United States Department of Agriculture

Kosciusko Vegetation Management and Watershed Improvement Project

Draft Environmental Assessment

Forest Service
Alaska Region

Tongass National Forest
Thorne Bay Ranger District

R10-MB-762(a)

August 2015

Cover Photo: Young-growth forest along National Forest System road 1525000 near Edna Bay on Kosciusko Island. Photograph by Erin Stevens.

For more information contact: Delilah Brigham, Team Leader
P.O. Box 19001
Thorne Bay, AK 99919
907-828-3232
dbrigham@fs.fed.us

Federal Recycling Program
Printed on Recycled Paper

Table of Contents

Introduction

The Thorne Bay Ranger District of Tongass National Forest (Tongass NF, Forest) is proposing this vegetation management and watershed improvement project in primarily young-growth stands on Kosciusko Island. The three action alternatives for the Kosciusko Vegetation Management and Watershed Improvement Project (Kosciusko Project) described in this Draft Environmental Assessment (DEA) are consistent with the 2008 *Tongass National Forest Land and Resource Management Plan* (Forest Plan). The analysis and decision are subject to the objection process (36 CFR 218.7 parts (a) and (b)). Implementation of this project may include use of the stewardship contracting authority provided in the 2003 Appropriations Act (P.L. 108-7).

The July 2, 2013 *Secretary's Memorandum* 1044-009 addressing sustainable forestry in Southeast Alaska affirms that the U.S. Department of Agriculture is committed to maintaining Southeast Alaska's exceptional natural resources in perpetuity while also doing its part to ensure that the communities within the Tongass National Forest are economically vibrant.

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."

Sealaska Land Entitlement Finalization

On December 19, 2014, Congress passed *H.R.3979 – Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015*(the Act). Section 3002 of the Act, *Sealaska Land Entitlement Finalization*, finalized the remaining land entitlement under the *Alaska Native Claims Settlement Act* (ANCSA) for Sealaska Corporation. In March of 2015, Sealaska Corporation received conveyance to approximately 70,075 acres throughout Southeast Alaska. On Kosciusko Island, approximately 11,970 acres and 32 miles of road were conveyed to Sealaska as part of the final conveyance. Section 3002(d) of the Act is specific to road easements on Kosciusko Island. Within a year of enactment, Sealaska and the Forest Service shall enter into an agreement relating to the access, use, maintenance, and improvement of the roads and facilities. Section 3002(c)(4)(D)(ii) of the Act provides an easement to Sealaska on Kosciusko Island to connect the "Cape Pole Road" to the "South Shipley Bay Road". Reconstruction and use of the Shipley Bay Road and sort yard are also included. Within two years of enactment of the Act, reservations of easements shall be made under Section 17(b) of ANCSA (43 U.S.C. 1616(b)) on these roads.

Additionally, the Act designated "LUD II Management Areas" as conservation areas on National Forest System (NFS) lands; two of these newly designated areas are on Kosciusko Island. Finally, Section 3002(e)(4) of the Act, *Tongass National Forest Young Growth Management*, states "the Secretary of Agriculture may allow the harvest of trees prior to the culmination of mean annual increment of growth in areas that are available for commercial timber harvest under the Tongass National Forest Land and Resource Management Plan to facilitate the transition from commercial timber harvest of old growth stands." H.R.3979 became law during the planning process of the Kosciusko Project. The components of the law mentioned above changed the land ownership and land management of the project area, as well as the proposals presented within this DEA for

treatment of the remaining NFS land within the project area. The Purpose and Need is similar (see page 5), but the strategies presented to best meet those objectives on remaining NFS lands at the landscape scale have shifted and are further described in the Alternatives section beginning on page 8.

Background

The majority of timber harvest on Kosciusko Island occurred between 1945 and 1965, with the most recent old-growth timber sale on NFS lands occurring in 1997. During that span, approximately 19,300 acres were cut, resulting in large contiguous stands of young-growth. These areas lack structural diversity and other key features of the old-growth stands they replaced.

Most past harvest in the project area occurred during a time when little mitigation was in place to protect non-timber resources like we have under the current Forest Plan. As a result, some young growth from past timber harvest occurs in areas no longer emphasized for timber production, like the beach buffer and riparian areas. Conversely, there are areas where timber production is the emphasis for management, though the ability to manage intensively for timber is limited by the concentration of resources now requiring protection through the application of existing Forest Plan Standards and Guidelines.

Many stands harvested prior to 1966 have now grown to a size where they could be treated commercially to achieve both ecological and transition objectives. However most have not reached the culmination of mean annual increment (CMAI), which is defined in the National Forest Management Act as the point in time when the average annual growth is at its maximum for a stand of trees. On the Forest, the point where the stands meet national requirements that allow for even-age harvest is referred to as “95 percent of CMAI” (Forest Plan, pg. 4-71 TIM3 I. L.). Current calculations indicate that the CMAI requirement will not be reached within any of the young-growth stands in the project area until about 2030; however, H.R.3979 relaxed this requirement by allowing the harvest of trees prior to CMAI to aid with transition objectives, so long as the timber appraises at a positive value for sale. Stands not meeting CMAI requirements are included for even-aged harvest in the Kosciusko Project due to this allowance.

There are also opportunities to treat some of the youngest stands using pre-commercial thinning to promote future forest health and productivity, encourage species diversity, and improve wildlife habitat.

The interdisciplinary team designed the original Proposed Action in the *Scoping Document* (August 2014) and *Public Comment Period Document* (November 2014) based on a strategy that breaks the project area into zones where: 1) resource concerns like wildlife travel corridors, riparian areas, and high-vulnerability karst areas coincide or are concentrated, and 2) resource concerns are minimal and timber production can be the major focus of future management. The Proposed Action used the strategy of responding to current resource condition needs for long-term health and productivity while progressively planning to meet future needs during the transition away from old-growth management. To do this, the proposal focused on restorative forestry treatments in areas where the most resource concerns exist now. The action alternatives presented in this Draft Environmental Assessment still integrate this strategy, though at different scales due to the land conveyance. The action alternatives are described beginning on page 8 with a range from an emphasis on maximizing timber harvest to treatments that focus on mitigating potential long-term effects as a result of land conveyance, as well as from activities on adjacent state and private lands within the project area.

Project Area

The project area is located approximately 48 air miles northwest of Thorne Bay, Alaska (see Figure 1 on page 4), and is about 56,063 acres in size, roughly the southern half of Kosciusko Island, including the community of Edna Bay. Of the approximately 37,202 acres of NFS land in the project area, approximately 3,465 acres are under consideration for various treatments in this project. The Forest Plan Land Use Designation within the project area is predominantly Timber Production (TM), with some areas of designated Old-Growth Habitat (OG), and Special Interest Areas (SIA, geologic); the project area now also includes LUD II Management Areas designated in H.R.3979.

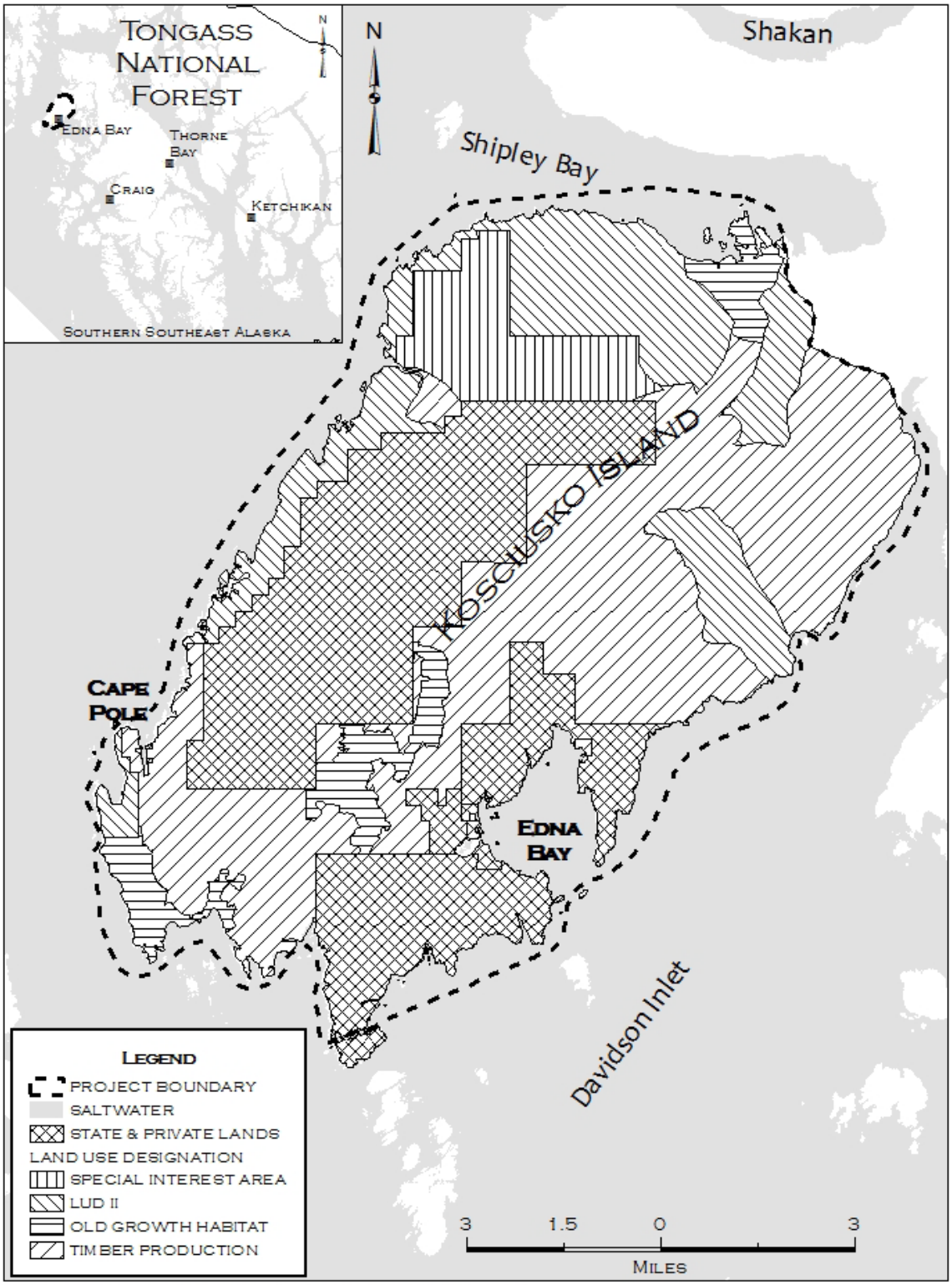
Purpose of and Need for Action

There is a need to move National Forest System lands within the Kosciusko Project area closer to the desired conditions outlined in the Forest Plan and to meet the Forest-wide goals and objectives for Forest resources. The action alternatives are intended to: 1) help move the Forest forward in transitioning to young-growth management while enhancing wildlife habitat, improving riparian areas, and maintaining function of high-vulnerability karst areas; 2) supply a small component of old growth to meet the needs of the local community; 3) restore riparian management areas and improve fish habitat; 4) manage water flow and blockages to improve karst hydrologic systems; and 5) treat invasive plant infestations. The purpose would be accomplished primarily through young-growth vegetation treatments, young-growth and old-growth timber harvest, stream restoration treatments, invasive plant management, and road treatments.

Young-growth Management

Kosciusko Island has been identified as one of the best places on the Forest to begin the transition from old-growth timber to young-growth. It contains a large concentration of young-growth stands that contain sawtimber-size material now suitable for commercial harvest, although 7,352 acres of young growth previously located on NFS lands are now under Sealaska Corporation ownership. Most of the young-growth on Kosciusko Island occurs as extensive single story, even-aged stands that are dense with trees, a situation that limits diversity and, if not corrected, can cause concerns for the long-term ability of the landscape to meet multiple resource objectives. Given the large contiguous acreages of young growth in the project area, there is a need to address this situation.

Many older young-growth stands in the project area are in a condition where vegetative treatments can be designed to meet the commercial timber objectives for the transition, while at the same time improving wildlife habitat and promoting circumstances that benefit multiple resources into the future. Stands where the timber is not large enough for commercial harvest are being considered for pre-commercial thinning treatments to reduce stand density and promote stand characteristics favorable for both timber production and wildlife habitat. In addition to the use of existing roads, additional road reconstruction, reconditioning, and construction of temporary roads may be necessary to provide access for the proposed young-growth treatments.



KoeVMWMP2015_VicinityWithLUDMap.mxd blmiller 05/29/2015

Figure 1: Vicinity Map with Forest Plan Land Use Designations for the Kosciusko Project.

Old-growth Timber Harvest

The community of Edna Bay on Kosciusko Island uses old-growth timber from the surrounding NFS land for building material. The isolation of the community makes obtaining lumber from other sources difficult. The purpose of including old-growth timber harvest in this proposal is to provide an economic timber supply that could be purchased by the local mills. Small old-growth timber sales or stewardship contracts would support some of these needs. The stands proposed for management are in areas that would be economically feasible to access and operate in. Road reconstruction, reconditioning, and/or temporary road construction would be needed for this timber harvest.

Riparian Management Area (RMA) Restoration

Another purpose of this proposal is to improve water quality and fish habitat. Harvested watersheds contain high-value fish habitat in combination with high-value surface and sub-surface water flow. The riparian zones of these watersheds had relatively high levels of timber harvest prior to enactment of the Tongass Timber Reform Act (TTRA). The management goal is to promote overall riparian area health by providing conditions where the function of riparian areas are either maintained or improved.

Riparian improvement activities are primarily proposed within and/or adjacent to the proposed young-growth treatment areas. These actions would also occur where past harvest activities have resulted in an undesirable resource condition. Additionally, some fish stream crossings on NFS roads in the project area do not meet Standards established in the Forest Plan, and so are rated “red”, which means they do not provide fish passage at all flows. Other crossings may require additional analysis to determine if they meet Forest Plan requirements. Potential restoration needs, methods, and results that are desired from this proposal are outlined in Table 1 below.

Table 1: Proposed Kosciusko Project RMA Restoration.

