside project; pre-commercial thinning, where it occurs in riparian areas; and the Earl West Cove Area timber sale.

Alternative 1

Under this alternative, none of the timber harvest or road construction activities described would occur. There would be no direct or indirect effects to the aquatic or fisheries resources, which are discussed in detail in the Aquatics Resource Report.

Alternative 2

Direct and Indirect Effects

Alternative 2 may have peak flow changes in 7 watersheds based on the transient snow zone evaluation in Grant et al. (2008). The predicted peak flow changes are between 10 to 22 percent based on road and harvest percentages (Table 66). The largest predicted change would be in 19010209010102 at 21.7 percent. Table 67 gives the proposed roads and stream crossings in each watershed.

Table 66. Alternative 2 harvest acreages by watershed and harvest type

7th Level Watershed	Acres	Total Harvest	Clearcut Harvest	UA33 Harvest	Predict Peak Flow Change %
McCormack Creek	2,886	477	276	201	19
Kunk Creek-Frontal Zimovia Strait-D	835	52	0.00	52	16
19010209010102	1,629	460	316	144	22
Kunk Creek-Frontal Zimovia Strait-E	1,996	274	195	79	18
Wrangell Island-Frontal Eastern Passage-D	733	64	14	49	16
Pat Creek	4,598	345	129	216	16
Wrangell Island-Frontal Eastern Passage-C	456	77	61	16	10

Table 67. Alternative 2 proposed roads and stream crossings by watershed

7th level watershed	NFS miles	Temp miles	NFS stream crossings	Temp stream crossings
19010209010102	0.78	0.84	1	5
19010209010202	0.47	1.14	3	2
19010209010303	0	0.27	0	1
19010209020403	0.16	1.02	0	4
19010209020506	1.33	3.37	0	1
19010209020512	0.71	0.58	5	5
19010209070102	0.84	0.94	2	0
Fools Inlet-Frontal Ernest Sound-A	0.18	1.38	1	2
Kunk Creek-Frontal Zimovia Strait-C	0.55	0.15	3	4
Kunk Creek-Frontal Zimovia Strait-E	1.32	0.06	1	2
Long Lake	1.16	0.44	0	4
Lower Fools Creek-A	0.53	1.27	0	0
McCormack Creek	3.82	0.25	2	6
Pats Creek	3.25	0.46	0	5
Upper Fools Creek	0.41	0.51	2	4
Upper Salamander Creek	1.69	0.48	1	1

Cumulative Effects

Table 68 summarizes cumulative harvest, road and peak flow predictions for Alternative 2. Cumulative effects of past and proposed timber harvest would result in four watersheds over 20 percent cumulative harvest area with the largest at 29 percent for 19010209010102 followed by McCormack Creek at 27 percent. Road densities would be over 2.0 mi/mi^2 for 6 watersheds with 3 watersheds over 3 mi/mi^2. The largest road density would be McCormack Creek at 3.15 mi/mi^2. Peak flow increases would be over 10 percent in 8 watersheds with the largest at 24 percent for 19010209010102 followed by McCormack Creek at 23 percent.

Table 68. Cumulative harvest, road density and peak flow response for Alternative 2

7th level watershed	Harvest area cumulative %	Cumulative road density (mi/mi^2)	% peak flow cumulative response
McCormack Creek	27.35	3.15	23.20
Kunk Creek-Frontal Zimovia Strait-D	2.74	3.03	15.82
19010209010102	29.34	2.27	23.80
Kunk Creek-Frontal Zimovia Strait-E	23.59	2.26	22.08
Wrangell Island-Frontal Eastern Passage-D	11.43	2.10	18.43
Pats Creek	8.16	2.05	17.45
Lower Salamander Creek	17.54	1.90	11.26
19010209010304	20.83	1.76	12.25

Alternative 3

Direct and Indirect Effects

Alternative 3 may have peak flow changes in 6 watersheds based on the transient snow zone evaluation in Grant et al. (2008). The predicted peak flow changes are between 16 to 19 percent based on road and harvest percentages. The largest predicted change would be McCormack Creek at 18.9 percent (Table 69). Alternative 3 will add 29.9 miles of road. Table 70 gives the proposed roads and stream crossings in each watershed. Table 71 gives cumulative harvest, road and peak flow predictions.

Table 69. Alternative 3 proposed harvest acres and predicted peak flow changes

7th level watershed	Acres	Total harvest	Clearcut harvest	UA33 harvest	Predict peak flow change %
McCormack Creek	2,886	528	299	228	19
Kunk Creek-Frontal Zimovia Strait-D	835	75	0	75	16
19010209010102	1,629	115	87	29	17
Kunk Creek-Frontal Zimovia Strait-E	1,996	206	116	90	17
Wrangell Island-Frontal Eastern Passage-D	733	85	0	85	16
Pats Creek	4,598	224	112	112	16

Table 70. Alternative 3 roads and proposed stream crossings for each watershed

7th level watershed	NFS miles	Temp miles	NFS stream crossings	Temp stream crossings
19010209010102	0.78	0.96	1	5
19010209010202	0.47	1.14	3	2
19010209010303		0.21	0	1
19010209020403	0.16	1.02	0	1
19010209020506	1.33	3.25	5	5
Fools Inlet-Frontal Ernest Sound-A	0.18	0.58	1	2
Kunk Creek-Frontal Zimovia Strait-E	1.32	0.91	1	2
Long Lake	1.16	1.27	0	3
Lower Fools Creek-A	0.53	0.06	0	3
Lower Salamander Creek	0	0.44	6	3
McCormack Creek	3.82	1.52	4	0
Pat Creek	3.05	0.16	0	0
Upper Earl West Creek	0	0.46	0	0
Upper Fools Creek	0.41	0.7	4	2
Upper Salamander Creek	1.69	0.48	1	1

Cumulative Effects

Cumulative effects would result in McCormack Creek at 26.8 percent. Alternative 3 would result in six watersheds over the 2.0 mi/mi^2 road density with the highest at 3.2 mi/mi^2 for McCormack Creek. Table 71 summarizes cumulative harvest, road and peak flow predictions for Alternative 3.

Table 71. Cumulative harvest, road density and peak flow response for Alternative 3

7th level HUC watershed	Cumulative harvest area %	Cumulative road density (mi/mi^2)	% change in peak flow predicted from cumulative effects
McCormack Creek	26.80	3.20	23.04
Kunk Creek-Frontal Zimovia Strait-D	3.65	3.03	16.10
19010209010102	12.92	2.31	18.88
Kunk Creek-Frontal Zimovia Strait-E	19.82	2.25	11.95
Wrangell Island-Frontal Eastern Passage-D	11.11	2.10	18.33
Pat Creek	7.04	2.01	17.11
Lower Salamander Creek	17.63	1.90	11.29
19010209010304	19.80	1.76	11.94

Alternative 4

Direct and Indirect Effects

Alternative 4 may have peak flow changes in 5 watersheds based on the transient snow zone evaluation in Grant et al. (2008). The predicted peak flow changes are between 16 to 19 percent based on road and

harvest percentages with the largest being McCormack Creek at 18.9 percent (Table 72). Table 73 gives the proposed roads and stream crossings in each watershed.

Table 72. Alternative 4 proposed harvest acres and predicted peakflow changes by watershed

7th level watershed	Acres	Total harvest	Clearcut harvest	UA33 harvest	Predict peak flow change %
McCormack Creek	2,886	540	294	246	19
Kunk Creek-Frontal Zimovia Strait-D	835	75	0	75	16
19010209010102	1,629	107	87	21	17
Kunk Creek-Frontal Zimovia Strait-E	1,996	206	116	90	17
Pats Creek	4,598	241	139	102	16

Table 73. Alternative 4 proposed roads and stream crossings

7th level watershed	NFS miles	Temp miles	NFS stream crossings	Temp stream crossings
19010209010102	0.78	0.99	0	5
19010209010202	0.47	1.14	3	2
19010209010303	0	0.23	0	1
19010209020403	0	1.67	0	1
19010209020506	1.33	3.3	5	5
19010209020512	0.71	0	2	0
19010209070102	0.83	0	0	0
Fools Inlet-Frontal Ernest Sound-A	0.18	0.58	1	2
Kunk Creek-Frontal Zimovia Strait-C	0.55	0.9	3	4
Kunk Creek-Frontal Zimovia Strait-E	1.31	0	1	2
Long Lake	1.16	1.64	0	6
Lower Earl West Creek		0.15	0	1
Lower Fools Creek-A	0.3	0.29	0	0
Lower Salamander Creek	0	0.44	0	2
Lower Thoms Creek	0	0.13	0	0
McCormack Creek	3.43	1.9	6	2
Pats Creek	3.25	0.22	5	0
Upper Earl West Creek	0	0.46	0	0
Upper Fools Creek	0.09	0.81	4	2
Upper Salamander Creek	1.69	0.48	1	1

Cumulative Effects

Cumulative effects of past and proposed timber harvest would result in two watersheds over 20 percent cumulative harvest area with the largest at 28 percent for McCormack Creek. Road densities would be over 2.0 mi/mi^2 for 5 watersheds with 2 watersheds over 3.0 mi/mi^2. The highest road density would be McCormack Creek at 3.2 mi/mi^2. Peak flow increases would be over 10 percent in 8 watersheds with the largest at 24 percent for McCormack Creek. Table 74 summarizes cumulative harvest, road and peak flow predictions for Alternative 4.

Table 74. Cumulative harvest, road density and peak flow response for Alternative 4

7th level HUC watershed	Cumulative harvest area %	Cumulative road density (mi/mi^2)	% change in peak flow predicted from cumulative effects
McCormack Creek	28.49	3.20	23.55
Kunk Creek-Frontal Zimovia Strait-D	3.65	3.03	16.10
19010209010102	12.75	2.32	18.83
Kunk Creek-Frontal Zimovia Strait-E	19.82	2.24	20.95
Pats Creek	7.56	2.04	17.27
Lower Salamander Creek	16.67	1.90	11.00
Kunk Creek-Frontal Zimovia Strait-C	13.60	1.89	10.08
19010209010304	22.75	1.76	12.82

Table 75. Alternative 5 proposed harvest acres and predicted peakflow change

7th level watershed	Acres	Total harvest	Clearcut harvest	UA33 harvest	Predict peak flow change %
Kunk Creek-Frontal Zimovia Strait-D	835	75	0.00	75	16
McCormack Creek	2,886	496	165	331	18
19010209010102	1,629	115	67	49	17
Wrangell Island-Frontal Eastern Passage-D	733	85	0.00	85	16
Lower Salamander Creek	4,143	216	28	188	11
19010209010304	1,178	65	0.00	65	12
Kunk Creek-Frontal Zimovia Strait-E	1,996	206	100	106	12

Table 76. Alternative 5 proposed roads and stream crossings

7th level watershed	NFS miles	Temp miles	NFS stream crossings	Temp stream crossings
19010209010102	0.78	0.87	1	5
19010209010202	0	0.3	0	1
19010209010303	0	0.21	0	0
19010209020506	0.8	1.78	4	2
19010209020512	0.71	0	2	0
Fools Inlet-Frontal Ernest Sound-A	0.18	0.58	1	2
Kunk Creek-Frontal Zimovia Strait-C	0.55	0	3	4
Kunk Creek-Frontal Zimovia Strait-E	1.32	0.5	1	1
Long Lake	1.16	1.06	0	3
McCormack Creek	2.39	0.78	4	2
Pats Creek	2.84	0.1	3	0
Upper Earl West Creek	0	0.46	0	0
Upper Fools Creek	0.09	0.7	0	2
Upper Salamander Creek	1.61	0.39	1	1

Alternative 5

Direct and Indirect Effects

Alternative 5 may have peak flow changes in 7 watersheds based on the transient snow zone evaluation in Grant et al. (2008). The predicted peak flow changes are between 11 to 18 percent based on road and harvest percentages with the largest at 17.85 percent for McCormack Creek (Table 75). Table 76 gives the proposed roads and stream crossings in each watershed.

Cumulative Effects

Cumulative effects of past and proposed timber harvest would result in five watersheds over 20 percent cumulative harvest area with the largest at 25 percent for McCormack Creek. Road densities will be over 2.0 mi/mi^2 for 5 watersheds. Peak flow increases would be over 10 percent in 7 watersheds with the largest at McCormack creek with 22.5 percent. Table 77 summarizes cumulative harvest, road and peak flow predictions for Alternative 5.

Table 77. Cumulative harvest, road density and peak flow response for Alternative 5

7th level HUC watershed	Cumulative harvest area %	Cumulative road density (mi/mi^2)	% change in peak flow predicted from cumulative effects
Kunk Creek-Frontal Zimovia Strait-C	2.07	24.39	10.60
Kunk Creek-Frontal Zimovia Strait-D	3.62	3.65	16.10
McCormack Creek	2.72	25.00	22.50
19010209010102	2.28	12.10	18.63
Wrangell Island-Frontal Eastern Passage-D	2.10	11.11	18.33
Lower Salamander Creek	1.83	15.81	10.74
19010209010304	1.76	19.80	11.94
Kunk Creek-Frontal Zimovia Strait-E	1.76	19.30	11.79

Essential Fish Habitat (EFH)

EFH is the water and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. Freshwater EFH includes streams, rivers, lakes, ponds, wetlands and other bodies of water currently and historically accessible to salmon. Marine EFH in Alaska includes estuarine and marine areas from tidally submerged habitat to the 200-mile exclusive economic zone.

All watersheds in the project area contain chum, coho and pink salmon; steelhead and cutthroat trout; and Dolly Varden char. Sockeye salmon is not found in any of the watersheds within the project area. Each watershed contains small- and medium-sized drainages which contribute to a marine sport and commercial fishery and support a limited freshwater fishery. Both the recreational and commercial fisheries are important to the local economy of the area, and these fish populations contribute to the subsistence needs of the local communities.

The Tongass National Forest developed a juvenile fish passage evaluation criteria matrix with an interagency group of professionals (Flanders and Cariello 2000). The condition of existing roads, culverts, and drainage features was assessed using road condition surveys conducted between 1995 and 2005. As part of these surveys, each road crossing structure in a fish stream is assessed for its ability to provide unimpeded fish passage (USDA Forest Service 2001a). The evaluation matrix stratifies culverts by type, and establishes thresholds for culvert gradient, stream channel constriction, debris blockages, and vertical

barriers (or perch) at culvert outlet. Fish crossings are categorized red, gray, or green according to passage conditions. Fish crossing categories are as follows (USDA Forest Service 2012):

- **Green Category:** conditions have a high certainty of meeting adult and juvenile fish passage requirements at all desired stream flows;
- **Gray Category:** conditions are such that additional and more detailed analysis is required to determine their juvenile fish passage ability. This additional analysis includes use of the FishXing analytical software; and
- **Red Category:** conditions that have a high certainty of not providing juvenile fish passage at all desired stream flows (also called red pipes).

According to the most current road condition survey data (collected from 1995 to 2015), there are 38 red and gray Class I and Class II stream crossings within the project watersheds. A complete listing of culverts may be found in the Aquatic Resources Report and additional information in Issue 4 of this document.

Marine Environment

Watersheds within the project area include shoreline along Zimovia Straight and the Eastern Passage and contain diverse estuarine and tidal habitats, areas vital for some commercially important species such as Dungeness crab, king crab, and juvenile salmon.

These areas are part of a complex and diverse ecosystem that includes shrimp, flatfish, marine worms, starfish, sponges, anemones, sea cucumbers, urchins, shellfish, plankton, marine algae, and other organisms. Marine access facilities and log staging areas are planned points of concentrated activity along these shoreline environments, with the remaining shoreline protected by a 1,000-foot buffer (USDA Forest Service 2008a). The Pats Creek or Earl West marine access facility could be used to barge or raft the logs for this project.

Water quality effects include increased risk in fuel spills from equipment used for barge loading, increases in sediment levels from increased road use, and bark leachates and shading beneath log rafts and equipment floats. The effects are likely to be limited in both quantity and distribution as most activities and spills would be on-shore having only localized effects to near-shore fish and fish food resources from runoff to the marine environment. Barging logs instead of rafting them would have fewer effects on marine species.

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act states that all federal agencies must consult the National Marine Fisheries Service (NMFS) for actions and proposed actions that may adversely affect EFH for federally managed marine and anadromous fish species. The Act promotes the protection of essential fish habitat through review, assessment, and mitigation of activities that may adversely affect these habitats. Essential fish habitat consultation has been combined with the Forest Service NEPA process. Consultation procedures have been documented in an attachment to a June 26, 2007 NMFS letter to the Regional Forester.

Although this consultation procedures document expired as of June 28, 2012, consultation is still required under the Act and the 2007 procedures remain applicable and have been followed for this EFH assessment.

The four main steps in the consultation process are the following:

- The Forest Service determines if the proposed action will have “no adverse effect” or if it “may adversely affect” EFH. Only the “may adversely affect” determination triggers consultation.
- An EFH Assessment is prepared by the Forest Service as a component of the NEPA and forwarded to the NMFS to initiate formal consultation.

- The NMFS will respond in writing as to whether it concurs with the conclusion in the EFH Assessment and may provide conservation recommendations to further minimize effects of the action on EFH.
- The Forest Service must provide a written response to NMFS within 30 days explaining its evaluation of the conservation recommendations. The response may include reasons for not following the recommendation.

The formal consultation begins when NMFS receives a copy of the draft environmental impact statement (DEIS) with the EFH Assessment. Documentation of the consultation process, including a summary of how EFH may or may not be adversely affected and the consultation requirements have been satisfied will be included in the FEIS. The Record of Decision (ROD) will contain a summary of the EFH consultation conclusions.

This EFH assessment satisfies the requirements by providing: (1) a description of the proposed action; (2) an analysis of the potential adverse effects of the action on EFH and the managed species; (3) the Forest Service's conclusions regarding the effects of the action on EFH; (4) a discussion of proposed mitigation, if applicable.

Floodplains

Executive Order 11988 directs Federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains. This project does not propose floodplain occupancy. Roads crossing floodplains have been designed to pass floods in accordance with the BMPs. Road cards provide site-specific details.

Major floodplains are mapped as soil units and small stream flood plains are mapped by process group. Both entities are used to define the riparian management areas (RMA) for this project. All activities were designed to avoid all RMAs. Some past historical harvest of approximately 3,000 feet of stream classified as floodplain may have been affected from 1965 to 1996.

No mapped floodplains were found within any of the proposed activity areas for any action alternative. Further, none of the action alternatives propose new road construction or timber harvest on floodplains in the analysis area. Because there would be no actions taken within mapped floodplains in the analysis area, there would be no direct or indirect effects. Because there are no direct or indirect effects to mapped floodplains from any of the action alternatives, there would be no cumulative effects. Small unmapped floodplains may be present within RMAs and may be crossed by new road construction. Roads crossing these areas have been designed to pass floods and minimize effects in accordance with the BMPs as depicted on the road cards.

Essential Fish Habitat Effects Determination

The Forest Service determines that the Wrangell Island Project may adversely affect freshwater and marine EFH for the following reasons:

- The project entails ground disturbing actions (i.e., timber harvest and road construction, including fish bearing stream crossings) in watersheds that contain anadromous species.
- Log hauling would occur on existing roads that cross anadromous fish streams.
- Log transfer would occur at facilities in the proximity of marine waters and inter-tidal habitats.
- Unforeseen events such as landslides, debris blockages of culverts, fuel spills, and road failures could occur.

The Forest Service will ensure that adverse effects to EFH would be minimized through implementation of the following measures:

- All Class I and II streams within the project area will be protected by a no-harvest buffer (RMA) of 100 feet or more.

- All Class III streams will be protected by no-harvest buffers to the top of the side slope (v- notch) according to the Forest Plan. This minimizes the potential impact to downstream EFH.
- Additional precautionary measures will be prescribed to minimize windthrow in RMA buffers where the risk of windthrow is high or where extensive windthrow has occurred. These measures include retaining additional trees adjacent to the RMA to help ensure resistance to windthrow.
- Temporal restrictions will be made to limit in-water work to protect critical fish life stages.
- Maintenance will be built into road construction contracts to correct existing erosion features.
- All proposed road crossing structures installations will adhere to fish standards and guidelines for passage in the Forest Plan (USDA Forest Service, 2008a, pp. 4-11 to 4-12).
- New and reconditioned roads will be closed to motor vehicle use after silvicultural activities are complete.
- Temporary roads will be decommissioned following timber harvest and firewood gathering.
- Log staging activities will occur outside the minimum 300-foot buffer protecting Class I streams.
- Standards and guidelines of the Forest Plan and best management practices (BMPs) will be implemented to protect water quality and aquatic habitat protection for all freshwater streams and for the marine access facilities within the project area. See unit cards for specific applications of BMPs in the vicinity of freshwater streams.
- Annual marine dive surveys around the marine access facilities will ensure Alaska pollutant discharge elimination system (APDES) requirements are met for bark accumulation when production values are met.

Unavoidable Adverse Impacts

Unavoidable adverse impacts to EFH associated with this project include short-term increases in sediment delivery and subsequent turbidity in streams from road construction and maintenance activities. Other short-term impacts include bark accumulation, leachate, and shading impacts to the marine environment near the marine access facility.

Irreversible and Irretrievable Commitments of Resources

This project does not propose any irreversible or irretrievable commitments of aquatic resources.

Cultural Resources

The National Historic Preservation Act (NHPA) sets forth government policy and procedures regarding "historic properties"; districts, sites, buildings, structures, and objects included in, or eligible for, the National Register of Historic Places. Section 106 of the NHPA, requires that Federal agencies consider the effects of their actions on such properties, following regulations issued by the Advisory Council on Historic Preservation (ACHP).

The Section 106 review process seeks to consider historic preservation concerns with the needs of Federal actions. Review occurs through consultation with the Alaska State Historic Preservation Officer (SHPO), the ACHP, Indian Tribes, and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. One of the goals of consultation is to identify historic properties that potentially may be affected by the undertaking and assess potential effects and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

The National Environmental Policy Act requires Federal agencies to consider effects of their actions on cultural resources which include historic and prehistoric sites regardless of eligibility status to the NRHP.

Tribal Consultation

The Forest Service consulted with the Wrangell Cooperative Association (WCA), the tribal group which is culturally affiliated with the project area. Forest Service archaeologists and other members of the interdisciplinary team met with WCA concerning the planned project and supplied them with a copy of

the Cultural Resource Report entitled *Cultural Resource Investigations in the Wrangell Island Project Area, Southeast Alaska* for review and comment (Smith 2014). Copies of the report were also sent to the Tlingit and Haida Central Council, Sealaska Corporation and Sealaska Heritage Institute.

To ensure that the procedural requirements of 36 CFR §800 were met, a cultural resource investigation of the Wrangell Island project area was conducted. In accordance with the Programmatic Agreement (2010) among the Forest Service Alaska Region, the ACHP, and the SHPO, a resource report was submitted to SHPO under 36 CFR §800 regulations implementing Section 106 of the NHPA. The SHPO concurred with the Forest Service finding of "No Historic Properties Affected" for this project.

Methods

The cultural resource evaluation of the Wrangell Island Project began with a literature search of past cultural resource surveys in and around the project area. The Forest Service consulted with the local tribal group (WCA), and reviewed various historical and ethnographic accounts, including Alaska Heritage Resource Survey (AHRS) listings, Alaska Office of History and Archaeology (OHA), Petersburg/Wrangell Heritage files and atlases, special use files, GIS archaeological site and survey data, and the Tongass Site Database.

Over the past four decades Forest Service archaeologists have conducted 44 literature and survey investigations covering over 1,083 acres in the area of potential effect, which resulted, in part, in the discovery of 27 sites.

In addition to the background research and previous survey, the Forest Service and SWCA Environmental Consultants conducted a pedestrian survey of 383 acres of various types of terrain in search of undiscovered sites and other cultural resources. Six additional sites were discovered and recorded.

The Forest Service conducted their field inventory to comply with the NHPA and the NEPA and designed an analysis method that reduces the likelihood that an unanticipated discovery will occur during development. The model recognizes two sensitivity zones in the Alaska Region: high and low. Briefly, the high sensitivity zone includes all land between mean lower low water and 30 m of elevation above mean high water. It also includes certain landscape features like karst and rock shelter areas, streams and lakes, mineral locations, and places described ethnographically or in myths and legends. The low sensitivity zone is all land not relegated to the high sensitivity zone. The model is further described in the Programmatic Agreement (2010). The process of updating the model to include a paleoshoreline model that aids in the prediction of site locations is ongoing (Carlson and Baichtal 2015). Cumulatively, cultural resource survey in the area of potential effect (APE) has included inventory of both high and low sensitivity areas. A total of 33 sites have been documented, 30 of which are in the high sensitivity zone. The location of the sites were plotted with respect to proposed activities to determine if known sites could potentially be impacted with project implementation. Six of the discovered were evaluated while surveying for this project to determine their eligibility status to the National Register of Historic Places. Evaluations are based on a set of criteria described in the National Historic Preservation Act.

Intensive cultural resource surveys and site monitoring have been implemented across the Tongass National Forest beginning in the late 1970s. The current archaeological research and survey designs are based on the results of this work, as well as more modern analysis methods and technology. These methods are designed to preserve and protect significant sites and provide information that will help guide future research and resource management. In addition, continued public education by the Forest Service to increase awareness concerning cultural resources and site stewardship assists the agency in effectively managing the region's heritage sites.

Analysis Area

The Wrangell Island project area includes all of Wrangell Island. The APE is the analysis area used for this project. It is defined by the Wrangell Island Project boundaries with the exception of that part of

Wrangell Island that lies north of the east–west division line between Township 62 South and Township 63 South. The island's northern extreme was excluded from the APE because no project activities are proposed for the area. The APE includes all project harvest units, access roads, and associated actions that require ground disturbing activities. Most of the activities are planned for terrain in the low sensitivity zone for cultural resources (USDA Forest Service 2010b).

Affected Environment

According to oral tradition and various historical accounts, the Tlingit are the dominant native group of Southeast Alaska. The Wrangell Island project area lies within the traditional territory of the Stikine Tlingit, who occupied a large territory, extending up the Stikine River as far as Telegraph Creek in what is now British Columbia, and encompassing the mainland Alaska shore from Union Bay on the Cleveland Peninsula north to Cape Fanshaw. The territory reaches west to include portions of Kupreanof and Prince of Wales Islands, and all of Etolin, Mitkof, Wrangell and Zarembo Islands.

The prehistory of southeast Alaska can be traced through the archaeological record for thousands of years. Geologic processes that shaped southeast Alaska created a diverse landscape that would have been open for human exploitation by the end of the last ice age, some 14,000 years ago. The present-day archipelago hosts dramatic fjords, thousands of bays and inlets, and elevated marine beaches and deltas along the coastline. Some of these features indicate uplift of the land relative to the sea since the glacial maxima; all provide ecological niches that supported a thriving human population for thousands of years.

Pollen records and radiocarbon dates from nearby Mitkof Island characterize the Holocene vegetation history (Ager et al. 2010:263-267). Following deglaciation, pine woodland with abundant alders, sedges, sphagnum mosses and ferns colonized southeast Alaska. By ca 11,460 cal yr BP Sitka spruce and mountain hemlock replace pines over much of the landscape. Sometime around 10,200 cal yr BP western hemlock arrived and expanded to be one of the most common species. A peat bog habitat advanced after about 7,100 cal yr BP indicating a regional climate shift to cooler and wetter conditions. During the late Holocene, ca 2,200 cal yr BP, cedar was well established. The present-day archipelago is a dense rainforest of spruce, hemlock and cedar with intermittent muskeg environments.

A study of fossil vertebrates in the Alexander Archipelago, primarily at cave sites on Prince of Wales and surrounding islands, has helped interpret the Ice Age history of vertebrates. Radiocarbon-dated vertebrate remains support a glacial maximum refugium theory with specimens dating to as early as 40,000 yrs BP and continuing through the Middle Wisconsin, Glacial Maximum and the Post Glacial (Heaton and Grady 2003: 46-47).

Archaeological evidence indicates that humans were living off the rich marine environment at least as early as about 10,000 years ago. The archaeological record and ethnographic information were used to formulate a regional northern Northwest Coast cultural sequence divided into stages or periods (Ames and Maschner 1999: 18; Davis 1990: 197-202; Moss 1998: 88; 2004: 181-182, 2011: 47). Most of the proposed divisions are consistent but with some time sequence variations (Moss 2004: 181; Moss 2011: 49). Recognizing the sequence was based on a relatively small data set; the divisions were coarsely formulated to include the Early Period (10,000 – 5,000 BP), the Middle Period (5,000 – 1,500 BP), and the Late Period (1,500 BP – AD 1741) (Moss 1998: 92-102; Moss 2004: 181-182). Briefly, the Early Period is associated with chipped stone assemblages, often taking the form of a microblade tool tradition. The Middle Period is defined by an increase in the number and size of archaeological sites, more diversified bone tool assemblages and wood stake fish traps and weirs. A continuation of these site types, an increase in fort sites, and written history accounts help define the Late Period.

The Tlingit Indians call southeast Alaska their traditional homeland and were well established by the time Europeans began plying the waters of the inside passage between Dixon Entrance to the south and Yakutat Bay to the north. Developed social organization, custom and tradition suggest ancient ties to the

landscape and early European explorers found signs of Tlingit influence and occupation across the entire region (Niblack 1970 [1888]: 231, 232).

Tlingit lifestyle is based on an annual subsistence cycle where activities were naturally based upon seasonal influences. Spring was the time for halibut fishing and gathering foods like herring eggs, beach greens, seaweed and roots; summer activities centered on salmon and berry harvesting; fall was the occasion for deer and water fowl hunting; and winter was when gray cod were harvested and shellfish were gathered (Newton and Moss 1984: 5, 13, 14, 15, 18, 20).

The Tlingit social organization is an effective means of designating territorial rights and stratifying social levels. Tlingit territory is geographically divided into some 14 or so tribes or kwans, each consisting of two parties called Raven and Eagle (sometimes Wolf instead of Eagle). The party or moiety serves to arrange marriages and are matrilineal in decent. Each moiety is made up of a number of clans that function as the active principle of life, law and religion (Emmons 1991: 21, 23; Olson 1967: 1). The clan is a blood relationship that binds its members in close union and is made up of households of closely related families living together under one roof (Emmons 1991: 27). Although clans owned larger territorial rights, households had their own salmon streams, fishing, hunting and berrying grounds.

Wrangell Island lies within the traditional territory of the Stikine or Wrangell Tlingit (Goldschmidt and Haas 1998 [1946]:73, Chart 4). The Stikine Tlingit are referred to as the Shtax'heen Kwaan or the Bitter Water People. The name is said to refer to one of two things: the Stikine River's silty glacial waters or the chattering of teeth caused by its cold fresh water (Emmons in Rabich-Campbell 1988: 21). Either way, the name's association with the Stikine River seems clear. The Stikine Tlingit territory is large, extending up the Stikine River as far as Telegraph Creek and encompassing the mainland shore from Union Bay on the Cleveland Peninsula north to Cape Fanshaw. The territory reaches west to include portions of Kupreanof and Prince of Wales islands, and all of Etolin, Mitkof, Wrangell and Zarembo islands (Olson 1967: 3).

Travel to distant reaches of the Stikine's territory for resources was common and created a need for seasonally occupied villages and camps. The Kiks.àdi clan primarily inhabited the island's western and south/southeast shores, and ventured as far inland as Thoms Creek. A large village (known as Old Town) was situated on the west edge of the island, which was inhabited by both the Kiks.àdi and the Naanyaa.aayi (Goldschmidt and Hass 1998 [1946]: 73-78). It was abandoned after the Russians left the area and American interests arrived.

Russian, European, and American interest in southeast Alaska began in the early 1700s fueled by the desire to obtain territory and valuable resources. The Russians were some of the first explorers in southeast Alaska. In 1741, Vitus Bering made his second voyage east of the Russian Pacific coast and reached southeast Alaska, claiming it as a Russian territory. By 1787, the Russians had established small fur-trading outposts in "Russian America," and unified their efforts under the United American Company (changed to the Russian American Company [RAC] in 1799). They established trade relations in southeast Alaska with the Tlingit to obtain more furs for less effort—a business deal that initially worked well for both sides (Arndt et al. 1987: 164, 187-189).

In 1834 the Russians heard the Hudson Bay Company (HBC) was interested in trade up the Stikine River. The Russians acted swiftly and built Redoubt St. Dionysius on the northern end of Wrangell Island. The island was named for Ferdinand Von Wrangel, manager of the RAC around 1830. Stikine Tlingit Chief Shakes V, recognized some advantages of cooperation with the Russians, and moved the Tlingit village from its former site at "old town" on Wrangell's west coast, to Shakes Island in the heart of the current city of Wrangell to be near the Russian Redoubt.

Under the terms of an 1839 lease agreement with the HBC, the RAC withdrew from the post in 1840 (Arndt et al. 1987: 186, 189). The HBC renamed the post Fort Stikine and traded with the Stikine Tlingit

until the post was abandoned in 1849 (ADCCED 2016). The fort remained under the British flag until Alaska's purchase by the U.S. in 1867.