Potential Restoration Needs	Proposed Restoration Method	Intended Result – Desired Future Condition
Short-term stream stabilization	In-stream work to replace roughness elements, such as large woody debris (LWD), into stream channels where losses of those elements have occurred	Returns structure and complexity into streams and maintains dynamic floodplain processes which meters erosion and improves aquatic habitat
Long-term stream stabilization	Riparian thinning in RMAs that have been previously harvested	Accelerates the return of forest within RMAs to old-growth-like conditions, expediting the recruitment and maintenance of LWD in stream channels and restoring natural flood plain processes
Improved fish passage at road crossings	Removal or improvement of “Red” fish crossing structures	Improves the upstream/downstream migration of fish at road crossings Increase the amount of upstream habitat available to fish
Improved water quality in watersheds where roads do not meet maintenance standards	Correct drainage paths and structures associated with roads that contribute to water quality degradation	Diminishes water quality degradation
Improved watershed/karst function	Silvicultural treatments and/or erosion control methods	Improves water quality and overall watershed function

Karst Systems

This proposal is also designed to enhance karst hydrologic function and maintain, to the extent practicable, the natural karst processes and the productivity of the karst landscape. Within the project area there are approximately 38,659 acres of carbonate bedrock in which karst systems have developed. In karst terrain, groundwater may flow relatively quickly through complex underground systems of fissures and caves. Concerns primarily involve potential changes of groundwater flow in these underground systems. Any management activity that causes sediment or organic debris to build up in the subsurface drainage system may degrade natural karst processes and the productivity of the karst landscape. The majority of past timber management and road construction activities occurred prior to there being any measures for karst resource protection. Past activities caused sediment to be delivered into karst systems and some blockages have occurred. These blockages have increased surface flow and erosion in some areas. Opportunities exist to improve the karst systems where ditches, culverts, slash, and beaver dams/structures are impeding natural water flows or creating unnatural water flows to karst features.

Invasive Plants

Invasive plant infestations are known to occur in the project area in both natural and human-caused disturbance areas. These infestations compete with native vegetation. They have potential to continue to spread or to act as a seed source for future introductions. The need to treat infestations is based on the invasiveness of the species, and the size and location of the infestation.

Public Involvement

Scoping

The Kosciusko Vegetation Management and Watershed Improvement Project was published in the first quarterly (Fiscal Year 2015) Tongass NF Schedule of Proposed Actions (SOPA) on October 1, 2014, and quarterly since then, although the project had also been listed and on hold several years prior as Kosciusko Vegetation Management Project. Individuals who requested more information on the project as well as adjacent landowners, local community members and leaders, affected special use permittees; those representing local conservation organizations, partner groups, community organizations; and various tribal associations and corporations were mailed the scoping letter, scoping document, and a proposed action map for review. Within the scoping letter, all aforementioned groups and individuals were also invited to public meetings and subsistence hearings scheduled in the communities of Thorne Bay, Naukati, and Edna Bay in August 2014. Tongass National Forest issued a press release to further inform the public on the scoping period and the associated public meetings. The scoping documents were posted to the project web page at: http://www.fs.usda.gov/goto/R10/Tongass/Kosciusko. Scoping was initiated on August 1, 2014, with request for comments by August 18, 2014.

Fourteen letters were received during the scoping period. Comments received from the public are located in the project record and are also accessible on the project webpage. Using internal comments as well as the comments from other agencies, private industry, groups, and individuals, the Forest Service developed a list of issues to address. Issues identified from comments for the original Proposed Action pertained to the following: herbicide use, old growth harvesting, windfirmness, effects to the community of Edna Bay, biomass removal, deer forage, export

volume, even-aged harvest, policy for young-growth transition, road access, and a bridge to access lands across Trout Creek. Responses to these issues are located in the project record, and helped form the basis for alternatives to the Proposed Action that were displayed in the *Public Comment Period Document* in November 2014.

Additionally, after the scoping period, Sealaska Corporation requested a consultation meeting with Tongass National Forest in regards to the project being within areas they were pursuing under, what was called at the time, the *Southeast Alaska Native Land Entitlement Finalization and Jobs Protection Act*, a proposed bill that identified lands they were requesting be transferred to Sealaska Corporation.

Public Comment Period

A second opportunity for public involvement was provided beginning November 24, 2014 when the *Public Comment Period Document* was sent to all groups and individuals previously involved, as well as to those who had since provided input or requested to be on the mailing list for the project. The documents were posted to the project webpage at that time as well. This additional 30-day comment period provided the public a chance to review the alternatives developed by the Interdisciplinary Team in response to issues raised during the scoping period. Fourteen letters were received during the comment period; these are located in the project record and are also accessible on the project webpage, listed on the previous page. Comments received were reviewed to identify concerns the public had with the project; most were consistent with the previous list of issues raised. H.R.3979 finalizing the Sealaska Land Entitlement was passed before this comment period ended; this new information formed the basis of nearly all new concerns submitted from the public.

Issues

Although there are often many potential issues and concerns associated with planning actions that may affect the human and natural environment, National Environmental Policy Act (NEPA) direction requires detailed analysis of only those issues that may be significant. This ensures that the analysis and documentation are focused primarily on the issues that are most important to the project area and the decision to be made.

The Forest Service analyzed internal comments as well as the comments from other agencies, private industry, groups, and individuals that were submitted during public involvement phases. The following statements are the issues that were determined to be potentially key or significant and within the scope of the project.

- Cumulative effects from the proposed activities combined with past management and the reasonably foreseeable future actions on private lands may have adverse effects on wildlife habitat, water quality, scenery, and subsistence.
- The scale and frequency of harvest entries, as well as the prescriptions implemented, from all current, proposed, and reasonably foreseeable future actions across Kosciusko Island from all landowners may affect the socio-economic stability of the community.
- The Forest Service should promote a quicker transition to a primarily young-growth industry and limit harvest and utilization of old growth.

Alternatives

Alternative 1: No Action

No new actions would be initiated for treatment of resources on NFS lands in the project area. Current management practices and those authorized by other NEPA decisions would continue, and future decisions affecting NFS lands within the project area would not be precluded from occurring.

This alternative provides a foundation for describing and comparing the magnitude of environmental changes associated with the action alternatives against those changes that occur with no new action on NFS land at this time. This alternative, unlike the following action alternatives, does not meet the purpose and need for this project.

Action Alternatives

Alternatives 2, 3, and 4 were developed by the Interdisciplinary Team (IDT) and approved by the District Ranger to provide a reasonable range of options for meeting the purpose and need of this project and to address the issues identified from public involvement (see page 7). The list of actions in the "common to all" section below would apply to all three action alternatives; actions unique to Alternatives 2, 3, and 4 are described in their respective sections following below.

Common to all Action Alternatives:

- Pre-commercial thinning would occur on 1,695 acres within stands currently (2015) 31 to 44 years old. This treatment would reduce the extent of stands in the stem exclusion stage and promote the creation of a more diverse and abundant understory vegetation component across the landscape. The treatment is proposed for stands in the Timber Production, Old Growth Habitat, LUD II, and Special Interest Area LUDs, and in the 1,000-foot beach buffer.
- An additional 170 acres of young-growth in RMAs would be pre-commercially thinned to reduce stand density, and promote stand diversity and wildlife habitat.
- Old growth would be harvested using even-aged management prescriptions on approximately 27 acres and uneven-aged management prescriptions on approximately 37 acres. Old-growth harvest would result in about 1,051 MBF (thousand-board feet, volume measurement) of timber.
- Where karst systems have been impacted, blockages may be removed, and diverted water flow from culverts and ditch features would be remedied.
- Invasive plant infestations known to occur within NFS lands in the project area or those found there during implementation or monitoring may be targeted for appropriate control treatments and/or monitoring. Treatment options would be limited to manual and mechanical methods.
- All new temporary roads would be decommissioned when all management activities are completed.
- Existing rock quarries would be further utilized as needed and approximately 5 new rock quarries would be developed to support road construction and road reconditioning.
- In-stream restoration activities may occur on up to one mile of stream segments. "Red" culverts in the project area may be removed or replaced, and culverts that need further

analysis would be evaluated and also removed or replaced if determined to be impeding upstream travel for fish.

Finally, applying to all action alternatives, *Sealaska Land Entitlement Finalization* Section 3002(d) of the Act states the Secretary of Agriculture and Sealaska shall enter into an agreement relating to the access, use, maintenance, and improvement of the roads and facilities on Kosciusko Island. Alternatives 2, 3, and 4 propose to construct about 0.5 miles of road on Sealaska lands on decommissioned road prism. Timber haul is proposed on 9 miles of existing roads on Sealaska land. The access, use, maintenance, improvement, and post-haul disposition of these roads would be part of the agreement.

Alternative 2

The primary objective of this alternative is to maximize harvest efficiency and volume production in the near term to best facilitate the objectives of the transition at this time. Alternative 2 proposes mostly even-aged management in openings up to about 100 acres in size, with reasonable settings left between the proposed units to be harvested in the future, also designed for even-aged management. Uneven-aged management is proposed within the beach buffer according to the direction in the current Forest Plan, as well as adjacent to one area of concentrated karst features.

Even-aged management using clearcutting is constrained under the National Forest Management Act (NFMA) on the Tongass NF to openings of 100 acres or less, with certain allowances to go up to 150 acres. Clearcuts must maintain a reasonable setting or harvest area between them. Since many of the original stands proposed for management at Kosciusko are well over 150 acres, they had to be divided into smaller openings and spaced out over time to meet NFMA requirements. Proposed units were designed to be as large as possible given this constraint. Harvest adjacent to the openings in the remainder of the stand cannot occur until regeneration from the first harvest has reached about 5 feet tall, attaining an adequately stocked condition. For sites in the project area, that stocking level is estimated to be reached at about 10 years post-harvest.

Alternative 2 proposes young-growth timber harvest on approximately 861 acres using even-aged management on suitable lands and on 75 acres with uneven-aged management, which would result in about 30.2 MMBF (million-board feet, volume measurement) of timber. These treatments, as well as those common to all action alternatives, would require about 1.5 miles of new temporary road construction, 3.9 miles of new temporary road construction on existing road prism, 4.2 miles of road reconditioning, and 18 miles of road maintenance. See Figure 2 for a map of actions proposed in this alternative.

Alternative 3

Alternative 3 attempts to best meet the goals of both Alternatives 2 and 4, with harvests in young-growth stands that would be designed to address the objectives of transition, while also considering and managing for the long-term effects to other resources on the landscape. With proposed treatments that resemble elements of both other action alternatives, the effects of Alternative 3 would also be expected to be in the range between those of Alternatives 2 and 4. This proposal would utilize even-aged management with a combination of moderate and large sized openings. In the matrix between these larger openings, two-aged management would create patch clearcuts up to 20 acres in size, harvesting up to 50 percent of the stand acreage. Additionally, uneven-aged management would be used within the beach buffer per the current

Forest Plan, adjacent to an area of concentrated karst features, and to enhance portions of the landscape that were identified to function as wildlife corridors.

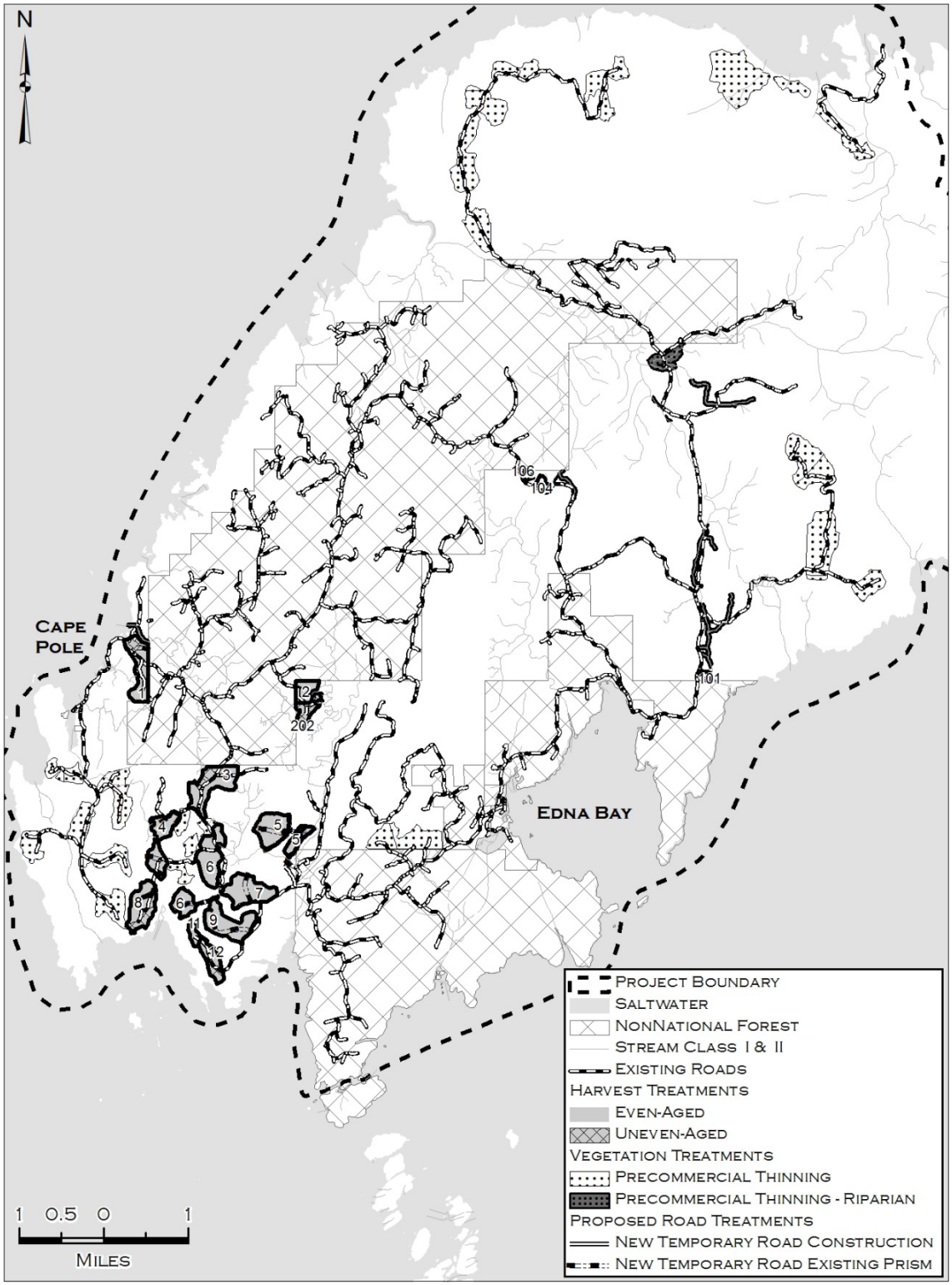
Alternative 3 proposes young-growth timber harvest on approximately 396 acres using even-aged management, 856 acres with two-aged management, and 209 acres with uneven-aged management, which would result in about 29.9 MMBF of timber. Implementation of this alternative would require about 1.5 miles of new temporary road construction, 4.9 miles of new temporary road construction on existing road prism, 4.7 miles of road reconditioning, and 18 miles of road maintenance. See Figure 3 for a map of actions proposed in Alternative 3.

Alternative 4

The primary objective of Alternative 4 is to mitigate potential long-term effects as a result of the land conveyance within the project area, while still addressing the Forest's transition to primarily young-growth management. There is uncertainty in the extent and intensity of future harvests on the substantial acreage of the project area that was conveyed to Sealaska Corporation on Kosciusko Island, and what the landscape-scale impact to wildlife and other resources may be. Proposed treatments designed to meet the objectives are: 1) uneven-aged management, where group selections up to two acres in size comprise about 33 percent of the stand acreage; and 2) two-aged management, where up to 50 percent of the stand acreage would be harvested as patch clearcuts up to about 20 acres in size.

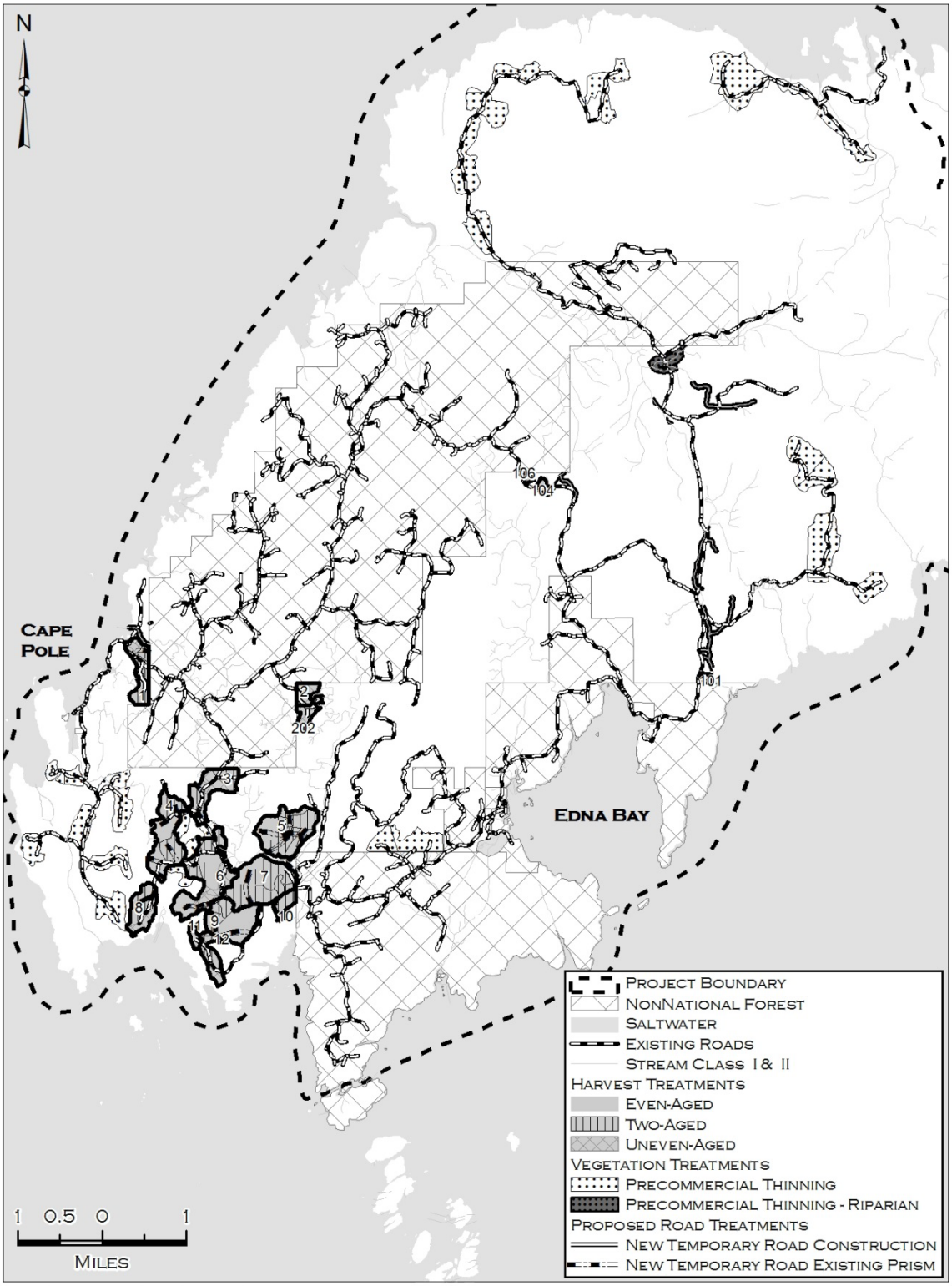
Stands are considered uneven-aged when there are three or more distinct age classes. Harvest usually occurs as group selections up to about two acres in size or as single-tree selections. The prescription for uneven-aged management in this alternative would primarily be based off a series of harvests conducted from trails, and creating group openings dispersed through the stand. The first entry, from this proposal, would harvest about a third of the stand area in this manner. The second entry could occur about 30 years after, similarly harvesting another third of the stand. The third harvest could occur 60 years in the future. Single-tree selection is not expected to be necessary to achieve the goals of the alternative.

Alternative 4 proposes young-growth timber harvest on about 1,084 acres using uneven-aged management and 399 acres using two-aged management, which would result in about 19.0 MMBF of timber. Proposals in Alternative 4 would require about 1.3 miles of new temporary road construction, 5.3 miles of new temporary road construction on existing road prism, 4.7 miles of road reconditioning, and 18 miles of road maintenance.



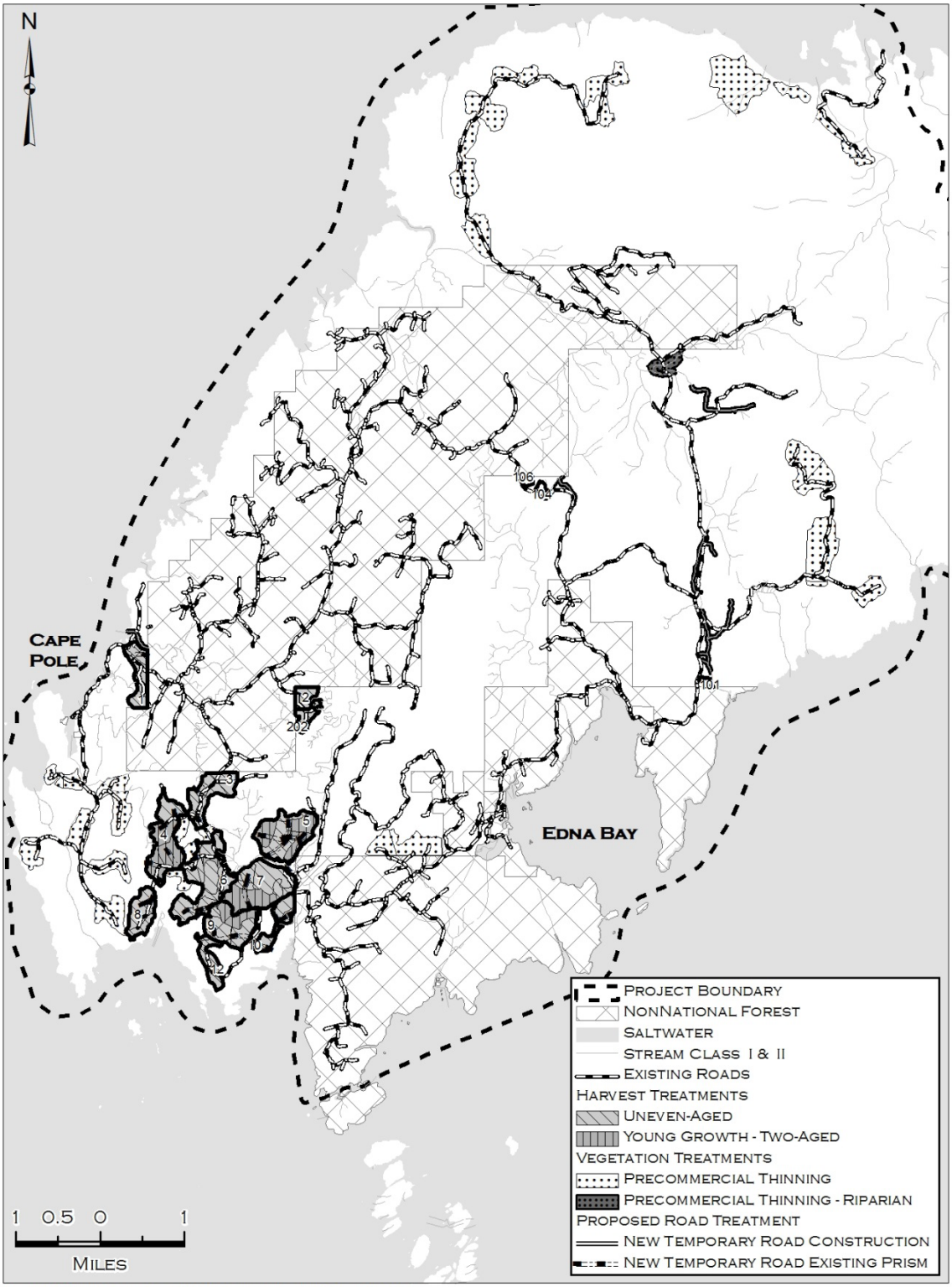
KosVMWIP2015_Alt2Map.mxd blmiller 07/29/2015

Figure 2: Alternative 2 Map for the Kosciusko Project.



KosVMWIP2015_Alt3Map.mxd blmiller 07/29/2015

Figure 3: Alternative 3 Map for the Kosciusko Project.



KosVMWIP_2015_Alt4Map.mxd blmiller 07/29/2015

Figure 4: Alternative 4 Map for the Kosciusko Project.

Comparison of Alternatives

The actions that differ between Alternatives 2, 3, and 4, as described in their above sections respectively, are the treatments used for young-growth timber harvest and management of the transportation system. These differences are summarized in Table 2 below. Note that actions proposed that are common to all action alternatives, such as old-growth timber harvest and pre-commercial thinning, are not displayed since there are no differences between alternatives.

Table 2: Comparison of Alternatives.

Activity Description	Alternative 2	Alternative 3	Alternative 4
Young-growth: even-aged management (acres)	861	396	0
Young-growth: two-aged management (acres)	0	856	399
Young-growth: uneven-aged management (acres)	75	209	1,084
Young-growth treatment (total acres)	936	1,461	1,483
Young-growth total volume (MMBF)	30.2	29.9	19.0
New temporary road construction (miles)	1.5	1.5	1.3
New temporary road construction on existing road prism (miles)	3.9	4.9	5.3
Road reconditioning (miles)	4.2	4.7	4.7
Road maintenance (miles)	18	18	18

The Draft Unit Cards that would be used to implement any of the action alternatives described above, if selected, are available on the project webpage; see page 6 of this Draft EA for the web address. There is an introduction section that describes the purpose of the Unit Cards and resource concerns for implementation, followed by a Unit Card for each proposed timber harvest unit, as well as a map corresponding to each Unit Card.

Alternatives Considered but Eliminated From Detailed Study

Additional action alternatives may be analyzed if proposed during scoping, collaboration, or public comment periods, and if they meet the Purpose and Need of the project. The Responsible Official selects which alternatives to consider and study in detail, and which ones will not be studied in detail. In addition to the No Action Alternative and three action alternatives selected to be analyzed in detail for this project, alternatives suggested during public involvement and in response to issues raised were considered. Alternatives not considered in detail may include, but are not limited to, those that fail to meet the purpose and need, are technologically infeasible or illegal, or would result in unreasonable environmental harm. Some of the suggested alternatives are to not implement certain actions; these are not being analyzed in detail as separate alternatives because they are inherently included in the No Action Alternative effects analysis, and will be compared to the action alternatives. Descriptions of alternatives considered but removed from detailed study are described below, along with the reasons for their elimination from detailed study. For the Kosciusko Project, these alternatives include: no herbicide treatments or applications, spot treatment on all invasive plant populations, no old-growth harvest, and a programmatic approach to young-growth management on Kosciusko Island.

Herbicide treatments on invasive plant populations

Concern Statement: Commenters stated that the application of herbicides should not be considered because it may affect water quality, wildlife, and subsistence use. Only mechanical

pulling, hand pulling, landscape fabric, and outreach to the community for "Weed Pull Adoption Sites" should be used to treat invasive plant populations.

Response: An alternative was initially considered in which herbicide would be applied where determined to be the best and most effective option for eradication. At this time, an alternative which includes the use of herbicide application is not being analyzed in detail, in order to be considered in a broader context in the future. Community outreach and involvement are feasible with all alternatives; it could be an approach to treating infestations that does not require a NEPA decision.

Spot treatment on all invasive plant populations

Concern Statement: Commenters have requested that spot spraying with an herbicide be used on all invasive plant populations because other treatments may not remove or control the spread of some species of invasive plants.

Response: Although targeted herbicide use may provide the most efficient option for eradication of specific infestations, it is not the only effective tool for invasive treatments. Some infestations, based on the species' characteristics and extent, are feasible to treat by manually hand-pulling, and herbicide would be unnecessary. Other infestations are so widespread, that they would not be feasible to eradicate through spot spraying, and are not considered a priority for treatment in this project.

No old-growth harvest

Concern Statement: Harvest in old-growth stands may affect the functioning and sustainability of the whole ecosystem; therefore, the local community should supply their needs from the larger young-growth trees.

Response: An alternative was considered in which no old-growth stands would be harvested, but was not analyzed in detail because it would not meet the Purpose and Need for this project. The No Action Alternative would analyze the effects from excluding old-growth harvest from this project, although not in conjunction with harvest of young growth. The action alternatives would analyze the effects from both young-growth and old-growth harvest. The purpose of including a small amount of old-growth timber harvest in this project is to provide a small-scale timber supply for local mills. The Forest Plan Standards and Guidelines were developed to maintain full ecosystem function and provide protection and management of Forest resources.

Programmatic approach to young-growth management on Kosciusko Island

Concern Statement: Commenters have expressed concerns that since this proposed project begins the transition to a young-growth based industry, a programmatic approach that implements a "tree farm" management policy should be developed in which all acres of young-growth stands should be "NEPA cleared" so that management treatments can be conducted in a timely manner.

Response: A vegetation management plan is being developed that would guide management activities for all young-growth stands in the project area into the future. This project proposes to implement the beginning stages of that plan. Since the Tongass NF has never executed a large-scale young-growth management project like the Kosciusko Project we believe it would be prudent to wait until we see results before we begin to clear programmatic treatments. What we learn from this project would help inform the vegetation management plan for Kosciusko Island

as well as future young-growth NEPA decisions across the Tongass NF, which may be more programmatic in nature.