The discovery of gold in 1861 on the Stikine River fueled community growth as an outfitter for gold prospectors. In 1868, Fort Wrangell was built by the U.S. Army, after the United States officially purchased Alaska from Russia. Gold continued to draw prospectors who staged in Wrangell and traveled up the Stikine River to the Cassiar gold fields during 1874 and again in 1897, when hundreds of miners traveled north during the Klondike Gold Rush (ADCCED 2016).

Presbyterian and Catholic churches and schools were established in Wrangell by missionaries during the early 1870s and Alaska's first Protestant church and American school were established in 1877 (CBWA 2014: 4).

The fishing industry got its start after the purchase of Alaska. Fish traps and canneries were built around the region mainly seeking the harvest of salmon. In 1889 the Glacier Packing Company opened as a fish packing facility in Wrangell and employed more Chinese laborers than American or native (Brady 1897). During this time period, famed lawman Wyatt Earp traveled through Wrangell and filled in as marshal of Wrangell for 10 days; he declined to become a full-time town marshal (CBWA 2014: 3). In 1903, the City of Wrangell was incorporated, at which point the U.S. Postal Service altered the official name from "Wrangel" to "Wrangell," (AlaskaWeb 2016).

The Forest Reserve Act of 1891 allowed for forested public lands to be placed into reserves, from which timber could be harvested and lands could be managed (USDA Forest Service 2009c). In 1902, the Alexander Archipelago Forest Reserve was established, and shortly thereafter, changed to the Tongass National Forest. The Forest Service brought timber management to southeast Alaska, from which small mills and communities sprang. The agency provided employment, public access opportunities, and economic development in the form of lumber and wood products. The first sawmill in Alaska was located in Wrangell; it shipped airplane lumber to Great Britain. Japanese interests in the saw and pulp mills created another foreign interest in Wrangell (CBWA 2014: 4).

As the wood and fiber industry took hold, it and fishing became Wrangell's primary economic base. Along with the mill, there were two salmon canneries, two shrimp and two crab canneries within Wrangell City limits. In 1929 the canneries employed more than 150 people.

Fur farming was also very important in the Wrangell area with farms of fox, mink, beaver, marten, and muskrat on Wrangell and the surrounding islands (CBWA 2014).

The Alaska Native Brotherhood and Alaska Native Sisterhood lobbied to have the first native boarding school, the Wrangell Institute, opened in 1932. Native children were brought in from throughout Alaska for education of grades kindergarten through high school (CBWA 2014: 4).

Although abundant spruce and hemlock resources helped expand the lumber and wood products industry on Wrangell Island (AlaskaWeb 2016), falling lumber prices and an industry-wide decline in lumber production caused the Alaska Pulp Corporation sawmill, Wrangell's largest employer, to close in late 1994. The residual effects are still felt today, with the Wrangell Sawmill closing in 2009.

According to the Tongass Sites Database and Office of History and Archaeology Integrated Business Suite and the work completed for this project, there are 33 prehistoric and historic period archaeology sites in the APE. Prehistoric period sites include 8 shell middens, 5 petroglyphs, 2 pictographs, a wood stake fish trap, and 2 lithic scatters. Historic period sites include a boat, a burial, a building, 4 cabins, a cedar bark source area, 2 gardens, a fur farm, an outpost, a wood platform, a trail and 2 wolf traps.

Environmental Consequences

Direct and Indirect Effects

There are 33 sites within the APE. Six of these sites were discovered during pedestrian surveys for this project.

All but three of the archaeology sites in the APE are located within a 1,000-foot protected buffer established along the beach and estuary fringe and defined in the Forest Plan Standards and Guidelines (USDA Forest Service 2008a, p. 4-4). All of the alternatives propose to harvest timber from inland locations, and none would encroach on the buffer zone. None of the sites outside the buffer zone are in areas proposed for project activities.

None of the proposed alternatives would have a direct or indirect effect upon known or newly discovered cultural sites in the project area.

Cumulative Effects

The cumulative effects analysis area coincides with the APE. Cumulative impacts to cultural resources may result from natural erosion, weathering, decay, sedimentation, wind events and cultural processes such as public use and commercial development. Commercial, recreational and subsistence uses are the primary activities that occur within the Wrangell Island project area. Most of the recorded cultural sites are concentrated near the marine shore where visitor access is generally by boat. Increased visitation and expanded use of the beach and estuary fringe could have a cumulative effect on cultural resources. Vandalism and looting, or inadvertent damage, such as ground compaction from trampling, erosion along trails or minor excavation associated with camping may occur with increased use. Activities associated with this project include road building and maintenance and timber harvest. Additional foreseeable activities that may take place in the project area vicinity include timber and salvage harvest projects, pre-commercial tree thinning, State entitlement land selections, utility corridor work, Alaska Mental Health Trust land sale program, Alaska Department of Transportation utility and transportation corridors and road improvements. Depending on the location and scope of these projects, cultural resources could be affected. The cumulative effects of the project alternatives are not likely to result in adverse impacts on the cultural resources regardless of whether the sites are in the 1,000-foot protected buffer established along the beach and estuary fringe. The project does not increase access to those sites located outside the buffer zone and activities associated with the project are not occurring near the sites.

Effects Common to All Alternatives

There are 33 sites in the APE but none are in areas proposed for project activities. Most of the areas that are suitable and available for timber harvest in the APE are on steep and highly elevated terrain and within the cultural resource low sensitivity zone. All of the action alternatives propose timber harvest and road work in these areas and implementation, regardless of the alternative, would have no effect on known cultural resources. Most of the known archaeology sites in the project area are located within a protected buffer established along the beach and estuary fringe and defined in the Forest Plan Standards and Guidelines (USDA Forest Service 2008a, p. 4-4). All of the alternatives propose to harvest timber from inland locations, and none would encroach on the buffer zone. There are three sites located outside the buffer zone, but they are not in areas proposed for activities. None of the proposed action alternatives would have a direct or indirect effect upon known cultural resources within the APE.

Mitigation and Monitoring

The Forest Plan addresses the desired condition of cultural resources through a monitoring and evaluation plan. As specified in the Programmatic Agreement (2010), the Forest Service monitors selected areas of direct impact during and/or after the actual ground disturbance. If inadvertent discoveries of human remains or unanticipated discoveries of cultural resources are made during project implementation all work in the area shall cease and the District Ranger and Forest Service archaeologist will be contacted

immediately. The Forest Service shall fulfill its consultation requirements in accordance with 36 CFR §800.13. Mitigation measures developed in consultation with the State Historic Preservation Officer to stratify implementing regulations of the NHPA would be agreed upon and effected before project activities would begin or continue.

Environmental Justice

Executive Order 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. Environmental justice analysis considers whether there is a disproportionately high and adverse effect from any of the alternatives on low-income and minority populations in communities near the project area, and incorporates by reference the analyses presented in the Wildlife and Subsistence Resource Reports. The Wrangell Island Project is a federal action that has potential environmental effects. The analysis area for environmental justice includes the communities of Wrangell and Thoms Place.

The Council on Environmental Quality (CEQ) issued guidance on analyzing effects on environmental justice under NEPA in December 1997. This guidance clarified that such analyses should recognize the interrelationships between cultural, social, occupational, historical, and economic factors that may amplify the environmental impacts. Impacts on subsistence resource use also impact the social and cultural lives of residents. The CEQ guidance clarified that the identification of disproportionate effects does not preclude the agency from going forward with the proposed action, but should heighten attention to project alternatives, mitigation and monitoring needs, and the preferences of the affected communities (CEQ 1997, p. 10).

Effects

The effects of the actions are indiscriminate and not expected to have a disproportionately high and adverse effect on the health or well-being of the minority or low-income populations who use the project area. There are no cumulative or foreseeable projects within the area of analysis that would cause a disproportionately high and adverse human health or environmental effect on any minority or low-income population.

Plants: Sensitive and Rare

Introduction

This section summarizes the botanical data available for the plants in the project area and analyzes and discloses the effects of the proposed Wrangell Island Project in relation to threatened, endangered, sensitive, and rare plants. The plant species evaluated include those sensitive plant species known or suspected to occur on Wrangell Island, according to the 2009 Forest Service Region 10 Sensitive Plant List, and rare plants ranked imperiled or critically imperiled by the Alaska Natural Heritage Program (USDA Forest Service 2009a).

Forest Service policy requires that an effects analysis be conducted for activities that could affect species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS). The only plant in Alaska that is federally listed or proposed as threatened or endangered by the USFWS is Aleutian holly fern (*Polystichum aleuticum*), which is listed as endangered. It is known only from Adak in the Aleutian Islands chain and is not expected to occur on the Tongass National Forest; therefore, it will not be addressed further in this document.

Methods

Analysis Area

The analysis area for direct and indirect effects to sensitive and rare plants is the project area, which consists of Wrangell Island in its entirety. The analysis area for cumulative effects was also constrained to Wrangell Island because of its geographic isolation from nearby lands by sea passages, which could restrict biological interactions with other sensitive or rare plant occurrences on the Forest.

Units of Measure

The units of measure for the analysis of project effects are the number of occurrences of sensitive and rare plants known to occur in the project area, and the acres of suitable habitat for sensitive plants known or suspected to occur in the project area that would be directly or indirectly impacted by timber harvest or road construction.

Review of Existing Information

A review of existing information was conducted to document the sensitive and rare plants known to occur in the project area and to identify habitats likely to contain sensitive plant species known or suspected to occur in the project area. The Forest Service Natural Resource Information System (NRIS) database for Threatened, Endangered, and Sensitive Plants (TESP) was searched for known sensitive or rare plant occurrences in the project area. Additionally, the University of Alaska Fairbanks ARCTOS herbarium database and the Consortium of Pacific Northwest Herbaria were also searched for other possible locations of sensitive or rare plants in the project area (UAMH 2015, University of Washington 2015).

Habitat characteristics for sensitive plant species known or suspected to occur in the project area were identified based on relevant literature, habitat descriptions from regional floras, and forest species conservation assessments. Depending on the habitat requirements of each species, landscape information selected to assess potential habitat included landform, elevation, aspect, slope, slope position, soil type, surface geology, proximity to shoreline, and vegetation cover type. Relevant GIS map layers were then analyzed to quantify the amount and location of suitable habitat for each species. Acreage estimates based on map overlays are approximate and may tend to overestimate the potential habitat because they are based on macro-habitat information currently available in GIS, and no statistical analysis or accuracy assessment is applied; nevertheless, they provide a means of comparing the effects of the alternatives by assessing the relative proportion of each habitat that is affected. In addition, habitat map layers based on statistical modeling were used to identify suitable habitat for some of the sensitive plant species on the Forest (Turner 2012). For each species, the habitat model with the highest assessed accuracy was used.

Field Surveys

Botanical field surveys were focused primarily in habitats of sensitive plants known or suspected to occur in the project area. Areas where impacts to sensitive plants or their habitat could most likely occur under the action alternatives but had not been previously surveyed were given the highest priority, such as within potential harvest units and road corridors. Where feasible, suitable habitat outside of but near areas of potential activity were also surveyed, in order to locate additional plant occurrences within the project area, if possible.

Field surveys were conducted from 2010 to 2012 during the appropriate time of year to locate and identify sensitive and rare plants. In Southeast Alaska this occurs approximately mid-June to mid-August. Survey routes were mapped using a hand-held GPS unit. For each survey, a complete list of plant species encountered on the survey route was compiled, and any sensitive or rare plant occurrence identified in the survey was documented. Plant identifications were based on Hitchcock and Cronquist (1973), Hultén (1968), Tande and Lipkin (2003), and Douglas et al. (1998). Taxonomic nomenclature followed the Natural Resources Conservation Service PLANTS database (NRCS 2013).

Seventy-three surveys were completed within the project area, covering a total of 448 acres. Fifty surveys included portions of the available timber harvest unit pool, and approximately 128 acres were surveyed

occurred within these areas. The remaining surveys were in habitats located outside potential harvest units. Field survey and element occurrence data, including survey routes and sensitive and rare plant occurrences, were entered into the NRIS-TESP database.

Analysis

All project alternatives were analyzed to determine the direct and indirect impacts to sensitive or rare plant species known to occur in the project area, and sensitive plant species that are suspected to occur. The cumulative effects of other past, present, and foreseeable future activities were also considered in determining the effects of the Wrangell Island Project on these species. Using this information, the overall likelihood and consequences of effects were then assessed using a standardized risk assessment (Stensvold 2011) for each proposed alternative.

Direct and Indirect Effects

Direct effects are those which are caused by an action and occur at the same time and place as the action. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

Direct effects mainly occur through physical damage and/or destruction to individual plants. Crushing can cause physical injury or death to individual plants, and burying will also likely result in death. When a plant is injured, its ability to optimally produce and store food, reproduce, compete for nutrients, and resist pests and herbivores may be compromised, which can negatively affect its growth and survival in a particular location. Some plants are more vulnerable to injury than others, depending upon the growth form of the plant and the habitat in which it occurs.

The direct effects of proposed timber harvest were analyzed by overlaying proposed timber harvest unit boundaries for each project alternative over known sensitive and rare plant occurrences and their associated habitat in the project area. Any sensitive or rare plant occurrence or that was either wholly or partially within the units, or sensitive plant habitat within the units, was assumed to be directly impacted by the activity. Direct effects of proposed new road construction were analyzed by overlaying proposed road segment lines over known sensitive and rare plant occurrences and their associated habitat in the project area. A 42.6-foot buffer on either side of the road segment line was used to represent an average road corridor width of 85 feet for forest logging roads (Powell 2014). Sensitive or rare plant occurrences either wholly or partially located within proposed road corridor, and their associated habitat within the corridor, were assumed to be directly impacted by road construction.

A 164-foot buffer was chosen for this analysis to account for potential indirect effects such as windthrow or hydrologic changes that may occur over the long-term in undisturbed areas due to activities in adjacent areas. Some effects may occur beyond 164 feet but the likelihood and consequences usually become more limited as distance increases. Indirect effects of proposed timber harvest were analyzed by buffering timber harvest unit boundaries for each project alternative by 164 feet and then overlaying this buffer on known sensitive or rare plant occurrences and sensitive plant habitat. Indirect effects of proposed road construction were analyzed by buffering the 85 feet width of the road corridor by 164 feet and overlaying the buffered area over known sensitive plant occurrences and suitable habitat. Sensitive or rare plant occurrences located outside road corridor but either wholly or partially located within the 164-foot buffer, and sensitive plant habitat within the buffer, were assumed to be indirectly impacted by road construction.

Cumulative effects are those that occur when the effects of an action are added to or interact with effects of other actions in the past, present, and foreseeable future in a particular place and within a particular timeframe. Reasonably foreseeable actions are those that are currently planned or scheduled to occur. The accumulation of impacts on sensitive or rare plants can affect viability of the species by reducing the numbers of individuals, the distribution of occurrences, and the amount and/or quality of habitat, which in turn adversely impact reproduction success, genetic variability, and resilience to future disturbances.

The direct and indirect impacts of past actions were analyzed by overlaying a GIS map layer of previously harvested stands and existing roads on known locations of sensitive and rare plant occurrences and estimated sensitive plant habitat in the project area. Impacts of present and reasonably foreseeable future actions were assessed by summarizing the effects of actions that are likely to occur in the project area and evaluating their risk of impact to sensitive and rare plants.

Affected Environment

Roughly half of Wrangell Island is productive forest land, with the rest consisting mostly of forested and non-forested wetlands and sphagnum bogs that occur on poorly drained till underlying a deep layer of organic material. Alpine and subalpine vegetation covers relatively small areas because most elevations on the island are below 2,000 feet. Middle and lower elevations are habitat for forests of western hemlock (*Tsuga heterophylla*) and mountain hemlock (*Tsuga mertensiana*), Sitka spruce (*Picea sitchensis*), western red cedar (*Thuja plicata*), yellow-cedar (*Callitropsis nootkatensis*), and shore pine (*Pinus contorta* var. *contorta*). Productive forest cover types include western hemlock and/or mountain hemlock, Sitka spruce, and mixed hemlock-Sitka spruce. Low productivity forest types include those that are at high elevation, have a low site index, are in muskeg, are dominated by rock cover, or are located in a recurrent slide zone. These are often open-canopied forests consisting of a mix of conifer species including western and mountain hemlock, western red cedar, yellow-cedar, and shore pine. Non-forest vegetation types include alder brush, brush, grassland, alpine, uplifted beach, muskeg-meadow, and recurrent slides/talus slopes.

Sensitive Plants

Sensitive plants are those species identified by the Regional Forester as having potential for loss of viability, as evidenced by 1) significant current or predicted downward trends in population numbers or density, and/or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670). These species are given special consideration by US Forest Service regulations and manual direction. The regulatory and policy framework concerning the management of sensitive plants is contained within Forest Service manual direction 2670. Seventeen vascular plants and one lichen are designated as sensitive in the Alaska Region. Analysis of effects of this project on sensitive plants is documented in the project biological evaluation for sensitive plants, which is included in the project record.

Lesser roundleaved orchid is the only sensitive plant species known to occur within the project area, where 11 occurrences have been documented (Table 78). Due to the presence of suitable habitat, 6 sensitive plants/lichens are suspected to occur in the project area: Alaska rein orchid, Calder's lovage, edible thistle, mountain lady's slipper, Henderson's checkermallow and lung lichen (See Table 78 and Stensvold 2013). Eleven other sensitive plant species are not known to occur within the project area and they are not suspected to occur, either because suitable habitat does not exist in the project area or because the project area is located outside of their known or suspected geographic range of distribution. Since there is no risk of impacts to these species, they will not be addressed further in this analysis.

Table 78. Alaska Region (Region 10) sensitive plant and lichen species known or suspected to occur in the Wrangell Island project area

Common name	Scientific name	Habitat	Presence in project area
Alaska rein orchid	*Piperia unalascensis*	Open forests, grassy slopes, meadows, bogs, heath, and streambanks in the lowland and montane zones (1, 2).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.
Calder's loveage	*Ligusticum calderi*	Forest edges, meadows, and calcareous areas in the montane, subalpine, and alpine zones (1).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.
Edible thistle	*Cirsium edule* var. *macounii*	Dry meadows and talus slopes, and open forests in the upper montane to subalpine/alpine zones (1).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.
Henderson's checkermallow	*Sidalcea hendersonii*	Upper beach meadows and beach/forest ecotone in the lowland zone (1).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.
Lesser roundleaved orchid	*Platanthera orbiculata*	Old growth forest, open forest, forest edges, and bogs in the lowland to montane zones (1, 3).	Known. Documented occurrences in the project area.
Lung lichen	*Lobaria amplissima*	Trunks of old-growth trees in lowland beach/forest ecotone that is exposed to open ocean (1, 4).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.
Mountain lady's slipper	*Cypripedium montanum*	Upper beach meadow, Forest edge, open forests and wet meadows in the lowland, montane, and subalpine zones (1, 5).	Suspected. Project area contains suitable habitat within known or suspected geographic range of the species.

References: (1) Stensvold 2013; (2) Dillman 2011a; (3) Dillman 2008; (4) Dillman 2011b; (5) Turner 2011.

Rare Plants

The survey criteria for rare plants on the Tongass National Forest is described in Dillman and Krosse (2009) and USDA Forest Service 2009b. These plants generally are included in the Alaska Natural Heritage Program Rare Plant Tracking List (AKNHP 2015). The list of Tongass rare plants is dynamic, and species may be added or dropped according to changes in conservation or taxonomic status. Unlike Region 10 listed sensitive plant species, effects are analyzed only for rare plant species known to occur in the project area. Analysis of effects of this project on rare plants is documented in the rare plant resource report, which is included in the project record.

Two rare plant species are known to occur in the project area: inundated clubmoss (*Lycopodiella inundata*) and threeleaf foamflower (*Tiarella trifoliata* ssp. *laciniata*). These species are both ranked by the Alaska Natural Heritage Program (AKNHP 2015) as secure globally (G5), but rare within the state (S3). Although rare plants on the Forest are usually state-ranked as imperiled (S2) or critically imperiled (S1), these two species are considered for this analysis because their distribution in Alaska is restricted to the southern half of the Tongass which means these populations occur within the most northern extent of their ranges. No other plant species that are currently considered rare were recorded in the project area.

Inundated clubmoss occurs in peat bogs, pools in peatlands, and lake margins in lowland and montane elevations (Douglas et al. 1998). Eleven occurrences are known within the project area. Threeleaf foamflower occurs in moist forests, meadows, and stream banks from lowland to subalpine elevations (Douglas et al. 1998). Only one occurrence of this species is known within the project area.

Environmental Consequences

Effects Common to All Action Alternatives

Direct effects of the project would only occur within timber harvest units and proposed road corridors and associated infrastructure such as log landings and rock quarries. Timber harvest has varying degrees of direct impacts on vegetation, depending on the harvest method used. An even-aged harvest method usually has the most intensive impacts. The timber yarding method can cause varying impacts, with the severity related to the amount of soil disturbance the yarding method creates. Even-aged harvest usually results in dense regeneration of conifer saplings, which can suppress understory vegetation due to insufficient light penetration under the canopy. Precommercial thinning can delay the period of understory suppression, but eventually the canopy can close again and suppress most understory plants. Uneven-aged harvests may have less severe and more temporary direct effects on vegetation, since a large portion of unharvested trees are left clumped or scattered across the harvest unit. However, sensitive and rare plant species can also be vulnerable to impacts from less intense harvest methods because they often have specific habitat requirements such as old-growth forest structure, and even a partial harvest could create conditions that inhibit the ability of these species to persist over the long term.

Road construction completely crushes or buries plants located in the road bed, and plants located along the road right-of-way can also be crushed, buried, or damaged as a result of vegetation clearing or road maintenance activities. Road construction usually affects vegetation more completely and permanently than timber harvest because it involves intense ground disturbance. Log landings and rock quarries are usually constructed adjacent to roads and are considered as part of road construction in this analysis. Excavation of rock material will crush, bury, or damage plants in the immediate location of the quarry. Since most soil is removed in the excavation process, quarries will remain in a long-term unvegetated state.

Indirect effects to sensitive and rare plants from project activities can occur both within and adjacent to harvest units and road construction areas. Indirect effects may include changes in soil physical and chemical properties, surface and groundwater flow, solar exposure, species composition, and risk of future disturbances such as windthrow or landslides. The magnitude of indirect effects from an action can depend on many variables, including the type and intensity of the action, the distance from the action, the time since the action occurred, and the physical and biological conditions of a site. Although it is possible that indirect effects on sensitive and rare plants could occur at long distances from an action, the probability and magnitude of effect generally decrease rapidly with increasing distance from the action.

The indirect, long-term impact of actions such as timber harvest or road building to adjacent vegetation is uncertain. Past studies of microclimate of forests adjacent to harvests indicate that edge-related microclimate effects may occur up to and beyond 656 feet from the harvest edge, but decline sharply inside adjacent unharvested forest, with most change occurring within 66 feet of the harvested edge; although the magnitude of an effect can differ among the climatic variables of interest (Chen et al. 1993, 1995; Concannon 1995; Russell et al. 2000). Because it is difficult to statistically test changes in rare or uncommon species, the actual duration and magnitude of edge effects on these species is uncertain. However, rare or uncommon species may be more susceptible than common species to disturbance or to other random effects that lead to extirpation of a population (Nelson and Halpern 2005; Heithecker and Halpern 2007). Furthermore, a lack of immediate, edge-related declines in a population does not preclude the possibility of future declines. Research on edge effects on forest vegetation adjacent to harvests indicates that changes in temperature and light availability are greatest at the edge, but decline sharply

inside adjacent unharvested forest. Declines among some groups of vascular and nonvascular plants is often greatest approximately 16 to 33 feet from the edge (Heithecker and Halpern 2007). However, frequency and intensity of disturbances such as windthrow could further compromise the edge, resulting in changes in microclimate further into the adjacent vegetation than what resulted initially from the harvest. It is important to note the limitations of these studies, particularly the short duration of sampling following harvest. Species composition could eventually return to that of the original plant community, although it may take several decades.

Comparison of Alternatives

Sensitive Plants

Since no timber harvest or road construction would occur under Alternative 1 (the No Action alternative), no direct or indirect impacts to any known sensitive or rare plant or sensitive plant habitat in the project would occur. None of the action alternatives are expected to have direct or indirect impacts to any known sensitive plant occurrences in the project area. Also, no alternative would affect suitable habitat for Henderson's checkermallow or lung lichen.

Alternative 5 would have the least impact on combined habitat for sensitive plants (Table 79), including about 5 percent of the estimated habitat of lesser roundleaved orchid. Next, by increasing overall levels of overall impact on sensitive plant habitat, is Alternative 3, followed by Alternative 4. Alternative 2 would have the most potential impact on sensitive plant habitat, including about 8 percent of suitable habitat for lesser roundleaved orchid.

The overall risk of adverse effects from all action alternatives is low to moderate for lesser roundleaved orchid, and low for Alaska rein orchid, Calder's lovage, edible thistle, and mountain lady's slipper. There is no risk of adverse effects to Henderson's checkermallow and lung lichen.

Table 79. Estimated acreage of sensitive plant habitat affected by proposed timber harvest and road construction under the action alternatives

Species	Alt 2	Alt 3	Alt 4	Alt 5
Alaska rein orchid	49	34	50	50
Calder's loveage	1,409	1,059	1,322	847
Edible thistle	56	47	50	42
Henderson's checkermallow	0	0	0	0
Lesser roundleaved orchid	2,050	1,510	1,479	1,149
Lung lichen	0	0	0	0
Mountain lady's slipper	1,028	756	723	668
Total	**4,592**	**3,406**	**3,624**	**2,756**

Rare Plants

Under Alternative 1, the likelihood of impacts to occurrences of rare plants is none because no timber harvest or road construction would occur. Threeleaf foamflower would not be directly or indirectly impacted by either by timber harvest or road construction under any action alternative, since the only known occurrence in the project area is located well outside of proposed harvest unit boundaries and proposed roads.

Some occurrences of inundated clubmoss could be impacted under all action alternatives. Alternative 5 would have the least risk of impact, with two occurrences affected by timber harvest and one affected by

road construction. Alternative 3 would have the next highest risk of impact, with two occurrences each affected by timber harvest and road construction, respectively. Alternatives 2 and 4 would both have the highest risk of impact, with three occurrences affected by timber harvest and two affected by road construction. It is important to note that this species occurs exclusively in non-forested muskeg habitat and would likely have little or no long-term effects from timber harvest. However, road construction in this habitat could damage or destroy individuals and affect the natural hydrology near the road corridor.

The overall risk of adverse effects from all action alternatives to inundated clubmoss is low to moderate. There is no risk of adverse effects to threeleaf foamflower under any of the action alternatives.

Cumulative Effects

On Wrangell Island, past and present activities causing disturbance to vegetation are largely a result of timber harvest, road construction, special uses, and dispersed recreation. Timber harvests and road construction have contributed most to the past alteration of habitat on Wrangell Island. Timber harvest has occurred on approximately 6,800 acres of National Forest System (NFS) land beginning in the early 1900s. These areas have regenerated into vigorous predominately even-aged timber stands. Past harvest areas can be found over much of the island, including areas that are currently in LUDs where timber harvest is no longer allowed. Timber harvests can extensively alter habitat quality for old growth-dependent plants such as lesser roundleaved orchid. The current effects on sensitive and rare plants may be dependent on the length of time since harvest, as well as the harvest method. Forest stands harvested by less intensive methods (e.g., selective tree, helicopter yarding) may require fewer years to recover than those harvested by more intensive methods (e.g., clearcut, shovel yarding).

There are approximately of 100 miles of existing National Forest System roads within the analysis area. Of these, approximately 73 miles are open to the public for motorized travel. There are an estimated 34 miles of road in other land ownerships within the analysis area. It is uncertain if sensitive or rare plants have been lost or damaged due to past road construction. However, road construction involves intense ground disturbance, and any sensitive or rare plants in the road corridor would likely have been destroyed, with long-term impacts on habitat, especially from NFS roads. It is also uncertain what the effects of past recreation, mining, or building construction activities may have had on sensitive or rare plants. These activities have been infrequent in the project area and are not likely to have contributed to substantial loss of sensitive plants or their habitat, and no substantial changes in the frequency of these activities are anticipated.

None of the 11 occurrences of lesser roundleaved orchid documented in the project area have been directly affected by past timber harvest. Two occurrences could have been indirectly affected by past timber harvest. No known occurrences have been directly or indirectly affected by past road construction on NFS lands. Sensitive plant habitats that have likely been minimally affected by past timber harvest and road construction activities are those of Henderson’s checkermallow, Alaska rein orchid, lung lichen, and edible thistle, while the largest effects of past management activities likely have been in potential habitat of lesser roundleaved orchid and Calder’s lovage. It is important to note that quantifying the magnitude of actual effects from past activities requires monitoring the changes to affected occurrences and habitat over time; this information is not available from past activities in the project area. Some locations where activities such as timber harvest occurred many decades ago may have recovered some or all of their undisturbed habitat characteristics. Areas with more recent harvests may not recover their previous habitat characteristics for decades into the future. Some highly modified areas, such as NFS roads and rock quarries, may never recover from the original disturbance.

Present activities that could impact sensitive or rare plant species in the project area include timber harvest, road construction, and other land development actions. At present, no such projects are being implemented on NFS lands in the project area, except for small roadside timber micro-sales. Although some timber harvest may currently be occurring on private or state-owned lands in the project area, the

level of impact is uncertain, because information on sensitive and rare plant occurrences or sensitive plant habitat on non-NFS lands is limited.

The annual amount of roadside timber harvested on NFS lands is variable but can be up to 500 MBF/year. The location of harvests is also variable but is most likely to occur along existing roads on Wrangell Island. The location and extent of pre-commercial thinning on NFS lands is uncertain at this time, but will always occur in previously harvested stands that have a dense regrowth of young trees. Impacts to sensitive or rare plants are possible due to these activities, but the risk is relatively low, because these activities will be concentrated either along existing roads or in previously harvested areas, which have already been impacted by previous activities. However, undocumented occurrences that have already been indirectly affected by past activities could be further impacted.

The Alaska Mental Health Trust Land Office (AMHT) has recently completed timber harvest in the project area totaling 104 acres, with 0.6 miles of road construction. AMHT also conducts an annual land sale program which could impact lands in the project area. The locations and extent of future timber offerings have not yet been determined. On June 30, 2015, an Agreement to Initiate was signed for a land exchange between the Forest Service and AMHT for multiple parcels across the Tongass National Forest. This proposal includes 1,105 acres of AMHT land within the analysis area to be transferred to the Forest Service. Newly acquired Forest Service land would be managed under the same Land Use Designation as adjacent National Forest land, which in this case would be the Scenic Viewshed Land Use Designation. Under this land use designation, the potential for future timber harvest or road construction would be limited, resulting in a low likelihood of impacts to sensitive or rare plants.

The Alaska Department of Natural Resources - Division of Forestry has published a 5-Year Schedule of Timber Sales (2015 to 2019) (ADNR 2015). The amount of annual offerings is not determined until the offering is publicized. The Earl West Cove Area timber sale, planned for 2019, will potentially harvest 700 acres of timber and a construct 5 miles of roads. The State is still in the process of completing its Alaska Statehood Act of 1959 entitlement selections for the 16,683 acres of NFS land identified near Thoms Lake/Thoms Place on Wrangell Island. The State has assigned Priority “C” ranking or a very low priority for conveyance for this parcel, but it continues to be State-selected lands for the foreseeable future. No timber harvest or road building is proposed within the Thoms Creek selection.

The City and Borough of Wrangell is in the initial stages of planning development of the currently undeveloped 140-acre Institute Property near the 5-mile marker on Zimovia Highway for housing, health care and educational facilities. This property abuts the National Forest. The City and Borough of Wrangell have expressed interest in pursuing ownership and development of the privately owned former saw mill site, for industrial purposes, possibly including a timber processing facility. There are no firm proposals at this time. Because suitable habitat for sensitive or rare plants is not likely to occur in these areas, the potential for future impacts is low.

Design Features and Monitoring

Since no known sensitive plant occurrences will be directly or indirectly affected under any alternative, design features to protect sensitive plant occurrences are not necessary. If any previously undiscovered sensitive plants are encountered in timber harvest units or road construction areas at any time prior to or during implementation of this project, Forest Plan Standards and Guidelines designed to protect sensitive plants shall be considered.

Specific direction from Forest Plan Standards and Guidelines for rare plants, such as using directional felling and yarding away from rare plants, is included in the management prescriptions for harvest units that may affect known rare plant occurrences. Where possible, and while meeting required road design specifications, similar design features are included in road layout and construction specifications. The implementation and effectiveness of these design features will be monitored during and/or after the

commencement of related project activities. If any previously undiscovered rare plants are encountered in timber harvest units or road construction areas at any time prior to or during implementation of this project, Forest Plan Standards and Guidelines designed to protect rare plants shall be considered at those sites.