Environmental Consequences

This section describes the environmental impacts of the alternatives in relation to whether there may be significant environmental effects as described in 40 CFR 1508.27. The following documents are available upon request and are hereby incorporated by reference into this assessment:

- Final Draft Silviculture Resource Report, For Young and Old-growth Stands in the Kosciusko Vegetation Management and Watershed Improvement Project Area; Sheets, July 28, 2015 (Silviculture Report)
- Kosciusko Vegetation Management and Watershed Improvement Project, Environmental Assessment, Timber Resource Report; Brand, June 15, 2015 (Timber Report)
- Kosciusko EA, Transportation Resource Report; Jacobson, July 2015 (Transportation Report)
- Kosciusko Vegetation Management and Watershed Improvement Project Final Draft Wildlife Report; Dillman, July 2015 (Wildlife Report)
- Kosciusko Draft Biological Assessment/Biological Evaluation; Dillman and Mahara, July 31, 2015 (Wildlife BA/BE)
- Kosciusko Vegetation Management and Watershed Improvement Project Draft EA, Soils and Wetlands; Reynolds, June 4, 2015 (Soils and Wetlands Report)
- Draft Watershed Report for the Kosciusko Vegetation Management and Watershed Improvement Project; Harris, April 30, 2015 (Watershed Report)
- Kosciusko Vegetation Management Watershed Improvement Project, Fisheries Resource Report; Mahara, June 2015 (Fisheries Report)
- Geology, Minerals, Karst and Cave Resource Report for the Kosciusko Vegetation Management Watershed Improvement Project; Baichtal, June 8, 2015 (Geology Report)
- Kosciusko Vegetation Management and Watershed Improvement Project EA, Scenery Resource Report; Steward, June 2015 (Scenery Report)
- Kosciusko Vegetation Management and Watershed Improvement Project, Rare Plants Resource Report; Dillman and Reynolds, July 30, 2015 (Botany Report)
- Draft Biological Evaluation for Plants, Kosciusko EA; Dillman, July 2015 (Botany BE)
- Kosciusko Vegetation Management and Watershed Improvement Project, Invasive Plants Risk Assessment Report; Dillman and Reynolds, July 31, 2015 (Invasive Plants Report)
- Kosciusko Heritage Report, R2015100554028; Marshall, May 6, 2015 (Heritage Report)
- Climate Change Report for the Kosciusko Vegetation Management Watershed Improvement Project; Harris, May 29, 2015 (Climate Change Report)

Note that these documents are currently available in “Draft” form; upon finalization of this EA, the reports will also become “Final”. The full analysis and conclusions about the potential effects for each resource, including affected environment (existing condition), methodology, assumptions, and supporting literature, are available in the above reports and other supporting

documentation located in the project record. The following sections are discussions of resources that have relevance to a determination of significance. The cumulative effects boundary for each resource varies, depending on where the extent of effects on that resource may occur as a result of project implementation; for example, Fisheries considers effects at a watershed scale, while Soils uses the Kosciusko Project area as the effects analysis boundary. Within these boundaries, cumulative effects analysis also requires consideration of all other activities that have occurred or are anticipated to occur, regardless of land ownership and using the best information available. These activities are described in detail in a document titled *Past, Present and Reasonably Foreseeable Future Activities in the Kosciusko Project Area*, available in the project record as well as preserved geospatially in GIS data for analysis. Past activities include but are not limited to even-aged timber harvest, pre-commercial thinning of young-growth stands, and a variety of special use permits for rock material; presently ongoing activities include personal use firewood gathering, road maintenance, and timber harvest currently occurring on other land ownerships within the project area; and future actions which are anticipated to occur include road work in Edna Bay, outfitter and guide activities, and timber harvest on lands now under Sealaska Corp. ownership. See the aforementioned document for further details on these and more activities, and for the assumptions used for the anticipated harvests on Sealaska land within the project area.

Table 3 as follows on pages 17 through 24 displays a summary of effects of implementing each alternative, followed by a summary of the analysis completed for each resource, which should be referred to for explanations of the below table contents. As previously mentioned, more detailed information for all resource effects analysis can be found in the project record in their corresponding resource reports, listed above.

Table 3: Summary of Effects Analysis.

Silviculture				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Effects on forest structure	Maintains all young-growth acres in the existing condition. Old-growth stands are not affected.	Maintains 861 acres of currently even-aged young growth with even-aged management and converts 75 acres to uneven-age management. Converts 27 acres of old growth to even-aged and maintains 37 acres as uneven-aged. Allows for some large-scale variation in young growth across the landscape; more than Alt 1 but less than Alt 3 or 4.	Maintains 396 acres of currently even-aged young growth with even-aged management and converts 856 acres to two-aged management and 202 to uneven-aged management. Converts 27 acres of old growth to even-aged and maintains 37 acres as uneven-aged. Allows for good variation in young-growth structure across the landscape; more than Alt 1 and 2 but less than Alt 4.	Converts 399 acres of even-age young growth to two-aged management and 1,084 acres to uneven-aged management. Converts 27 acres of old growth to even-age and maintains 37 acres as uneven-age. Allows for the greatest variation in forest structure across the landscape of all alternatives.

Silviculture (cont'd)				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Effects on forest health and productivity	Maintains the existing condition which would result in increased risk long term.	Reduces risk of insect and disease over Alternative 1, but equal to Alternatives 3 and 4.	Reduces risk of insect and disease over Alternative 1, but equal to Alternatives 2 and 4.	Reduces risk of insect and disease over Alternative 1, but equal to Alternatives 2 and 3.
Effects on regeneration and species composition	Maintains the existing condition, does not allow for the opportunity to increase the occurrence of cedar in young-growth stands in the project area.	Allows for more cedar to be present in young growth long term, more so than Alternatives 1 and 4, but about equal to Alternative 3.	Allows for more cedar to be present in young growth long term, more so than Alternatives 1 and 4, but about equal to Alternative 2.	Allows for more cedar to be present in young growth long term, more so than Alternative 1, but less than Alternative 2 and 3.
Effects on windthrow risk	Maintains the existing condition where risk is minimal.	Increases short-term risk along harvest edges. About equal to or slightly more than Alternative 3.	Increases short-term risk along harvest edges. Slightly less than Alternative 2 but more than Alternatives 1 and 4.	Minor short-term increase over the existing condition.
Effects to future young-growth timber volume and availability	Maintains the existing condition where timber stands are growing towards CMAI.	Harvests young-growth stands prior to CMAI. Produces the most volume in the near term of all alternatives but maintains an-aged class imbalance on NFS lands in the project area long term. This effect is likely to be amplified by State and private harvesting.	Harvests young-growth stands prior to CMAI. Produces less volume in the near term but allows for a more even flow in the long term.	Harvests young-growth stands prior to CMAI but primarily via uneven-aged management. Produces the least volume in the near term but allows for a more even flow in the long term. The most NFS acres would be allowed to grow to CMAI and beyond.
Timber Economics				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Volume (MMBF)	0	30.2	29.9	19.0
Logging/Transportation Cost/MBF	$0	$333.05	$334.48	$332.72
Road Costs/MBF	$0	$22.97	$25.60	$37.82
Indicated Bid Value	$0	$(3,424,735) - $1,208,896	$(3,410,321) - $1,040,053	$(2,390,051) - $495,903
Number of Annualized Direct Jobs	0	122-150	118-144	78-95

Transportation				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Miles of temporary road construction	0	5.4	6.4	6.6
Miles of reconditioned NFS road	0	4.2	4.7	4.7
Miles of road to be closed after the timber harvest activities	0	10.1	11.5	11.7
Costs including maintenance, reconditioning, and new temporary road construction	$0	$697,275	$748,156	$729,527
Wildlife and Subsistence				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
NFS lands: Acres of current and post-project low/medium POG and high POG (HPOG) by WAA WAA 1525 low/med (Historical: 4,090 acres) WAA 1525 HPOG (Historical: 18,897 acres) WAA 1526 low/med (Historical:18,897 acres) WAA 1526 HPOG (Historical: 18,905 acres) Note: The project would not affect large-tree POG (SD67)	<u>WAA 1525</u> low/med POG 4,090 (0% change from historical acres) high POG: 10,302 (-45% from historical acres) <u>WAA 1526</u> low/med 20,521 (0% change from historical acres) high POG: 16,453 (-13% from historical acres)	WAA 1525 low/med POG 4,070 (-1% from current) WAA 1525 HPOG 10,269 (-1% from current) WAA 1526 low/med POG 20,521 (0% from current) WAA 1526 HPOG 16,453 (0% from current)		
Changes in old-growth patch sizes	No change from current			
Changes to interior forest acres	No change from current (6,049 acres in WAA 1525; 13,720 acres in WAA 1526)	-1.1 acres in WAA 1525 0 acres in WAA 1526		

Wildlife and Subsistence (cont'd)				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Change in acres of deep snow habitat for deer and marten; current and at stem exclusion stage (%) in WAA 1525 Note: the project would not affect deep snow habitat in WAA 1526	Current: 0% change Stem exclusion: -1%	Current: -2% Stem Exclusion: -2%		
Change in acres of average snow deer winter range and non-winter deer habitat: current and at stem exclusion stage (%) in WAA 1525 Note: the project would not affect this habitat in WAA 1526	<u>Average snow</u> Current: 0% Stem exclusion: -1% <u>Non-winter</u> Current: 0% Stem exclusion: -1%	<u>Average snow</u> Current: 0% Stem exclusion: -1% <u>Non-winter</u> Current: +4.5% Stem exclusion: -1%	<u>Average snow</u> Current: 0% Stem exclusion: -1% <u>Non-winter</u> Current: +7% Stem exclusion: -1%	
Changes in deer habitat capability in WAA 1525 (Historical value: 2257) Note: the project would not affect deer habitat capability in WAA 1526	Current: 1327 (-41% from historical value) Stem exclusion: 1320 (-1% from current)	Post-treatment: 1387 (+4.5% from current) Stem Exclusion: 1314 (-1% from current)	Post-treatment: 1420 (+7% from current) Stem Exclusion: 1314 (-1% from current)	
Acres of year-round marten habitat in WAA 1525 (Historical: 18,665 acres) Note: the project would not affect this habitat in WAA 1526	10,070 (-46% change from historical acres)	10,037 (-1% change from current)		
Effects to identified wildlife corridors	No change	Young-growth treatments would improve the connectivity between the OGRs in VCU 5440 and 5450.		
Acres of treated young growth	0	936	1,461	1,483
Change in road densities by WAA and Kosciusko Island	No change	WAA 1525: increase 0.1 miles per square mile from 1.8 to 1.9 on NFS lands, and increase 0.1 miles per square mile from 2.1 to 2.2 on all lands WAA 1526: no change at 0.25 miles per square mile Island: no change at 0.8 miles per square mile on NFS lands, and increase 0.1 miles per square mile from 1.1 to 1.2 on all lands		
Endangered Species Act Determination: Humpback Whale	No Effect	May affect, not likely to adversely affect.		

Wildlife and Subsistence (cont'd)				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Region 10 Sensitive Species Effect Determination: • Steller sea lion • Yellow-billed loon • Queen Charlotte goshawk • Black oystercatcher	All species: No Impact	Steller sea lion and Queen Charlotte goshawk: 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. Yellow-billed loon and black oystercatcher: No Impact		
Soils				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Cumulative acres of detrimental soil conditions	1,274	1,316	1,332	1,330
Percent of project area with detrimental soil conditions	2.3	2.4	2.4	2.4
Wetlands				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Acres of proposed wetland impacts (harvest and roads)	0	31	31	31
Cumulative acres of harvested wetlands	1,139	1,169	1,169	1,169
Percent of wetlands harvested	6	6	6	6
Cumulative acres of wetlands converted to road	113	114	114	114
Percent of wetlands converted to road	0.2	0.2	0.2	0.2
Fisheries and Watersheds				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Total acres of proposed harvest units	0	999	1,526	1,547
Acres of proposed clearcut harvest units	0	888	423	267
Acres of proposed canopy removal	0	925	933	600

Fisheries and Watersheds (cont'd)				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Number of the 21 project watersheds that cumulatively exceed the 20/30 threshold until 2055	8	8 (5 of these 8 will have additional canopy removal)	8 (5 of these 8 will have additional canopy removal)	8 (5 of these 8 will have additional canopy removal)
Number of the 21 watersheds that cumulatively exceed the 2.5 percent area as road threshold	1	1	1	1
Number of the 14 red pipes that would be removed or replaced in the project	0	14	14	14
Approximate distance in meters of upstream habitat that would be opened up from this project	0	1,700	1,700	1,700
Number of new fish stream crossings (would provide fish passage)	0	1	1	1
Anticipated miles of Class I and Class II streams that would have harvest in the RMA (on non-NFS land only)	23.0	23.0	23.0	23.0
Anticipated acres of harvest in Class I and Class II RMAs (on non-NFS land only)	648	648	648	648
Acres of PCT treatment in previously harvested Class I and Class II RMAs	0	224	224	224
Miles of potential in-stream restoration	0	1	1	1
Freshwater Essential Fish Habitat (EFH)	No project actions, no adverse effects on Freshwater EFH	May adversely affect Freshwater EFH		
Marine EFH	No project actions, no adverse effects on Marine EFH	May adversely affect Marine EFH		

Geology, Minerals, Karst, and Caves				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Acres of moderate-vulnerability karst treated by harvest type	0 acres treated	802 acres even-aged and 61 acres uneven-aged	418 acres even-aged, 213 acres uneven-aged, and 755 acres two-aged	978.62 acres uneven-aged and 388.37 acres two-aged
Acres of high-vulnerability karst treated by harvest type	0 acres treated	28 acres even-aged and 9 acres uneven-aged	4 acres even-aged, 23 acres uneven-aged, and 40 acres two-aged	65 acres uneven-aged and 11 acres two-aged
Scenery				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Change in the level of Scenic Integrity by Viewshed (Direct and Indirect Effects)				
Shipley Bay Cabin	No Change	Negligible Change	Negligible Change	Negligible Change
Sumner Strait	No Change	Slightly Noticeable	Slightly Noticeable	Slightly Noticeable
Sea Otter Sound to Cape Pole	No Change	Noticeable Change	Noticeable Change	Noticeable Change
Tuxekan Pass to Edna Bay	No Change	Negligible Change	Negligible Change	Negligible Change
Karheen Pass to New Tokeen	No Change	Negligible Change	Negligible Change	Negligible Change
Marble Pass	No Change	Negligible Change	Negligible Change	Negligible Change
Pole Anchorage	No Change	Slightly Noticeable	Slightly Noticeable	Slightly Noticeable
Community of Edna Bay	No Change	Negligible Change	Negligible Change	Negligible Change
Community of Pole Anchorage	No Change	Negligible Change	Negligible Change	Negligible Change
Scenic Integrity by Viewshed (Cumulative Effects)				
Shipley Bay Cabin	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Sumner Strait	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Sea Otter Sound to Cape Pole	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Tuxekan Pass to Edna Bay	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Karheen Pass to New Tokeen	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Marble Pass	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Pole Anchorage	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Community of Edna Bay	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Community of Pole Anchorage	Negligible Change	Negligible Change	Negligible Change	Negligible Change

Sensitive and Rare Plants				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Populations and habitats of sensitive plants directly and indirectly impacted	No impacts	No direct or indirect effects to the known populations or habitats of *Lobaria amplissima*, lesser round-leaved orchid, Unalaska mist-maid, Henderson's checkermallow, or dune tansy. May be direct or indirect effects to the unknown populations or habitat of spatulate moonwort, moosewort fern, mountain lady slipper, yellow lady's slipper, Calder's lovage, Alaska rein orchid, and lesser round-leaved orchid.		
Populations and habitats of rare plants directly and indirectly impacted	No impacts	No direct or indirect effects to the known or unknown populations or habitats of Pacific silver fir, maidenhair spleenwort, northern golden saxifrage, fragile rockbreak, mountain bladderfern, twinberry honeysuckle, Adder's-mouth orchid, Alaska oniongrass, Pacific ninebark, Douglas' spirea, western meadow-rue, and Carlott's violet. May be direct or indirect effects to unknown populations or habitats of whiteflower rein orchid.		
Invasive Plants				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Risk of invasive plant spread	Low	Moderate to High The high risk is associated with spread of invasive plant species already in the project area.		
Risk of new invasive plant introduction and spread	Low	Moderate and Short-term Mitigation and monitoring measures should limit the spread and establishment of potential new invasive plants not in the project area.		
Risk of invasive plant spread along new and existing roads	Low	High There would be additional spread of some high-priority invasive plants, but mitigation and monitoring measures should limit the spread and could limit some existing high-priority invasive plants not already widely distributed.		
Heritage				
Measurement Indicator	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
Number of acres surveyed of both low and high sensitivity for Heritage resources	N/A	Over 651 acres		
Number of archaeological sites in the Area of Potential Effect (APE) and mitigation/protection as required	N/A	23 historic properties identified, all removed from the APE		

Silviculture

The effects analysis area used is the Kosciusko Project area. The timescale used to analyze effects is the next 100 years or the projected time when a substantial change is expected to occur.

Direct and Indirect Effects on Forest Structure

Alternative 1

Changes to Old-growth Stand Structure

Old-growth stands would remain in a predominantly old-growth condition and function as such. Small-scale, frequent disturbance events would continue, fostered by disease and decay.

Changes to Stand Structure in Commercial Young-growth Stands

Stem exclusion to beginning understory re-initiation stage stands would continue to grow and transition fully into the understory re-initiation stage structure over the next 40 to 50 years.

Changes to Pre-commercial Young-growth Stands

Lower productivity stands would remain primarily in the stand initiation stage for the next 5 to 10 years before entering fully into stem exclusion structure that would be expected to last for 100 to 120 years after that.

Average productivity stands are in stem exclusion now and are expected to stay in that structure for the next 50 to 75 years before exhibiting considerable characteristics of the understory re-initiation stage.

Alternatives 2, 3, and 4

Old-growth Harvest

About 27 acres would be converted using even-aged management to less complex stand structure that maintains few of the old-growth characteristics and functions present today.

About 37 acres would be harvested using uneven-aged management that maintains two-thirds of the existing old-growth structure for the next 30 years. The one-third of the area harvested would be in small openings two acres or less that progress through structural changes similar to even-aged management. After two additional harvest entries spread over 60 years, the entire stand would be converted to a mosaic of three separate age classes with stand structure that ranges from stand initiation to stem exclusion and stem exclusion that is trending toward understory re-initiation structure.

Commercial Young-growth Treatments

Where even-aged management is used, stem exclusion to beginning understory re-initiation stage stands would be converted to stand initiation stage structure. Following this harvest, it would require about 50 to 60 years to again advance to the same stand conditions present today and another 40 to 50 years to transition fully into understory re-initiation structure.

Where two-aged management is used, 50 percent of the harvest area would remain intact. A patchwork of openings up to about 20 acres in size would be dispersed throughout the harvest area. These areas would progress through structural changes similar to even-aged management. After 30 years the remaining stand area would be harvested.

Where uneven-aged management is used two-thirds of the stand area would be retained in the first harvest entry. These areas would continue to grow from late stem exclusion to understory re-initiation structure. The harvested areas would regenerate as homogenous young growth and move through the same structural stages as the even-aged system already discussed. The second entry would be planned to occur in about 30 years or at a time when the young growth from this first harvest has been pre-commercially thinned and the slash from that treatment does not limit wildlife movement. This entry would similarly harvest another third of the stand. Following this harvest, there would remain one-third of the stand in late understory re-initiation structure that would be trending toward old-growth structure. One-third of the stand would be in 30-year-old stem exclusion from the first harvest and follow-up PCT, and one-third would be regenerating new growth. A third entry would then occur 60 years in the future harvesting the oldest portion of the stand. Harvest in this manner would result in stands of high vertical and horizontal structural diversity due to the high variability in age, tree size, and individual tree characteristics. Repeated harvest entries in this manner would generally mimic a natural regime of frequent but low-intensity disturbances.

Table 4: Acres Treated by Harvest System and Alternative.

Harvest System	Alternative 2	Alternative 3	Alternative 4
Even-aged	861	396	0
Two-aged	0	856	399
Uneven-aged	75	209	1,084

Upland Pre-commercial Young-growth Treatments

Stands proposed for PCT generally range from the stand initiation stage to stem exclusion. A PCT treatment would prolong the stand initiation stage where present and promote the development of understory re-initiation stage structure sooner in stands that are already in stem exclusion. In non-development areas where the desired condition is ultimately old-growth-like structure, PCT would promote conditions that allow that objective to be achieved sooner than if left untreated.

Riparian Pre-commercial Young-growth Treatments

The first treatment would be a patch thinning where thinned areas are spaced out along the stream corridor to mitigate effects to other resources. Pre-commercial thinning in these areas would promote the development of understory re-initiation stage structure sooner. The unthinned areas would continue into the stem exclusion stage until thinned about 10 years in the future. Within-stand diversity can be increased by favoring trees with specific characteristics important for wildlife.

Where riparian in stream work occurs adjacent to pre-commercial size young-growth stands, some trees would likely need to be cut for access trails between the stream and the existing road system. Trails are expected to be minimal. This is not expected to have any noteworthy effects to stand structure at the stand level.

Direct and Indirect Effects on Forest Health and Productivity

Alternative 1

Changes to Old-growth Stands

Under Alternative 1 no new timber harvest would occur. It is expected that forest growth would continue to be offset by decay. Insect and disease processes at work would persist at approximately current levels, but due to the generally unhealthy condition, the forest remains at risk and vulnerable to insect and disease attack. Hemlock dwarf mistletoe, where present, would remain in the stand and may infect hemlock stems that regenerate in the gaps adjacent to infected overstory trees.

Changes to Commercial Young-growth Stands

In general, commercial size young-growth stands in the project area are typically healthy and growing well with no foreseeable insect or disease issues that need immediate attention. This is primarily due to the extensive past PCT that has taken place that reduced stocking to healthy levels.

Changes to Pre-commercial Young-growth Stands

The primary function of PCT in regard to forest health and productivity is to reduce long-term insect and disease risk while promoting the growth of the trees that would best meet future objectives. Without treatment, pre-commercial size stands would remain predominantly in a stem exclusion stage. The relatively small spacing between each tree causes stress that would allow for an increased chance that insects and diseases could more easily take hold and spread. The overall productivity of the stand may be somewhat less than the full potential due to this overcrowding. Although these stands are relatively insect-, disease-, and defect-free, there would be a forfeiture of any opportunity to remove trees that are less likely to meet desired conditions and to promote the growth of those that are. Currently there are no foreseeable insect or disease issues in these stands; however, in light of a warming climate, there is potential for future issues to develop that are not apparent today if these stands are left in an overstocked condition. Yellow-cedar are typically constrained to lower productivity sites with poorer drainage since they do not compete well with other species on better sites. Yellow-cedar on poor sites would be susceptible to cedar decline.

From a timber production standpoint, less desirable trees may outcompete better trees with little defect, somewhat reducing the economic potential of any future harvests. Stands that are never pre-commercially thinned would take longer to develop enough large trees to make harvest practical. An abundance of non-merchantable stems reduces the economic feasibility of harvesting and decreases the opportunity for an economic future timber supply.

Stands proposed for riparian thinning are generally on highly productive sites but are overstocked. This overstocked condition would increase risk of large scale insect and disease outbreaks over time if not corrected. Currently there are no foreseeable insect or diseases issues in these stands; however, in light of a warming climate, there is potential for future issues to develop that are not apparent today if these stands remain in an overstocked condition.

Alternatives 2, 3, and 4

Old-growth Harvest

Where even-aged management is prescribed, the productivity of those areas for timber production would be enhanced. The risk of insect, disease, and decay within the newly established growing stand would be minimized. The new trees that regenerate after even-aged treatments would be vigorous and free from decay. The insect and disease processes at work in the stands previous to harvest, including hemlock dwarf mistletoe, would be mostly eliminated.

Where uneven-aged management is prescribed, forest health concerns can be used as factors to determine which trees to harvest. An attempt would be made to remove the trees that pose the greatest risk to the health of the new stand, but would have to be balanced with maintaining an economic sale. Due to the amount of disease and decay found within the old-growth stands proposed for harvest, it is unlikely that all or even a substantial proportion of the trees with disease and decay would be removed. Productivity of these stands would be reduced in proportion to the amount of old trees that remain and occupy growing space.

In uneven-aged management stands there would be a risk of the new stands being infected with the same diseases and decays present in the stands at time of harvest. This risk would generally be proportional to the amount of basal area retained. Decay organisms would be transferred between trees when decay ridden trees fall and strike adjacent healthy trees either during harvesting operations or during weather events post-harvest. Hemlock dwarf mistletoe would remain in the stand and likely infect the hemlock regeneration even with selection criteria favoring the removal of infected overstory trees first. The larger old trees retained for wildlife would be generally of low vigor. These trees are not expected to respond to the increase in growing space created by harvest.

Commercial Young-growth Treatments

Where even-aged management is used in commercial young-growth, the risk of insect or disease would remain basically the same. There would be no expected increase or decrease in productivity of the land for growing trees. Even-aged stands would be replaced with similar stands that grow through the same stages and experience the same risk factors as the stands replaced. Harvesting using larger clearcuts would be similar to the methods used originally to establish the stands now being proposed or harvested. Bole wounding and root damage can be a concern for introducing insect and disease issues into young-growth stands. Few trees are likely to be injured along the margin of openings and adjacent to roads and trails. Even-aged management using larger openings provides the lowest risk of damage to residual trees during the logging operation.

Where two-aged management is used, 50 percent of the harvest area would remain intact for a period of 30 years. A patchwork of openings up to about 20 acres in size would be dispersed throughout the harvest area. There would be no expected increase or decrease in productivity of the land for growing trees or noteworthy changes in risk of insect or disease. The portions of the stand left intact are not expected to be at any major risk of insect or disease within the planned rotation time. Where openings occur, a similar stand composition would regenerate and grow through the same stages and experience the same risk factors as the portions of the stand they replaced except at a smaller scale. Some trees are likely to be injured along the margin of openings and adjacent to roads and trails. The increase in edge resulting from smaller, more frequent harvest openings would therefore result in a slightly increased risk of harvest-related

bole wounding over even-aged management. Wounds may attract insects such as bark beetles, and would be places for decay organisms to enter the tree.

Where uneven-aged management is used, two-thirds of the stand area would be retained in the first harvest entry and about one-third would be harvested in what would result in small openings and connecting trails. A second and third entry would be planned to occur in 30 and 60 years in the future harvesting about one-third of the stand at each entry. Uneven-aged management would carry a greater risk for insect and disease than the other systems for two primary reasons. First, the potential for residual tree injury is greatest compared to two-aged and even-aged since there would be multiple harvest entries scheduled relatively frequently, and the small harvest openings and connecting trails would result in a large amount of edge where wounding of residual trees is most likely to occur. Some wounded trees may develop decay at the damage site or attract insects like spruce bark beetles under certain circumstances. Second, utilizing uneven-aged management would result in older age classes of trees occupying the landscape than the other two systems. Growing older aged stands allows more time for decay and other issue to develop. An older age cohort in the stand increases the potential for some trees to become stressed and less vigorous resulting in increased potential for insect or disease to establish. Careful harvest administration along with the overall good health and vigor of the stands being treated would be expected to render this potential issue irrelevant.

Upland Pre-commercial Young-growth Treatments

Pre-commercial thinning would promote stand health and disease resistance long-term by removing diseased trees and opening growing space that reduces competition stress and mortality. Where PCT is used, stresses on trees due to overcrowding would be reduced. Trees would be better spaced and individual trees that exhibit signs of disease or decay would be a priority for removal. By commercial harvest age, stands would be less defective, average a larger diameter and have fewer sub-merchantable sized stems. This would make these stands more economically viable and allow for wider range of potential future harvest options. During PCT operations, yellow-cedar can be promoted on sites where decline is of less concern.

Riparian Pre-commercial Young-growth Treatments

Pre-commercially thinned riparian stands would be healthier post-treatment than if left untreated. Trees would be better spaced and grow large enough to contribute to the riparian ecosystem at a faster rate. Stands would be less at risk of insect and disease attack over the long term. Trees with specific characteristics important for wildlife can be maintained and their growth promoted.

Where riparian in-stream work occurs adjacent to pre-commercial size young-growth stands, some trees would likely need to be cut for access trails between the stream and the existing road system. Trails are expected to be minimal. This is not expected to have any noteworthy effects to forest health and productivity at the stand level.

Direct and Indirect Effects on Regeneration and Species Composition

Alternative 1

Changes to Old-growth Stands

Under Alternative 1, no harvest would occur. Small- to moderate-sized openings in the forest canopy would be created over time by windthrow and trees falling as a result of decay. Hemlock

regeneration would have a competitive advantage over other species when small openings in the canopy do occur. At some point in the future, it is expected that some stands in the project area would suffer larger-scale damage from a severe storm event, leading to the regeneration of those stands. Regeneration would likely be prolific with species composition similar to the former stand. Sitka spruce regeneration may have somewhat of a competitive advantage due to soil disturbance from upturned trees. There would be little opportunity to influence the species composition of the regenerating stand. Understory plant abundance and composition would remain approximately the same over time, increasing as openings occur and then decreasing as those openings are occupied by new trees.