Invasive Plants

Introduction

Invasive plants directly compete with native plants and can cause displacement of the native plants by site occupancy. In addition, these species can have a number of indirect effects including changes to biological diversity. Potential impacts include changes in the food base for wildlife and possible changes in the natural soil erosion and sediment accumulation dynamics. EO 13112 directs all federal agencies to address the impact their actions may have on invasive plants.

The Forest Plan and Forest Service policy (FSM 2900) provides direction to determine the risk of the introduction and spread of invasive species for proposed activities, and to address the impacts the actions may have on invasive species. In deciding what plants qualify as “invasive”, the Alaska Natural Heritage Program’s (ANHP) Weed Ranking Project results were used (Carlson et al. 2008). The ranking is based on climate (the climatic conditions where the plant is known to thrive), biological characteristics and dispersal ability of the plant, the plant's distribution, and feasibility of control. Plants are ranked on a scale of 0 to 100, with a high ranking being the most invasive. Not all non-native plant species have been ranked.

This section provides a summary of the potential effects of the proposed alternatives on the introduction and spread of invasive plants. Included are design features that would minimize these risks. The effects of implementing the action alternatives would increase the current risk for introduction, spread, and establishment of invasive species. A complete analysis is available in the Invasive Plants resource report, which can be found in the project record.

Methods Used to Analyze Effects

The analysis is based on the following assumptions:

- Proposed harvest areas are expected to regenerate rapidly which results in a low susceptibility to invasive plant invasion.
- Eradication of all the high priority species in the project area is not feasible at this time due to their extensive distribution. Control strategies, such as containment and tolerance, will be implemented for many of the ubiquitous invasive plant species.
- Existing sort yards and marine access facilities, outside the National Forest will be used. These areas may have high priority invasive plant infestations. This will decrease the amount of additional disturbance on NFS lands, but may increase the risk of spreading new infestations on to the National Forest.
- Implementation of design measures will help prevent the introduction and spread of high priority invasive species.

A risk assessment was conducted for invasive species in the project area based on project impacts that would affect known and potential invasive plant infestations. Factors considered included current inventory of invasive plants, habitat alteration or ground disturbance, habitat vulnerability, increased vectors as a result of project implementation, and design features (See invasive plant resource report in the project record).

Habitat alteration or ground disturbance is evaluated based on the amount of exposed mineral soil which is a function of the amount of potential ground disturbance caused by the proposed action. Habitat vulnerability takes into account proximity of the habitat to an existing infestation. Vectors are agents that

transport seeds or plant material from one location to another thereby facilitating the further spread of invasive species populations.

Habitats characterized by a lack of disturbance and environmental extremes such as the high degree of shading found on closed-canopy forest floors, the extremely low pH of sphagnum bogs, or undisturbed road-less areas are considered at low risk of invasive plant infestations. Areas with high disturbance, moderate soil moisture and pH, and lack of shading are considered to be at high risk and are more vulnerable to infestations by invasive plant species. A habitat is at high risk to becoming infested if it is disturbed by activities; it is at moderate risk if it is within close proximity to ground disturbing activities; and at low risk if it is far from ground disturbing activities.

Effects Analysis Indicators

The risk of invasive plant introduction or spread is assessed by considering a combination of the extent of known and potential ground-disturbing activities, the proximity to a source population and potential vectors. Vectors are agents that transport seeds or plant material from one location to another thereby facilitating the continued spread of invasive plant populations. Ground disturbing activities take into account the two elements which typically promote the spread of invasive plant: open sunlight and exposed mineral soil. Exposed mineral soil is a function of the degree of disturbance. Sunlight is a function of overall canopy cover and vegetative density.

The following indicators were used to measure potential effects of project activities on invasive plant species:

- Miles of newly constructed road
- Miles of road open to motor vehicle use (existing and proposed)

Incomplete and Unavailable information

A comprehensive survey of all NFS lands for invasive plant species has not been conducted for the entire project area. Additionally, surveys may be somewhat outdated due to the amount of time that has passed since they were conducted.

The lack of complete survey information is not critical for the analysis of the potential affects from this project because the impacts are assumed to be associated with new disturbance from the proposed activity.

Analysis Area

The analysis area is Wrangell Island which encompasses lands under multiple ownerships with invasive plant populations that may expand in size or infest new areas as a direct or indirect effect of any action alternative. The extent of the project area allows for an assessment of risk at appropriate landscape and local scale to determine effects, making the island a suitable geographic area to assess impacts. The focus of the analysis is the introduction and spread on invasive plants on to NFS lands over the next 5 to 10 years.

Affected Environment

Undeveloped areas on Wrangell Island are relatively free of invasive plants. Infestations are primarily associated with roads and areas that receive a high amount of human use. Wrangell Island has a well-developed road network connecting the community of Wrangell to the National Forest road system. The road and trail system include a 12-mile recreation driving loop road, 2 marine access facilities, 58 active rock quarries, 7 hiking trails including a high-country trail system, and 17 developed recreation sites. The town of Wrangell and the marine access facilities at Pats Creek and Earl West are expected to be the primary sources for introduction of new invasive plants.

In 2013 the District completed an environmental analysis for an integrated weed management plan that allows for multiple treatment methods (including manual, mechanical and chemical) to eradicate, contain

or control existing and new weed infestations (USDA Forest Service 2013b). In 2015, District employees began controlling invasive plants along roads and rock quarries that would be used for constructing new roads in the project area.

Existing Condition

Information pertaining to invasive plants within the Wrangell Island project area is based on surveys conducted in 2006 and 2010, as well as existing information contained in the Natural Resource Information System (NRIS) database Invasive Species (NRIS-TESP/IS), a national database maintained by the Forest Service.

In 2006, the road system on Wrangell Island was surveyed, sampling points every ¼ mile. In 2010, contractors conducted invasive plant surveys in rock quarries, Class I stream crossings, and road segments identified by the Forest Service within the analysis area. Additionally, invasive plants identified in natural areas away from roads and rock quarries during the 2010 season were reported.

A total of 58 non-native species were documented on Wrangell Island in 2006 (Arhangelsky 2006). Of these, 5 are considered high priority species for the Wrangell Ranger District: reed canarygrass (*Phalaris arundinacea*), orange hawkweed (*Hieracium aurantiacum*), oxeye daisy (*Leucanthemum vulgare*), meadow hawkweed (*Hieracium caespitosum*) and common hawkweed (*Hieracium lachenalii*). Table 80 summarizes the invasive plants on National Forest System (NFS) lands, their invasive ranking and general locations in the project area.

Table 80. Invasive species known to occur on NFS lands in the Wrangell Island project area

Scientific name	Common name	Rank 0 (low) to 100 (high)[1]	General locations
Phalaris arundinacea	reed canary grass	83	Widespread along roadsides; some riparian and beach meadows
Hieracium aurantiacum	orange hawkweed	45-79	Common in the City of Wrangell; scattered, small population on NFS land
Leucanthemum vulgare	oxeye daisy	61	Scattered, small populations along 6259 road
Hieracium caespitosum	meadow hawkweed	79	Scattered, small populations along 6265 road
Hieracium lachenalii	common hawkweed	57	Common in City of Wrangell; scattered, small populations on NFS land
Lotus pedunculus	bird's-foot trefoil	65[2]	Along 6265 road near Earl West; limited to areas where planted for erosion control
Trifolium repens	white clover	59	Widespread along roadsides
Taraxacum officinale	common dandelion	58	Along 6267 road, scattered with low population
Holcus lanatus	common velvetgrass	56	Roads near town, small populations on NFS land
Ranunculus repens	creeping buttercup	54	Roads near town; lower Salamander recreation site; scattered along roadsides
Dactylis glomerata	tall fescue	53	Scattered, small population
Trifolium pratense	red clover	53	Widespread along roadsides
Hypochaeris radicata	hairy catsear	44	Along roads 50055, 50022 and 6260
Plantago major	common plantain	44	High use recreation sites

1 Ranking designated by the Alaska Natural Heritage Program

2 Ranking for *Lotus corniculatus*

During 2010 surveys, 46 infestations of high priority invasive plant infestations were documented on NFS lands on Wrangell Island. Forty-five of these infestations were reed canarygrass (*Phalaris arundinaceae*) found along road sides, stream crossings, and rock quarries. This species was also identified in 2006 over much of the island. One infestation of oxeye daisy (*Leucanthemum vulgare*) was located in a rock quarry close to the city of Wrangell. No invasive plant populations were identified near known rare or sensitive plant populations. Other species commonly found during the 2006 and 2010 surveys include orange hawkweed (*Hieracium aurantiacum*), meadow hawkweed (*H. caespitosum*), and narrowleaf hawkweed (*H. umbellatum*), most of which occurred along existing road corridors on non-NFS lands.

Several invasive plants are known to exist within the city limits of Wrangell but have not been documented elsewhere on Wrangell Island. These species include common tansy (*Tanacetum vulgare*), Japanese knotweed (*Polygonum cuspidatum*), Canada thistle (*C. arvense*), and yellow sweetclover (*Melilotus officinalis*). These species could be transported onto NFS lands by humans or vehicles travelling from within the City of Wrangell to NFS lands and could have direct or indirect impacts on native habitats.

Other invasive plant species documented within the analysis area in 2006 and 2010, but not considered high priority invasive plants for the Wrangell District include wall hawkweed (*Hieracium murorum*), white clover (*Trifolium repens*), tall fescue (*Schedonorus phoenix*), hairy catsear (*Hypochaeris radicata*), orchardgrass (*Dactylis glomerata*), red clover (*Trifolium pratense*), annual bluegrass (*Poa annua*), bird's-foot trefoil (*Lotus corniculatus*), common dandelion, and common velvetgrass (*Holcus lanatus*).

Past Treatment Activities

Invasive plant treatments have focused on small populations having a high invasive rank. In 2015 road corridors with low infestations and rock quarries that would be used for source rock for this project were targeted for treatment. Approximately 18 miles of road (50050, 50060, 50054 and 6271) and 5 rock quarries were spot-treated using herbicide. Target species included a newly found Bohemian knotweed infestation, reed canary grass, oxeye daisy, velvet grass, orange hawkweed, and yellow hawkweed.

Prior invasive plant management activities include eradication of Canada thistle (*Cirsium arvense)* at the Anita Bay overlook campsite, bull thistle (*Cirsium vulgare)* on the 6272 road, dandelion at the Earl West recreation site, and orange hawkweed at the Thoms creek recreation site.

Environmental Consequences

All of the alternatives would result in an increased risk for introduction and spread of invasive plants on NFS lands due to disturbance, habitat alteration and increased vectors associated with road use. Primary long-term habitat alterations expected as a result of this project include soil disturbance from road reconditioning, construction, and maintenance over time, and removal of native vegetation.

Road construction and road maintenance would result in increased disturbance on the current road system, as well as creating extensive disturbance where new roads are constructed and rock quarries are developed. Roadside areas are at a high risk of establishment of invasive plants due to constant ground disturbance and proximity to vectors. Areas immediately adjacent to the road have bare soil, a prime habitat for invasive plant species establishment; excavation of ditches can create additional bare mineral soil.

The other primary long-term habitat change in a timber sale area are disturbances associated with field camps, sort yards and marine access facilities built or repaired to support timber harvest operations. These types of sites already exist in the project area from previous timber sales and are not expected to expand substantially with the proposed timber sale. These areas are large, open, disturbed sites ideally suited for many invasive species.

The ground disturbance and open habitat created by timber harvest creates an opportunity for invasive plants to invade previously forested habitat, particularly with higher levels of soil disturbance caused by high lead and shovel logging systems. However, none of the known invasive plants currently in the project area have been found in managed stands, nor are they expected to thrive inside a unit once the forest regenerates. Harvested areas are considered to have an extremely low risk for establishment of invasive plants due to the rapid regrowth of understory vegetation and the development of a dense forest stand.

Secondary long-term alterations (indirect effects) in habitat, as a result of this project are changes in light availability and wind patterns on the ground. The additional light, wind speed (especially along roads), and increased water runoff along roads can all favor the spread of invasive plants.

Increased Vectors

The increased vectors that may occur as a result of this project are primarily associated with the miles of new roads constructed and increased traffic on existing roads, thus miles of road construction and open road miles are the primary unit of measure to analyze and compare the effects of each alternative. Other potential vectors include spreading rock from infested rock quarries, unclean equipment brought from other locations, and new stream crossings. Barges or ships used to transport logs may be a vector for aquatic plants, primarily through ballast water.

Seed sources used to revegetate road side clearings and rock quarries for erosion control would not be a vector if a certified weed-free seed is used. An increase in traffic of NFS and temporary roads as a result of this project would increase potential vectors. An increase in vectors may result from recreationists using the increased network of open roads and trails for a variety of purposes including hunting, fishing, camping, hiking, wildlife viewing, and subsistence activities if roads remain open. New roads may also result in increased vehicle and foot traffic in areas previously less accessible.

Direct and Indirect Effects of the Alternatives

This project proposes to construct up to 32.3 miles of new road and may create a number of new rock quarries. Potential existing rock quarries and possible locations of new rock quarries have not been identified, nor has rock sources for the project been finalized. Furthermore, modification to the existing Wrangell Ranger District Access and Travel Management Plan (ATM) is a component in Alternatives 2, 3 and 4; the modification would result in more roads maintained for motorized access which increases the risk of introduction and spread of invasive plants. Collectively, the proposed activities would result in moderate to high alterations to the current conditions.

The overall risk of invasive plant establishment is low or moderate depending on the level of activity proposed for each alternative (Table 81). While project design features would limit the potential for additional infestation, new roads would offer increased access to recreational users, who may transport seed or plant material into the area. All roads constructed for this project that are left open after harvest activities, provide a conduit for the introduction and spread of invasive plants.

Table 81. A summary of the level of risk of invasive plant spread by alternative based on proposed road construction, road reconditioning and miles of open road after project implementation

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Total proposed road construction	0.0	32.1	29.8	32.3	21.6
Road reconditioning (maintenance of closed roads)	0.0	5.8	5.8	5.4	4.1
Miles of open road (including motorized trails) after project is complete	73.0	100.7	99.2	99.9	72.8
Risk of spread	Low	Moderate	Moderate	Moderate	Low

Cumulative Effects

Cumulative are those that occur when the effects of an action are added to, or interact with, the effects of past, present and or foreseeable actions. The summary of past, present and reasonably foreseeable management activities table (Table 4 in Chapter 1) was reviewed for activities that may cumulatively contribute to invasive plant introduction and spread of invasive plant species. The effects of these projects are largely dependent on the implementation and effectiveness of preventative practices and control efforts. Considering the combination of past, present and reasonably foreseeable projects with the Wrangell Island Project, Alternatives 1 and 5 would have a the lowest cumulative road miles and would cumulatively have the lowest risk of introduction or spread; Alternatives 2, 3, and 4 would have a higher risk due to the increased amount of road that would be kept open and drivable for the foreseeable future.

Design Features

The effects analysis is based on implementation of the following design features:

- Clean ground-based equipment (road building equipment, yarders, shovels, skidders, forwarders, harvesters, processors or feller bunchers, etc.) prior to mobilization to the project area to avoid the introduction of new invasive plants into the project area,
- Coordinate invasive plant control with the land owners of existing facilities such as marine access facilities, sort yards, or camp sites used for the project to reduce the spread of invasive plants into the project area.
- Require contractors to access rock material that is free of any high priority invasive species from existing quarries for construction of new roads. This will require an invasive species specialist to inventory all rock sources prior to use and certify in writing that it is acceptable. If any rock sources become contaminated with high priority species and certification cannot be attained without treatment methods, consider the use of contaminated rock for re-constructing existing roads with known infestations.
- Required erosion control materials, such as hay or straw bales, jute matting, or other synthetic sediment fence shall all be from certified weed-free materials.
- If possible, plan road maintenance activities (brushing and ditching) when invasive plants are at early flowering stage (such as early spring and summer) and prior to seed set to help eliminate spread of seeds.
- Maintain crushed rock stockpiles and active quarries in a condition free of invasive plants.

Monitoring Recommendations

The following monitoring action is recommended.

- Monitor newly constructed roads prior to closure for high priority invasive plants to determine the effectiveness of design features and implement control measures prior to road closure.

Recreation

Introduction

This section discusses the potential effects of the Wrangell Island Project on the recreation resource. More detailed information is available in the recreation resource report located in the project record.

The Issue 4: Access Management section also provides information on road access management which is an important component of recreation use.

Methods Used to Analyze Effects

The analysis of existing recreation settings is based on the Forest Service recreation opportunity spectrum (ROS) system. The ROS system maps landscapes based on the physical setting (from pristine to highly developed); and the recreation experience expectations of people using the area (from zero/low to very high social encounters with other users). Key ROS setting characteristics considered in the analysis

include remoteness, size of the area, evidence of humans and human activity, user density, and land management objectives. Potential effects to ROS settings are estimated based on the harvest method, harvest units, roads, and include a 0.5 mile zone of influence around each harvest unit and road. The analysis is conducted using GIS software.

Analysis Area

The analysis area for direct, indirect and cumulative effects on the recreation resource is Wrangell Island.

Units of Measure

Acres of change to the ROS system classification was used as an indicator to measure potential effects on of project activities on recreation and its settings.

In addition, a qualitative assessment was completed to look at the likely impacts from proposed timber harvest and road construction/reconditioning on:

- Recreation places and sites,
- Recreation uses, and
- Special use permits and outfitter/guide use.

Affected Environment

Recreation Places

Wrangell Island offers a variety of recreation opportunities and Forest Service recreation developments for the public. Although different people have different expectations of and reasons for using areas of the island, most of the recreation use involves recreation sites. The Recreation and Lands Resource Report provides more detailed information on recreation sites and use, and can be found in the project record.

Developments such as cabins, campsites and trails are included in inventoried recreation places, along with roads and the recreation opportunities provided by those roads. The majority of the recreation is dispersed across the island. Dispersed recreation areas that may or may not have highly developed facilities, but are regularly used for recreation activities by the public, are also included in the inventory.

For the purposes of this discussion, the analysis area is divided into six geographical areas, described below. The six areas are illustrated in Figure 28.

North Wrangell

Recreation use is high in the North Wrangell area because of its interface with the town of Wrangell. The combination of recreation facilities in this area are managed by a combination of federal, State, and local agencies. In this analysis, only those facilities on NFS lands are discussed. Inventoried recreation places in this area include the Rainbow Falls, Institute, and North Wrangell Trails (including trailheads on Zimovia Highway and out the Spur Road); the lower and upper Rainbow Falls viewing decks; and the Shoemaker Overlook, North Wrangell High Country, and Pond Shelters. Just south of the trail system is a large area of undeveloped and isolated land before the island is bisected by the Pats Valley. Some alternatives propose timber harvest and road construction within this area, which would provide additional access to dispersed recreational opportunities close to town.

Pats Lake, Old Hermit and Midpoint

Because this area is also close to town and is roaded, it is popular for many types of recreational activities. Inventoried recreation places in this area include the Pats Valley Road System, Midpoint Road System, Midpoint dispersed recreation area, and the Middle Ridge Public Recreation Cabin. Recreation activities include firewood gathering, hunting, fishing, berry picking and recreational driving. Pats Lake provides winter activities such as ice skating, snowmobiling, off-highway vehicle (OHV) use, and ice fishing. Timber roads have provided two dispersed recreation areas: the Hermit area, adjacent to the road system, and the Midpoint area. Midpoint is popular for winter recreation use because it is close to town

and provides easy access to good snow. The Middle Ridge Cabin is the only public recreation cabin on Wrangell Island. It is the Wrangell District's highest use cabin and is used year-round.

Nemo-Skip Loop Road

The Nemo-Skip Loop Road and its associated recreation facilities are popular with both residents and tourists. Inventoried recreation places in this area include the Nemo-Skip Road System; Nemo Information/Host site; Yunshookuh, Three Sisters, Anita Bay, and Highline Campsites; the Saltwater Trail and Turn Island Beach Campsite; and the Thom's Lake trailhead. The area is popular for recreational driving and provides outstanding views overlooking Zimovia Strait. There are a variety of recreational opportunities including tent and RV camping, picnicking, a boardwalk trail to the beach campsite to the beach campsite at Turn Island, and the three site Yunshookuh campground with a fully accessible campsite.

Salamander, Earl West and Highbush Lake

This area provides for dispersed recreation opportunities along the road, along with several developed sites that are especially popular with local residents. Campsites along Salamander Creek provide for single family use at Upper Salamander or group use at Lower Salamander. Both have swimming opportunities that make them ideal for families with small children. The Salamander Ridge Trail provides high country access to outstanding views of the Back Channel and Salamander drainage. Highbush Lake provides dispersed recreation opportunities including a skiff for public use. The Earl West Marsh is popular for dispersed recreation activities, and the marine access facility at Earl West provides a boat ramp for saltwater access to Berg Bay, Anan Wildlife Observatory, and other popular areas to the south and east of Wrangell Island. Inventoried recreation places in this area include: Upper and Lower Salamander Campsites, Salamander Ridge Trail, Highbush Lake Recreation Area, Earl West Recreation Site, Earl West Marsh and the NFS roads in this area.

Long Lake

Inventoried recreation places in this area include the Long Lake Roadside Recreation Area and Long Lake Trailhead, the boardwalk around the pond area near the site, and the Long Lake Trail and the Long Lake Shelter.

The Long Lake roadside facilities provide accessible opportunities for day use with a picnic table, fire ring, and outhouse, and a trailhead for the three-fifths mile boardwalk Long Lake Trail. Nearby, there are remnants of an old boardwalk trail with paths around a pond area providing exploration opportunities. There is a three-sided shelter with a table, fire ring and outhouse at Long Lake. A skiff is provided for public use.

On the Long Lake Trail, visitors enter a more remote and undeveloped setting with the boardwalk and recreation facilities being the only obvious human developments. Once on the lake, visitors can expect solitude from others and a setting with undisturbed natural scenery.

Fools Inlet and Thoms Creek

Recreation use in this area is dispersed with most activities being associated with recreational driving. Thom's Lake and Creek provides for fishing opportunities, with the Thom's Lake trail providing access to the lake, and the Thom's Creek Crossing Campsite on Road 6299 providing good access to the creek for stream fishing. The Fool's Inlet estuary is popular for waterfowl hunting, with hunters accessing the area from both the saltwater and overland from the road system as there are no trails in this area.

The only developed inventoried recreation place in this area is the Thoms Creek Crossing Recreation Site, but other inventoried, but undeveloped recreation places, include the road system, Thoms Lake, Little Thoms Lake and saltwater use areas at Blake Island Bay, Southeast Cove and Fools Inlet.

Thoms Lake Trailhead is located on the Nemo-Skip Loop Road area, but the trail and lake are within the Fools Inlet and Thoms Creek area. The Thoms Lake Trail is gravel-surfaced. It crosses State land near the

lake. There is a public recreation cabin on State land at the lake. Little Thoms Lake is a popular dispersed recreation site and is usually accessed by foot from Road 6599.

Recreation Setting

The existing recreation settings of NFS lands on Wrangell Island are a result of past timber harvest and road construction in recent decades. The roads are the primary contributor for recreation access and existing recreation opportunities on Wrangell Island. Historically, following the completion of harvest activities, new recreation opportunities were identified and recreation facilities were developed to provide the desired experiences.

The recreation setting was analyzed using GIS mapping tools and the ROS inventory system. Table 82 displays the existing ROS for Wrangell Island, and Figure 29 displays the existing ROS categories within the analysis area.

Table 82. ROS classes on Wrangell Island, listed from least to most developed, and the acres of each

ROS class	Acres
Semi-Primitive, Non-Motorized	40,987
Semi-Primitive, Motorized	28,113
Roaded Natural	2,858
Roaded Modified	59,681
Rural	1,433
Urban	1,234
Total acres	**134,306**

Figure 28. Wrangell Island is divided into 6 recreation areasBackside of Figure 28 (Recreation Areas)

Environmental Consequences

Summary of Effects

The effects of the alternatives are displayed on how the proposal would change recreation opportunities overall. Many factors are taken into consideration including the long-term effects of harvest on scenery as seen from recreation use areas, disturbance associated with harvest activities near popular recreation sites, and long-term changes to recreation opportunities for an area.

Recreation Setting

The recreation settings in the analysis area are determined by a variety of factors including the natural setting of the area where people go to recreate, the ease of access to facilities, and the level of recreation development provided. As describe earlier, one method the Forest Service uses to describe and map recreation settings is the Recreation Opportunity Spectrum. This method divides landscapes into classes, factoring in proximity to roads and development, access, level of development, and level of expected social interactions. These ROS classes are then mapped.

Timber harvest and road construction can have an effect on ROS class. The effects of each alternative are measured by the change in acres of the undeveloped Semi-Primitive Non-motorized and Semi-Primitive Motorized ROS to a Roaded Modified ROS class. While timber harvest changes ROS class in absolute terms, the use of partial harvest by helicopter yarding, which leaves at least two-thirds of the stand and which requires no road construction, would have less effect on ROS than a clearcut harvest using cable or ground-based yarding. Therefore, in this analysis the amount of proposed roaded clearcut harvest in each alternatives is also displayed.

Figure 29 displays the ROS Inventory Mapping for Alternative 1, showing the existing ROS inventory. To illustrate the highest degree of impact proposed, Figure 30 displays all harvest units proposed in Alternative 2 and included in the Roaded Modified ROS class.

Table 83 displays the number of acres changed from Semi-Primitive Non-motorized and Semi-Primitive Motorized ROS to Roaded Modified for each alternative, based on both scenarios. These changes in ROS class can be viewed as positive or negative depending on an individual's expectation for a recreation experience.

Table 83. Amount of change in ROS class

	Acres changed to Roaded Modified All harvest methods	Acres changed to Roaded Modified Clearcut harvest
Alt 1	0	0
Alt 2	9,926	4,632
Alt 3	5,138	3,402
Alt 4	6,367	4,711
Alt 5	7,463	3,114

Recreation Places

The design of each action alternative would cause different effects on the recreation places. Following is a description of the impacts from each alternative to recreation places in each of six recreation areas.

North Wrangell

None of the inventoried recreation facilities north of Pats Valley would be affected by any alternative since there is no harvest proposed within the sight or sound of these facilities. Alternatives 2, 4, and 5 all propose harvest in a parcel of previously undeveloped area north of Pats Valley and south of the trail systems. Implementing any of these alternatives would result in development of a new dispersed recreation area due to the public motorized access these alternatives would provide. This new access

would likely be used for hiking/exploring and as easier access to hunting areas that were previously more difficult to get into. Refer to the Access Management Maps (Figure 8, Figure 9, Figure 10, Figure 11 and Figure 12) and the Issue 4: Access Management section of this EIS for more information on public access.

Alternatives 1 and 3 propose no timber harvest or road construction in this area, which would result in no change from the existing recreation condition. Alternatives 2 and 5 propose the same road systems and harvest units in the North Wrangell Area. In Alternative 2, the new NFS road 6251 into the Mill Basin road would be open to public motorized use, while it would be closed to public motorized use in Alternative 5. However, Alternative 5 would still provide easier pedestrian access to this area. Alternative 4 proposes significantly less timber harvest in this area; however, it also constructs this road which would be open to public access.

Pats Lake, Old Hermit and Midpoint

The harvest strategies proposed in this area are similar among the action alternatives. All propose a new road (Road 50062/50058) which would provide easier access to the Middle Ridge Cabin. However, the access management for this road would have the greatest effect on recreation opportunities. Alternatives 2, 3 and 4 leave the road open to public motorized access and create a loop route for recreational travel. Alternative 5 would close the road to public access. Alternatives 2, 3 and 4 also convert other newly constructed roads to OHV trails.

All action alternatives propose harvest activities that would result in log haul past the Middle Ridge Cabin which would have a negative effect on cabin users during logging operations. The level of effect is directly related to the amount of timber transported on this road in each alternative. Of the action alternatives, Alternative 5 would cause the least amount of disturbance.

Nemo-Skip Loop Road

The campsites on the Nemo-Skip Loop Road overlooking Zimovia Strait are popular recreation sites. Due to this setting, most users of this area fully expect their experience to include obvious signs of development associated with timber harvest.

All action alternatives propose similar harvest levels in the area surrounding the Nemo campsites with a few minor differences in unit boundaries and yarding methods. All alternatives would meet scenery integrity objectives around these recreation sites. The partial harvest with at least two-thirds of the stand remaining should not be noticeable to recreation users. There would be noticeable long-term scenic impacts from the clearcut units proposed in Alternative 2, 3, and 4. Alternative 5 proposes only partial harvest in this area.

Salamander, Earl West and Highbush Lake

In the action alternatives, harvest is proposed in three areas: near the Salamander Ridge Trail, near Earl West Marsh, and near Highbush Lake.

Alternatives 2 and 4 would have greater effects than Alternative 3 due to harvest proposed in the Salamander Ridge area. Alternative 2 would have slightly more effect than Alternative 4 because it proposes a harvest unit near the Earl West Marsh area that is not included in Alternative 4. Alternative 5 would have the least effect because it proposes partial harvest with no road building.

Figure 29. Existing recreation opportunity spectrum inventory on Wrangell Island - least impact (Alternative 1)

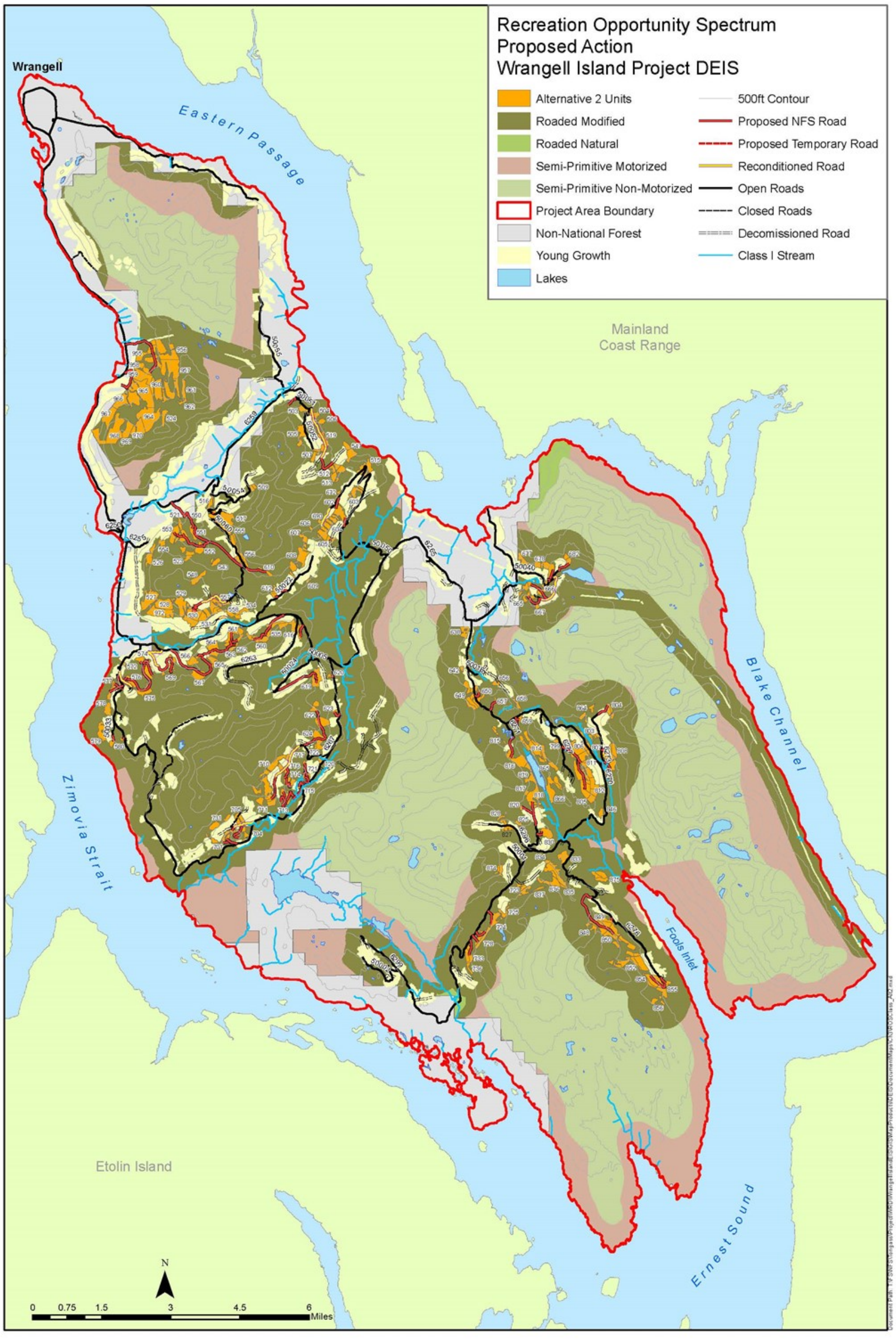

Figure 30. Recreation opportunity spectrum inventory for the Proposed Action (Alternative 2) – highest impact (maximum harvest)

Long Lake

Although the area is initially accessed by the road system traversing a heavily harvested area, once visitors start down the Long Lake Trail, there are no visible impacts from resource development. All of the action alternatives propose some level of harvest in this area, which would be noticeable to regular users of the Long Lake area. Alternatives 3 and 5 propose the least harvest in the area around Long Lake. Any harvest proposed in these alternatives would be viewed at a distance. The sights and sounds of harvest would be easily observable from the lake, but with low harvest levels proposed, the disturbance would be short-term. Under Alternatives 3 or 5, people might be able to see impacts from light harvest in Unit 866 to the south, although the harvest would not dominate the landscape.

Alternatives 2 and 4 propose partial harvest in the area surrounding Long Lake. Scenery objectives would be met but the overall character of the setting would change to one that had been altered by human activity and change the character of area. Harvest activities would require temporary closure of the site for safety, impacting public access. Alternatives 3 and 5 propose some changes in this area, but the activities proposed would not result in long-term significant changes to the Long Lake Area.

Fools Inlet and Thoms Creek

All of the action alternatives propose harvest to the west of Fools Inlet, with Alternative 2, 3, and 4 proposing harvest along the road system between Fools Inlet and Thoms Creek Crossing. Alternatives 2, 3, and 4 propose road construction, clearcut and partial harvest units. Alternative 5 proposes a relatively minor amount of helicopter harvest in the area.

Because this area has been modified by previous timber harvest and road building, and recreation use is lower than elsewhere on the island, timber harvest in this area is expected to have negligible effects on recreation.

The main difference in recreation effects is the public access management proposed between the alternatives. Alternatives 1 and 5 propose to close public motorized access in the Thoms Lake area. Alternatives 2, 3, and 4 would continue to allow public motorized access.

Summary of Effects

Direct effects considered when ranking the alternatives include long-term changes to scenic conditions, length of disturbance due to logging activities, transportation strategies for public motorized use once harvest activities are complete and long-term changes in recreation opportunities. Additional information is in the Recreation Resource Report.

Table 84 provides a summary of the relative ratings and ranking of each alternative's effects to the recreation sites and use areas on Wrangell Island. The alternatives are rated (1 through 4) based on the direct effects expected at each site and then added to determine the relative rating for each area. The higher the number, the greater the effect to recreation.

Alternative 1 is considered the "baseline" and is assigned a "0". If an alternative would result in no impact to a recreation site, that alternative is assigned a "0" as well. In cases when the same harvest strategy is proposed in more than one alternative; the alternatives are assigned the same rating number. It is important to note these rankings are relative. For example, a "2" does not mean that the alternative has twice as much impact as an alternative with a "1"; it means the alternative has "more" impacts than the alternative with a "1".

Table 84. Rating of the effects from each alternative to the recreation sites and use areas on Wrangell Island (does not include roads)

Area	Recreation Site or Use Area	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1 North of Pats Valley	North Wrangell Trail System	0	0	0	0	0
	Pond Shelter	0	0	0	0	0
	North Country Shelter	0	0	0	0	0
	Shoemaker Shelter	0	0	0	0	0
	Area 1 Summary Ranking	**0**	**0**	**0**	**0**	**0**
2 Pats Valley / Hermit / Midpoint	Middle Ridge Dispersed Recreation	0	2	2	2	1
	Middle Ridge Cabin	0	2	2	2	1
	Old Hermit Dispersed Recreation	0	2	3	2	1
	Area 2 Summary Ranking	**0**	**6**	**7**	**6**	**3**
3 Nemo-Skip Loop Road	Nemo Point Host Site	0	1	1	1	1
	Yunshookuh Loop Site	0	1	1	1	1
	Three Sisters Viewpoint Rec Site	0	2	2	2	1
	Anita Bay Overlook Rec Site	0	2	2	2	1
	Highline Rec Site	0	0	0	0	0
	Turn Island Saltwater Trail	0	0	0	0	0
	Turn Island Rec Site	0	0	0	0	0
	Thom's Lake Trailhead	0	0	0	0	0
	Area 3 Summary Ranking	**0**	**6**	**6**	**6**	**4**
4 Salamander / Earl West / Highbush Lake	Upper Salamander Rec Site	0	0	0	0	0
	Lower Salamander Rec Site	0	0	0	0	0
	Salamander Ridge Dispersed Recreation	0	3	2	3	1
	Salamander Ridge Trail	0	1	1	1	1
	Earl West Marsh Dispersed Recreation	0	2	1	1	1
	Earl West Rec Site	0	0	0	0	0
	Highbush Lake Rec Site	0	2	2	2	1
	Area 4 Summary Ranking	**0**	**8**	**6**	**7**	**4**
5 Long Lake	Long Lake Roadside Rec Site	0	2	1	2	1
	Long Lake Trail	0	2	1	2	1
	Long Lake Shelter	0	2	1	2	1
	Area 5 Summary Ranking	**0**	**6**	**3**	**6**	**3**
6 Fools Inlet / Thoms Lake and Creek	Fools Inlet Dispersed Recreation	0	2	2	2	1
	Thom's Creek Crossing Rec Site	0	0	0	0	0
	Little Thom's Lake Dispersed Recreation	0	0	0	0	0
	Thom's Creek Dispersed Recreation	0	0	0	0	0
	Thom's Lake Dispersed Recreation	0	0	0	0	0
	Area 6 Summary Ranking	**0**	**2**	**2**	**2**	**1**
Total		0	28	24	27	19

It is important to note these rankings are relative, not additive. For example, a "2" does not mean that the alternative has twice as much impact as an alternative with a "1"; it means the alternative has "more" impacts than the alternative with a "1". That difference could be very small (like a minor difference in harvest strategy) or quite large (like a 50-acre clearcut instead of no harvest).

Direct and Indirect Effects

For the action alternatives, all timber harvest and road building activities would be located outside any existing 2001 Inventoried Roadless Areas (IRAs). These IRAs would continue to provide opportunities for solitude and remote primitive and wild recreation opportunities for those who seek them. Road construction and timber harvest would change the ROS classes and reduce the amount of area in Semi-Primitive, Non-Motorized, and Semi-Primitive, Motorized while increasing the amount of area in Roaded Modified. The amount of area in Roaded Natural, Rural, and Urban would remain the unchanged. Alternative 2 would cause the most change to existing ROS as 9,926 acres would be converted to Roaded Modified, followed by Alternative 5 at 7,463 acres, Alternative 4 at 6,367, and Alternative 3 at 5,138. These changes represent a less than 5 percent change from the existing condition.

Alternatives 2, 3 and 4 have similar overall impacts to the recreation resource on Wrangell Island. The alternatives do vary in their effects to key recreation areas on the island. Alternatives 2, 4 and 5 would build a road into the Mill Basin which would provide access to an area of the National Forest that does not currently have access. This road would be open to the public for motorized access in Alternatives 2 and 4. Alternative 5 closes the road, but it could continue to provide non-motorized access. Alternatives 2 and 4 propose helicopter harvest near Long Lake that would change the recreation setting, whereas Alternatives 3 and 5 do not propose harvest near the lake.

The action alternatives would have effects on other recreation sites and use areas (See Table 84). Overall, Alternative 2 would implement the most effect, followed in descending order, by Alternatives 4, 3, and 5.

The access management proposed by each alternative would have an effect on recreation by providing motorized public access on some roads. Alternative 2 would provide the most open roads at 86.7 miles, followed closely by Alternative 4 at 86.3 miles, and Alternative 3 at 85.4 miles. Alternatives 1 and 5 would provide the fewest miles of open road with 73.0 and 72.8 miles, respectively. Alternative 2 also provides the most roads designated as OHV trails with 14 miles, followed by Alternative 3 with 13.8 miles, and Alternative 4 with 13.6 miles. Alternative 5 does not propose any OHV trails.

Overall, the direct and indirect effects of the timber harvest, road construction, and access management proposed under each alternative would have a short-term effect on recreation.

Cumulative Effects

The past, present and reasonably foreseeable effects from other activities on Wrangell Island are not expected to have an effect to recreation occurring in the analysis area.

Silviculture

Introduction

This section discusses the rationale used in selecting silvicultural prescriptions for harvest units analyzed in the proposed Wrangell Island Project. The project proposes timber harvest resulting in a change of vegetation in portions of the project area. Proposed harvest units can be described as productive old-growth (POG) stands where tree growth is generally offset by decay resulting in decadent stands of timber. Vegetation modification may include changes to forest structure, species composition, and stand health and stability. Changes in vegetation are determined by a prescribed silvicultural system that meets project goals and objectives while staying within Forest Plan Standards and Guidelines.

Units of Measure

The following units of measure were used to measure potential effects of the project alternatives on vegetation from silvicultural treatments.

- Changes to stand productivity and forest health
- Changes to regeneration potential
- Changes to species composition
- Changes to stand stability from windthrow hazard

Resource Analysis Area

The analysis area for direct and indirect effects is National Forest land on Wrangell Island. The analysis area consists of value comparison units (VCUs) 4750, 4760, 4770, 4780, 4790, 4800, 5040 and 5050.

Inventory and Analysis Methods

Initial project area information was obtained from the Tongass National Forest GIS library, aerial photos, and the Forest Service Activity Tracking System database (FACTS). About half of the inventory data of the project area was collected during the 2010 field season using the Common Stand Exam (CSE) protocol with the intensity of one plot per 10 acres. Existing stand exam data for the other half of the unit pool acreage was available and some walk-through exams were also conducted to supplement the project inventory. The data was then summarized using the Natural Resource Information System: Field Sampled Vegetation program (FSVeg). This information is available in the project record.

The information gathered by this inventory was used to diagnose existing stand condition, which included stand characteristics, volume and species composition, stand structure, regeneration, windthrow potential and disease and decay severity. Logging system feasibility for each stand was also assessed.

Silvicultural Systems

Two silvicultural systems (even-aged and uneven-aged) are prescribed for the proposed harvest to best achieve management objectives. Management objectives identified by the interdisciplinary team (IDT) include:

- Retention of old-growth structure for wildlife
- Favorable timber sale economics
- Protection of soils, watershed, wildlife habitat, and scenery characteristics
- Maximizing wood-fiber production
- Achieving the Forest Plan LUD desired condition while adhering to Forest Plan Standards and Guidelines

Silviculture treatments are proposed to meet management objectives. The following criteria were used to develop appropriate treatments:

- Forest Plan LUD desired condition and standards and guidelines
- Operational feasibility (logging system)
- Timber appraisal estimates
- Stand conditions (disease and decay)
- Windthrow hazard rating

Complete silvicultural prescriptions will be written for stands selected for harvest in the Record of Decision.

Affected Environment

Species composition

The project area consists of a mosaic of coniferous forests in managed and unmanaged conditions, interspersed with muskeg, scrubland, and alpine plant communities. A mixture of forest types and plant communities exists across the area as a function of drainage, aspect, and elevation. Soils are predominantly well-drained and support productive western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*) forests. Soils that are not well-drained are less productive for tree growth and support mixed-conifer forests. Mixed-conifer forests have a higher cedar component: Alaska yellow-cedar (*Callitropsis nootkatensis*) and western redcedar (*Thuja plicata*). Higher percentages of Sitka spruce are

found along streams and other well-drained sites. The understory shrubs are primarily blueberry (*Vaccinium* spp.), red huckleberry (*Vaccinium parvifolium*), and rusty menziesia (*Menziesia ferruginea*). Many species of vascular plants, lichens, and mosses occur throughout all habitat types. Forested muskeg with a high percentage of Alaska yellow-cedar occurs throughout the project area, especially in the lower elevations. Muskeg areas also support shore pine (*Pinus contorta*) and mountain hemlock (*Tsuga mertensiana*). Mountain hemlock is also more prevalent at higher elevations. Red alder (*Alnus rubra*) is found on disturbed sites such as roadsides, certain harvested stands, and along stream banks.

Vegetation series are the hierarchy in a classification system that classifies the vegetation by dominant overstory species. All seven vegetation series contained within the Preliminary Forest Plant Associations developed by Pawuk and Kissinger (USDA Forest Service 1989) exist in the project area. The seven series include the western hemlock series, western hemlock-Alaska yellow-cedar series, Sitka spruce series, mixed-conifer series, mountain hemlock series, shore pine series and the western hemlock-western redcedar series. Western hemlock with a *vaccinium* understory is the most prevalent forest plant association in the project area.

Most of the proposed harvest areas are a mosaic of two or more vegetation series. The project area contains all seven forested conifer series commonly found throughout Southeast Alaska. These conifer species are grouped by the dominant overstory species and are as follows: Sitka spruce; western hemlock; mountain hemlock; western hemlock-Alaska yellow-cedar; western hemlock-western redcedar; mixed-conifer; and shore pine series. Western hemlock, western hemlock-Alaska yellow-cedar, western hemlock-western redcedar, and mixed-conifer are the major series. The Sitka spruce series, mountain hemlock series, and shore pine series are also represented, but on a smaller scale.

On the Tongass, Alaska yellow-cedar and western redcedar are found in mixed-conifer stands, usually as a component of the more shade tolerant western hemlock type. These cedars are typically found in the lower volume class strata as they are out-competed by western hemlock on higher productivity sites.

Plant associations are a type of vegetation classification system based on the climax plant community. Stands within a specified plant association are comprised of vegetation with similar species composition and abundance. Plant associations can be used to predict site response to changes caused by management practices.

The project area tree species composition includes: western hemlock (56 percent), Sitka spruce (11 percent), Alaska yellow-cedar (17 percent), mountain hemlock (8 percent), western redcedar (8 percent), shore pine and red alder (each less than 1 percent). These percentages are based on percent of live tree basal area (BA) for all diameters, generated from stand exam data stored in the National Field Sampled Vegetation Database (FSVeg) for the project unit pool.

Stand Structure

Forest stand structure is defined as the horizontal and vertical distribution of components including the height, diameter, crown layers, and stems of trees, shrubs, herbaceous understory, snags, and down woody debris (Helms 1998). All proposed harvest units in the project area have an old-growth stand structure**.** Old-growth structure varies depending on habitat type but generally contains large trees over 150 years in age, multi-layered canopies, and moderate shrub understory. Coarse, woody debris typically is abundant on the forest floor as large, decaying logs. Some whole trees may lay horizontally – uprooted by windthrow.

Forest Health and Natural Disturbance

Various natural phenomena affect the life cycle of forest trees, which experience damage, decay, and eventual mortality. Table 85 shows the occurrence and relative severity of current damage, and potential damage in the case of windthrow hazard, for each of the major damaging agents in the old-growth unit pool. A complete list of stand conditions by unit is included in Appendix A of the silviculture resource

report. All units in the unit pool received at least a moderate rating for one of the four damaging agents shown in Table 85.

Table 85. Existing condition in the Wrangell Island Project unit pool expressed as percent of unit pool by rating

Severity rating	Dwarf mistletoe	Decay fungi	Windthrow hazard rating	Yellow-cedar decline
High	13	27	18	12
Moderate	35	52	79	28
Low	52	21	3	60

Primary Source: Common Stand Exams

Dwarf Mistletoe

The occurrence of dwarf mistletoe in late successional western hemlock stands is widespread throughout Southeast Alaska, and was recorded in many of the proposed harvest areas in the project area. Dwarf mistletoe is apparently limited by climate (elevation and latitude), becoming uncommon or absent above 500 feet in elevation and 59º N latitude (Haines, AK) (USDA Forest Service 2016). It often produces cankerous swellings at the point of infection of limbs or main stems. It reduces the vigor and growth rate of infected trees and reduces the quality of timber. Heavily infected western hemlock trees have branch proliferations (called “witches’ brooms”), bole deformities, reduced height and radial growth, less desirable wood characteristics, and a greater likelihood of heart decay, top kill, and death. These symptoms are all potential problems in stands managed for wood production. Growth loss in heavily infested stands can reach 40 percent or more (Holsten et al. 2008, p. 140). The Wrangell Island Project proposes to partially harvest some stands with high mistletoe ratings to mitigate the effects of even-aged harvest on wildlife, scenery and watershed resources. Some wildlife species prefer mistletoe-infected trees for nesting.

The majority of unit pool acres rated low for the occurrence of dwarf mistletoe. Fifty-two percent of acres in the unit pool were issued a “low” severity rating, 35 percent were given a “moderate” severity rating, and 13 percent of acres in the unit pool were issued a “high” severity rating. A “low” rating was given when mistletoe was absent or only seen occasionally, and where present, was rated less than 3, according to the Hawksworth mistletoe rating system (Hawksworth 1977). Units that rated low for dwarf mistletoe typically had a heavy cedar component. A “moderate” rating was given to units when about half of the western hemlock trees observed in the unit had mistletoe infestation ratings of 3 or less. A “high” rating was given when most hemlock trees were infected with a rating higher than 3.

Decay Fungi

Approximately one-third of the old-growth timber board foot volume in Southeast Alaska is defective, largely due to decay from heart-rot fungi (USDA Forest Service 2013a). Heart and root-rotting fungi in trees can weaken the support structures, thereby leading to breakage. As the broken portion of the tree falls to the forest floor, it may wound adjacent trees and lead to eventual infection of the damaged trees. This is a continual process in old-growth forests in Southeast Alaska and contributes to diversity in stand structure.

Decay-causing fungi are present in all stands within the project area. Twenty-one percent of the unit pool acres rated low for the occurrence of decay fungi (a low rating was given if less than 30 percent of the trees sampled recorded stem decay), 52 percent of the unit pool acres rated moderate (30 to 50 percent of the trees sampled recorded stem decay), and 27 percent of the unit pool acres rated high (more than 50 percent of the trees sampled recorded stem decay).

Wind Disturbance

The major natural disturbance agent to timber stands in Southeast Alaska is wind, also referred to as windthrow. Wind influences stand structure and development, including beneficial effects, such as exposure of mineral soil and mixing of soil associated with uprooted trees, which favors the regeneration of Sitka spruce and cedar, and the creation of ecologically beneficial large woody material.

Wind disturbance occurs over a continuum dependent on topographic features (Nowacki and Kramer 1998, pp. 1-8). Old-growth structure stands develop through a process called gap dynamics, whereby small openings in the forest canopy, created by trees falling or dying, are colonized by shrubs, and eventually conifers. Some gaps are created by wind disturbance, in the form of uprooted trees and stem breakage. Over time, a multi-layered stand develops via gap dynamics. In areas where wind disturbance promotes gap dynamics, stands may reach a certain degree of stability with respect to wind.

In the Wrangell Island project area, evidence of high wind disturbance was generally found in areas with topographical exposure, aspect to prevailing SE wind direction, or adjacent managed stands. The amount of existing windthrow in a stand is an important indicator of windthrow hazard. Certain characteristics are indicators of windthrow hazard for individual trees, as well as for the stand as a whole. These characteristics and the stand's windthrow history were used to evaluate the windthrow hazard for each stand (Stathers et al. 1994, pp. 15 to 17). Eighteen percent of the unit pool acres rated high for windthrow. Units with a southeast exposure generally have a high windthrow risk. Seventy-nine percent of the unit pool acres rated moderate. Stands that rated moderate have factors that contribute to poor tree anchorage with low wind force, moderate resistance to overturning and moderate wind force, or good resistance to overturning and high wind force. Three percent of the unit pool acres are well-sheltered with little evidence of past wind damage. These units rated low for windthrow.

Alaska Yellow-cedar Decline

Yellow-cedar decline functions as a classic forest decline and has become a leading example of the impact of climate change on a forest ecosystem. The term forest decline refers to situations in which a complex of interacting abiotic and biotic factors leads to widespread tree death, usually over an extended period of time. It can be difficult to determine the mechanism of decline, and the causes of many forest declines throughout the world remain unresolved (USDA Forest Service 2016).

Yellow-cedar decline is linked to climate change. Yellow-cedar trees are killed by freezing injury to fine roots where there is insufficient snowpack to insulate them from lethal cold temperatures (less than 23°F). Since yellow-cedar is a long-lived tree, many affected yellow-cedar forests established under the colder, more favorable climate of the Little Ice Age (1400-1850). An abnormal rate of yellow-cedar mortality began around 1900, spiked in the 1970s and 1980s, and continues today. On wet sites, where yellow-cedar faces less competition from western hemlock and Sitka spruce and is more abundant, yellow-cedar trees with shallow fine roots are particularly vulnerable to freezing injury. Research into root and foliar cold tolerance has shown that yellow-cedar roots are more vulnerable to this type of injury than associated conifers. Impacted forests tend to have mixtures of old dead, recently dead, dying, and living trees, indicating the progressive nature of tree death. From the time crown symptoms appear, it often takes 10 to 15 years for trees to die, making it difficult to associate observations from aerial surveys to weather events in particular years. Yellow-cedar is extraordinarily decay resistant and tree often remain standing for 80 to 100 years after death (USDA Forest Service 2016).

Forest Health Protection and colleagues from the Forest Service Alaska Regional Office and National Forest System have developed a comprehensive conservation strategy for yellow-cedar in Southeast Alaska to account for yellow-cedar decline. In four sections and multiple appendices, this report focuses on what is known about: the ecology, cultural and commercial values, taxonomy, and silvics of the tree; the mechanism and risk factors of yellow-cedar decline; guidance and opportunities for the active management of yellow-cedar; the development of models to spatially display and estimate the distribution

of yellow-cedar and the risk factors for decline now and into the future; and the current and projected future status of yellow-cedar in 33 management zones in Alaska. The report is available for download at: http://www.fs.fed.us/pnw/pubs/pnw_gtr917.pdf (Hennon et al. 2016).

Yellow-cedar decline has affected over a half million cumulative acres in Southeast Alaska. The large acreage of standing dead yellow-cedar trees (snags), the high value of yellow-cedar wood, and its long-term retention of wood properties suggest promising opportunities for salvage. The Tongass National Forest has partnered with the Alaska Coastal Rainforest Center and the University of Alaska Southeast to conduct economic feasibility studies of yellow-cedar salvage. In some settings, salvage recovery of yellow-cedar snags may yield valuable wood products and economic, social and ecological benefits. Yellow-cedar snags could supply local mills with valuable timber and potentially offset harvests in healthy, old-growth yellow-cedar stands (USDA Forest Service 2016).

Forest Health Protection conducted aerial surveys and mapped 11,259 National Forest acres of yellow-cedar decline and 1,697 acres of State and Private acres of yellow-cedar decline on Wrangell Island. Aerial mapping and stand exam data indicate that 12 percent of the unit pool acreage rated high for yellow-cedar decline. Twenty-eight percent rated moderate and 60 percent rated low. Units were rated based on the percentage of the unit affected by yellow-cedar decline. Units with greater than 66 percent of the area affected were rated as high; units with 33 to 66 percent affected were rated as moderate, and units with some decline (but less than 33 percent) were rated as low.

Environmental Consequences

Desired Condition

The desired future condition for stands within the Wrangell Island project area is determined by the LUDs established by the Forest Plan, and to some degree by the proposed project's goals and objectives. The goals and objectives of the LUDs in the Wrangell Island project area are presented in Chapter 3 of this document (See Land Use Designations). Also, see Figure 2 in Chapter 1.

Silvicultural Systems

A silviculture system is planned series of treatments for tending, harvesting and regenerating a stand of trees. Silvicultural systems have been developed to increase the volume of commercially valuable timber in less time, maintain or improve wildlife and fish habitat, and either maintain or enhance scenery values. No single silvicultural system for a forest stand can be used to achieve all the desired combinations of amenities and products. Instead, a variety of treatments applied over an area results in a mosaic of stands for different uses. Management actions, through timber harvest and/or other treatments such as thinning or pruning, alter the existing stand condition.

The Forest Plan Standards and Guidelines and USDA Forest Service Manual 2400 (Timber Management) provide detailed information about the silvicultural systems recommended for the Tongass. Uneven-aged management results in a stand of younger trees interspersed with older trees that are distributed either in clumps, or more evenly across the stand in three or more age classes. Even-aged management results in the conversion of mature stands to faster growing stands of a single age. The post-harvest conditions of the forest stand for all systems are dependent upon the existing plant community, the site productivity, any retained canopy structure, and advanced regeneration. Post-harvest stocking surveys monitor the mix of species that regenerate. Species composition is monitored to ensure that the mix of species reflects that which would be expected at that site.

For stands using an even-aged system, the detailed prescription will be for the length of the rotation. Uneven-aged stands have no final rotation age, but rather have multiple entries designed to maintain different age classes. These prescriptions provide guidance for treatments following the proposed timber harvest for this project, and may include subsequent entries, thinning, and pruning.

Even-aged Systems

The objectives of this system include growing the stand to maximize wood-fiber production in the shortest timeframe and to provide favorable timber sale economics and logging feasibility. Natural regeneration in these stands is expected to be abundant, and would represent the original species composition with trees of a single age. The treatment schedule would include a pre-commercial thinning when inter-tree competition begins to slow tree growth and crowns shade-out understory plants. Pre-commercial thinning concentrates growth on fewer stems. Tree growth improves and after several decades on a productive site, crowns again begin to close in. At this time, trees typically have reached merchantable size. An intermediate treatment such as a crown thinning could be commercially viable. Growth on residual trees would improve and conditions for maintaining understory vegetation for wildlife would be enhanced. The stand would be scheduled for a rotational harvest at Culmination of Mean Annual Increment (CMAI) which would be between 80 and 120 years stand age, depending on site productivity.

Clearcutting

This harvest method removes all of the merchantable trees in a stand. The site becomes fully exposed for the development of a new age class.

Clearcutting with Reserves

This harvest method for this project involves retaining 15 percent of the stand's live basal area, either in single trees or small groups. Reserve trees would be left inside and away for unit boundaries. This method mimics the effects of natural windthrow events, and is generally used to meet scenery or wildlife needs in areas where timber production is the primary goal. There are visual priority routes (VPRs) in the project area and proposed harvest units adjacent to these VPRs. Some trees would be retained (reserves) to lessen the impact of clearcutting to the scenery resource. This prescription would be applied to two stands: Stand 4770-564 (40 acres) and Stand 4770-567 (28 acres). These stands are visible from the visual priority travel route (VPR) #6265.

Another instance where reserve trees might occur inside the boundary of an even-aged clearcut harvest area is where wind-firming is prescribed by specialists during unit layout. Maintaining a reasonable assurance of windfirmness (wind-firming or RAW), would typically be applied to unit edges or stream and visual buffers determined to be at risk for wind damage after harvest due to high exposure to southeast storm winds. Specific locations where wind-firming is applied would vary depending on the topography (exposure) and aspect of the buffer within the unit.

Justification for Clearcutting

Clearcutting is prescribed for all units where there are no other conflicting resource issues to preclude or minimize the occurrence of potentially adverse impacts from hemlock dwarf mistletoe, other insect and disease infestations, logging system damage, and windthrow. This system will also minimize windthrow potential in the residual stands. Finally, clearcutting maximizes the use of conventional yarding systems (cable and shovel), which maintains the potential for an economic timber sale being offered.

Intermediate Treatments

Following timber harvest using even-aged regeneration methods, the managed stand goes through distinctive developmental stages. Removal of the forest overstory alters the site conditions that influence density and species composition of the understory vegetation. Natural regeneration restocks the harvested areas with conifer seedlings. The National Forest Management Act (NFMA) mandates that areas must be reforested within five full growing seasons following harvest. The minimum required trees per Region 10 FSH 2409.17, is 300 trees per acre. This is monitored with regeneration stocking surveys and certification of successful reforestation. Different components dominate the stand at different stages, and the overall forest structure changes as the new stand develops. The level of change depends on the type of silvicultural treatment applied, as well as subsequent treatments applied during stand development.

Characteristics such as tree height, diameter, and overall stand productivity vary according to site productivity. However, young-growth stands typically show less variability in tree diameter and height than the old-growth stands they are replacing. Young-growth timber ranges in size from seedlings to saplings, to pole-timber and to the larger saw-timber.

Thinning

Thinning improves conditions for timber production. Pre-commercial thinning (PCT) removes excess trees from over-stocked stands. Thinning improves growing conditions for crop trees by reducing competition for resources, such as light, nutrients, water and space. The best growing, vigorous trees are selected as crop trees, along with species preference depending on specific stand objectives. Thinning can be used to promote species diversity, which benefits wildlife and increases the stand's resiliency to biotic and abiotic stressors. Alaska yellow-cedar is often the first preferred crop-tree species in thinning prescriptions. This helps promote the slower growing tree by removing faster growing trees that compete for the growing space, nutrients, water and light. By selecting species other than hemlock as the crop trees, the timber value of a stand may be increased and the biodiversity is increased. PCT can be used to achieve various residual stand densities depending on the overall resource objectives. PCT is a treatment which not only redistributes stand growth on selected stems, but also delays canopy closure (stem exclusion) and extends the time that forage is available for wildlife species. PCT is a common intermediate silvicultural treatment employed in young-growth stands on the Tongass.

Pruning

Pruning can benefit wildlife by improving growing conditions for understory vegetation. Pruning increases the amount of light reaching the forest floor, particularly side-lighting from the lower angle of sunlight found in northern latitudes. Pruning can increase the value of the first log in a tree by removing branches that create knots that lower log grade. Epicormic branching sometimes occurs on Sitka spruce stems following pruning. There appears to be genetic variation within the species in regards to epicormic branching on Sitka spruce following pruning. There may also be degrees of epicormic branching as it relates to amount of light reaching the stem. Hemlock and cedar species do not exhibit epicormic branching as spruce do. More study is needed to better understand the effects and benefits of pruning young growth on the Tongass. There are on-going studies, such as TWYGS, and other pruning treatments should be monitored over time, that will offer more information. To date, only an incidental amount of pruning has been implemented in the project area, primarily to improve line of sight conditions around road curves.

Uneven-aged Systems

This system regenerates and maintains a multi-aged stand structure by removing a portion of the trees across age classes. The objective of uneven-aged silvicultural systems is to maintain or create a stand with trees of three or more distinct age classes, either intimately mixed or in small groups. Uneven-aged systems usually involve more intensive management than even-aged systems. The retained structure provides wildlife habitat and maintains scenery quality. Under the uneven-aged silvicultural system proposed for this project, approximately 67 percent of the stand’s pre-treatment basal area would be retained. The next entry into these stands would be in 40 to 60 years, when additional basal area would again be removed from each stand in groups or as individual trees.

Single Tree Selection

This harvest method regenerates and maintains a multi-aged stand structure by removing single trees or small groups of trees across age classes, either in clumps or somewhat uniformly throughout the stand. The objective of single tree selection (STS) is to maintain visual quality and provide wildlife habitat, as well as maintaining a multi-storied stand structure, while still achieving economic harvest of timber. Harvest trees are selected to meet the above objectives. Healthy, young trees in the intermediate crown class would be a priority for retention to promote economic future entries. Older trees with low timber,

but high wildlife, value would also be a priority for retention. The canopy gaps and disturbance created by harvesting the remaining trees would promote new tree regeneration to facilitate future harvest entries, as well as promote the growth of understory plants important for wildlife.

Stands proposed for this treatment would remove approximately, but no more than 33 percent of the basal area. Uneven-aged management would allow for selective timber harvest in stands where road construction is infeasible, where scenery restrictions apply, or where elevational corridors of old-growth structure are desired. The objective of this system is to economically harvest a portion of the stand while retaining trees that would be economical to harvest in the next entry, while mitigating other resource concerns. Uneven-aged silvicultural systems usually involve more intensive management than even-aged systems. There is no final rotation age associated with this system, as periodic entries are designed to maintain multiple age and diameter classes. Actual stand-specific basal area removal amounts by species will be set in the stand prescription.

Table 86 shows the acres affected by alternative for this project and how these acres are proposed for treatment.

Table 86. Acres harvested by silvicultural system and harvest method for each alternative

Silvicultural System	Harvest Method	Logging System	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Even-aged Management	Clearcut	Cable/Shovel	0	1,713	1,633	1,725	868
		Helicopter	0	0	0	0	0
	Clearcut with reserves	Cable/Shovel	0	68	68	68	68
		Helicopter	0	0	0	0	0
		Even-aged Total	**0**	**1,781**	**1,701**	**1,793**	**936**
Uneven-aged Management	STS (up to 33% removal)	Shovel	0	119	43	134	114
		Helicopter	0	3,410	1,440	1,604	2,754
		Uneven-aged Total	**0**	**3,528**	**1,483**	**1,738**	**2,868**
		Total acres	**0**	**5,309**	**3,184**	**3,531**	**3,804**

Direct and Indirect Effects of the Alternatives

The effects on vegetation are the result of the silvicultural prescription. Even-aged prescriptions are designed to increase stand productivity, maximize regeneration potential, maintain or improve species composition, reduce wind hazard risk and maintain or improve forest health. Uneven-aged prescriptions are designed to maintain at least three age classes of trees, maintain or improve the wildlife habitat value, maintain or improve the aesthetic value, maintain or improve the conifer regeneration potential and understory vegetation and maintain or improve stand structure (multi-storied).

Alternative 1

Under this alternative, no timber harvest would occur for this project. There would be no direct effects to forest structure, forest health and productivity, regeneration and species composition, or risk of windthrow, which are discussed in detail in the Silviculture Resource Report.

There would be no indirect effects to forest structure, forest health and productivity, regeneration and species composition, or risk of windthrow.

Alternatives 2, 3, 4 and 5

The following section describes the direct and indirect effects to forest structure, forest health and productivity, regeneration and species composition, and windthrow risk.