Changes to Commercial Young-growth Stands

The species composition of commercial-sized stands under the No Action Alternative would remain basically the same into the future. As these stands age, Sitka spruce may make up more of the stand basal area because they are typically the dominant tree and would outcompete some of the co-dominant and intermediate western hemlock. As some trees die and the distance between tree crowns increase, the canopy would gradually open and understory plants would slowly increase in abundance and diversity. Little noteworthy new tree regeneration would be expected as a result of natural changes in these stands. Even though these stands are relatively wind and weather resistant, storm events, particularly those involving a combination of wind and wet snow or ice, can cause substantial damage mainly through breakage in the tree tops. When this occurs small gaps in the canopy develop and those openings become colonized by understory plants first, then by new trees. Being shade-tolerant, western hemlock regeneration would have an advantage.

Changes to Pre-commercial Young-growth Stands

The species composition of pre-commercial sized stands under the No Action Alternative would remain basically the same. Sitka spruce and western hemlock would typically dominate the moderate to higher productivity sites. Cedar would be mostly limited to lower productivity poorly drained sites. Yellow-cedar on these sites would be susceptible to decline.

The species composition in riparian stands would change over time based primarily on the amount of red alder present. Red alder is a relatively short lived, shade-intolerant tree that, once overtopped by other species, would quickly die out of the stand. Red alder is present in some of the stands proposed for riparian treatment, particularly where past disturbance either from logging or by stream channel movement has occurred. Over time, red alder would be replaced in these stands by mainly Sitka spruce and, to a lesser extent, western hemlock. Where alder is not present, the species composition would remain mostly unchanged in the short term, then as the stands age, Sitka spruce would increase somewhat as they dominate these sites.

Alternatives 2, 3, and 4

Old-growth Harvest

Where even-aged openings are prescribed, the resulting tree regeneration is expected to be vigorous and representative of the approximate species mix of the former stand. The even-aged opening prescribed would create conditions that are favorable for tree planting and the management of cedar. There would be a good opportunity to plant yellow-cedar on sites favorable for the long-term survival of the species. These sites often occur where yellow-cedar does not currently exist.

Where uneven-aged management is prescribed, growing space would be limited somewhat by the retention of overstory trees. Since group openings of up to two acres are being used, this is not expected to be an issue. Natural regeneration would occur in the stand in satisfactory amounts and represent the composition of the original stand. The limited openings in the canopy would somewhat favor hemlock regeneration over other species long term. Openings of one acre and larger would offer an opportunity to plant yellow-cedar.

Following harvest, understory plants would flourish in the openings created by all three systems. After 10 to 15 years, tree regeneration would dominate and begin to shade the understory out.

Young-growth Commercial Treatments

Where even-aged and two-aged management is used in commercial young-growth, a flush of understory plants would occur shortly after harvest both in the openings and along the margins. This would be followed by extensive tree regeneration in the opening. After 10 to 15 years the understory would begin to be shaded out by this new tree regeneration. Sitka spruce and western hemlock would naturally occupy the openings. The even-aged and two-aged openings prescribed would create conditions that are favorable for tree planting and the management of cedar. There would be a good opportunity to plant yellow-cedar on favorable sites. Side-lighting into the residual stand from the openings would enhance understory plant abundance and diversity.

Where uneven-aged management is used, the smaller, more linear openings are expected to regenerate adequately with both Sitka spruce and western hemlock. Western hemlock would have a competitive advantage due to the limited openings. Where larger openings of one to two acres occur, there would be an opportunity to plant yellow-cedar. Understory plant occurrence and diversity would be enhanced over the existing condition. The extensive edge created under this system would make the increase in understory more available to deer in winter over other treatments. When using uneven-aged management, harvest entries would be more frequent but at a smaller scale than with the other systems. This would result in more time that a robust understory would be present in the landscape over a given time period. There would be fewer acres of robust understory present than with other systems but these acres would be more evenly distributed across the landscape.

Pre-commercial Young-growth Treatments

In stands proposed for PCT, yellow-cedar would be the first, and western redcedar the second, priority to be maintained as leave trees. Both species would be thinned to a more narrow spacing than other species. This would result in an important increase in the occurrence of the species in young-growth stands long term. Both cedar species are typically under-represented in older commercial young-growth stands in the project area since they didn’t compete well on the better sites those stands occupy. It is also likely the cedar that did survive were discriminated against during past PCT treatments.

Where cedar species are not present, Sitka spruce and western hemlock would be selected as leave trees. Because Sitka spruce often represents the most vigorous and robust trees in the stand, they may be selected for retention more frequently than western hemlock.

After thinning, the added growing space would increase the amount and diversity of understory plants until the canopy recloses in approximately 15 years.

Tree regeneration in any appreciable amount is not expected as a result of PCT treatments.

Riparian Young-growth Treatments

Most stands proposed for riparian thinning are primarily productive sites regenerated with spruce and hemlock. After thinning, the spruce component is expected to increase slightly since spruce are most often the more vigorous species. Red alder is prescribed to be left uncut to provide diversity.

Tree regeneration is not expected to occur following treatment.

Where riparian in-stream work occurs adjacent to pre-commercial size young-growth stands, some trees would likely need to be cut for access trails between the stream and the existing road system. Trails are expected to be minimal. This is not expected to have any noteworthy effects to regeneration and species composition at the stand level.

Direct and Indirect Effects on Windthrow Risk

Alternative 1

Changes to Old-growth Stands

Under the No Action Alternative, stands would remain in a predominantly old-growth condition. Small-scale, frequent disturbance events would continue in the stand until a large-scale event occurs. The inherent windthrow risk within stands would not change appreciably.

Changes to Commercial Young-growth Stands

No harvest would occur and wind risk would remain approximately the same. Even though these stands are relatively wind and weather resistant, storm events involving a combination of wind and wet snow or ice can cause damage mainly through tree bole and top breakage. Small openings in the canopy created by this process are not expected to predispose these stands to any added windthrow risk. Since most of these areas were pre-commercially thinned in the past, they tend to have stand and individual-tree characteristics that make them less susceptible to wind damage if undisturbed. The expected trend is for these stands to become more stable over time as thin, intermediate, and overtopped trees die out, and dominant spruce with good taper and lower height-to-diameter ratios make up more of the stocking.

Changes to Pre-commercial Young-growth Stands

As densely stocked pre-commercial sized stands grow and compete for light, trees would become tall and thin, predisposing them to wind and weather damage in the future particularly if the stand is opened up by harvest. In the short term, un-thinned stands would maintain a dense structure, which decreases the intensity of wind within the stand and the potential for damage.

Alternatives 2, 3, and 4

Old-growth and Commercial Young-growth Harvests

Windthrow risk was evaluated for each unit considering prevailing wind direction, topography, and evidence of windthrow both within proposed units and along edges of previous harvest units. Specific measures have been prescribed to reduce or minimize windthrow risk adjacent to unit edges, and within stream buffers. These measures are included on the unit cards and in the detailed unit prescriptions located in the project record.

Where even-aged and two-aged management is prescribed, windthrow risk would be eliminated within the harvest unit by the removal of all large trees. The future young growth created would typically be equally windfirm to the young-growth commercial stands they replaced. Where old growth is harvested, the regenerated stand would likely be more windfirm than the stands they replaced.

Exposed stand edges would, however, have increased risk of windthrow in the first few years after harvest due to the adjacent opening. The shape, location, and proximity of one harvest unit to another was planned to minimize windthrow along opening edges to the extent practical.

In two-aged management the potential for wind damage to stand edges might be slightly higher than under even-aged management because of the increased edge. This may be somewhat offset by the smaller opening size though.

Where uneven-aged management is prescribed, wind risk would remain approximately the same as in the stand prior to harvest. Openings would typically be 2 acres or less, which are considered to be windfirm (Stathers, R.J., T.P. Rollerson, and S.J. Mitchell 1994, Windthrow Handbook for British Columbia Forests; see Silviculture Report).

In all harvest areas, high-vulnerability karst areas and RMAs that have stream channel stability concerns and potential for windthrow would be evaluated for RAW. Those karst areas and RMAs determined to be at risk would be reviewed in the field once preliminary unit boundaries are in place. The specific windfirming prescription for that RMA would be determined at that time.

Pre-commercial Young-growth Treatments

Both upland and riparian pre-commercial stands proposed for thinning would have an increased risk of windthrow immediately after treatment. The residual tree spacing prescribed would mitigate this risk. The maximum residual tree spacing prescribed would be 16 feet by 16 feet. This spacing has been used extensively in similar stands in the area without windthrow issues. In riparian areas, the patch thinning prescription would further mitigate short-term windthrow risk. Over time the treated areas would stabilize. Pre-commercial thinning promotes tree and stand characteristics that impart long-term windthrow resistance.

Where riparian in-stream work occurs adjacent to pre-commercial size young-growth stands, some trees would likely need to be cut for access trails between the stream and the existing road system. Trails are expected to be minimal. This is not expected to have any noteworthy effects to windthrow risk at the stand level.

Effects to Future Young-growth Timber Volume and Availability

Harvesting in young growth would occur prior to CMAI under all action alternatives. In general, growth and yield modeling indicates that harvesting prior to CMAI would reduce long-term volume production over waiting until CMAI is reached. Stands proposed for commercial young-growth harvest (stand origin date 1951 to 1960) would average about 34.6 MBF net in the year 2016. By year 2056 those same stands would average 91.4 MBF per acre, net. Assuming we harvest these stands on a 60-year rotation and each rotation produces about the same volume, after three rotations or 180 years, we would have produced 103.8 MBF per acre. If the same stands were harvested on a 90 year rotation, after 180 years or two rotations, they would produce about 182.8 MBF per acre, or about 76 percent more volume.

Kosciusko Island Harvest Projections for NFS Lands

The information below shows how young-growth harvest volume would be available on Kosciusko Islands out to year 2056. This projection is based on the assumption that if we pick an action alternative proposed in this Kosciusko Project EA, that same style of management would be applied across all Forest Service young-growth on the Island into the future and beyond this particular NEPA document. The tables below show what harvest volumes could be achieved under each alternative starting in 2016 (implementing the current proposed Kosciusko Project alternative) and then each decade from then on out to 2056. Volumes are based on projections from the FPS model. All alternatives have harvests scheduled to initially occur when the stand has achieved about 30 MBF per acre net or greater if possible. This roughly equates to the trees having a merchantable height tall enough to produce two 36-foot long sawlogs. The acres reported below are gross; they do not account for high-vulnerability karst, stream buffers, RMAs, or other resource issues that may reduce harvest acres. The harvest designs do not make considerations for maintaining any certain percentage of un-harvested area by watershed within any 30-year period. Maps showing the proposed harvest areas and the timing of those harvests can be seen in Appendix A of the Silviculture Report.

Table 5: Harvest Projections from Year 2016 to 2056 Using the Alternative 2 Strategy.

	Even-aged Harvest			Uneven-aged Harvest (1st Entry)			Uneven-aged Harvest (2nd Entry)			Total	
Year	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Year	MMBF
2016	853	34.9	29.8	76	11.4	0.9	0	0	0.0	2016	30.6
2026	922	44.4	40.9	385	12.9	5.0	0	0	0.0	2026	45.9
2036	1887	42.6	80.4	300	11.8	3.5	0	0	0.0	2036	83.9
2046	1255	46.9	58.9	57	11.7	0.7	76	25.9	2.0	2046	61.5
2056	675	51.3	34.6	0	0	0.0	385	26.9	10.4	2056	45.0

Table 6: Harvest Projections from Year 2016 to 2056 Using the Alternative 3 Strategy.

	Even-aged Harvest			Two-aged Harvest (1st Entry)			Two-aged Harvest (2nd Entry)		
Year	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF
2016	419	34.4	14.4	869	17.3	15.0	0	0	0.0
2026	140	42.5	6.0	299	20	6.0	0	0	0.0
2036	754	34.5	26.0	1271	18.7	23.8	869	31.6	27.5
2046	570	35.2	20.1	636	18.1	11.5	299	34.6	10.3
2056	0	0	0.0	293	22.6	6.6	1271	33.5	42.6

	Uneven-aged Harvest (1st Entry)			Uneven-aged Harvest (2nd Entry)			Total	
Year	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Year	MMBF
2016	179	12	2.1	0	0	0.0	2016	31.6
2026	576	13.2	7.6	0	0	0.0	2026	19.5
2036	350	17.5	6.1	0	0	0.0	2036	83.4
2046	80	11.7	0.9	179	26.6	4.8	2046	47.6
2056	0	0	0.0	576	27.5	15.8	2056	65.0

Table 7: Harvest Projections from Year 2016 to 2056 Using the Alternative 4 Strategy.

	Even-aged Harvest			Two-aged Harvest (1st Entry)			Two-aged Harvest (2nd Entry)		
Year	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF
2016	0	0	0.0	465	18.4	8.6	0	0	0.0
2026	0	0	0.0	165	18.8	3.1	0	0	0.0
2036	0	0	0.0	827	18.9	15.6	465	31.2	14.5
2046	0	0	0.0	678	16.8	11.4	165	32.8	5.4
2056	0	0	0.0	34	23.8	0.8	827	33.8	28.0

	Uneven-aged Harvest (1st Entry)			Uneven-aged Harvest (2nd Entry)			Total	
Year	Acres	MBF/ac	MMBF	Acres	MBF/ac	MMBF	Year	MMBF
2016	1028	12	12.3	0	0	0.0	2016	20.9
2026	806	13.5	10.9	0	0	0.0	2026	14.0
2036	1514	11.9	18.0	0	0	0.0	2036	48.2
2046	643	12.1	7.8	1028	25.5	26.2	2046	50.8
2056	258	14.8	3.8	806	27.6	22.2	2056	54.8

Discussion of Alternatives

Alternative 2 would produce the greatest volume early in the Tongass transition to young growth. The trade-off for timber production is that after 2056 most of the acres would be cut and there would not be any volume available until the original harvests areas can be cut again in the third rotation. There could be a 20-year or longer wait before stands cut in 2016 are again ready to be harvested. This could be an issue for Edna Bay but would not likely be much of a concern to a young-growth industry due to the greater availability of young-growth timber elsewhere on the Forest by that time.

Both Alternatives 3 and 4 defer acres in both two-aged and uneven-aged management until 30 years out. The third entry into the uneven-aged stands is not shown in the projection but would occur in 2066. Both Alternatives 3 and 4 have less volume for cutting in the short term but would allow for a smoother volume flow after 2056. They would also maintain a more diverse stand structure with more acreage of older age classes represented in the landscape at any one particular time.

Acreages shown are the total proposed for harvest. Where two-aged management is proposed, the stand average volume-per-acre is halved to represent that about half of the stand total acres are being harvested in that entry. Where uneven-aged is proposed the stand average volume used is one-third to represent that about one-third of the stand would be harvested in that entry.