Even-aged management removes all trees in a single harvest (clearcut), or nearly all the trees (clearcut with reserves). The direct effects include changing old-growth structure (multi-layered and multi-aged) to young-growth structure (single-layer and single-age). Forest health effects of even-aged management include reducing hemlock dwarf mistletoe, stem decay and wind hazard risk. Stands that have yellow-cedar decline offer salvage opportunities. Harvesting stands with even-aged systems at different time intervals across the landscape creates a mosaic of different structures (age classes) at the landscape, or watershed level. Even-aged systems favor less shade-tolerant species, like Sitka spruce and Alaska yellow-cedar and PCT can further promote species other than western hemlock. The even-aged system directly creates relatively homogenous, single-aged stands.

Forest health would be improved and diseases like hemlock dwarf mistletoe and stem decay would be greatly reduced. Salvage of yellow-cedar in decline would get a valuable wood source to market. Timber productivity could be increased with even-aged management. Slow growing stands of decadent, mature trees beyond CMAI would be replaced by healthy, fast growing, vigorous young trees in even-aged managed stands. Conventional logging systems used with even-aged systems can churn soils promoting Sitka spruce regeneration. Sitka spruce is considered a disturbance-driven species and favors soil mixing and mineral soils. The benefits associated with a mosaic of structures (age classes) across a watershed or landscape would be realized. Benefits include wildlife species diversity associated with plant species diversity.

Uneven-aged management regenerates and maintains a multi-aged stand structure by removing a portion of the trees across age classes. The objective of uneven-aged silvicultural systems is to maintain a stand with trees of three or more distinct age classes, either intimately mixed or in small groups. Uneven-aged systems usually involve more intensive management than even-aged systems. The remaining structure provides wildlife habitat and minimizes the effect on the scenery resource. Under the uneven-aged silvicultural system proposed for this project, approximately 67 percent of the stand's pre-treatment live basal area would be retained. The next entry into these stands would be planned for 40 to 60 years after the initial harvest, when additional basal area would again be removed from each stand in groups or as individual trees.

Single Tree Selection harvest method regenerates and maintains a multi-aged stand structure by removing single trees or small groups of trees across age classes, either in clumps or somewhat uniformly throughout the stand. The objective of STS is to maintain visual quality and provide wildlife habitat, as well as maintaining a multi-storied stand structure, while still achieving economic harvest of timber. Harvest trees are selected to meet the above objectives. Healthy, young trees in the intermediate crown class would be a priority for retention to promote economic future entries. Older trees with low timber value, but high wildlife value would also be a priority for retention. Canopy gaps and disturbance created by harvesting a portion of trees in the stand would promote new tree regeneration to facilitate future harvest entries, as well as promote the growth of understory plants important for wildlife.

Stands proposed for this treatment would remove up to 33 percent of the pre-treatment live basal area. Uneven-aged management would allow for selective timber harvest in stands where road construction is infeasible, where scenery restrictions apply, or where elevational corridors of old-growth structure are desired. The objective of this system is to economically harvest a portion of the stand while retaining trees that will be economical to harvest in the next entry, while mitigating other resource concerns. The silvicultural prescription would maximize the flexibility of helicopter yarding, while retaining a higher

percentage of trees that have higher value for wildlife, or small diameter trees that would be more economically valuable in the future.

Uneven-aged silvicultural systems usually involve more intensive management than even-aged systems. There is no final rotation age associated with this system, as periodic entries are designed to maintain multiple age and diameter classes.

Table 87. Acres harvested by silvicultural system and harvest method

Silvicultural System	Harvest Method	Logging System	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Even-aged Management	Clearcut	Cable/Shovel	0	1,713	1,633	1725	868
	Clearcut with Reserves	Cable/Shovel	0	68	68	68	68
		Even-aged Total	**0**	**1,781**	**1,701**	**1,793**	**936**
Uneven-aged Management	STS (up to 33% removal)	Shovel	0	119	43	134	114
		Helicopter	0	3,410	1,440	1,604	2,754
		Uneven-aged Total	**0**	**3,528**	**1,483**	**1,738**	**2,868**
		Total acres	**0**	**5,309**	**3,184**	**3,531**	**3,804**

Cumulative Effects

As with the direct and indirect effects above, the analysis area for cumulative effects is the Wrangell Island Project area. The timeframe considered for this project analysis effects on vegetation is 10 years. This timeframe is based on the size of this project and the timeframe of recent past timber sale projects. The Wrangell Island Project is a large project and the proposed action would likely be comprised of several large and small sale offerings. Timber sale activity is expected to span several years, and 15 years is a reasonable timeframe to analyze effects on vegetation for all stands included in the proposed action. The Forest Plan management objectives are expected to be achieved during the 10 to 15 year life of the plan to accomplish Plan goals (USDA Forest Service 2008). The Wrangell Island Project also expects to achieve management objectives in 15 years to accomplish project goals. It is recognized that the Forest Plan has a 100-year planning horizon.

Alternative 1 - No Action

There are no direct or indirect effects from timber harvest to forest structure, forest health and productivity, regeneration and species composition, or windthrow risk and therefore no cumulative effects. Stands in the project area would follow a natural course of forest succession. There would be no increase in the amount young-growth acreage suitable and available for future harvest in the project area under this alternative.

Common to all Action Alternatives

All action alternative provide a supply of timber using silvicultural systems utilizing treatment methods with sound prescriptions that are sustainable over time. The action alternatives would use a mixture of even-aged regeneration methods to convert old-growth structure to young growth and an uneven-aged regeneration method to harvest a portion of the trees while maintaining old-growth structure.

All action alternatives would contribute new young-growth acreage to the 6,800 acres of existing young-growth on NFS land in the project area with even-aged regeneration methods. Across action alternatives,

a range of 936 to 1,793 of the proposed treatment acres would be even-aged management. The action alternatives propose to harvest trees from 1,483 to 3,528 acres with an uneven-aged regeneration method. These acres would be in addition to the existing 434 acres that have been harvested using uneven-aged systems on NFS lands in the project area.

Forest health would be improved and diseases like hemlock dwarf mistletoe and stem decay would be greatly reduced. Salvage recovery of yellow-cedar in decline would get a valuable wood source to market. Stand productivity would be increased with even-aged management. Slow growing stands of decadent, mature trees beyond CMAI would be replaced by healthy, faster growing, vigorous young trees in even-aged managed stands. Larger openings (up to 2 acres for uneven-aged prescriptions) would improve conditions for regeneration, particularly for those species less shade tolerant, more than smaller openings would. Growing conditions for understory vegetation would also be improved by opening the overstory canopy to allow more light to the forest floor.

In the past, cumulative effects to forest vegetation have resulted from timber harvest and intermediate silvicultural treatments. The project area has approximately 6,800 NFS acres of young-growth originating from mostly even-aged harvesting. Timber harvest in the project area began in the early 1900s and was concentrated around the town of Wrangell and its sawmill. Early harvest was mostly single trees and small areas converted to some form of development. Larger areas on Wrangell Island were harvested beginning in the 1960s and timber harvest in the project area peaked in the 1980s and 1990s. Timber harvest on Wrangell Island has continued to the present at a decreased level.

All previously harvested areas, with the exception of stands harvested within the last 3 years, have successfully regenerated. Since 1979, approximately 4,000 NFS acres of young-growth stands in the project area have been pre-commercially thinned to improve tree growth and vigor.

Alternative 2

Alternative 2 converts 1,781 acres of old growth to young growth with even-aged prescriptions. This amounts to a 3 percent reduction in NFS POG acres on Wrangell Island – leaving 85 percent of the historical NFS POG intact. Alternative 2 would implement partial harvest with uneven-aged prescriptions on 3,528 acres. The total amount of treated acres in this alternative is 5,309 acres. The treatment acres for this alternative amounts to 10 percent of the existing NFS POG on Wrangell Island.

Alternative 3

Alternative 3 converts 1,701 acres of old growth to young growth with even-aged prescriptions. This amounts to a 3 percent reduction in NFS POG acres on Wrangell Island – leaving 85 percent of the historical NFS POG intact. Alternative 3 would implement partial harvest with uneven-aged prescriptions on 1,483 acres. The total amount of treated acres in this alternative is 3,184 acres. The treatment acres for this alternative amounts to 6 percent of the existing NFS POG on Wrangell Island.

Alternative 4

Alternative 4 converts 1,793 acres of old growth to young growth with even-aged prescriptions. This amounts to a 3 percent reduction in NFS POG acres on Wrangell Island – leaving 85 percent of the historical NFS POG intact. Alternative 3 would implement partial harvest with uneven-aged prescriptions on 1,738 acres. The total amount of treated acres in this alternative is 3,531 acres. The treatment acres for this alternative amounts to 7 percent of the existing NFS POG on Wrangell Island.

Alternative 5

Alternative 5 converts 936 acres of old growth to young growth with even-aged prescriptions. This amounts to a 1 percent reduction in NFS POG acres on Wrangell Island – leaving 87 percent of the historical NFS POG intact. Alternative 5 would implement partial harvest with uneven-aged prescriptions on 2,868 acres. The total amount of treated acres in this alternative is 3,804 acres. The treatment acres for this alternative amounts to 7 percent of the existing NFS POG on Wrangell Island.

Soils

Introduction

Soil resource concerns are related to soil productivity or the potential loss of soil productivity, and off-site effects from soil erosion or landslides. The productivity of soils directly or indirectly affects the productivity of other forest resources. Tree growth, wildlife and fish habitat quality, and recreations uses depend in part on the quality of soils (USDA Forest Service 2008b). The Forest Service Manual 2550 provides soil quality standards to maintain soil productivity and to sustain ecological processes and functions so that desired ecosystem services are provided in perpetuity. This section provides a summary of the potential impacts of the proposed Wrangell Island Project on soil productivity, soil erosion, and mass wasting.

Units of Measure

The identified issues and concerns relevant to soils were developed based on internal review and external scoping comments from the public. The concern directly pertinent to the potential impacts of the proposed project on the soil resources in the analysis area are loss of soil productivity from road construction and logging disturbance in harvest units, and subsequent erosion due to management-induced mass wasting and logging disturbance.

The following indicators were used to measure the potential direct and indirect effects on soil resources resulting from the proposed activities:

- Estimated acres of detrimental soil disturbance due to yarding disturbance, temporary road constructions, and other management activities;
- Length of road construction on slopes greater than 67 percent, or unstable slopes; and
- Acres of harvest on slopes steeper than 72 percent gradient.

Analysis Methods

Several data sources are used in the evaluation of effects on soil resources, including geologic maps, soil survey and mass wasting hazard data, light detection and ranging (LIDAR) and photogrammetric and Shuttle Radar Topography Mission (SRTM) topographic data, stereo-pair aerial photographs and more recent digital orthophotography, and field reconnaissance.

Slope data (elevation, gradient, and aspect) are derived from Forest Service LIDAR and USGS digital elevation models (derived from photogrammetric or SRTM imagery), and are also used for the analysis. Interpretation of stereo-pair aerial photographs and digital orthophotography was used for mapping of surficial geology and mass wasting features, and for identifying downslope and downstream resources. For this analysis, field reconnaissance was performed in individual harvest units where slopes were anticipated to exceed 72 percent, and along National Forest System (NFS) road segments where slopes exceeded 67 percent. Field reconnaissance was also performed in areas with lesser slopes if a slope stability concern was identified that warranted a field visit. Slope stability interpretations are used to assess the risk of impact due to management activities.

Based on soil disturbance monitoring data and findings of Landwehr and Nowacki (1999), ground-based logging disturbances was estimated at 6 percent of the harvest area and 4 percent for cable systems. To calculate the impact of temporary roads a 42-foot width was used to include pullouts and landings.

Incomplete and Unavailable Information

Our ability to predict impacts to soil conditions in response to the management activities is limited due to the natural range of variability in soils, their characteristics, and their response to a variety of factors. Nonetheless, there is sufficient information for the analysis area to provide a credible evaluation and comparison of the magnitude and extent of likely effects of the proposed action and the alternatives for the Wrangell Island Project based on the outcome other projects of a similar nature. The analysis is based on the premise that standard practices would be used that follow established best management practices.

Analysis Area

The analysis area for direct and indirect effects on soil resources encompasses the proposed harvest unit pool, proposed roads, and the adjacent areas that would potentially be subject to project-related impacts. The analysis area for cumulative effects impacts analysis area is the NFS lands on Wrangell Island.

Affected Environment

Soils Description

Soils in the analysis area have been strongly influenced by high precipitation and cool temperatures. Under these conditions, organic matter decomposes slowly and tends to accumulate. A thick organic surface horizon composed of forest litter is commonly developed on mineral soils. Deep organic soils develop where movement of water is impeded by bedrock or other restrictive horizons. Organic soils derived solely from vegetative biomass accumulations vary greatly in depth depending on location. Organic soils vary in depth from less than 14 inches thick, to greater than 20 feet in thickness in low relief muskeg areas.

Spodosols are the dominant mineral soils developed beneath the forest cover. Podzolization, where organic material and iron and aluminum oxides are transported from the topsoil to the subsoil, is the primary soil process forming spodosols. Over time, podzolization can reduce site productivity by immobilizing important plant nutrients and forming cemented layers of iron and aluminum oxides that slow soil drainage. Bormann et al. (1995) posits that windthrow is a primary mechanism in disrupting the formation of podzol horizons, and is an important factor in maintaining long-term forest soil productivity.

Colluvial soils are formed by the gravity-driven downslope transport of eroded soil, rock, and organic material. During field reconnaissance, it was noted that soils situated on steep slopes are predominantly colluvial. Field observations noted that many did not exhibit segregation of the soil profile due to podzolization, indicating that soil mixing on steep slopes in the analysis area is a significant pedoturbation mechanism.

Soil texture generally reflects the textural characteristics of the parent material. Table 88 provides a general summary of the texture and drainage characteristics of mineral soils developed from the bedrock and glacial units occurring on sloped areas in the analysis area. Soil drainage is inversely related to forest productivity, with very poorly-drained sites supporting scrub forests, while deep, well-drained mineral soils support the high volume timber stands.

Table 88. Soil texture and drainage related to parent material

Parent Material	Typical soil texture	Soil drainage
Metasedimentary rocks	Silt loam derived from fine-grained shale; sandy loam derived from coarse-grained sandstone	Poorly-drained when derived from fine-grained shale; moderately well- to well-drained when derived from coarse-grained sandstone
Metamorphic rocks	Sandy loam containing dispersed mica grains	Moderately well-drained to well-drained; locally poorly-drained
Granitic intrusive rocks	Sandy loam	Moderately well-drained to well-drained; locally poorly-drained
Late Pleistocene lodgement till	Loam and silt loam	Poorly-drained
Late Pleistocene ablation till	Sandy loam	Moderately well-drained to well-drained; locally poorly-drained

Soil Productivity

Soil productivity is defined as the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Several factors contribute to the soil productivity in the analysis area including drainage, soil depth and nutrient cycling, windthrow and pedoturbation, mass wasting, and management activities. Soil disturbance associated with management activities can significantly impact soil productivity. Soil erosion resulting in sediment delivery to aquatic habitats can degrade the habitat for aquatic organisms.

The Forest Service has established soil quality standards for the Alaska Region. Soil quality standards are the allowable levels of change that provide reasonable assurance that no long-term losses in inherent productivity of the soil will result. The standards require that the 85 percent of the total acreage in the activity area be left in a condition of acceptable productivity following land management activities. It is assumed that if this soil quality standard is satisfied then soil productivity will be maintained. Soil quality monitoring data on the Tongass indicates that shovel yarding utilized on shallow slopes, and partial suspension (cable systems) utilized on steep slopes will generally meet the soil quality standards (Landwehr and Nowacki 1999, Landwehr et al. 2012, and Landwehr 2014).

Mass Wasting

Landslides are a dominant erosional process occurring on steep slopes in the analysis area. Site-specific conditions, including slope steepness, soil thickness and moisture, and bedrock structure are significant factors affecting the stability of a forest slope. The rate and form of precipitation, such as large rainstorm or rain-on-snow events, are key factors in triggering slope failures. Mass wasting, a general term that includes all forms of downhill soil and rock movement is a natural ecological process operating in the analysis area. Landslides clear large trees and open the forest canopy, allowing shade-intolerant seedlings to grow. However, landslides also can remove organic and mineral soil horizons and can significantly decrease soil productivity. Management activities, including timber harvest and road construction, can increase the rate of landslide occurrence above the naturally occurring rate.

Bedrock and glacial history can significantly impact slope stability in the project area. The meta-sedimentary and metamorphic rocks exposed on Wrangell Island are prone to bedrock landslides when bedding planes are oriented parallel to the slope. Shallow soil failures commonly occur on steep slopes underlain by granitic intrusive rocks, where exfoliation or tectonic jointing in this rock type can contribute to rock fall and landslides on steep slopes. Rotational landslides, or slumps, occur in areas where thick soils are underlain by lodgement till. Ground water perching on the impermeable lodgement till reduces the shear strength of the overlying saturated soil, resulting in destabilization of the soil layer. Debris flows, associated with high precipitation events, can be initiated by landsliding that mobilizes a highly saturated soil mass.

Swanston (1974) suggests that tree roots can increase the shear strength of the soil mass in the following ways: 1) roots anchoring the soil mass and into seams and fractures in the parent material; 2) roots providing a continuous long fiber adhesive binder to the entire slope soil mass; 3) roots tying the slope together across zones of weakness and instability to more stable soil masses; and 4) roots providing downslope support to an unstable soil mass through buttressing. Ziemer and Swanston (1977) indicate that smaller diameter roots lose strength within 2 years after a hemlock or Sitka spruce is cut, and the larger diameter roots of these species lose approximately 50 percent of their strength at 10 years after cutting. Ziemer (1981) provides an estimate for the net reinforcement of a soil layer resulting from root decay of cut trees and root growth of re-sprouted trees in clearcut forests. He found that the net reinforcement in a clearcut area decreases to approximately 20 percent of the original (pre-harvest) root strength after 10 years, and increases to approximately 80 percent of the original strength after 20 years. The highest vulnerability for slope failure resulting from a loss of root strength is centered at 10 years after harvest, and the period where the net reinforcement is less than 50 percent of the pre-cut strength ranges from 2 to 15 years after harvest.

An examination of existing landslides on Wrangell Island (Soil Resource Report) found, as expected, a preponderance of landslides initiated on steeper slopes. There was a higher than expected number in the 35 to 50 degree slope class. This class also has the highest number of road related landslides, which partially explains the high number. As Swanston (2006) pointed out in his Mitkof Island report, it is not possible to predict where slope failure will occur; at best those areas at high risk of failing can be identified. Figure 31 shows the mapped landslides on Wrangell Island.

Harvest on Slopes Greater than 72 percent Gradient

The Forest Plan removed lands with slope gradients of 72 percent or greater from the tentatively suitable timber base due to high risk of soil mass movement. However, at the project level the Forest Supervisor, may approve limited timber harvest on slopes steeper than 72 percent on a case-by-case basis based on the results of an on-site analysis of slope stability, and an assessment of potential impacts of accelerated erosion on downslope and downstream fish habitat, other beneficial uses of water, and other resources. As mentioned above, site-specific conditions, including soil thickness, texture, micro topography, and bedrock structure, are factors considered in evaluating suitability for harvest.

Field reconnaissance and a digital elevation model were used to identify lands with a slope gradient greater than 72 percent. Based on a GIS evaluation of digital elevation data, there are approximately 13,114 acres in the analysis area where the slopes equal or exceed 72 percent.

Road Construction on Slopes Greater than 67 percent Gradient

Forest Plan Standards and Guidelines (USDA Forest Service 2008a) provide direction for locating and designing roads in a manner to minimize effects on soil and water. Both the Forest Plan and the Alaska Forest Practices Act (11ACC95.290) require avoidance of locating road on a slope greater than 67 percent or on an unstable slope. Best management practice (BMP) 14.7 identifies methods to minimize the chance and extent of road-related mass failures (USDA Forest Service 2006), including the need for a geotechnical investigation to generate design parameters.

Landings

During implementation of a timber sale offering, landing size, location, and construction specifications must be agreed upon by the Forest Service timber sale administrator, and the timber purchaser. Landings will be located, designed, and constructed to minimize soil erosion and water quality degradation (Region 10 BMP 13.10; FSH 2509.22, 2006). Typical yarder landings vary in size from a wide spot in the road for small mobile yarders, to about 0.1 to 0.2 acre for a 90-foot tower yarder. In general, most yarder landings would likely be less than 0.1 acre in size. In shovel yarding harvest units, it is likely that those roads which access the harvest units will be used as continuous landings, thereby eliminating additional landing construction costs. Detrimental soil disturbance from landings is included in the temporary road width calculation.

Table 89. Summary of existing soil disturbance related to past management activities

Type of disturbance	Area of disturbance (acres)
Existing temporary roads	165
Pre-2001 timber harvest[1]	285
Landslides	102
Existing NFS roads	680
Existing quarries[2]	132
Total area of disturbance	**1,365**

1 Based on an estimated 5 percent disturbance in harvest units

2 Based on 2 acres per quarry

Existing Soil Disturbance

Existing soil disturbances related to past management activities are summarized in Table 89. An estimated total of 1,365 acres of productive NFS lands have been converted into nonproductive forest land.

Environmental Consequences

All of the action alternatives propose timber harvest and road construction which would result in soil disturbance (Table 90 and Table 91). Harvest units were modified to avoid areas with soil resources concerns, additionally harvest methods and prescriptions were planned to reduce the potential for soil impacts. Productive forest land lost due to conversion to roads or for rock quarry development is considered an irretrievable loss resulting from this project.

Cable yarding is likely to result in more soil disturbance than the helicopter yarding method due to the dragging of logs and complete, or near complete, removal of the overstory trees. The use of selective harvesting techniques and helicopter logging is expected to reduce the amount and severity of disturbance. Selective logging also allows us to remove fewer or no trees, in areas with slope stability concerns, resulting in very little affect to natural conditions. In shovel units with slopes steeper than 35 percent, skid trails would be identified in the field, and a rehabilitation plan would be developed prior to harvest.

Road construction and harvest units have been designed to minimize soil disturbance and avoid alteration of inherent slope stability. However, implementation of the project may result in increased landslide occurrence. Roads and units with a high risk of slope failure have site-specific design features identified in the unit and road cards to reduce the risk of associated impacts. Implementation of these measures is expected to result in the amount of soil disturbances for all alternatives to be well within the Alaska Region soil quality standards and guidelines. Soil disturbance from logging activities may result in erosion and sedimentation of streams when these activities are in close proximity to stream courses, on ephemeral flow paths, or on steep slope gradients.

An on-site slope stability assessment was conducted for proposed harvest units having an area greater than 1 acre in size, based on slope model, where slopes are greater than 72 percent. Reconnaissance reports summarizing on-site analysis have been completed and are filed in the Wrangell Island Project EIS project record.

Proposed road construction on steep slopes ranges from 0.6 mile in Alternative 5 to 1.4 miles in Alternative 4 (Table 91). Landslides may result from blasting during road construction on steep slopes or loading slopes with fill material. On-site review of slope stability has been conducted along proposed NFS road alignment segments where slopes are greater than 67 percent (and in areas with lesser slopes where a slope stability concern was identified that warranted an on-site review). Summaries of these on-site reviews have been completed and are filed in the Wrangell Island Project EIS project record.

Road construction on fine-textured glacial deposits presents a high risk for slope failure. Two proposed roads (50076 and 50062) are partially underlain by fine-textured glacial deposits and are included in all action alternatives.

Table 90. Estimated acres of detrimental soil disturbance

Disturbance type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Yarding	0	95	84	91	54
Temporary roads	0	81	77	88	49
Total acres	**0**	**175**	**160**	**180**	**103**

Table 91. Acres of harvest and miles of road construction on steep slopes

Slope description	Harvest type	Alt 2	Alt 3	Alt 4	Alt 5
Acres of harvest on slopes >72%	Cable	100	92	108	45
	Helicopter	168	119	145	132
Miles of road on slopes >67%	n/a	1.34	1.32	1.38	0.6

Alternative 1 – No Action

This alternative is used as a measure to compare the action alternatives with the existing conditions in the project area. If selected, no new timber harvest or road construction would take place. The existing small timber sale program would continue as planned in the Roadside project. Road management decisions would be implemented as planned in the Wrangell Ranger District Access and Travel Management Plan decision (USDA Forest Service 2007b). There would be no direct or indirect effects to the soil resource caused by new management activities. This alternative would not contribute to the cumulative impact to the soils resource from past and reasonably foreseeable future road construction and logging. Natural disturbances, such as landslides, would continue to occur depending largely on rainstorm severity and duration.

Alternatives 2, 3, 4, 5

All of action alternatives propose timber harvest and construction of infrastructure to remove timber which would result in soil disturbance. All construction of NFS roads, temporary roads and the proposed sort yard would require the use of rock quarries. Productive forest land is lost due to conversion to roads or for rock pit development; this is considered an irretrievable loss resulting from this project.

Soil disturbance from logging activities may result in a loss of soil productivity and sedimentation of streams in some locations. The disturbances from the proposed harvest are expected to be minor and would be limited to the immediate harvest unit. However, erosion and sedimentation are a concern when soil disturbances are in close proximity to stream courses or ephemeral flow paths and on steep slopes.

Figure 31. Soil stability and existing landslides on Wrangell Island

Of the four action alternatives, Alternatives 5 would have the least impact to the soil resource. Alternative 4 would construct the most temporary road (16.2 miles) thus it has the potential to have the highest impact to the soil resource. The amount of detrimental soil disturbances for all alternatives is expected to be within the Alaska Region soil quality standards and guidelines.

Increased landslide frequencies can occur when constructing roads and harvesting timber on steep slopes. Proposed road construction on steep slopes ranges from 0.6 to 1.4 miles; proposed harvest on steep slopes ranges from 177 acres to 268 acres for the action alternatives (Table 91). These areas have been field reviewed and are expected to meet soil quality standards with planned prescription, yarding method and site-specific design features as specified on the unit card. Road construction on slopes greater than 67 percent would have a geotechnical investigation prior to construction.

Excavation for road construction on fine-textured glacial deposits may contribute to landslides in the Pats Creek watershed in all action alternatives.

Even with implementation of BMPs and site-specific practices for soil protection on unit and road cards, it is expected that the implementation of any of the action alternatives would result in detrimental soil disturbance. Based on the analysis the amount of detrimental soil disturbance is expected to be within Region 10 Soil Quality Standards.

Soil disturbance

Alternatives 2, 3, and 4 are similar in the amount of detrimental soil disturbance they would create. Alternative 4 is slightly higher followed by Alternatives 2 and 3. Alternative 5 would result in the least amount of detrimental soil disturbance (Table 90). Implementation of all alternatives would result in detrimental soil conditions within Region 10 Soil Quality Standards.

Harvest on slope gradients greater than 72 percent

Alternatives 2, 3, and 4 are similar in the amount timber harvest that would occur on steep slopes. Alternative 5 is substantially less in part because it harvests fewer acres overall (Table 91). All harvest units with slopes over 72 percent gradient have received an on-site analysis for slope stability as required by the Forest Plan.

Road construction on unstable slopes and slope gradients greater than 67 percent

Alternatives 2, 3 and 4 are nearly identical in the amount of road that would be constructed on steep slopes. Again, Alternative 5 would construct less road on steep slopes (Table 91). Road locations on slopes over 67 percent have been reviewed for slope stability, and a slope stability specialist will be involved in plan reviews during the design process.

Cumulative Effects

Cumulative effects consider the proposed and past actions as described above, with those considered reasonably foreseeable. Reasonably foreseeable projects that may affect soil resources include small timber sale projects, as well as future landslides.

It is anticipated that less than 10 acres of detrimental soil disturbance would occur from reasonably foreseeable activities.

Based on the past and foreseeable actions listed in Table 4, along with actions proposed by this project, a total of 870 to 950 acres would have detrimental soil conditions on NFS lands on Wrangell Island. Lands used for the development of infrastructure such as NFS roads are not included in this calculation. Detrimental soil disturbances is expected to be well within the Region 10 soil quality standards and guidelines.

Design Features

Site-specific practices to avoid soil disturbances are prescribed on unit and road cards. For units using a cable yarding method, these include suspension requirements or avoidance of specific locations. In units with shovel yarding method practices, include use of slash and cull logs to create a log mat to float the equipment; avoid shovel logging on saturated soils and on deep organic soils; restrict shovel operations to slope gradients less than 35 percent slopes unless specific travel corridors have been identified in the field. If excessive mineral soil disturbance occurs during logging operations (ruts deeper than 12 inches or aerial extent greater than 15 percent), yarding should discontinue until an appropriate yarding method is assigned.

All helicopter units have an uneven-aged, single tree selection prescription retaining 66 percent of the old-growth stand structure. For units having areas identified for minimal or no tree removal for resource purposes, more intensive harvesting may occur in other portions of the unit.

Road construction on slope gradients greater than 67 percent would have a geotechnical investigation and appropriate erosion control measures identified prior to construction.

Monitoring

The Alaska Region identifies 25 percent as the maximum slope gradient for shovel yarding and recommend interdisciplinary review prior to operating on steeper ground. With increasing slope gradient, there is typically more soil disturbance from rutting, pulling stumps, and soil displacement. Soil disturbance monitoring conducted by Landwehr (2014) has documented an increased amount of detrimental soil disturbance when equipment operates on ground exceeding 30 to 35 percent. It is recommended that harvest units using shovel yarding on slope gradients greater than 35 percent are monitored to ensure soil quality standards are met, to provide a better sense of the disturbance that occurs with increasing gradient and to assess the effects on site productivity.

Road and units from this project may be included in the sampling pool for the annual Forest Plan monitoring. Activities would be reviewed to determine if standards and guidelines are being applied and if they are effective at meeting resource objectives.

Subsistence

Introduction

Subsistence is a broad term applied to many natural resource uses by rural Alaskans. In the Alaska National Interest Lands Conservation Act (ANILCA), subsistence is defined (in part) 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” (ANILCA Sec. 803). The continuation of these uses “consistent with sound management principles, and the conservation of healthy populations of fish and wildlife” are provided for by ANILCA (Sec. 802).

Summary

The proposed project area encompasses all of Wrangell Island, within the Wrangell Ranger District of the Tongass National Forest. The rural communities most impacted by potential changes to subsistence resources would be the residents of Wrangell and Thom’s Place.

The direct effects from the Wrangell Island Project could affect subsistence uses of deer, black bear, marten, wolves, and timber, as well as the collection of firewood, berries and other forest products. Other subsistence resources such as marine mammals, salmon, other finfish, otters, waterfowl, mushrooms, and marine invertebrates should not be impacted.

The potential foreseeable and cumulative effects from implementing of the proposed action, do not present a significant possibility of a significant restriction to subsistence uses of black bear, marten, wolf,

otter, marine mammals, waterfowl, salmon, other finfish, marine invertebrates, timber or the collection of firewood, mushroom, berries and other foods themselves, but access to these resources would be affected. A possibility of a restriction may already exist for deer in the long-term, and for all alternatives (See the Sitka Black-tailed Deer section below).

A subsistence hearing will be held during the 45-day comment period following the release of this DEIS.

Affected Environment

Salmon and other finfish, shellfish, marine plants and mammals, wood, terrestrial wildlife including deer and other mammals, berries, and timber are all subsistence resources harvested by rural communities in Southeast Alaska. From 1987 to 2001, interviews were conducted with 1,064 households in 24 Southeast Alaska communities as part of the Forest Plan subsistence administrative studies. Marine resources, including fish, mammals, and plants, comprise the majority of subsistence harvests in all communities. Over half of the total per capita harvest came from marine resources.

Eighty-five percent of the households reported harvesting subsistence food (Kruse and Muth 1990 as cited in USDA 1997b FEIS, Part 1, pp. 3-215). Almost one-third of rural households obtained at least half of their food from subsistence resources. In 1987, over half of all households harvested more than 80 pounds of edible subsistence foods per person. A quarter of households harvested more than 250 pounds per person. By weight, fish and marine invertebrates accounted for 61 percent of subsistence resource harvests. Deer, other land mammals, and marine mammals represented 21, 4, and 3 percent, respectively (USDA 1997b FEIS, Part 1, pp. 3-215 to 3-221). The primary subsistence resource covered by this analysis is deer. The project area is also an important source for firewood, timber and other forest products.

Analysis Area

Wrangell[4]

Wrangell is located on the north end of Wrangell Island, near the mouth of the Stikine River, an historic trade route to the Canadian interior. According to the 2010 Census, Wrangell had a population of 2,369, with Alaska Natives comprising approximately 16 percent of the total (U.S. Census Bureau 2010). Wrangell's population increased by 22 percent between 1970 and 1990, and then decreased by 171 residents or 7 percent between 1990 and 2000. The population decreased by an estimated 79 residents or 3 percent from 2000 to 2010. Total estimated population was 2,406 in Wrangell in 2014 (ADOL 2015).

Wrangell began as an important Tlingit site primarily because of its proximity to the Stikine River. Wrangell clans held a monopoly of trading rights along the Stikine. In 1811, the Russians began fur trading with area Tlingits and built a stockade named Redoubt Saint Dionysius in 1834. In 1867, a military post named Fort Wrangell was established as part of the Alaska Territory. The community continued to grow because of its strategic location as a fur trading center, and as an outfitter for gold prospectors between 1861 and the 1930s (ADF&G 1994; ADCCED 2006).

Wrangell Island residents are known to use the project area more than residents of other communities within southeast Alaska. This opportunity is due to easy access to areas of the island through the road system and by boat. Local subsistence activities done by residents of Wrangell include hunting deer, bear, moose, and waterfowl; fishing for salmon, halibut, and other finfish; and gathering shellfish and berries and other forest products. Resources most commonly used include Chinook salmon, halibut, Dungeness crab, deer, and berries, as well as firewood and timber.

Wrangell residents mainly harvest deer on Wrangell and the surrounding islands, with the majority of harvest occurring in Game Management Unit 3 (GMU 3). Deer harvest in GMU 3 has declined from 1998

[4] Much of the information in this section is from the Forest Plan FEIS (USDA Forest Service 2008b, pp. 3-703 to 3-708).

to 2002, increased from 2002 to 2004, and has fluctuated between 2005 and 2010 (USDA Forest Service 2008b). Deer harvest by Wrangell residents is spread over many wildlife analysis areas (WAAs), but five WAAs account for 72 percent of the total (WAAs 1905, 1903, 1901, 1530 and 1906). The ADF&G reports that in WAA 1903 (Wrangell Island), from 1996 to 2013, an average of 69 deer were harvested with the lowest number harvested in 2002 (29 deer) and highest in 2006 (105 deer). The proposed project area is located within WAA 1903, which accounted for approximately 10 percent of the annual harvest of deer for Wrangell residents between 1996 and 2001. Deer populations within GMU 3 have historically fluctuated with high and low extremes.

Methods Used to Analyze Effects

Abundance and Distribution

Due to their association with old-growth forest habitat, which is the main terrestrial habitat type affected by the proposed alternatives, deer were chosen as the "indicator" for potential subsistence resource consequences concerning the abundance and distribution of the resources. The community-based subsistence analysis focuses largely on deer, which is the largest terrestrial component of subsistence food resources, and this is based on the Sitka black-tailed deer effects analysis in the Wrangell Island Project Wildlife Resources Report.

For analyzing effects on abundance and distribution the following assumption was made:

- Reductions in deer habitat capability will result in decreased abundance and distribution of deer in WAA 1903. As habitat is removed, the land can support fewer deer, which in turn means fewer deer available to humans.

Competition and Access

Competition for subsistence resources is a result of factors such as fish and game regulations, mobility, the natural distribution of game species, decreases in resource populations as a result of habitat reductions, decreases in resource populations as a result of over-harvest, and access provided to rural communities in the form of roads, ferries, and commercial air carriers. Competition for the more abundant wildlife and fisheries resources near rural communities results from the combination of these factors.

For analyzing effects on competition, the following assumptions were made (USDA Forest Service 1997a, p. 3-226):

- New road construction adjacent to communities with ferry access will result in increased competition from outside communities.
- 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.

Environmental Consequences

ANILCA requires that any analysis of project-related effects be completed because changes in access to subsistence resources due to project-related activities can affect the level of effort required, time involved, and the effectiveness of harvesting these resources. Altered distributions and abundance of subsistence resources can effect competition between subsistence and non-subsistence user, as well as competition between individual subsistence users.

Sitka Black-tailed Deer

Abundance and Distribution

The abundance and distribution of deer is generally based on assessing the number and location of deer available for hunter harvest. The number of deer available to humans or deer habitat capability is presented in Table 92. Deer habitat capability is modeled by estimating the current population with an

estimate of high and medium quality foraging habitat which is then applied to a future population estimate. The deer habitat capability has decreased by 15 percent in WAA 1903, due to timber harvest between 1954 and the present (Table 93).

Table 92. Deer habitat capability (measured from theoretical number of deer) and percent reduction by alternative, in WAA 1903 on NFS lands only

Deer habitat capability (DHC)	Existing (Alt 1)	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	2,678	--	--	--	--
Current (2015)	2,264	--	--	--	--
1 year post-implementation (2016)	2,216 (100%)	2,160 (5%)	2,198 (3%)	2,187 (3%)	2,193 (3%)
Stem exclusion (2042)	2,215 (98%)	2,053 (9%)	2,114 (7%)	2,098 (7%)	2,105 (7%)

Table 93. Percentage of deer habitat capability from historical (1954) on all land ownerships and total deer available to humans, by alternative in WAA 1903

Deer habitat capability (DHC)	Existing (Alt 1)	Alt 2	Alt 3	Alt 4	Alt 5
WAA 1903 (mi^2)	208	--	--	--	--
Hunter demand[1] (Avg. per yr.)	69	--	--	--	--
Historical DHC (1954)	2664	--	--	--	--
Current DHC (2015)	2292	--	--	--	--
DHC and percent of historical DHC 1 year post-implementation (2016)	2,216 (85%)	2,160 (81%)	2,198 (82%)	2,187 (82%)	2,193 (82%)
DHC and percent of historical DHC at stem exclusion (2042)	2,215 (83%)	2,053 (77%)	2,114 (79%)	2,098 (78%)	2,105 (79%)

1 Hunter harvest data from 1996 to 2012 was used to estimate hunter demand (Lowell 2014)

It is assumed that a deer population at carrying capacity should be able to support a sustainable hunter harvest (demand) of approximately 10 percent of the habitat capability while also providing a reasonably high level of hunter success in the WAA (USDA Forest Service 1997a, p. 3-674). Habitat capability output from the Interagency Deer Model (hereafter referred to as the deer model) has been used as an indicator of the ability of an area to support deer populations capable of maintaining human harvest demands. The deer model is a linear model and as such has limitations. Although the units of measure for the deer model output are in terms of total deer and deer/mi^2, these do not represent actual populations (USDA Forest Service 2008a, p. 3-282). Person et al. (1997) clarified that habitat capability of at least 18 deer/mi^2 is needed to support wolves and deer hunter demand on a sustainable basis where deer are the primary prey of wolves.

Table 94. Deer density (deer/mi^2) from current (2015) condition on NFS lands in WAA 1903

Deer Density	Existing/Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	15.3	--	--	--	--
Current (2015)	12.9	--	--	--	--
1 year post - implementation	12.9	12.3	12.5	12.5	12.5
At stem exclusion (2042)	12.6	11.7	12.0	12.0	12.0

Table 95. Cumulative change in deer density (deer/mi^2) from current (2015) condition on all land ownerships in WAA 1903

Deer Density	Existing/Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Historical (1954)	12.9	--	--	--	--
Current (2015)	10.9	--	--	--	--
1 year post-implementation	10.9	10.4	10.6	10.5	10.5
At stem exclusion (2042)	10.6	9.9	10.2	10.1	10.1

Competition and Access

Competition for subsistence resources is a result of factors such as fish and game regulations, mobility, the natural distribution of game species, decreases in resource populations from habitat reductions, decreases in resource populations from over-harvest, and access provided to rural communities in the form of roads, ferries, and commercial air carriers. Competition for the more abundant wildlife and fisheries resources near rural communities results from the combination of these factors. Habitat alternations that reduce carrying capacity, which could in turn reduce deer densities, would also increase competition for deer if allowable levels of harvest remain the same. Alternatives resulting in the greatest reduction in deer carrying capacity and increase in the road system would be expected to result in the greatest likelihood of increasing competition for resources.

Subsistence users typically hunt in traditional areas surrounding their communities. Subsistence users access WAA 1903 via by road (motorized and/or on-foot) or by boat. Some hunters may access specific areas using more than one form of transportation, but others may favor one form of transportation over another, such as a boat over a vehicle (USDA Forest Service 2008b, p. 3-430). The primary mode of access for harvesting deer in WAA 1903 is by vehicle (e.g., passenger vehicle, ATV, motorcycle).

Table 96. Miles and density of open roads on all land ownerships in WAA 1903

Measure	Existing roads	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Miles	133.3	109.2	144.2	142.9	143.4	109.2
Density[1] (mi/mi^2)	0.64	0.53	0.69	0.69	0.69	0.53

1 Wrangell Island is 208mi2

2 Motorized trails are included in Alternatives 2, 3 and 4

3 Open non-NFS roads (includes Borough and State)

Roads can affect subsistence both positively and negatively by providing access, dispersing hunting pressure, and creating the potential for increased competition. Road systems tend to bring more people into an area, and they may also give subsistence hunters access to previously remote areas and provide a

greater opportunity for subsistence harvest (USDA Forest Service 2008b, p. 3-430). Table 96 displays the current amount of open road in WAA 1903 and how it changes by alternative.

Alternative 1 – No Action

Direct and Indirect Effects

Abundance and Distribution – Current on-going management activities would continue; however, there would be indirect effects to deer habitat capability over time in the absence of young-growth management as existing harvested stands move into stem exclusion causing a reduction in the abundance of deer. Deer habitat capability would not change much post-project completion (2016) but it is expected to be reduced by 2 percent at stem exclusion (2042) (Table 92). The ongoing and future pre-commercial thinning of managed stands would alleviate the amount of acres entering stem exclusion and increase deer forage on Wrangell Island.

Access – No new roads are proposed under Alternative 1, but approximately 24.1 miles of existing roads would be closed, leaving approximately 73 miles of open Forest Service road that allows the public to access subsistence resources (Table 55). Therefore, Alternative 1 would affect access to existing subsistence resources on Wrangell Island, including firewood, timber and other forest products.

Competition – Reduced access to subsistence resources could lead to increased competition. Therefore, Alternative 1 could affect competition for subsistence resources on Wrangell Island.

Cumulative Effects

Because there would be an indirect effect to abundance and distribution from Alternative 1, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Stands entering stem exclusion would continue into the future but be alleviated through thinning. One possible benefit is the Alaska Mental Health Trust (AMHT) land exchange where the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and of little value to this POG-associated species other than foraging habitat.

Abundance and Distribution – Deer habitat capability would be reduced on Wrangell Island under Alternative 1, because of existing harvested stands entering stem exclusion, but this reduction would be minimal and have a minor reduction of deer habitat capability on Wrangell Island. Therefore, under Alternative 1, the abundance and distribution of subsistence resources would remain as they are; however, a small reduction on deer habitat capability is expected as stands move into stem exclusion. Although the no action alternative would create a reduction, the deer population on Wrangell Island would be sufficient for subsistence hunters.

Access – There would be cumulative effects to access of subsistence resources because 24.1 miles of road are scheduled to be closed under alternative (Table 55); leaving approximately 109.2 miles of open roads on all land ownerships on Wrangell Island (Table 96). Any other project that closed additional roads would cumulatively affect this project. At this time no other project are scheduled to cause additional closures.

Competition – There are no cumulative effects to competition of subsistence resources because factors such as fish and game regulations, mobility, the natural distribution of game species, decreases in resource populations as a result of habitat reductions, and decreases in resource populations as a result of over-harvest are not expected to occur under the no action alternative. Therefore, there would be no cumulative effects to competition when combined with past, present and reasonable foreseeable future projects with the implementation of the Wrangell Island Project.

Alternative 2

Direct and Indirect Effects

Abundance and Distribution - Treatments proposed under Alternative 2 would result in the reduction of deep snow deer habitat by 58 acres and reduce deer habitat capability by 3 percent from current condition (Table 36). At stem exclusion, deer habitat capability would be further reduced by 9 percent of existing condition (Table 92). Alternative 2 would also have an immediate reduction in deer density by 0.6 deer/mi^2 post-project implementation and further reduce deer density by 1.2 deer/mi^2 at stem exclusion (Table 94).

Access - The construction of approximately 32.1 miles of proposed new road and 5.8 miles of reconditioning of closed roads, would affect how deer are accessed on the island (Table 54). Upon project completion, the total mileage of open Forest Service roads accessible by motorized traffic would be approximately 101, which includes motorized trails (Table 55). Therefore, Alternative 2 would have a beneficial impact on subsistence users trying to access deer and other subsistence resources including timber and firewood. Logging slash from harvest operations would be accessible for firewood gathering for a short period of time following harvest.

Competition - Roads can affect subsistence users by providing access, dispersing hunting and fishing pressure, or creating the potential for increased competition through road closures. Alternative 2 would increase the amount of open roads across the island. Therefore, Alternative 2 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Cumulative Effects

Because there would be direct/indirect effects from Alternative 2, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities (Table 4). Activities on Wrangell Island that have affected deer habitat cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. One possible benefit is the AMHT land exchange; the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and is of little value to this POG associated species (Sitka black-tailed deer) other than foraging habitat.

Abundance and Distribution - Alternative 2 would maintain 81 percent of the original (1954) deer habitat capability at project completion and 77 percent of the original at stem exclusion (Table 93) Deer density would maintain 10.4 deer/mi^2 1 year post-project implementation and 9.9 deer/mi^2 at stem exclusion (Table 95). Alternative 2 would also result in a cumulative reduction of deer habitat by 4 to 34 percent, based on habitat type. Implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past, present, and reasonably foreseeable projects, it should allow for the continued existence of deer and maintain current levels of subsistence harvest.

Access - Cumulative open road miles for motorized use on WAA 1903 under Alternative 2, for all landownerships and at all elevations would be 144.2, which is an increase from existing operational condition (Table 96). Therefore, Alternative 2 would have increased access to subsistence resources, including timber and firewood.

Competition – Changes in deer abundance and distribution from timber harvest, increased road access to resources and the potential increase in hunter demand for deer would affect competition for deer between

users. Hunter harvest data from 1996 to 2013 was used to assess hunter demand and deer habitat capability was used to estimate the theoretical number of deer available. On Wrangell Island (WAA 1903), the average hunter harvest is 69 deer/year. Therefore, under Alternative 2 hunter harvest of deer on Wrangell Island represent approximately 3.1 percent of the modeled deer habitat capability. Therefore, habitat capability in WAA 1903 would continue to be adequate to sustain the current levels of deer harvest. Furthermore, increased miles of open road should alleviate the competition for subsistence resources across the Island.

Alternative 3

Direct and Indirect Effects

Abundance and Distribution - Treatments proposed under Alternative 3 would result in the reduction of deep snow deer habitat by 47 acres and reduce deer habitat capability by 3 percent from current condition (Table 36). At stem exclusion, deer habitat capability would be further reduced by 7 percent from existing condition (Table 92). Alternative 3 would also have an immediate reduction in deer density by 0.4 deer/mi^2 at project completion and 0.9 deer/mi^2 at stem exclusion (Table 94).

Access - The construction of approximately 29.8 miles of new road would have an effect how deer are accessed on the island (Table 54). At project completion, the amount of open Forest Service roads would increase to a total of 99.2 miles, which includes motorized trails (Table 55). Therefore, Alternative 3 would have a beneficial impact on subsistence users trying to access deer and other subsistence resources, including timber and firewood. Logging slash from harvest operations would be accessible for firewood gathering for a short period of time following harvest.

Competition - Roads can affect subsistence users by providing access, dispersing hunting pressure, or creating the potential for increased competition through road closures. Alternative 3 would increase the amount of open roads across the Island. Therefore, Alternative 3 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Cumulative Effects

Because there would be direct/indirect effects from Alternative 3, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities (Table 4). Activities on Wrangell Island that have affected deer habitat and cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s with an additional 1,250 acres planned over the next 10 years. One possible benefit is the AMHT land exchange; the Forest Service would gain approximately 1,105 acres, but the majority of this land has already been harvested and is of little value to deer other than foraging habitat.

Abundance and Distribution - Alternative 3 would maintain 82 percent of the original (1954) deer habitat capability at project completion and 79 percent of the original at stem exclusion (Table 93). Deer density would be maintained at 10.6 deer/mi^2 1 year post-project implementation and 10.2 deer/mi^2 at stem exclusion (Table 95). Alternative 3 would result in a cumulative reduction of deer habitat by 4 to 34 percent from historical (1954) condition, based on habitat type. Implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past present and reasonably foreseeable should allow for the continued existence of deer and maintain current levels of subsistence harvest.

Access - Cumulative open road miles in WAA 1903 under Alternative 3, for all landownerships and all elevations would be 142.9, which is an increase from existing operational condition (Table 96). Therefore, Alternative 3 would have a beneficial effect on subsistence hunters accessing subsistence resources.

Competition - Hunter success would be expected to remain relatively high and deer numbers are not expected to significantly change at project completion or at stem exclusion. Furthermore, Alternative 3 would increase the miles of open road across the Island. Therefore, Alternative 3 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Alternative 4

Direct and Indirect Effects

Abundance and Distribution - Treatments proposed under Alternative 4 would result in the reduction of deep snow deer habitat by 54 acres and reduce deer habitat capability by 3 percent from current condition (Table 36). At stem exclusion, deer habitat capability would be further reduced by 7 percent of existing condition (Table 92). Alternative 4 would also have an immediate reduction in deer density by 0.4 deer/mi^2 at project completion and 0.6 deer/mi^2 at stem exclusion (Table 94).

Access - The construction of approximately 32.3 miles of proposed new road would have an effect on where deer are hunted on the island (Table 54). At project completion, the mileage of open road on Forest Service land would increase from the existing condition, making the total miles available for public use approximately 100, which includes motorized trails (Table 55). Therefore, Alternative 4 would have a beneficial impact on subsistence users trying to access deer and other subsistence resources including timber and firewood. Logging slash from harvest operations would be accessible for firewood gathering for a short period of time following harvest.

Competition - Roads can affect subsistence users by providing access, dispersing hunting pressure, or creating the potential for increased competition through road closures. Alternative 4 would increase the amount of open roads across the Island. Therefore, Alternative 4 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Cumulative Effects

Because there would be direct/indirect effects from Alternative 4, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities (Table 4). Activities on Wrangell Island that have affected deer habitat and cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s, with an additional 1,250 acres planned over the next 10 years. One possible benefit is the AMHT land exchange; NFS lands would gain approximately 1,105 acres, but the majority of this land has already been harvested and is little value to deer other than foraging habitat.

Abundance and Distribution - Alternative 4 would maintain 82 percent of the original (1954) deer habitat capability at project completion and 78 percent of the original deer habitat capability at stem exclusion (Table 93). Deer density would be maintained at 10.6 deer/mi^2 1 year post project implementation and 10.1 deer/mi^2 at stem exclusion (Table 95). Alternative 4 would also result in a cumulative reduction of deer habitat by 4 to 34 percent, based on habitat type. Implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past present and reasonably foreseeable projects, it should allow for the continued existence of deer and maintain current levels of subsistence harvest.

Access - Cumulative open road miles in WAA 1903 under Alternative 4, for all landownerships and at all elevations would be 143.4 miles, which is an increase from existing operational condition (Table 96). Therefore, Alternative 4 would have a beneficial effect for subsistence hunters accessing subsistence resources.

Competition - Alternative 4, hunter success would be expected to remain relatively high and deer numbers are not expected to significantly change at project completion or at stem exclusion. Furthermore, Alternative 4 would increase the amount of open roads across the Island. Therefore, Alternative 4 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Alternative 5

Direct and Indirect Effects

Abundance and Distribution - Treatments proposed under Alternative 5 would result in the reduction of deep snow deer habitat by 24 acres and reduce deer habitat capability by 1 percent from current condition (Table 36). At stem exclusion, deer habitat capability would be further reduced by 7 percent of existing condition (Table 92). Alternative 5 would also have an immediate reduction in deer density by 0.4 deer/mi^2 at project completion and 0.6 deer/mi^2 at stem exclusion (Table 94).

Access - The construction of approximately 21.6 miles of proposed and temporary new road would have short-term effects on how deer are accessed on the island because at project completion, all proposed new and temporary roads would be closed (Table 54). Alternative 5 would also implement the Wrangell Ranger District Access and Travel Management Plan (ATM) where an additional 24.1 miles of existing open Forest Service roads would be closed to the public (Table 55). Therefore, Alternative 5 would have a negative effect on access to existing subsistence resources on Wrangell Island.

Competition - Roads can affect subsistence by providing access, dispersing hunting and fishing pressure, and creating the potential for increased competition through road closures. Under this alternative, all new NFS and temporary road proposed, in addition to 24.1 miles closed through the ATM, may increase competition for deer on Wrangell Island.

Cumulative Effects

Because there would be direct/indirect effects from Alternative 5, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Activities on Wrangell Island that have affected deer habitat and cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles), property development on non-NFS land and any future timber sales proposed by federal, State or tribal organizations. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s, with an additional 1,250 acres planned over the next 10 years. One possible benefit is the AMHT land exchange; the Forest Service would gain approximately 1,105 acres, but the majority of the land has already been harvested and is of little value to deer other than foraging habitat.

Abundance and Distribution - Alternative 5 would maintain 82 percent of the original (1954) deer habitat capability at project completion and 79 percent of the original at stem exclusion (Table 93). Deer density would be maintained at 10.5 deer/mi^2 1 year post-project completion and 10.1 deer/mi^2 at stem exclusion (Table 95). Alternative 5 would also result in a cumulative reduction of deer habitat by 4 to 33 percent, based on habitat type. Implementation of the proposed project will increase habitat fragmentation, human disturbance, and cause a loss of habitat, but when combined with past present and reasonably foreseeable projects, it should allow for the continued existence of deer and maintain current levels of subsistence harvest. Although some habitat would be maintained because 75 percent of the harvest prescriptions are proposing partial harvest.

Access - Cumulative open road miles in WAA 1903 under Alternative 5 for all landownerships and all elevations would be 109.2 miles, which is a decrease from existing operational condition (Table 96). Therefore, Alternative 5 would have a negative effect for subsistence hunters trying to access subsistence resources.

Competition - Alternative 5, hunter success would be expected to remain relatively high and deer numbers are not expected to significantly change at project completion or at stem exclusion. Although, Alternative 5 would decrease the amount of open roads on Wrangell Island. Therefore, Alternative 5 is not expected to increase competition for subsistence resources on Wrangell Island. Any improved motorized access from temporary roads would be of short duration because all temporary roads would be closed at project completion.

Other Subsistence Resources

None of the Wrangell Island Project alternatives would present "a significant possibility of a significant restriction" of subsistence uses for most subsistence resources (black bear, marten, wolf, otter, timber as well as the collection of firewood, berries, marine mammals, waterfowl, salmon, mushrooms, and other finfish). These resources are briefly discussed below.

All Alternatives

Direct and Indirect Effects

The Wrangell Island Project would have no measurable effect on the abundance and distribution of, access to, or competition for marine invertebrates, salmon, other finfish, waterfowl, furbearers, and species that utilize estuary, riparian, or coastal habitats, such as wolves or bears. The risk of project-related impacts to these resources from timber harvest would be unmeasurable because of Tongass Timber Reform Act (TTRA) stream buffers, Forest Plan beach and estuary, riparian, inventoried roadless areas, and old-growth reserve strategy standards and guidelines. There would be some minor impacts to some species such as bear, wolves and marten through the reduction of habitat which will be discussed below.

Abundance and Distribution - Under all action alternatives, POG habitat would be reduced which could have a minor effect on abundance and distribution because of increased habitat fragmentation. The proposed project would authorize harvest of 48 to 73 MMBF of timber on approximately 3,100 to 5,300 acres. Although this project would cause a reduction in habitat it would not significantly affect the harvest of subsistence resources. For more information see Wrangell Island Wildlife Report.

Access – New proposed roads or roads closed through the Wrangell Island Project activities would not significantly affect how subsistence resources are accessed. Alternatives 2, 3 and 4 would increase access on the Island by 26 to 27 miles through new road construction and conversion to motorized trails, where Alternative 1 and 5 would reduce access by closing approximately 24 miles. This would change the Forest Service Access Travel Management Plan for Wrangell Island. Although there are proposed reductions in the miles of road for some alternatives, subsistence users would still have access.

Competition – It is assumed through road closures and reduction of habitat that competition for subsistence resources may increase but be alleviated by access to new areas. POG habitat) would be reduced by the action alternatives for some species such as bear, wolves and marten but this reduction should be minimal and not negatively affect competition for these species. Alternatives 2, 3, and 4 would increase the miles of open road on the Island and by doing so, spread out the hunting and trapping pressure. Road closures in Alternatives 1 and 5 could create an increase in hunting and trapping competition in some areas. Although competition may increase under some alternatives, there would still be a sufficient population of subsistence species to sustain subsistence users.

Cumulative Effects

The Wrangell Island Project would have no measurable effect to the abundance or distribution of, access to, or competition for marine invertebrates, salmon, other finfish, waterfowl, furbearers, and species that

utilize estuary, riparian, or coastal habitats, such as wolves or bears. Therefore, the project would make no contribution to cumulative effects to these species. Exceptions are the bear, wolves, and marten which would have minor affects through the reductions in POG habitat and/or increased road densities and related effects associated with increased human access under all alternatives (See the species-specific discussions in the Wildlife Report). Ongoing and foreseeable timber harvest projects would contribute to these effects. Because there would be direct/indirect effects to abundance and distribution, competition and access from Alternative 1, there would be cumulative effects when combined with past, present, or reasonably foreseeable future activities. Activities on Wrangell Island that have affected potential goshawk habitat and cumulatively add to this project include: timber harvest (6,800 NFS acres), road/trail construction (100 miles), installation of utility corridors (26 miles) and property development on non-NFS land. Activities that have improved habitat include pre-commercial thinning which has improved approximately 4,000 acres since the 1970s, with an additional 1,250 acres planned over the next 10 years. One possible benefit is the AMHT land exchange. National Forest System lands would acquire approximately 1,105 acres, but the majority of the land has been harvested and is of little value to POG associated species, but may provide an abundance of berries.

Abundance and Distribution - The Wrangell Island Project would result in temporary increases in the abundance and distribution of food plants, and temporary increases in access to food plants, personal use timber and freshwater fish. Present and foreseeable timber harvest from federal, State or mental health trust land (through increases in early seral forest) would contribute to these effects. Past timber harvest from federal (6,800 acres), State and mental health trust lands has altered the distribution of some species through changes in the distribution of habitat types and road development. Ongoing and foreseeable timber harvests and associated road construction, as well as other development, would contribute to these effects. Therefore, the Wrangell Island Project, in conjunction with past, present and foreseeable actions, may further alter the abundance or distribution of some important subsistence species such as bears, wolves and marten because of habitat loss and fragmentation.

Access - Collectively, new proposed roads associated with the Wrangell Island Project, in addition to those resulting from other projects, would improve access and reduce competition for resources. With the exceptions of Alternatives 1 and 5, which would implement the ATM decision, and these road closures that would reduce access to subsistence resources over the long-term. Although approximately 24 miles of road could be closed it would have negligible impact over access for subsistence resources.

Competition – All alternatives that increase the miles of open road would be expected to alleviate competition for all subsistence resources. Alternatives 1 and 5 would likely increase competition for subsistence resources due to road closures. Although approximately 24 miles of road could be closed it would have negligible impact over competition for subsistence resources.

Subsistence Findings

The 2008 Forest Plan Final EIS (USDA Forest Service 2008b) included a cumulative effects analysis of resource development on subsistence resources which concluded that full implementation of the Forest Plan “may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of these resources, and on competition for these resources.” For this reason, timber sale activities cannot completely avoid cumulative landscape effects to subsistence uses. Based on this evaluation and ANILCA definitions of significance, it was determined that, in combination with other past, present and reasonably foreseeable future actions, all of the alternatives (if implemented through project-level decisions and actions) may result in a significant restriction of subsistence uses of deer, due to potential effects on abundance and distribution, and on competition. This determination is based on an anticipated increase in human population, an associated increase in subsistence activities, and the capability of the habitat to produce deer. As a result of this finding, the Forest Service will notify the appropriate State agencies, local communities, the Southeast Alaska Federal

Subsistence Regional Advisory Council, and State Fish and Game Advisory Committees. In addition, a subsistence hearing will be held sometime between the release of this DEIS and the FEIS.

Wetlands

Introduction

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR §230.41(a)(1)). The Forest Plan directs us to avoid alteration of, or new construction on, wetlands wherever there is a practicable alternative, and to consider the functions and values of wetlands as well as other non-wetland ecosystems in the project area.

Newly constructed roads and landings are expected to result in permanent impacts to wetlands. Harvesting forested wetlands is expected to result in a temporary impact to vegetation structure and hydrologic conditions, both would be restored with regrowth of the forest canopy. Site-specific concerns and design features to avoid wetlands are presented in unit and road cards.

Placement of fill material into wetlands is regulated under Section 404 of the Clean Water Act (CWA), which is administered by the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. Section 404(f)(1)(E) of the CWA provides that the construction or maintenance of forest roads for silvicultural activities is exempt from regulation under the Act, provided the roads are constructed and maintained in accordance with the State-approved best management practices (BMPs) and Federal baseline provisions to ensure t the flow and circulation of navigable waters are not impaired, their reach is not reduced, and any adverse effects would be minimized. All roads constructed for this project would be constructed and maintained in accordance with BMPs for forest road construction and as such, are expected to be exempt from permitting under Section 404 of the Clean Water Act. Wetland avoidance and minimization of disturbance to wetlands by new road construction is addressed and documented on road and unit cards.

Effects Analysis Indicators

The primary impacts to wetlands would be the alteration of wetland habitat by harvesting overstory vegetation, and loss of wetlands due to construction of infrastructure, primarily roads, for timber haul. The environmental component or indicator used to describe potential effects associated with the issues and concerns are acres of wetland harvest and aerial extent of wetland loss due to road construction.

Methods

The wetlands analysis is based on a wetland map generated for the project area. The map was developed using the attributes of existing soil map units, and refined using field information (See Wetland Resource Report in the project record). Due to varying accuracy of mapping, lacustrine and riverine wetlands are not consistently mapped. For example, the narrow lacustrine wetlands surrounding Pats Lake, Thoms Lake and Long Lake are mapped with the adjacent palustrine wetland. Thus, interpretations of wetland function and value are based on the interaction with adjacent habitats, as well as the wetland type.

The ability to predict actual changes in wetland conditions in response to project activities is limited due to the variability of soil and wetland types, soil mapping limitations, wetland characteristics, and their response to a variety of factors. Because detailed information about impacts to wetlands from past activities on non-NFS lands is not available, these impacts are considered but not quantified. Nonetheless, there is sufficient information about the project area to provide a credible evaluation and comparison of the magnitude and extent of likely effects of the proposed action and each alternative.

Analysis Area

The analysis area for direct and indirect effects to wetlands is defined as Wrangell Island itself because it represents a distinct geographic unit with defined boundaries, and is a sufficiently sized geographic area

to provide context for the impacts. The cumulative effects analysis area is the portion of Wrangell Island within the National Forest boundary, over a period of 10 years.

Affected Environment

Approximately 55 percent of Wrangell Island is mapped as a wetland (73,400 of 134,400 acres). Wetlands are located throughout the project area in landscape positions that receive enough water to create hydric soil conditions. The majority of these wetlands are palustrine wetlands, with estuarine, lacustrine and riverine wetlands making up the other component.

Existing Wetland Disturbances

Community development and forest management are the primary factors that have altered wetlands on Wrangell Island and have resulted in loss of wetlands. Infrastructure such as the airport, golf course, rifle range, ballfield, residential areas, and roads have impacted many acres of wetlands on the north end of Wrangell Island. On the NFS lands, road development is the primary activity that has resulted in the loss of wetlands, with recreation development resulting in a minor amount of loss.

Roads in Wetlands

Section 404 of the Clean Water Act directs the Forest Service to avoid alteration of and new construction on wetlands wherever there is a practical alternative. Due to the climate, local topographic conditions, and the large percentage of wetlands on Wrangell Island, it is usually impossible for projects involving road construction to avoid all wetlands. Where wetlands cannot be avoided, State-approved BMPs and the 15 Federal baseline provisions are used to minimize effects to the wetland. Special consideration is given to avoiding high-value wetlands. On NFS lands, Forest Service handbooks provide wetland guidelines. FSH 2509.22 (on Soil and Water Conservation) details State-approved wetland BMPs and incorporates the 15 Federal baseline provisions to minimize effects to wetlands. This forest service handbook is also consistent with the Alaska Forest Resources and Practices Act (AS 41.17).

Approximately 76 miles of existing roads on Wrangell Island are located in wetlands, impacting approximately 414 acres.

Timber Harvest on Wetlands

The potential direct and indirect effects of timber harvest on wetlands include hydrologic modification, which affects soil productivity and stand regeneration. Additional effects may include changes to nutrient pathways, changes in sediment transport, and changes to species composition and growth due to reduced shading.

Removal of forest canopy affects rain interception (Prussian 2008), snow storage, snowmelt, and soil moisture. Rainfall intercepted by the soil surface increases following clearcutting (Banner et al. 2005). Soils within harvest units tend to become wetter due to decreased canopy interception and evapotranspiration, which could result in slower growth or changed species composition. Soil moisture conditions remain elevated until evapotranspiration rates of the young stand become equivalent to pre-harvest conditions, which may take as long as 30 years (Jones 2000). This effect is expected to be temporary, and in partially harvested stands, retention of a portion of the canopy cover is expected to further minimize the effect of canopy removal on soil moisture.