Cumulative Effects

The analysis area for cumulative effects is the Kosciusko Project area. The following are the activities expected to contribute to cumulative effects to forest vegetation:

Timber Harvest on NFS Lands in Addition to the Kosciusko Project

Continued micro-sales and Free Use Timber Permits would occur throughout the project area along existing roads. Firewood cutting is also expected to occur. Both micro-sales and firewood cutting are limited to dead, down, and dying trees. Free use timber permits are usually for green

trees but are limited to 10 MBF per permit. Free use permits may be for either young-growth or old-growth timber.

Due to the characteristics and limited scale of these activities, micro-sales, free use, and firewood cutting are not expected to have appreciable effects to forest structure, forest health and productivity, regeneration and species composition, or windthrow risk at the project-area scale. Taken in combination with the proposed activities in the Kosciusko Project, these actions would not create a situation where cumulative effects create any level of additional concern.

Timber Harvest on State and Private Lands

Harvest on State Lands

Large harvest units totaling about 1,383 acres are scheduled on State lands in the southern peninsula of Kosciusko Island near Survey Creek by the State Division of Forestry (DOF) starting in 2015. DOF proposes to sell the timber as one sale with harvest units designed by the purchaser. The sale is expected to be harvested using even-aged management where the majority of the acreage may be harvested in one block. Additionally, the DOF is proposing to construct a Log Transfer Facility (LTF) and sort yard in Section 34, Township 68 South, Range 76 East, Copper River Meridian (West Edna Bay). No other harvest is foreseeable on state lands in the affected areas.

Harvest on University of Alaska Lands

The Edna Bay Timber Sale parcel was offered and sold by the University of Alaska in May of 2013. The sale is located on Kosciusko Island, southwest of the Edna Bay State Subdivision, Alaska State Land Survey (ASLS) 81-116. The total acreage for the Edna Bay parcel is 1,717, more or less: approximately 630 acres are old-growth Sitka spruce, western hemlock, and western red cedar, and approximately 900 acres are 50 to 70 year-old second-growth timber. The harvest is being carried out using even-aged management with the majority of the acreage being harvested in one block. The harvest of this area is ongoing.

Harvest on Sealaska Lands

Portions of the lands recently transferred to Sealaska are expected to be harvested in the near future. Sealaska has not provided the Forest Service with a plan regarding these operations but the Forest Service anticipates the actions could take place based on the knowledge of the area and harvest planning done by the Forest Service prior to the land transfer.

The Forest Service has modeled stand growth and development on most of the lands Sealaska has acquired and determined it would be reasonable to expect Sealaska could begin harvest operations on about 4,569 acres of old growth and about 3,473 acres of young growth within the next 10 years.

The proposed State of Alaska Parlay Timber Sale and the ongoing University of Alaska Timber Sale are both located in the southern peninsula of Kosciusko. The State of Alaska Sale will adjoin the University of Alaska Sale along the entire northern boundary. These harvests may result in a continuous even-aged harvest opening of approximately 3,100 acres. Harvest on Sealaska lands is projected to exceed 8,000 acres over the next 10 years. The Forest Service stands proposed for harvest are between the State and University harvests and the potential Sealaska harvests. The Kosciusko Project would adjoin the western edge of the State and University harvest in the vicinity of Survey creek and also adjoin the southern extent of potential Sealaska harvests in the central portion of the Island.

Cumulative Effects Summary

The young growth expected to be harvested on State and private lands currently range from stem exclusion to understory re-initiation stand structure. The harvesting of these areas using even-aged management would convert these areas to stand initiation structure. This would initially bring a flush of understory plants followed by tree regeneration and canopy closure and then eventually back to stem exclusion structure. The time these areas spend in stand initiation and stem exclusion in the future would depend on the productivity of the sites and if the areas are pre-commercially thinned. Overall it would be expected the stem exclusion structure would take about 25 to 30 years to return and it would be about 50 more years before these stands begin to move into understory re-initiation stage. Based on current practices on State and Private lands, it would not be expected that these stands would be allowed to grow long enough into the future to obtain understory re-initiation structure.

Where old growth is harvested, that structure would be converted to stand initiation as well and develop similarly.

Harvest on NFS lands as described for Alternative 2 of the Kosciusko Project would result in an additional 887 acres of stand initiation structure located between the State and University harvests to the west of Edna Bay and near the Sealaska parcels in the center of the island. There would be the potential for the University, State, Forest Service, and Sealaska harvest areas to essentially coalesce into one expanse of homogenous stand structure approaching 12,000 acres in size. Alternatives 3 and 4 offer opportunities to influence stand structure on NFS lands in ways that would somewhat mitigate the creation of large-scale homogenous stand structure in the project area. Alternative 4 would offer the most mitigation since it would essentially set the majority of NFS lands between Sealaska and State and University lands up for uneven-aged management. Uneven-aged management would, over time, result in more advanced stand structure that would otherwise be scarce in this section of the project area.

Since even-aged management is expected, harvest on State and private lands in the project area are not anticipated to have appreciable negative effects to forest health and productivity, regeneration and species composition or windthrow risk.

There is a high likelihood that substantial changes to forest structure would occur in the project area as a result of cumulative large-scale State and private timber harvest within the next 10 years.

Timber Economics

Timber sale economics affect the viability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies. Loss of this industry's business would negatively impact the ability to maintain the economic health of local communities. Three action alternatives were analyzed for this project. The scope of the affected environment included the communities near the project area as well as the Southeast Alaska region. The unit of measures used to evaluate the effects of the proposed action, and compare alternatives includes:

- Total volume of timber (MMBF)
- Logging and road costs (per MBF)
- Indicated bid value ($ per MBF)

- Number of annualized direct jobs

The Alaska Region Financial Analysis Spreadsheet Tool-Residual Value ("FASTR"), version October 21, 2013, was used to compare all Kosciusko Project alternatives. The FASTR model uses the same logging costs and manufacturing costs developed for the Alaska Region timber sale appraisal program. Timber volume estimates used in the project financial analysis are based on the Silviculture Forest Projection and Planning System (FPS) inventory database projections and site-specific stand examination information collected from stand exams within the proposed harvest areas. FASTR outputs are useful to gauge current economic conditions for a timber sale. While they do not provide a complete picture of actual costs and values at the time of offering, they do provide the Responsible Official with an economical range of project components and a relative comparison for alternatives.

Direct and Indirect Effects

Economic impacts of the project would most likely occur in the nearby communities on Prince of Wales Island. The direct and indirect employment and income likely to result from timber harvest is estimated by converting board feet to jobs and income. The economic analysis for Kosciusko Project includes adjustments to selling values based on the assumption that 50 percent of the young-growth volume would be approved for export, which follows the current export policy, as well as a scenario for 100 percent export of young growth. The 100 percent export scenario is included to illustrate the difference in potential economic impacts and sale value between the two export percentages. The following table shows a summary of the units of measure used in the timber economic analysis with a range of values shown from the current export policy guidelines of 50 percent, to 100 percent export of the young-growth western hemlock and Sitka spruce volume.

Table 8: Timber Economics Summary by Alternative.

	Alt 1	Alt 2	Alt 3	Alt 4
Volume (MMBF)[1]	0	30.2	29.9	19.0
Logging/Transportation Cost/MBF	$0	$333.05	$334.48	$332.72
Road Costs/MBF	$0	$22.97	$25.60	$37.82
Indicated Bid Value[2]	$0	$(3,424,735) – $1,208,896	$(3,410,321)- $1,040,053	$(2,390,051)- $495,903
Number of Annualized Direct Jobs	0	122-150	118-144	78-95

Source: G. Brand, FASTR (06/08/2015 FASTR output)

[1] Includes utility volume.

[2] ( ) indicates negative value

Cumulative Effects

Alternatives 2, 3, and 4 would contribute to the overall timber-related economy of Southeast Alaska. Alternative 1, however, would not contribute to the timber-related economy and timber from other areas on the Tongass NF would have to be used to provide a steady supply. Past timber sales have contributed the development of existing roaded infrastructure which would be used for each action alternative. Current and reasonably foreseeable future timber harvest from State of

Alaska, University of Alaska, and Sealaska Corporation projects would also help meet the timber demand and support logging and sawmill or export jobs.

Conclusion

Each action alternative is responsive to the need to manage the timber resource for production of sawtimber and other wood products from suitable lands made available for timber harvest on an even-flow, long-term sustained yield basis, and in an economically efficient manner. By meeting this need each alternative has the potential to support timber industry employment and benefit local and regional economies. The extent to which each alternative meets this need is correlated directly to the total volume of timber harvest for that alternative. At this time, Alternative 2 has the greatest potential to provide wood products in an economically efficient manner and create the most jobs, followed by Alternative 3, with Alternative 4 being the least viable.

Environmental Justice

Executive Order 12898 requires all federal actions consider the potential of disproportionate effects on minority and low-income populations in the local region. The Environmental Justice principles were considered in regards to the Kosciusko Project. The 2010 Census demographics and economic data for Edna Bay do not exceed requirements for additional Environmental Justice review when compared to the Prince of Wales – Hyder Census Area. No direct, indirect, or cumulative impacts to low-income households or minorities would occur as a result of Alternative 2, 3, or 4 of the Kosciusko Project.

Transportation

The units used for measuring potential effects and comparing the alternatives include:

- Miles of temporary road construction
- Miles of reconditioned NFS road
- Miles of road to be closed after these timber harvest activities.
- Costs including maintenance, reconditioning, and new temporary road construction.

The effects of roads and access management on resources are discussed in their respective resource sections and reports.

Proposed new road construction routes are field reviewed by resource specialists. Specific comments and concerns along with site-specific mitigation measures are discussed in their respective resource reports. The methodology for field review does not vary by alternative; rather, the roads are included or excluded by alternative based on the design criteria of each alternative.

No change to the Access and Travel Management (ATM) Plan for Kosciusko Island is proposed with this project. The plan, as depicted on the Motor Vehicle Use map (MVUM) will continue to guide motorized use within the project area. The ATM plan is reviewed annually for potential updates.

Direct and Indirect Effects

Road work required to support any timber sales as a result of this project would be the financial responsibility of that timber sale; general road maintenance funds would not be used. The use of roads to support a timber sale would not take away from road maintenance on other parts of the Tongass National Forest.

All newly constructed roads would be temporary roads. These roads would be decommissioned at the end of their use period. The costs for construction, maintenance, and decommissioning would be the financial responsibility of the timber sale.

The ATM plan would not change as a result of this project.

Rock quarries would be needed for road construction. Every one mile of new road construction would require about a one-acre rock quarry. Where feasible, existing quarries would be used; however, some new quarries may be required. All newly developed quarries would be reviewed and cleared by resource specialists prior to development. Quarry sites would be developed within 500 feet of a road and avoid Class I and Class II stream buffers, old-growth habitat reserves, eagle and goshawk nest tree buffers, and non-developmental LUDs.

Comparison of Alternatives

The following table provides a quantitative comparison of the alternatives. All roads, both existing and proposed, would be located, designed, constructed or reconditioned, and maintained following Best Management Practices (BMP), and other applicable laws, regulations, and specifications.

Table 9: Comparison of Road Work, Storage and Decommissioning, and Costs between Alternatives.

Miles of Proposed Road Work				
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**
Temporary Road Construction	0.0	1.5	1.5	1.3
New Road on Existing Prism	0.0	3.9	4.9	5.3
Road Reconditioning	0.0	4.2	4.7	4.7
Road Maintenance[1]	0.0	18	18	18
Upgrade Road on Sealaska Lands	0.0	0.5	0.5	0.5
Estimated Costs of Road Construction and Reconditioning				
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**
Temporary Road	0	$247,500	$247,500	$214,500
New Road on Existing Prism	0	$158,080	$194,007	$208,378
Reconditioning	0	$170,434	$185,388	$185,388
Road Maintenance[1]	0	$143,621	$143,621	$143,621
Total	0	$697,275	$748,156	$729,527
Miles of Storage and Decommissioning				
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**
Decommissioning	0.0	5.4	6.4	6.6
Storage	0.0	4.7	5.1	5.1
Estimated Costs of Road Storage and Decommissioning				
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**
Decommissioning	0	$16,200	$19,200	$19,800
Storage	0	$14,100	$17,100	$15,300
Total	0	$30,300	$36,300	$35,100

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

[1]- Total miles of road maintenance dependent on implemented haul routes.

Wildlife

For all citations in this Wildlife section, refer to the Wildlife Report and Wildlife BA/BE for full references. Past harvest on Kosciusko Island has resulted in reduction and fragmentation of productive old-growth (POG) stands, affected wildlife travel corridors, and reduced historical deer winter range. The proposed treatment of young-growth stands is expected to be beneficial to wildlife, especially deer.

Wildlife habitat concerns focus on changes to productive old-growth stands and its effects on a variety of wildlife species and treatments of young-growth stands.

Units of measure for wildlife are:

- Historical, current, and post-project acres of POG, high POG (HPOG), and large-tree POG (SD67; see description below)
- Changes in patch sizes
- Changes to interior forest acres
- Acres of deep snow habitat for deer and marten
- Acres of average snow deer winter range and non-winter deer habitat
- Changes in deer habitat capability
- Acres of year-round marten habitat
- Effects to identified wildlife corridors
- Acres of treated young growth
- Road densities by Wildlife Analysis Area (WAA) and Kosciusko Island

Wildlife analysis is done at several scales (see Table 10). At the largest scale some wildlife species are analyzed at the Forest level. The project area contains 56,063 acres, with 37,202 acres of National Forest System (NFS) land, 6,433 acres of State lands, and 18,861 acres in other ownerships (including 11,970 acres of Sealaska land), while 3 acres are owned by the Bureau of Land Management (BLM).

Numbers in wildlife analysis may not match numbers in other resource analysis due to rounding and GIS mapping differences.

Table 10: Scales of Analysis.

Scale	Acres
Tongass National Forest	16,900,000
Game Management Unit (GMU) 2	2,304,000
Prince of Wales (POW) Island	1,652,241
Kosciusko Island	110,353
Project Area (PA) - Total	56,063
PA - NFS lands only	37,202
Other ownership acreage in PA	18,861
WAA 1525 - acres in PA	48,098
WAA 1525 - acres outside PA	1,124
WAA 1525 - total	49,222
WAA 1526 - acres in PA	9,028
WAA 1526 - acres outside PA	58,501
WAA 1526 - total	67,529

Affected Environment and Existing Condition

Kosciusko Island is about 110,353 acres in size and is characterized by a low-relief karst landscape in the southern part where the majority of past management has occurred (most of WAA 1525). There has been less harvest in the more mountainous terrain to the north (WAA 1526).