Recreation Developments on Wetlands

Recreation developments in wetlands on Wrangell Island consist of trails, cabin, campsite, picnic sites, outhouses and parking areas. These developments are constructed on rock fill with similar issues and concerns as road construction. Additionally recreation sites have outhouse facilities with potential to affect water quality. Board walk trail construction has a minimal impact on wetlands as only the footings are in wetlands. Trails constructed with rock fill, such as the Thoms Lake trail have impacts more closely associated with roads than with board walk trails.

Even though recreation sites may impact wetlands, they also serve to concentrate the impacts of human use, thus reducing the extent of the disturbance. Additionally, the developments provide access for people to learn about and appreciate the wetlands. The National Core BMP technical guide (USDA Forest Service 2012) provides a set of BMPs which protect soil and water quality from recreation activities; for example, Fac-4 Sanitations Systems is a specific practice for Rec-2 Developed Recreation Sites to protect wetlands.

Existing recreation sites located primarily in wetlands include the Middle Ridge cabin and trail to Newt Lake, the High Country trails and shelters, the Long Lake trail, trailhead and shelter, and the Volunteer Loop trail. It is estimated that these developments have converted 30 acres to a non-wetland condition.

Urban and Residential Development on Wetlands

Community development dominates the northern tip of Wrangell Island, with residential developments extending down the coastline to McCormack Creek on the west, and to Hermit Creek on the east side of the Island. Extensive developments in wetlands include portions of the airport, the baseball fields, rifle range, industrial area, golf course, and the downtown commercial area. Development of residential lots typically require partially filling wetlands to make them suitable for building.

Environmental Consequences

All of the action alternatives propose some level of timber harvest and road construction on wetlands. The construction of roads and landings is expected to result in the greatest impact to wetlands. The placement of fill in wetlands would permanently affect the wetland properties and functions. Road fill placement will result in the loss of wetland buried under the fill.

The hydrologic effects of constructing roads are expected to remain within 10 feet of the road prism (Glaser 1999). Fill material used for road construction may act as a dam and interrupt the hydrologic connectivity of wetlands, or excessively drain them by acting as a conduit for water movement. The effects of newly-constructed roads and landings on wetland function depend in part, on the landscape position of the wetland and the substrate, or soil, within the wetland. Roads crossing mid-slope and lower-slope landscape positions have a greater chance of intercepting and diverting soil and surface water as the water moves downslope. Wetlands outside the disturbed road corridor (top of the cutbank to the toe of the fill) would retain wetland status but soil drainage may be affected for the first 10 feet beyond the disturbed road corridor (Kahklen and Moll 1999).

The type of rock used for newly-constructed roads and landings may also affect wetland conditions. The effects are dependent on the chemical makeup of fill material, the amount of fill, its particle size (surface area) and the amount of water. The road bed material may subside into the wetlands over time on roads with high traffic levels. Resurfacing these roads may result in a gradual widening of the road (Landwehr 2011, Landwehr and Dillman 2014).

Harvest activities may affect wetland hydrology resulting in increased soil moisture due to tree removal and loss of canopy interception and transpiration. The effects are expected to be short-term, lasting until a new stand of timber is established. In areas logged with a partial cut prescription with helicopter yarding, effects on wetlands are expected to be minimal. All harvested wetlands are expected to naturally regenerate and produce a young-growth stand.

Wetland avoidance and minimization of disturbance to wetlands due to new road construction is addressed and documented on road and unit cards. Alternatives 2 and 3 are similar in the number of wetland acres affected by road construction. Alternative 3 would result in greatest amount of wetland impact with 81 acres of wetland loss while Alternative 5 would result in the loss of the fewest acres (51).

Direct and Indirect Effects of the Alternatives

Alternative 1 – No Action

Under Alternative 1, no timber harvest or road construction activities would affect wetlands. Wetlands impacted by road construction in the past would continue to be impacted. Impacts from existing roads are expected to remain in close proximity to the road bed (Glaser 1999, Kahklen and Moll 1999). Unmaintained roads would likely recolonize with alder; open roads receiving high traffic may subside into the wetlands and gradually widen over time. Forested wetlands that were harvested in the past would regenerate and recover pre-harvest vegetation and hydrologic conditions.

Common to All Action Alternatives

Alternatives 2, 3, 4 and 5 would have direct impacts to wetlands from road construction, rock quarries and timber harvest on wetlands, including forested wetlands (Table 97). Indirect impacts include the potential changes to hydrology in harvest units and in close proximity to the road bed, these impacts are lessened during construction by road layout, and drainage design features.

Fill placed in wetlands for roads, landings, and pullouts would result in a permanent loss of wetland acreage in all action alternatives. Development of new rock quarries and landings may impact wetlands. Because quarry and landing locations are not known at this time, it is estimated that 1 acre of rock quarry would be developed for every mile of road constructed in wetlands.

Harvest activities are expected to have a minimal, short-term effect (30 years) on wetland hydrologic condition. Removal of overstory vegetation is expected to result in increased soil wetness. As young-growth canopy becomes established, conditions would return to pre-harvest conditions. The impacts would be less (negligible) in areas where single tree selection prescriptions are utilized.

Table 97. Wetland acres impacted by alternative, including forested wetlands

Impact type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Road construction (acres)	0	78	74	81	51
Rock quarry (acres)	0	14	13	15	9
Harvest (acres)	0	1,740	1,056	1,112	1,230

Alternative 2 – Proposed Action

This alternative proposes to harvest timber from 1,740 acres of forested wetland using a variety of silviculture prescriptions (Table 97). Of these, approximately 700 acres would be clearcut and 1,027 acres would have a partial harvest prescription. Proposed road construction activities in this alternative would result in conversion of 92 acres of wetland to a non-wetland condition.

Alternative 3

This alternative proposes to harvest timber from 1,056 acres of forested wetland using a variety of silviculture prescriptions (Table 97). Of these, approximately 650 acres would be clearcut and 406 acres would have a partial harvest prescription. Partial harvest prescriptions are expected to have a little to no effect on wetlands, impacts from clearcuts are as discussed above. Construction of roads would result in conversion of approximately 87 acres of wetland to a non-wetland condition.

Alternative 4

This alternative proposes to harvest timber from 1,112 acres of forested wetland using a variety of silviculture prescriptions (Table 97). Of these, approximately 720 acres would be clearcut and 391 acres

would have a partial harvest prescription. Alternative 4 would convert approximately 96 acres of wetland to a non-wetland condition due to newly-constructed roads.

Alternative 5

This alternative proposes to harvest timber from 1,230 acres of forested wetland using a variety of silviculture prescriptions (Table 97). Of these, approximately 427 acres would be clearcut and 802 acres would have a partial harvest prescription. Construction of roads would result in conversion of 60 acres of wetland to a non-wetland condition.

Cumulative Effects

The cumulative effects analysis area is that portion of Wrangell Island within the National Forest boundary. The cumulative effects analysis considers the incremental effects of the alternatives when added to other past, present, and reasonably foreseeable actions. The effects from past actions are included in the affected environment; present and reasonably foreseeable projects are described in Table 4. All of these projects are independent of the selected alternative; as such they would contribute equally to the cumulative effects for each alternative.

Reasonably foreseeable harvest activities by the State of Alaska, Alaska Mental Health Trust and the Forest Service small sale program may result in impacts to wetlands or loss of wetland, with effects similar in nature to those described for the Wrangell Island Project.

Ongoing road maintenance projects would likely result in improved wetland conditions. Maintenance projects include replacement of culverts, ditching and resurfacing roads, road storage and decommissioning of existing roads, and invasive plant control.

Summary of Effects

Road construction to support timber harvest activities poses the greatest impact to wetlands. The effects are expected to be limited to within 10 feet of the disturbed road corridor based on Kahklen and Moll (1999). Wetlands outside the fill area are expected to remain wetlands. Wetland avoidance and minimization of disturbance to wetlands by new road construction is addressed and documented on road and unit cards. BMPs would be implemented in all action alternatives to ensure hydraulic connectivity and beneficial functions of wetlands are not impaired. Alternatives 2, 3 and 4 are similar in the acres of wetland affected by road construction; however, Alternative 4 would result in greatest amount of wetland impact with 81 acres of wetland loss. Alternative 5 presents the least amount of wetland impact from road construction.

Harvest activities would have a short-term effect on wetland hydrology, due to increased soil moisture. In areas logged with an uneven-aged prescription using helicopter yarding, effects on wetlands may be negligible. Alternative 2 would harvest the greatest acres of wetlands, while Alternative 5 would harvest the fewest. All harvest areas are expected to naturally regenerate and produce a young-growth stand.

Design Features

The following design features would be incorporated in all of the action alternatives:

- Roads will be located to avoid wetlands to the extent practicable; avoidance, minimization, and design features for individual roads are documented on the road and unit cards.
- Drainage structures will be used in sufficient number to maintain natural hydrologic conditions. Ditching will be minimized to prevent excessive drainage.
- Ground-based logging systems will use slash to “float” the equipment minimizing wetland disturbance.

Findings and Disclosures

Several of the laws and executive orders listed in Chapter 1 require project-specific findings or other disclosures. These are included here, and will be included in the Record of Decision. They apply to all alternatives considered in detail in this DEIS.

Alaska National Interest Lands Conservation Act (ANILCA)

An ANILCA Section 810 and 811 subsistence evaluation was conducted. The evaluation can be found in the subsistence section of this chapter. No significant restrictions on the abundance and distribution of, access to, or competition for subsistence resources in the project area are anticipated (See the subsistence report in the project record).

However, the Forest Plan Final EIS concluded that Forest-wide, under full implementation of the Forest Plan, the only subsistence resource that may be significantly restricted in the future by federal forest management activities is subsistence use of deer. Subsistence hearings will be held as required.

Bald and Golden Eagle Protection Act of 1940 (as amended)

All alternatives would be in accordance with the interagency agreement established with the USFWS to maintain habitat to support long-term nesting, perching and winter roosting habitat for bald eagles.

Clean Air Act

Air quality would diminish on a recurring, temporary basis due to the construction of roads, timber harvest, and hauling. Limbs and logging slash would be burned at sort yards intermittently throughout the logging periods, which would deposit minor amounts of particulate matter and smoke into the air. Emissions anticipated from the implementation of any project alternative would be of short duration and are not expected to exceed State of Alaska ambient air quality standards (18 AAC 50).

Clean Water Act

Congress intended the Clean Water Act of 1972 (Public Law 92-500), as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4), to protect and improve the quality of water resources and maintain their beneficial uses. Section 313 of the Clean Water Act and Executive Order 12088 of January 23, 1987 address federal agency compliance and consistency with water pollution control mandates. Agencies must be consistent with requirements that apply to "any governmental entity" or private person. Compliance is to be in line with "all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution".

The Clean Water Act (Sections 208 and 319) recognizes the need for control strategies for nonpoint source pollution. The National Nonpoint Source Policy (December 12, 1984), the Forest Service Nonpoint Strategy (January 29, 1985), and the USDA Nonpoint Source Water Quality Policy (December 5, 1986) provide a protection and improvement emphasis for soil and water resources and water-related beneficial uses. Soil and water conservation practices (BMPs) were recognized as the primary control mechanisms for nonpoint source pollution on NFS lands. The Environmental Protection Agency supports this perspective in their guidance, “Nonpoint Source Controls and Water Quality Standards” (August 19, 1987).

The Forest Service must apply best management practices that are consistent with the Alaska Forest Resources and Practices Regulations to achieve Alaska Water Quality Standards. The site-specific application of BMPs, with a monitoring and feedback mechanism, is the approved strategy for controlling nonpoint source pollution as defined by Alaska’s Nonpoint Source Pollution Control Strategy (October 2000). In 1997, the State approved the BMPs in the Forest Service’s Soil and Water Conservation Handbook as consistent with the Alaska Forest Resources and Practices Regulations. This handbook is incorporated into the Tongass Land Management Plan.

A discharge of dredge or fill material from normal silviculture activities such as harvesting for the production of forest products is exempt from Section 404 permitting requirements in waters of the United States, including wetlands [404(f)(1)(A)]. Forest roads qualify for this exemption only if they are constructed and maintained in accordance with best management practices to assure that flow and circulation patterns and chemical and biological characteristics of the waters are not impaired [404(f)(1)(E)]. The BMPs that must be followed are specified in 33 CFR §323.4(a). These specific BMPs have been incorporated into the Forest Service's Soil and Water Conservation Handbook under BMP 12.5.

Effects on Prime Farm Land, Range Land, and Forest Land

No prime farm land or range land would be adversely impacted by the action alternatives. Forest land would maintain its productivity, except for those lands permanently occupied by roads built for long-term access for forest management.

Endangered Species Act

None of the alternatives is anticipated to have a direct, indirect or cumulative effect on any threatened or endangered species in or outside the project area. A biological evaluation has been completed, following FSM 2670 direction, and analyzes threatened, endangered, and petitioned species. It is included in the Wrangell Island EIS project record.

Environmental Justice/Civil Rights

Executive Order 12898 directs federal agencies to state clearly whether a disproportionately high and adverse human health or environmental impact on minority populations, low-income populations, or Indian tribes is likely to result from the proposed action and any alternatives. The Executive Order specifically directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

In accordance with Executive Order 12898, this project does not have disproportionately high and adverse human health or environmental effects on minority or low income populations.

Executive Order 11593

Executive Order 11593 directs federal agencies to provide leadership in preserving, restoring and maintaining the historical and cultural environment of the Nation. The work accomplished in accordance with Section 106 of the National Historic Preservation Act for the Wrangell Island Project meets the intent of this Executive Order.

Executive Order 11988

The numerous streams in the Wrangell Island Project make it essentially impossible to avoid all floodplains during timber harvest and road construction. Forest Plan Standards and Guidelines for riparian areas exclude most commercial timber harvesting from floodplains. Roads may be constructed in or through floodplains subject to the design requirements of the best management practices. Effects on floodplains from project activities have been avoided or minimized as much as possible.

Executive Order 11990

Executive Order 11990 requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Because wetlands are so extensive in Wrangell Island project area, it is not feasible to avoid all wetlands. The wetlands section in this chapter describes the types and amounts of wetlands in the project area and how they would be affected. Effects to wetlands are minimized through the application of best management practices (BMPs).

Road construction through wetlands is avoided where possible. Road cards contain site-specific details on road location through wetlands and how BMPs would be implemented. Based on the analysis in this chapter, it is estimated that the alternatives would result in the loss of approximately 51 to 81 acres (which equates to a loss of about 0.1 percent of wetland acreage in the project area) due to road fill.

Executive Order 12962

Executive Order 12962 requires federal agencies to evaluate the effects of proposed activities on aquatic systems and recreational fisheries. The project minimizes the effects on aquatic systems through project design, application of standards and guidelines, BMPs, and site-specific mitigation measures. Post-project road closures could limit access to some recreational fishing opportunities to foot or permitted off-highway vehicle (OHV). However, most recreational fishing throughout the Tongass occurs by boat in saltwater, and any adverse effects would be minimal.

Executive Order 13112 (Invasive plant species)

Executive Order 13112 requires federal agencies (in part) to evaluate whether the proposed activities will affect the status of invasive species; and to not carry out activities that promote the introduction or spread of invasive species unless it has been determined that the benefits of such action outweighs the potential harm caused by invasive species; and that all feasible and prudent measure to minimize risk of harm will be taken in conjunction with the actions.

Federal Cave Resource Protection Act

There are no known significant caves in the project area.

Magnuson-Stevens Fishery Conservation Act of 1996

The Magnuson-Stevens Fishery Conservation Act (1996) requires that all federal agencies consult with the National Marine Fisheries Service (NMFS) when any federal action is determined by the Forest Service “may adversely affect” essential fish habitat (EFH). The Forest Service’s position is that constructing new roads, harvesting timber near Class I streams and the use of the marine access facility may have an adverse effect on EFH. However, by following the measures to minimize adverse effects listed in the EFH assessment, other standards and guidelines from the Forest Plan and implementing BMPs, the effects on EFH would be minimized. This DEIS, which includes the EFH assessment, will be made available to the National Marine Fisheries Service to initiate formal consultation.

National Forest Management Act

All project alternatives fully comply with the Forest Plan. This project incorporates all applicable Forest Plan Standards and Guidelines and management area prescriptions as they apply to the project area, and complies with Forest Plan goals and objectives. All required interagency review and coordination has been accomplished; new or revised measures resulting from this review have been incorporated.

The Forest Plan complies with all resource integration and management requirements of 36 CFR §219. Application of Forest Plan direction for the Wrangell Island Project ensures compliance at the project level.

National Historic Preservation Act

Cultural resource surveys of varying intensities have been conducted, following inventory protocols approved by the Alaska State Historic Preservation Officer. Native communities have been contacted and public comment encouraged. The consultation and concurrence process with the State Historic Preservation Officer is complete. The SHPO concurred with the Forest Service finding of No Historic Properties Affected for this project.

Threatened and Endangered Species and Region 10 Sensitive Species

A biological evaluation was completed for Region 10 sensitive plants. A biological evaluation/assessment was completed for threatened, endangered and Region 10 sensitive vertebrates and consultation occurred between responsible federal agencies for threatened or endangered species potentially affected by the project activities. Standards and guidelines have been applied, as needed, to ensure that any listed threatened or endangered species or its habitat would not be adversely affected. The Forest Plan contains standards and guidelines for each designated sensitive species, and these are incorporated into the project as applicable.

Tongass Timber Reform Act

Application of Forest Plan riparian standards and guidelines ensures that no commercial timber harvest will occur within 100 feet of any Class I or II stream flowing directly into a Class I stream as required in Section 103 of the Act. The proposed project would provide timber for the Tongass timber program to seek to meet market demand if an action alternative is selected.

See Appendix A - Reasons for Scheduling the Environmental Analysis for the Wrangell Island Project for information on how Section 101 of TTRA is addressed.

USDA Forest Service Transportation; Final Administrative Policy

This project is consistent with the Travel Management Rule by limiting the transportation system to the minimum amount necessary for project activities.

Chapter 4. Lists and References

Chapter 4 includes lists of the document contributors (both interdisciplinary team members and other contributors), a distribution list for agencies, individuals, organizations, municipalities, tribes and other tribal groups who were sent the Wrangell Island DEIS, references cited in the DEIS, and an index of key words by page number.

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Distribution of the Draft Environmental Impact Statement

Individuals, agencies, tribes, organizations and the media on the project mailing list have been notified of the availability of the DEIS on the project website. This list of recipients is available in the Wrangell Island project record. Hard copies of the DEIS are available for public review at the Wrangell Public Library and the Wrangell Ranger District Office.

References Cited

The following list of references includes both literature cited in this DEIS and other sources of information used in the Wrangell Island Project analysis. Complete reference lists are included in individual resource reports which are on file in the Wrangell Island EIS project record.

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Appendix A - Reasons for Scheduling the Environmental Analysis for the Wrangell Island Project FY2016

Reasons for Scheduling the Environmental Analysis of the Wrangell Island Project

Introduction

Coordinated timber harvest project planning is essential for meeting the goals of the Tongass Land and Resource Management Plan (Forest Plan) and to provide an orderly flow of timber to local industry. To determine the volume of timber to offer each year, the Forest Service can look to current market conditions and the level of industry operations. However, the planning process for timber harvest projects requires the Forest Service to rely on projections of future harvest levels to decide how many timber harvest projects to begin each year. This document explains how the Forest Service uses information about future markets and past experience to determine the volume of timber that needs to be started through this process each year. This document relies on the annual timber demand analysis and the most recent project schedule.

The purpose of this document is twofold: first, to explain why this project was selected for inclusion into the Tongass National Forest (Tongass) Timber Program and second, to explain the basis and components of the Tongass Timber program. To accomplish this, the following questions are answered:

- How does the Wrangell Island Project fit into the Tongass Timber Program and How Does the Forest Service decide where Timber Harvest Projects are Located?
- Why is timber from the Tongass being offered?
- How does the Forest Service develop forecasts about future timber market demand?
- What steps must be completed to prepare a contract for offer?
- How does the Forest Service maintain an orderly and predictable timber program?

How Does the Wrangell Island Project Fit into the Tongass Timber Program and How Does the Forest Service decide where Timber Harvest Projects are Located?

The Wrangell Island Project is designed to respond to the July 2, 2013 Secretary of Agriculture's Memorandum 1044-009 (see subsequent discussion about Addressing Sustainable Forestry in Southeast Alaska) by proposing the commercial harvest of old-growth timber, that will contribute to the supply of timber needed to maintain timber industry infrastructure and job skills during the transition to young-growth management.

This project contributes to the timber program planning objective of providing an orderly flow of timber from planning through harvest to meet timber supply requirements. A position statement regarding this project's timber sale harvest plan (See subsequent discussion about the Gate 1 – Initial Planning of Timber Sale Projectwas completed to document that this project warrants additional investment of funds and personnel and that it is reasonable to be conducting an environmental analysis at this time. Anticipated budget allocations and resources are sufficient to prepare and offer this project as scheduled.

This project is currently in Gate 2, Project Analysis and Design (See subsequent discussion about the Gate 2 – Project Analysis and Design (and Decision) and involves environmental analysis and public disclosure as required by the National Environmental Policy Act (NEPA). A no-action alternative is also being analyzed. If an action alternative is selected in the decision for this project, this volume will be added to the volume available for offer.

This project meets all laws and regulations governing the removal of timber from National Forest System lands, including Forest Service policies as described in Forest Service manuals and handbooks, and the Forest Plan and Record of Decision.

Why is This Project Occurring in This Location?

Site-specific reasons the Wrangell Island Project is occurring in this location include:

- The project area contains sufficient acres of suitable and available forest land to contribute to a supply of timber from the Tongass which meets the annual market demand for each planning cycle.
- The project area is on Wrangell Island and the road system accesses all of the proposed timber harvest units, two existing log transfer facilities, and small mills located in the city of Wrangell. Because the project is connected to the same road system as the City of Wrangell it would help support direct and indirect employment through the supply of personnel, goods and services.
- The proposed harvest units are within development land use designations (LUDs) as allocated by the forest plan.
- The Wrangell Island project area contains sufficient acres of suitable and available forest land to make this timber harvest proposal reasonable. Areas with available timber need to be considered for harvest in order to seek to provide a supply of timber from the Tongass National Forest which 1) meets the annual market demand for such forest, and 2) meets the market demand from such forest for each planning cycle, pursuant to Section 101 of the Tongass Timber Reform Act (TTRA).
- Effect on subsistence resources from timber harvest are projected to have few differences based on the sequence in which areas are harvested. Harvesting other areas with available timber on the Tongass National Forest is expected to have similar potential effects on the resources, including subsistence resources, because of widespread distribution of subsistence use and other factors. Harvest within other areas is foreseeable under the Forest Plan.

Why is Timber Volume from the Tongass Being Offered for Sale?

National Legislation

On a national level, the legislative record is clear about the role of the timber program in the multiple-use mandate of the national forests. One of the original objectives for creation of national forests was to provide natural resources, including timber, for the American public. The Organic Administration Act of 1897 (partially repealed in 1976) directed the agency to manage the forests in order to "improve and protect the forest ... [and] for the purpose of securing favorable conditions of water flows, *and to furnish a continuous supply of timber* for the use and necessities of the citizens of the United States" (emphasis added). The Multiple-Use Sustained Yield Act of 1960 directs the Forest Service to administer federal lands for “outdoor recreation, range, timber, watershed, and wildlife and fish purposes.”

The National Forest Management Act (NFMA) of 1976 states that “the Secretary of Agriculture...may sell, at not less than appraised value, trees, portions of trees, or forest products located on National Forest System Lands.” Although the heart of the Act is the land management planning process for national forests, the Act also sets policy direction for timber management and public participation in Forest Service decision making. Under NFMA, the Forest Service was directed to “limit the sale of timber from each national forest to a quantity equal to or less than a quantity which can be removed from such forest annually in perpetuity on a sustained-yield basis.”

The NFMA directs the Forest Service to complete land management plans for all units of the National Forest System. Forest plans are developed by an interdisciplinary team to provide for the coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness. Forest plans designate

areas of national forest where different management activities and uses are considered appropriate, including those areas suitable for timber harvest.

Alaska-Specific Legislation

Timber volume from the Tongass is being offered as part of the multiple-use mission of the Forest Service identified in the public laws guiding the agency. In addition, Alaska-specific legislation and the Tongass Forest Plan direct the Forest Service to seek to provide timber to meet market demand, subject to certain limitations.

The Alaska National Interest Lands Conservation Act (ANILCA) and the Tongass Timber Reform Act (TTRA) provide direction on the issue of Tongass timber supply. TTRA, Section 101 deleted ANILCA, Section 705 (a), which mandated a fixed timber supply and fixed budget appropriations, and inserted the following :

Sec. 705. (a) Subject to appropriations, other applicable law, and the requirements of the National Forest Management Act of 1976 (P.L. 94-588); except as provided in subsection (d) of this section, the Secretary shall, to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the annual market demand from such forest for each planning cycle.

Tongass Land and Resource Management Plan

The Tongass Land and Resource Management Plan (Forest Plan), as amended, guides all natural resource management activities and establishes management standards and guidelines for the Tongass. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for different kinds of resource management. This Forest Plan embodies the provisions of the National Forest Management Act, the implementing regulations, and other guiding documents. The multiple-use goals and objectives, and the land use prescriptions and standards and guidelines, constitute a statement of the Forest Plan's management direction.

The Forest Plan was completed in 1979 and revised in 1997. The Record of Decision (ROD) for the 2008 Forest Plan Amendment was signed by the Alaska Regional Forester on January 23, 2008. The Forest Plan incorporates new resource information and scientific studies and reflects an extensive public involvement process. The Forest Plan defines appropriate activities within each of 19 LUDs. Approximately 79 percent of the Tongass is allocated to LUDs where scheduled commercial timber harvest is not allowed (See the subsequent section How Does The Forest Service Decide Where Timber Harvest Projects Should Be Located?).

The decision for the Forest Plan establishes the annual average Allowable Sale Quantity (ASQ) the maximum amount of timber that may be offered) at 267 million board feet (MMBF). This is the same as the ASQ established for the previous Forest Plan in 1997. While technically a limit on volume, in effect the ASQ also limits the amount of timber that may be harvested on the Tongass.

The environmental effects analysis in the Final EIS for the 2008 Forest Plan assumed the maximum timber harvest allowed under each alternative would occur annually over the next 100 to 150 years. In that way, the Forest Plan analysis displayed the maximum environmental effects that could be reasonably foreseen. However, substantially less timber volume and acres have actually been harvested than the maximum level allowed under the 1997 Forest Plan (See Figure 32). Thus, the effects on resources are expected to be less than projected in the 2008 Forest Plan Amendment Final EIS.

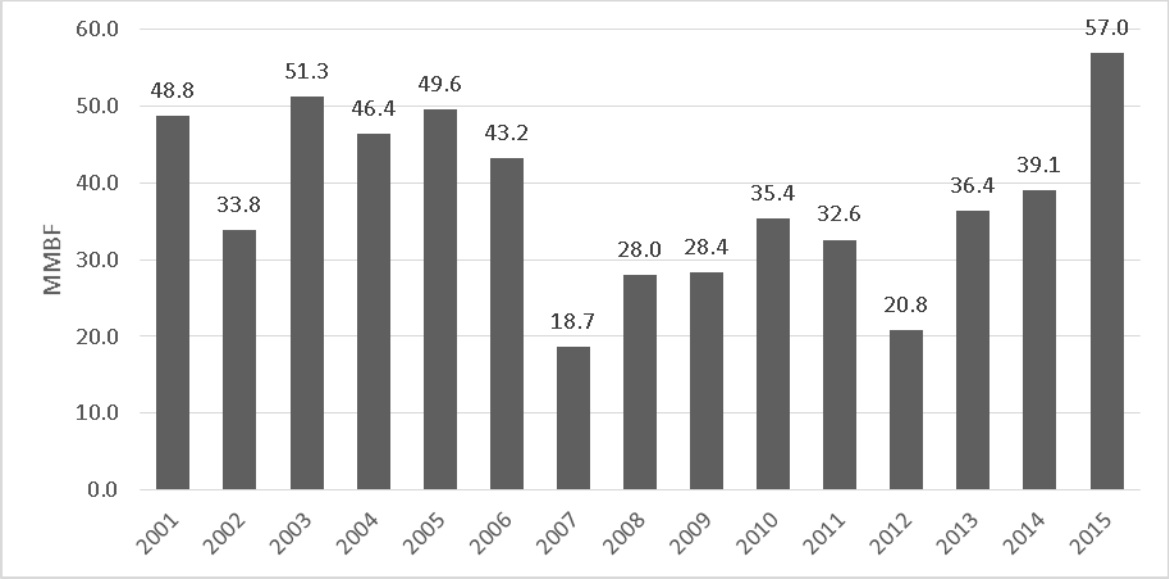


Figure 32. Tongass Timber Volume Harvested (MMBF) for Fiscal Years 2001-2015

USDA Investment Strategy for Creating Jobs and Healthy Communities in Southeast Alaska

After consecutive decades of population loss, the Southeast region and its 32 communities have experienced some population stabilization in recent years. However, socioeconomic community conditions remain tenuous with declining school enrollments, high energy costs, and limited job opportunities in many rural communities.

USDA agencies (Farm Service Agency, Forest Service, and Rural Development) and the U.S. Economic Development Administration (USEDA) have partnered to support community revitalization through investment in economic development planning, restoration-based job creation, and community capacity building. USDA investment strategy goals include:

- creating quality jobs and sustainable economic growth;
- promoting small business creation, expansion, and retention;
- improving access to capital; and
- promoting job training and educational opportunities.

To do this, USDA agencies collaborated with local business and community leaders to implement an industry cluster-based approach to economic development – the Southeast Alaska Cluster Initiative. Over the past five years (2010 – 2015), the USDA invested $1,030,000 in the Southeast Alaska Cluster Initiative via Forest Service and Rural Development agencies. June 2015 marks a significant milestone for the Southeast Cluster Initiative project as it signifies nearly five years of USDA investment in implementing a strategic approach to regional economic development including economic research, asset mapping, cluster work group facilitation, and consult regarding regional economic development opportunities.

While the Forest Service discontinued funding for the Southeast Cluster Initiative in 2015, significant staff resources remain invested to ensure the long-term sustainability of the overall effort. The USDA agencies continue to work together to align resources, focus investments, and collaborate to encourage economic diversification and community well-being across Southeast Alaska.

Addressing Sustainable Forestry in Southeast Alaska

The timber industry's long term survival in Southeast Alaska requires a transition from a dependence on old-growth timber to a program that is primarily supported by young growth. The goal is to transition from the dependence on harvest of old-growth forest to young growth forest management in a manner that allows the timber industry to adapt to these changed conditions to provide jobs and economic support for the communities of Southeast Alaska.

Transition to Young Growth Timber

On July 2, 2013, the Secretary of Agriculture issued Memorandum 1044-009 (*Addressing Sustainable Forestry in Southeast Alaska*) to support the transition away from old-growth timber harvesting towards a forest industry based on the utilization of young growth timber. The memorandum states that "To conserve the Tongass National Forest under the principles of the Multiple-Use Sustained-Yield Act of 1960, Tongass Timber Reform Act and other relevant statutes, we must speed the transition away from old-growth timber harvesting and towards a forest industry that utilizes second growth – or young growth – forests. Moreover, we must do this in a way that preserves a viable timber industry that provides jobs and opportunities for residents of Southeast Alaska."

Retaining the existing industry is critical to this approach, therefore the transition to young growth will be managed at a pace that allows operators to adjust, adapt, and develop markets for new products. The maintenance of the timber industry in Southeast Alaska will contribute to the diversity of the economy with the on-going development of other economic sectors such as tourism, recreation, fishing and mariculture and renewable energy.

The long term goal is that the majority of active forest management on the Tongass will be comprised of ecological restoration, young growth forest management, small and microsale old-growth timber sales and pre-commercial thinning. These projects would in turn supply local and regional wood products markets.

Old-growth "Bridge Timber"

Pursuant to the Secretary's memorandum, the Forest Service is asked to seek opportunities to supply sufficient old growth "bridge timber" while the industry re-tools for processing young growth. To achieve this, a supply of old-growth will continue to be offered while commercial young growth timber processing and marketing opportunities are explored and developed. This will help maintain the existing workforce and retain local knowledge and experience as businesses retool toward smaller diameter wood utilization.

The amount of old-growth "bridge timber" harvested will decrease as more young growth timber becomes economically viable to harvest. The duration and scale at which old-growth "bridge timber" will be needed is unclear. Factors such as the role of State and private land in contributing wood supply to a viable industry; the availability of suitable young growth that is mature and economic to harvest; export and domestic processing policies; and fluctuations in domestic and world markets for forest products must be considered, are unpredictable, and will influence the timeframe for transition.

Integration of Work

Integrating forest management activities from individual resource schedules for timber offers, watershed restoration and habitat improvement, and road decommissioning and maintenance incorporates community and collaborative input and priorities; aligns staff and budgets to increase efficiencies and effectiveness at the district and project-level and integrating multiple programmatic activities in larger landscapes. This also utilizes the existing industry and workforce capacity and provides a stable and consistent program of work to encourage new business investment. Declining budgets and unpredictable markets will likely make it difficult to implement every project as currently planned.

The efforts by several USDA entities and other stakeholders to explore and support economic diversification and job creation in Southeast Alaska with regards to the forestry and restoration, is important for two reasons: 1) it maintains current infrastructure in Southeast Alaska and therefore jobs, and 2) uses that infrastructure as a springboard to diversify the forestry sector, creating even more jobs.

How Does the Forest Service Develop Forecasts about Future Timber Market Demand?

Consistent with the provisions of the Tongass Timber Reform Act, the Forest Service makes two types of forecasts of market demand for timber from the Tongass. The first, "planning cycle market demand," forecasts the long-term demand for timber from the Tongass over the life of the Forest Plan, derived from trends in international demand for end products manufactured from such timber. Based on these long-term projections, the Forest Service also estimates annual market demand in order to determine how much timber to plan to offer.

Market Demand for the Planning Cycle

Research economists with the Forest Service's Pacific Northwest (PNW) Research Station have prepared several studies of "planning cycle market demand" for Tongass timber, including three General Technical Reports by Brooks and Haynes (1990, 1994, and 1997). In 2006, the PNW Research Station published new harvest projections (Brackley et al. 2006). This report and an addendum to it (Brackley and Haynes 2008) provided key information for the 2008 Forest Plan Amendment analysis.

The Brackley et al. 2006 projections include four scenarios: 1) limited lumber production, which represents the situation the timber industry in Southeast Alaska has faced over the last several years; 2) expanded lumber production, which assumes some form of demand stimulus occurs; 3) medium integrated industry, which assumes sufficient demand stimulus occurs to cause an expansion of the current industry capacity and better utilization of forest products removed from public timber contracts; and 4) high integrated industry, assumes some kind of additional demand stimulation to result in full utilization of all types of forest products available from the Tongass. More detailed information about these scenarios and their assumptions is in the Forest Plan Amendment Final EIS and ROD (January 2008), and in Brackley and Haynes 2008.

The Brackley et al. 2006 study displays alternative projections of derived demand for timber from the Tongass. For the first two scenarios, which assume no market for low-grade sawlogs and utility volume, the estimates of planning cycle demand include sawtimber only. For the two integrated industry scenarios, the projections include total volume, including both sawlogs and utility. Utility volume must be cut along with higher-quality timber even if there is no demand for it. It is the total volume of timber cut on the Tongass that is of most interest, in part because environmental effects result from total volume cut. In addition, any comparison of scenarios must be based on comparable figures. Table 98 shows annualized Brackley et al. 2006 projections for all four scenarios in terms of total volume.

Table 98. Tongass volume necessary to supply derived demand for decked log volume and chips, in million board feet (MMBF) (Alexander 2008[1])

Year	Scenario 1 Limited lumber	Scenario 2 Expanded lumber	Scenario 3 Medium integrated	Scenario 4 High integrated
2007	49.8	61.9	67	67
2008	49.8	66.4	139	139
2009	51.3	72.4	151	151
2010	52.8	78.5	166	166
2011	52.8	84.5	184	184
2012	54.3	90.5	204	286
2013	55.8	98.1	204	291
2014	57.3	105.6	204	295
2015	58.9	113.2	204	299
2016	58.9	122.2	204	303
2017	60.4	131.3	204	308
2018	61.9	140.3	204	312
2019	63.4	150.1	204	317
2020	64.9	163.0	204	325
2021	66.4	175.0	204	333
2022	67.9	187.1	204	342
2023	69.4	200.7	204	351
2024	70.9	215.8	204	360
2025	72.4	230.9	204	370

1 Annualized calculation to fulfill derived demand scenarios from Brackley et al. (2006). This table was created using annualized values provided by Dr. Allen Brackley (personal communication, Nov 29, 2006) from the model used to develop derived demand estimates in Brackley et al. (2006). The values for Limited Lumber Scenario and Expanded Lumber scenarios reported in this table have been adjusted to include low-quality material not included in the demand projections and include saw logs, cedar export, and utility (chip) volumes available from sawmill production. The Medium and High Integrated Scenarios are not adjusted and includes sawlogs, cedar exports, chip volumes, low-grade material, and utility in Brackley et al. (2006).

Draft Planning Cycle Market Demand for the ongoing Forest Plan Amendment for Transition to Young Growth

The PNW Research Station has drafted new timber harvest projections (2015-2030) with final publication still in progress (Daniels et al., in press) – the fifth such analysis performed since 1990. New timber demand projections do not require changes in the basic methodology for timber offer calculations in the procedure outlined by Morse (2000). Similar to prior long-term projections, projections of Alaska timber products output, the derived demand for logs, lumber, residue, and niche product, and timber harvest by owner were developed using a trend-based analysis.

While PNW Research Station developed these new long-term timber demand projections to inform the analysis for the 2015 Tongass Land and Resource Management Plan Amendment Draft EIS, all data and analysis remains in draft form until the manuscript is published. Planning for the Wrangell Island Project occurred under the 2008 Forest Plan and uses those demand assumptions as discussed above. Daniels et al. (in press) developed a baseline demand model, projecting from 2015 to 2030, to construct three scenarios representing alternative futures for timber harvest – all incorporating a transition from predominantly old growth to young growth timber harvest. The baseline demand model assumes projected trends in imports, consumption, and market share will remain constant.

Table 99. 2015 Forest Plan Amendment DEIS Table 3.22-15. Estimated annual maximum timber harvest on the Tongass by alternative, Year 1 to 100

5-Year Period	Years	Alt 1			Alt 2			Alt 3			Alt 4			Alt 5		
		YG	OG	Total	YG	OG	Total	YG	OG	Total	YG	OG	Total	YG	OG	Total
1	1-5	6.3	39.7	46.0	23.8	22.2	46.0	20.8	25.2	46.0	8.4	37.6	46.0	9.0	37.0	46.0
2	6-10	6.3	39.7	46.0	23.8	22.2	46.0	20.8	25.2	46.0	9.0	37.0	46.0	9.4	36.6	46.0
3	11-15	11.1	34.9	46.0	47.5	5.0	52.5	41.8	5.0	46.0	24.6	21.4	46.0	25.0	21.0	46.0
4	16-20	11.1	34.9	46.0	114.5	5.0	119.5	112.0	5.0	117.0	60.2	5.0	65.2	66.0	5.0	71.0
5	21-25	11.1	34.9	46.0	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
6	26-30	23.4	22.6	46.0	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
7	31-35	41.6	5.0	46.6	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
8	36-40	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
9	41-45	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
10	46-50	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
11	51-55	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
12	56-60	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
13	61-65	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
14	66-70	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
15	71-75	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
16	76-80	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
17	81-85	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
18	86-90	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
19	91-95	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4
20	96-100	129.4	5.0	134.4	114.6	5.0	119.6	112.0	5.0	117.0	84.4	5.0	89.4	88.4	5.0	93.4

Notes:

YG = young growth; OG = old growth

1 The shaded cells indicate the 5-year increment when the transition to young-growth harvest is expected to be completed.

2 These volumes are maximum harvest levels and include grade 1, 2, and 3 logs only.

Demand for Tongass National Forest timber currently depends on markets for sawn wood and exports of softwood logs. Therefore, the model was most sensitive to changes in Pacific Rim log demand. Areas of uncertainty include the prospect of continuing changes in markets and competition, the impact of the transition to young-growth timber, and the rates of investment in manufacturing in Alaska. While transitioning to young-growth management is the purpose of the Forest Plan Amendment, any alternative selected for the decision for the Amendment would still need an old-growth component with an annual range of 22 to 39 MMBF for at least the first 10 years (See Table 99). However, the rate at which this transition will occur is uncertain. The rate would depend on level of investment and, under any scenario, would require a "bridge" strategy to continue to allow some old-growth harvest to sustain communities and jobs through this transition. A major step, following the example of successful mills in the lower 48, would be for industry in Southeast Alaska to retool its equipment to process smaller logs from younger trees. To do so, however, requires substantial investment over several years.

The Wrangell Island Project can contribute to providing "bridge" timber to sustain the current industry and jobs in communities, while opportunities are developed for Southeast Alaska young-growth. Therefore, an underlying need exists for a reliable economic supply of sawtimber for Southeast Alaska mills to help support the timber industry and employment through the transition years until the industry can switch to a stable supply of young growth

Annual Market Demand

The annual market demand forecast is a methodology used to set the short-term goals for the Tongass Timber Program – volume the Forest plans to offer in the current year, pending sufficient funding and sufficient NEPA-cleared volume.

The formulas and procedures used in forecasting annual market demand are described in a Forest Service report titled Responding to the Market Demand for Tongass Timber (Morse, 2000). These procedures, which have become known as the "Morse methodology," are based on the premise that:

- Forest product markets are volatile, especially in the short run.
- Timber purchasers in Southeast Alaska have few alternative suppliers of timber if they cannot obtain it from the Tongass. Oversupplying this market has relatively few adverse economic effects; undersupplying it can have much greater negative economic consequences.
- It takes years to prepare National Forest timber for sale, including completion of environmental impact statements.
- It is difficult to estimate demand for timber from the Tongass, even a year or two in advance.
- Industry must be able to respond to rapidly changing market conditions in order to remain competitive.

Accordingly, the Morse methodology establishes a system that considers factors such as mill capacity and utilization of that capacity, and seeks to build and maintain sufficient volume of timber under contract (i.e., timber purchased but not yet harvested) to allow the industry to react promptly to market fluctuations. Industry actions such as annual harvest levels are monitored and timber program targets are developed by estimating the amount of timber needed to replace volume harvested from year to year. The methodology is adaptive, because if harvest level drop below expectations and other factors remain constant, future timber offerings would also be reduced to levels needed to maintain the target level of volume under contract. Conversely, if harvest levels rise unexpectedly, future timber volume targets would also increase sufficiently to ensure that the inventory of volume under contract is not exhausted. By dealing with uncertainty in a flexible, science-based fashion, the Morse methodology is an example of adaptive management.

The Morse methodology originally used the projected harvest from the final 1997 Brooks and Haynes report. These procedures were updated (Alexander 2008) to use the annual projected harvest figures from

Brackley et al. 2006 in calculations of annual timber offer targets. No further changes to the Morse methodology were required as a result of the updated long-term demand projections contained in the Brackley et al. study.

In 2008, due to the Region 10 shipment policy, the Ketchikan veneer mill, and the success of Alaska producers in niche or specially markets, Brackley et al. 2008 determined that demand for National Forest timber in Alaska was on a trajectory most similar to scenario 2 (expanded lumber production). In 2011, due to the sharp downturn in wood products markets, the 'Limited Lumber' scenario was used. However, due to the export policy and good overseas markets, this projection is back to being based on the 'Expanded Lumber, Scenario 2'.

For FY 2014, the goal for volume of timber to be offered is 142 MMBF. The next demand will be calculated after the decision on the Forest Plan is finalized. This number is not intended to represent actual timber purchases. Rather, it reflects the estimated volume of timber the Forest Service needs to offer to replace the volume expected to be harvested and help build a 3 year supply of timber under contract, which allows the industry to respond to market fluctuations. The actual volume of timber offered in any given year, however, reflects a combination of factors, such as final budget appropriations; completing the NEPA process; the practice of offering smaller sales for smaller operators rather than all the volume from a NEPA decision; the statutory requirement that timber sales offered in the Alaska Region appraise positive; and volume affected by litigation. Due to these factors, the amount of timber that is offered and sold may be less than the expected timber purchases as predicted in the annual demand calculations. The document displaying the most recent annual demand calculation and the factors used in these calculations are in the project record and on the Alaska Region public website http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5447816.pdf).

The planned annual timber volume offer could include a combination of new, previously offered, and reconfigured timber sales. Both green timber and salvage sales will be components of this program. Offerings will consist of those targeted for Small Business qualified firms, as well as a portion of the volume being made available for the open market.

For planning and scheduling purposes, the Tongass uses a 5-year timber sale plan, which is consistent with Forest Service Manual 2430. This 5-year plan is based on completed and ongoing environmental analyses and contains information to purchasers and other interested parties, and provides a plan that can be adjusted in response to changing market conditions. This plan is also located on the Alaska Region timber management public website after it is approved by the Forest Supervisor (See subsequent reference section for the internet address).

Both the "annual market demand" and the "planning cycle market demand" projections are important for timber program planning purposes. They provide guidance to the Forest Service to request budgets, to make decisions about workforce and facilities, and to indicate the need to begin new environmental analysis for future program offerings. They also provide a basis for expectations regarding future harvest, and thus provide an important source of information for establishing the schedule of probable future offerings. The weight given to the projections will vary depending on a number of factors, such as how recently they were done and how well they appear to have accounted for recent, site-specific events in the timber market. More information on timber demand on the Tongass is presented in Appendix G of the Forest Plan Amendment Final EIS (USDA Forest Service 2008d).

What Steps Must Be Completed to Prepare a Timber Volume Contract for Offer?

The Tongass timber program is complex. A number of projects are underway at any given point in time, each of which may be in a different stage of planning and preparation. A system of checkpoints, or "gates", helps the Forest Service track the accomplishments of each stage of a project from inception to contract termination (See Forest Service Handbook 2409.18 – Timber Sale Preparation).

Gate 1 – Initial Planning of Timber Sale Project

A timber sale project plan, often referred to as a position statement, is a brief analysis of the project area with the intent of determining the feasibility of a potential timber sale. After the position statement is developed, the Forest Service decides whether the project area merits continued investment of time and funds for completion (See Forest Service Handbook 2409.18, Chapter 20).

Gate 2 – Project Analysis and Design (and Decision)

This stage is commonly referred to as the "NEPA" phase and includes field work, public scoping, analysis, draft disclosure of the effects of the project on the environment, public comment, final analysis and disclosure, decision, and potentially administrative appeals and litigation. Gate 2 activities must be completed before a contract is awarded. Legislation, policy changes, and appeals and litigation have recently extended completion of some projects, often doubling the desired time frame (See Forest Service Handbook 2409.18, Chapter 30).

Gate 3 – Sale Plan Implementation and Appraisal (Preparation of a Timber Harvest Contract)

During this stage, the sale plan information and direction included in the decision document from Gate 2 is used to layout units and design roads on the ground. This step includes a timber sale appraisal that initiates Gate 4. Additional site-specific information is collected at this time. In order to maintain an orderly flow of timber volume, Gate 3 activities need to be complete before a contract is offered for bid (See Forest Service Handbook 2409.18, Chapter 40).

Gate 4 – Final Package Preparation, Review, Appraisal, and Offering (Advertise a Contract)

The costs and value associated with the timber volume designed in Gate 3 are appraised and packaged in a contract. The contract is a legally binding document that tells a prospective contractor how the timber must be harvested to conform to the project decision document. This step occurs during the final year of the project development and culminates with the advertisement of the project for sale (See Forest Service Handbook 2409.18, Chapter 50).

Gate 5 – Bid Opening

Gate 5 is completed with the opening of bids for the project. If a bid is submitted, contractual provisions govern when the award of the contract takes place, the contract length and operation season, and how timber removal is to occur (See Forest Service Handbook 2409.18, Chapter 60).

Gate 6 – Award a Contract

Gate 6 is the formal designation of a contract between a bidder and the Forest Service (See Forest Service Handbook 2409.18, Chapter 70).

How Does the Forest Service Maintain an Orderly and Predictable Timber Program?

Pools of Timber (Pipeline Volume)

As discussed earlier, the Forest Service tracks the accomplishment of the different steps of development of each timber harvest contract with the Gate System. From a timber program standpoint, it is also necessary to track and manage multiple projects as they move through the Gate System. Because of the timeframes needed to accomplish a given timber harvest project and the complexities inherent in that project and program development, it is necessary to track various timber program volumes from Gate 1 through Gate 6.

The goal of the Tongass is to provide an even flow of timber offerings on a sustained-yield basis to meet market demand. In recent years, this has been difficult to accomplish due to a combination of uncertainties such as delays related to appeals and litigation; changing economic factors, such as rapid market fluctuations; and industry-related factors, such as changes in timber industry processing capabilities. To achieve an even flow of timber volume offerings, 'pools' of volume in various stages of the Gate System are maintained so volume offered can be balanced against current year demand and market cycle projections.

Today, upward trends in demand are resolved by moving out-year timber projects forward, which may leave later years not capable of meeting the needs of the industry. In other instances, a number of new projects are started based on today's market but will not be available for a number of years. By the time the added projects are ready for offer, the market and demand for this volume may have changed. Three pools of timber volume are tracked to achieve an even flow of timber harvest offerings.

The objective of the timber pools concept is to maintain sufficient volume in preparation and under contract to be able to respond to yearly fluctuations in a timely manner. Table 99 displays the current estimated volume in each pool, as well as the goal which the Tongass has established for the volume to be maintained in each pool, based on historic patterns. Appeals and litigation can cause timber harvest projects to be reevaluated, which can cause delays in making projects available to move through the pools, thereby not fully meeting the goals for volumes in each pool.

Pool 1 - Timber Volume under Analysis (Gate 1 and Gate 2)

Volume in Gate 1, the initial planning step, represents a large amount of volume, but represents a relatively low investment in each project. This relatively low investment level offers the timber program manager a higher degree of flexibility and thus, does not greatly influence the flow of volume through the pipeline. A signed Project Plan (Forest Service Handbook 2409.18, Chapter 20) is the completion of this gate. Areas being considered at this time are Kuiu Island, Mitkof Island, Shrimp Bay, and Zarembo Island. A Gate 1 will be considered for Prince of Wales Island after inventory work has been completed. The amount of the volume at Gate 1 is subject to change during the Gate 2 analysis.

Gate 2, timber volume under environmental analysis, includes projects being analyzed and undergoing public comment through the NEPA process. This pool includes any project that has started the scoping process through those projects ready to have a decision issued. In addition, tracking how much volume is involved in appeals or litigation may be necessary to determine possible effects on the flow of potential timber projects. A signed NEPA decision (Forest Service Handbook 2409.18, Chapter 30) is the completion of this gate. Volume affected by appeals and litigation is tracked as a subset of this pool (Table 100). Areas under analysis at this time, in addition to this project, are Kosciusko Island, Wrangell Island, and Saddle Lakes on Revillagigedo Island.

Based on historic patterns, the Tongass has established a goal for the pipeline volume to be maintained in each of the timber pools. The goal for Pool 1 is to be maintained at approximately 4.5 times the amount of the projected harvest to account for projects at various stages of analysis. That goal reflects a number of factors which can lead to a decrease in volume available, such as a decision in Gate 1 to drop further analysis in a particular planning area (called the "no go" decision), a falldown in estimated volume between Gate 1 and Gate 2, and volume not available for harvest due to litigation.

Pool 2 - Timber Volume Available for Sale (Gates 3, 4, and 5)

Timber volume available for sale includes projects for which environmental analysis has been completed, and have had any administrative appeals and litigation resolved. Timber in this pool can include a combination of new offers, previously offered unsold contracts, and remaining volume from cancelled contracts. The goal is to maintain Pool 2 at approximately 1.3 times the amount of the projected harvest to allow flexibility in offering contracts.

Enough volume in this pool is needed to be maintained to be able to schedule future offerings of the size and configuration that best meets market needs in an orderly manner. Although projects may meet the above criteria, contracts may not be offered if the volume appraises deficit or if changed circumstances would affect the ability to offer them. Whether an offering appraises deficit may change over time depending on the market and other factors. Also, some projects are either designed for small sales, or otherwise slated for small sales, as part of the decision or as part of an informal appeal resolution.

The size of timber sale contracts are based on the needs of Tongass-wide sawmills. The goal is to match sale sizes to the needs of potential bidders in the area of interest while providing for cost-efficient operations (Forest Service Manual 2431.13). The Forest Service will plan sale offerings to encourage competitive bidding in a range of sizes and species that provides opportunities for businesses in Southeast Alaska.

The amount of volume to be offered as small sales is based on a determination of the need of mills in the vicinity of the project area. Also taken into consideration is the amount of volume under contract. Small volume contracts are generally offered in situations where: 1) the project is designed to be specifically allocated to small operators; 2) an allocation of volume for smaller offers has made during the decision or during informal appeal or objection resolution meetings; and 3) the harvest is within Phase 2 lands as determined by the Forest Plan (Forest Plan Record of Decision, p. 66). There is currently about 69 MMBF slated for small sales, however, much of this volume (about 53 MMBF) is located in the north end of Tongass where there are fewer mills.

The Pool 2 timber volume for sale (Table 99) does not identify that volume which, through a decision by the Responsible Official, is slated only for small sales because this volume is metered out and not all available in the current year (even though it has a completed Gate 2 NEPA). The average volume under contract for small sales for fiscal years 2005 through 2014 was approximately 19 MMBF, with a range of about 13 to 24 MMBF of volume under contract annually.

Delays at Gate 2 have affected preparation (Gate 3) and have made scheduling of offers uncertain. At Gate 4, contracts have been fully prepared and appraised, and are available to managers to advertise for bid. This allows potential purchasers an opportunity to do their own evaluations of these offerings to determine whether to bid, and if so, at what level.

Pool 3 - Timber Volume under Contract (Gate 6)

Timber volume under contract contains the volume that has been sold and a contract awarded to a purchaser, but which have not yet been fully harvested. Contract length is based on the amount of timber in the contract and the accessibility of the area for mobilization. The longer the contract period, the more flexibility the operator has to remove the timber based on market fluctuations. Timber contracts typically give the purchaser initially 3 years to harvest and remove the timber purchased; however, they can be extended under certain circumstances, such as inoperable periods of weather, injunctions, and other contractual delays.

The Tongass attempts to maintain roughly 3 years of remaining volume under contract to the industry as a whole. This volume of timber is the industry's dependable timber supply, which allows adaptability for business decisions. This practice is not limited to the Alaska Region, but is particularly pertinent to Alaska because of the nature of the land base. The relative absence of roads, the island geography, the steep terrain, and the consequent isolation of much of the timber land means that timber purchasers need longer-than-average lead times to plan operations, stage equipment, set up camps, and construct roads prior to beginning harvest.

A combination of projected harvest and projected demand is used to estimate the volume needed to maintain an even-flow timber program. As purchasers harvest timber, they deplete the volume under contract. Timber harvest is then planned and offered to give the industry the opportunity to replace this

volume and build or maintain their working inventory. Although there will be variation for practical reasons from year to year, in the long-run over both the high points and low points of the market cycle, the volume harvested should equal the timber volume sold.

The goal for Pool 3, volume under contract, is to maintain timber volume at approximately three times the amount of annual projected harvest. This allows the purchasers to have a continuous supply of timber volume available for harvest so they can plan their operations and be flexible to allow for weather conditions and market fluctuations.

Table 100. Accomplishments in Gate System and Timber Pools (MMBF)

Pipeline Pool Volume	FY 2014 Goal	March 2016
Pool [1] Volume Under Analysis (Gate 1 and 2)	639 [1]	156 to 233[2]
Pool [2] Volume Available for Sale (Gate 3, Gate 4 and Gate 5)	185 [3]	75[4]
Pool [3] Volume Under Contract (Gate 6)	426 [5]	90[6]

1 The goal for volume under analysis is approximately 4.5 times the projected harvest for the current year (based on 142 MMBF for the 2014 timber demand).

2 Volume under analysis includes all timber volume in projects with a completed project plan (Gate 1) through completion of the environmental analysis (Gate 2). This figure includes about 19 to 30 MMBF of young-growth timber. A range is shown to display the range of volume for the alternatives for the on-going Gate 2 projects.

3 The goal for volume available for offer is to have at least 1.3 times the projected harvest for the current year (based on 142 MMBF in projects that have approved NEPA and completion of timber contract preparation.

4 This only includes the volume that is available to offer which needs to have gone through the NEPA process. This figure does include volume involved with on-going litigation. It does not include that volume slated only for small sales, which is currently about 69 MMBF.

5 The goal for volume under contract is for purchasers to have three times the volume under contract (based on 142 MMBF).

6 Estimated volume under contract available for harvest as of March 2016 not including settlement contracts as described by 36 CFR §223.12 and those contracts which are in the process of being terminated. (Source: USDA Forest Service Alaska Region public website).

How Objections and Litigation Affect the Tongass Timber Program

Timber harvest projects require site-specific environmental analysis that usually is documented in an environmental assessment (EA) or an environmental impact statement (EIS). The public is notified of the analysis and is provided the opportunity to comment on project proposals.

This project will go through a pre-decisional administrative review process (36 CFR §218), which became effective March 27, 2013. This pre-decisional administrative review process is commonly referred to as an objection process. Under this process, individuals and entities may file objections after an environmental analysis document is completed but before a decision document is signed. This process builds on early participation and collaboration efforts, with the intention of resolving concerns before a decision is made. Often, to resolve those points made during the objections process, the Objections Decision officer requests that additional analysis is performed which may delay the scheduling of timber volume offers from the project.

After a project has advanced through the objection process, the project can still be litigated. Although litigation does not always preclude offering timber volume, the Forest Service and potential purchasers are often reluctant to enter into a contract where the outcome is uncertain. Since litigation can be a lengthy process, litigation can also affect the Forest's ability to provide a reliable timber supply. Often with an unfavorable decision, the court will vacate the project's decision and no volume can be offered

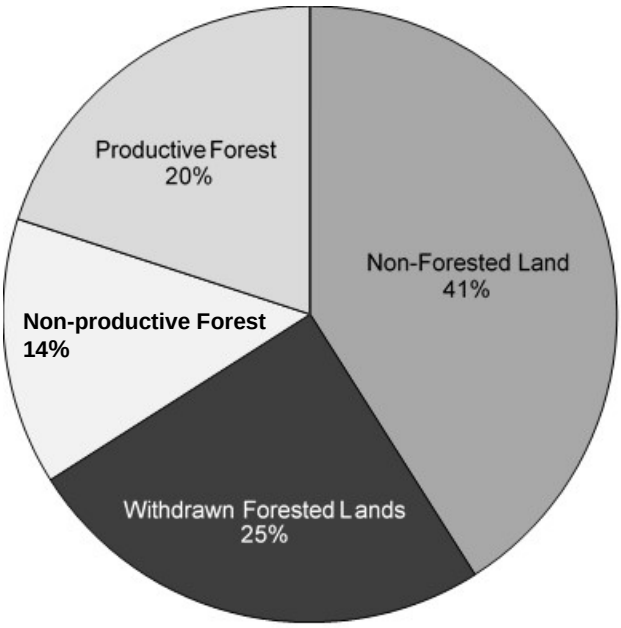
from that project. As of March 3, 2016, the NEPA volume under litigation is 258.4 MMBF and involves the Scott Peak, Overlook, Soda Nick, Traitors Cove and Big Thorne projects.

How Does The Forest Service Decide Where Timber Harvest Projects Should Be Located?

A primary consideration for where timber harvest projects should be located is the suitability of the land for timber production. The Forest Plan identifies the suitable land base for timber production, and the process for determining this suitability (Appendix A, Timber Resource Land Suitability).

Land Suitability for Timber Harvest

Many acres on the Tongass are not forested, therefore unsuitable for timber production. Of the forested lands, some of this land has been withdrawn for timber production by Congress for further consideration for resource management. On the Tongass, these lands include Wilderness and National Monuments. Other forested lands are not physically suitable for timber production due to non-forest vegetation, poor soils or steep slopes as determined by NFMA. These non-productive forested lands and non-forested lands provide other uses such as wildlife habitat for some species and various recreation uses. Figure 33 depicts the percentages of these land classifications within the Tongass.



Non-Forested land (41 percent) – Land that has never supported forests, e.g. muskeg, rock and ice.

Withdrawn Forested Lands (25 percent) – Lands designated by Congress, the Secretary of Agriculture, or Chief of Forest Service for purposes that preclude timber harvest, e.g. Wilderness Areas, LUD II areas.

Productive Forest (20 percent) – Forest land that meets all the criteria for timber production suitability over the planning horizon.

Non-Productive Forest (14 percent) – Forest land not capable of producing commercial wood on a sustained yield basis.

Figure 33. Tongass land suitability classification

Forest Plan Land Use Designations

The Forest Plan identifies a suitable land base for timber harvest called the “development” LUDs which primarily includes the Timber Production, Modified Landscape, and Scenic Viewshed LUDs. Many of the acres within these “development” LUDs are unsuitable for commercial timber production because of Forest Plan Standards and Guidelines, such as stream and estuary buffers, and other laws and regulations.

District-level Planning

The Forest Supervisor for the Tongass is responsible for the overall management of the Forest’s timber program. Included within these responsibilities is making the determination on the amount of timber volume to be made available to industry. Whether or not sufficient funding is appropriated to attain the program is the responsibility of the Congress and the President.

District Rangers develop a multi-year plan of potential timber harvest projects. The goal of the plan is to attain the targeted offer level for the current year, based on the estimated annual market demand, and to develop a timber program for several years of the planning cycle. The offer level for the current year is based, to the extent possible, on the forecasted annual market demand. Actual demand may fluctuate from year to year due to short-term market fluctuations. Actual offer levels vary year to year depending on several factors, including volume in Gates 2 through 3, and current market conditions.

The District Ranger is responsible for identifying and recommending the project areas for the 5-year schedule of integrated resource activities (TIP). The Ranger's role is to develop and recommend to the Forest Supervisor timber harvest projects that meet Forest Plan goals and objectives. Districts work on various timber harvest projects simultaneously, resulting in continual movement of projects through the stages of the timber program pipeline. This schedule allows the necessary time to complete preliminary analysis, resource inventories, environmental documentation, field layout preparations and permit acquisition, appraisal of timber resource values, advertisement of contract characteristics for potential bidders, bid opening, and physical award of the contract. Project delays through the completion of Gate 2 attributable to legal injunctions and litigation have affected the offer level in recent years. Once all of the Rangers' recommendations are made and compiled into a consolidated schedule, the Forest Supervisor is responsible for the review and approval of the final timber harvest plan and prioritization of projects as necessary.

Considerations the District Ranger takes into account for each project include:

- If the project area contains a sufficient number of suitable timber production acres allocated to development land use designations. Consideration includes if the timber volume being considered for harvest can be achieved while meeting Forest Plan goals, objectives, and standards and guidelines.
- Other resource uses and potential future uses of the area and of adjacent areas and of non-National Forest System lands.
- Areas where the investment necessary for project infrastructure (roads, bridges, etc.) is achievable with the estimated value of timber volume in the project area. Where infrastructure already exists the contract would allow any maintenance and upgrade of the facilities necessary for removal of timber volume.
- Areas where investments for the project coincide with long-term management based on Forest Plan direction.

The implementation of the timber projects depends in part on the final budget appropriation to the agency. In the event insufficient budget is allocated, or resolution of pending litigation or other factors delay projects, timber harvest projects are selected and implemented on a priority basis. Generally, the higher-priority projects where investments such as road networks, camps or log transfer facilities have already been established or where land management status is not under dispute. The distribution of projects across the Tongass is also taken into account to distribute the effects and to provide timber volume in proximity to timber processing facilities. Timber harvest projects scheduled for the current year that are not implemented, or the remaining volume of projects that are only partially implemented, are shifted to future years in the plan. The multi-year plan becomes very dynamic in nature due to the number of influences on each district.

Conclusion

There is a long legislative recognition that timber harvest is one of the appropriate activities on national forests, starting with the founding legislation for national forests in 1897. The Organic Administration Act provides that national forests may be established "to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of the citizens of the United States."

Congress' policy for national forests, as stated in the Multiple-Use Sustained Yield Act of 1960, is "the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." Accordingly, Congress has authorized the Secretary of Agriculture to sell trees and forest products from the national forests "at no less than appraised value." The National Forest Management Act directs that forest plans shall "provide for multiple use and sustained yield, and in particular, include coordination of outdoor recreation, range, timber, watershed, wildlife, fish and wilderness." ANILCA provided for timber harvest from the Tongass as well as other uses such as subsistence. Effects on subsistence resources from timber harvest Tongass-wide are projected to have few differences based on the sequence in which areas are harvested. Because of the multiple use mandate and other requirements of the laws, these effects to subsistence are necessary, consistent with sound management of public lands.

In addition to nationwide statutes, Section 101 of the Tongass Timber Reform Act directs the Forest Service to seek to meet market demand for timber from the Tongass, subject to certain qualifications. It is the goal of the Tongass to provide an even-flow of timber on a sustained-yield basis and in an economically efficient manner. The amount of timber offered each year is based on the objective of offering enough volume to meet the projected annual demand. That annual demand projection starts with installed mill capacity, and then looks to industry rate of capacity utilization under different market scenarios, the volume under contract, and a number of other factors, including anticipated harvest and the range of expected timber purchases.

As described by Morse (April 2000), in terms of short-term economic consequences, oversupplying the market is less damaging than undersupplying it. If more timber is offered than purchased in a given year, the unsold volume is still available for re-offer in future years. Conversely, a short fall in the supply of timber can be financially devastating to the industry.

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