Old-growth forests on the Tongass NF are classified as unproductive or productive. Productive old growth (POG) is generally defined as old-growth forest capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8 MBF per acre. The size-density model (SDM), which uses a combination of tree sizes and tree densities to classify forest structure (Caouette *et al*. 2006), is used to map POG and assess impacts to wildlife and habitats. This classification system builds on timber volume-based classification system (volume strata) for POG used prior to the 2008 Forest Plan (low-, medium-, and high-volume), which used only hydric soils and steep slopes as measures of productivity and growth. By incorporating the characterization of forest structure, the SDM is more applicable in assessing biodiversity, estimating timber values, and describing wildlife habitat than using timber volume alone.

Volume classes 6 and 7 (SD67) are highly productive forests associated with riparian areas, alluvial fans, colluvial[1] 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. This is the volume class most common in the project area.

POG is further defined into categories:

- High-volume POG (HPOG) is defined as the grouping of SD5S, SD5N, and SD67.
- Large-tree POG is defined as the SD67, representing the most productive of the POG types, and typically containing the highest density of large trees.

[1] a loose deposit of sharp edged rock debris that moves downhill without the help of running water in streams.

POG forest generally provides important cover and forage habitat for wildlife as a result of the dense canopy, which reduces snow accumulations in the understory during the winter but is open enough to provide understory vegetation during the spring, summer, and fall. The 2008 Forest Plan Final EIS provides more information on the development and use of the Size Density Model (Forest Service 2008b).

Even-aged, clearcut, forest management has been the most common silvicultural system used on Tongass National Forest. After clearcut harvest, conifers, shrubs, and herbaceous plants rapidly regenerate, fully occupying the site. This usually results in a stem exclusion stage of timber stand development at between 25 to 35 years of age. During the stem exclusion stage the understory shrub and herb layer may be virtually eliminated due to significant reductions in quantity and quality of light. Without stand disturbance, this stage can persist for 100 years or longer (USFS 2008b). The lack of understory shrubs, forbs, and herbs; structural diversity; and other components associated with late seral stages can have a negative impact on wildlife species dependent on these characteristics.

Managed stands in some areas are adjacent to one another and form large contiguous blocks of stem-excluded young growth, the largest of which is over 1,000 acres. Pre-commercial thinning has been accomplished in many harvested stands, providing the disturbance needed to allow light into the understory.

The majority of past harvest on Kosciusko Island has been at low elevations which are important areas for wildlife, including deer. Many of the young-growth stands have been thinned (36 percent) at some point but most are assumed to be in the stem exclusion stage again at this time (see Table 11). Existing conditions reflect the cumulative effects of past and current activities.

Table 11: Acres of Past Harvest.

Year	Harvest on NFS lands	PCT on NFS lands	Harvest on Other lands	PCT on Other lands	Total Harvest	Total PCT
Prior to 1950	31	0	1,500	0	1,531	0
1951-1960	5,461	4,867 (89%)	540	0	6,001	4,867
1961-1970	6,493	1,914 (29%)	960	0	7,453	1,914
1971-1980	3,548	212	240	110	3,788	322
1981-1990	843	0	0	0	843	0
1991-2000	104	0	67	0	171	0
Total	16,480	6,993 (42%)	3,307	110	19,787	7,103 (36%)

The biodiversity discussion includes analysis of POG, connectivity and corridors, fragmentation and patch size, and old-growth reserves (OGR) and OGR connectivity.

Productive Old Growth

The likelihood of a population persisting over time has been suggested to be related to some threshold level of habitat loss on the landscape (Fahrig 1997, 1999, 2003; Flather *et al*. 2002; Andren 1994). After reaching this threshold, the rate of population decline, and thus the likelihood of extinction, may increase (Haufler 2006). Reported threshold levels (percentage of habitat maintained on the landscape) range from 20 percent (Fahrig 1997) to 50 percent (Soule and Sanjayan 1998), depending in part on the dispersal capability of the species under consideration. Species such as the flying squirrel that have limited dispersal capabilities appear to

be more sensitive to habitat loss and fragmentation than species with greater dispersal capabilities such as goshawks and wolves (With 1999).

An intact, undeveloped landscape is assumed to be fully functional, maintaining focal species, communities, and/or systems and their supporting ecological processes within their natural ranges of variability (Poiani *et al*. 2000). Thus, the intactness of a landscape is another measure of the degree to which biodiversity has been affected by human actions. The definition of an intact landscape in the Forest Plan is a Value Comparison Unit (VCU) with at least 95 percent of the historical (1954) POG remaining. Although landscapes with higher amounts of past harvest likely may remain fully functional, this threshold represents an index used to identify areas that are in relatively pristine conditions and thus have the highest biological importance.

The threshold for percent of POG (by VCU) in the Forest Plan is the Legacy Forest Standard and Guideline. The Legacy Forest Standard and Guideline applies in VCUs where greater than 33 percent of the historical POG has been harvested. On both NFS land and lands in all ownership, VCUs 5440, 5450, and 5460 all have more than 33 percent of the historical POG harvested; however, the Legacy Forest Standard and Guideline does not apply to this project because all harvest in these VCUs is young-growth and the Standard and Guideline applies only to old-growth harvest.

Direct Indirect, and Cumulative Effects

All action alternatives would have the same effect on POG acres, ranging from zero to three percent depending on the VCU. Changes to POG acres at the WAA scale (these four VCUs combined) in WAA 1525 is estimated to be about one percent. There would be no change to any POG acres in WAA 1526.

Cumulatively, at the Island and VCU scales there would be no change to POG over what currently exists; in WAA 1525 there would be a reduction of about one percent, and there would be no change to the POG in any of the VCUs in WAA 1526 (see Table 12).

Table 12: Cumulative Effects to POG on All Lands.

Scale	VCU	Historical 1954 Acres	Current Acres	Percent Change 1954 to Current	All Alts	Percent Change Current to Post-treatment	Percent Change 1954 to Post-treatment	Percent Remaining 1954 to Post-treatment
WAA 1525	5430	12,623	8,531	-32%	8,528	-1%	-32%	68%
	5440	6,181	2,299	-63%	2,299	0%	-63%	37%
	5450	6,563	1,915	-71%	1,884	-2%	-71%	29%
	5460	9,240	5,773	-38%	5,754	-1%	-38%	62%
	Total	**34,607**	**18,518**	**-46%**	**18,465**	**-1%**	**-47%**	**53%**
WAA 1526	5410	3,611	3,228	-11%	3,228	0%	-11%	89%
	5411	5,421	5,421	0%	5,421	0%	0%	100%
	5470	1,845	1,845	0%	1,845	0%	0%	100%
	5471	2,163	2,163	0%	2,163	0%	0%	100%
	Total	**13,040**	**12,657**	**-3%**	**12,657**	**0%**	**-3%**	**97%**
Kosciusko Island		**47,647**	**31,175**	**-35%**	**31,122**	**-1%**	**-35%**	**65%**

Connectivity and Corridors

Connectivity of habitat on Kosciusko Island has been reduced by past harvest. In some areas past harvest activities have created large contiguous stands of young growth which may contain only narrow strips of old-growth forest. Some of the corridors were historically interior habitat acres included within much larger intact habitat patches. Past harvest and road building have fragmented these areas, creating large areas of young growth and creating smaller patches of old growth with more edge habitat in place of interior habitat. These remaining patches of old growth edge habitat now serve as corridors between the remaining patches of interior forest and other areas.

Given the age of many of the young-growth stands on Kosciusko Island it is likely that the older stands are providing at least some general connectivity and wildlife are using these areas as travel ways.

Besides the remaining old-growth corridors within the project area and Island-wide, both the beach buffer and stream buffers provide important corridors that aid in maintaining landscape connectivity. The beach buffer is low elevation habitat that can provide important connectivity, especially during the winter months.

The majority of harvest on Kosciusko Island occurred prior to the establishment of current Standards and Guidelines that restrict harvest within the 1,000-foot beach buffer and the RMAs. On NFS lands, only minimal areas of the beach buffer have had past harvest. These areas are between Survey Cove and Halibut Harbor, and one small area about one mile north of Cape Pole. The beach fringe along the southern portion of the Island, from Survey Cove east to the Edna Bay Marine Access Facility, is in either State or private ownership. This portion of the beach buffer is not functioning as a corridor because timber harvest practices on lands in other ownerships do not require a 1,000-foot beach buffer to be maintained.

The beach buffer from Cape Pole–north was designated as LUD II with the Sealaska land conveyance (Defense Authorization Act 2015).

There are no specified thresholds for connectivity corridors in the Forest Plan except for between medium and large OGRs (Forest Plan 2008 p. 4-91). Older young growth may contribute some to connectivity as many old-growth associated species on the Forest move across areas not in old-growth conditions (2008 Forest Plan FEIS Part 1, p. 3-173). The large areas of past harvest are developing toward old-growth conditions slowly, but may still lack the understory and structural diversity of old-growth stands. Most stands in the age class originating between 1951 and 1960 on NFS lands have been pre-commercially thinned, with the thinning occurring between 1977 and 1986 (4,867 acres, or 89 percent of the total acreage of 5,461). These treatments have resulted in increased understory plant occurrence and diversity as well as increased average stem diameter (larger trees). Thinning opens up the understory which over time results in making the stands easier to travel through.

The Forest Service has done extensive work on Kosciusko Island in the past to identify wildlife corridors and has carried many of those recommendations forward into this planning effort (see Wildlife Report).

Direct and Indirect Effects

Alternative 2 would have the most impact to corridors and connectivity due to the amount of even-aged harvest. Alternative 4, even though it harvests the most acres, would likely have the least negative effect on connectivity and corridors because no even-aged harvest would occur. The effect of Alternative 3 would be somewhere in between Alternatives 2 and 4.

Effects to corridors and connectivity for species such as marten and flying squirrel are discussed in a separate section.

Cumulative Effects

Cumulatively, activities on lands in other ownerships would reduce connectivity. The lands to the east of this proposed project are in State ownership and are expected to be harvested in the near future. To the west of this proposed project is Sealaska land; these acres will also likely be harvested in the near future. The result is that the entirety of NFS lands within the project area would likely function as a corridor or area of connectivity between the southern and northern parts of the Island. Alternatives 3 and 4 were designed to improve these connections. Treating corridors would benefit wildlife across the island and result in the entire southern portion of the island being better connected.

Fragmentation and Patch Size

In past project analyses, this discussion has referred to the fragmentation of large blocks of old-growth forest into smaller blocks of old-growth forest habitat. The direct effect of this project to blocks of old-growth habitat would be minimal. Under the action alternatives, generally uniform stands of young growth would be treated while large blocks of interior old-growth forests would not be converted to smaller, fragmented blocks. Under all action alternatives, 64 acres of old growth has been proposed for harvest. Therefore, the increase in fragmentation of large blocks of old growth would be very small (see Table 13); however the proposed treatments to uniform young-growth stands would increase the number of patches of young growth in the smaller size classes. Although there have been studies (see Wildlife Report), it is unknown what the specific effects of increased fragmentation of young growth may be to wildlife and bird species.

Table 13: Current Number of Patches per Patch Size Class (Acres).

Scale	0 - 50	50 - 100	100 - 250	250 - 500	500 - 1,000	1,000 - 10,000	10,000+
WAA 1525	85	5	6	1	0	1	1
WAA 1526	95	6	5	0	3	2	2
Kosciusko Island	180	11	11	1	3	3	3

Direct and Indirect Effects

Implementation of the action alternatives would result in acres that are currently in the stem exclusion stage being put back into large areas in the stand initiation stage through even-aged harvest resulting in an increase in forage availability; smaller areas in stand initiation combined with some overhead structure (two-aged); or relatively large areas of uneven-aged harvest. The areas of uneven-aged harvest would have only about one-third of the overstory removed at this time, eventually resulting in a stand with more old-growth-like characteristics (three or more distinct age classes, with openings up to two acres in size). Retaining two-thirds of the stand would provide snow interception; removing one-third of the stand would increase the amount of light reaching the forest floor, resulting in increased forage.

The project would result in an increase in fragmentation of young-growth stands; however, it would not result in the loss of any interior old-growth habitat acres. Little is known what the effects to wildlife would be if the proposed treatments increase the number of small patches of young growth. It is expected that treatments would increase edge effect around patches of young growth which would increase the amount of light reaching the forest floor and thereby increase the amount of plant forage species used by many wildlife species. Edge effects may include changes in vegetation structure, species composition (both plants and animals), predation rates, and disturbance (Murcia 1995, As 1999). Alternative 4, with no even-aged harvest, would have the least impact to fragmentation and patch size, followed by Alternative 3 and then Alternative 2.

Even-aged openings have the most effect on fragmentation, increasing the number of smaller patch sizes and edge effect; uneven-aged openings have the least effect. Under Alternative 2, even-aged openings of up to 100 acres would occur and would create additional fragmentation.

Under Alternative 3, a mix of uneven-aged, two-aged, and even-aged harvest would occur and would result in more connected habitat than under Alternative 2.

Alternative 4 would have the least effect to fragmentation and patch sizes because it does not propose any even-aged harvest. The acres of uneven-aged harvest, and to a lesser extent the two-aged harvest, would result in fewer smaller patches of young growth being created and less edge effect.

Pre-commercial thinning of about 1,864 acres would occur under all action alternatives and would not increase fragmentation. None of the alternatives would result in a significant change to patch sizes in old growth; all action alternatives would harvest 64 acres of old growth.

Little is known about the effects of proposed young-growth treatments to wildlife. However, Hagar *et al*. (1996) found that the hairy woodpecker and brown creeper were consistently more abundant in thinned than unthinned stands. There was an increase in red-breasted sapsucker (Hagar *et al*. 2001) following thinning and this may be due to trees wounded during thinning, producing foraging opportunities. The positive influence of thinning persisted for at least ten years for seven species including the red-breasted sapsucker (Hagar 2009). Foraging

opportunities are thought to increase; however based on Chambers *et al*. (1999) there is unlikely to be an affect to red-breasted sapsucker or hairy woodpecker, and while brown creepers may not use the areas for nesting they may continue to forage in these areas.

The brown creeper, red-breasted sapsucker, and hairy woodpecker are MIS and are discussed in more detail in the MIS section of this document.

Cumulative Effects

The lands in other ownership to both the east and west of the proposed project will likely be harvested in the near future. The harvest of these acres would increase the importance of the proposed treatments on NFS lands.

Existing Condition and Affected Environment – Old-growth Reserves

The conservation strategy in the Forest Plan (pp. 3-253 through 3-262) has two components: a Forest-wide network of old-growth reserves (OGRs), and the management of the land other than the reserves (the matrix). The old-growth reserves are designed to protect the integrity of old-growth forest habitat. The reserves –small, medium, and large– are scattered across the landscape. The land between the reserves, the matrix, may be allocated to a variety of LUDs and is managed and maintained by the Forest Plan Standards and Guidelines.

When OGR and other non-development LUD (SA and LUD II) acres in each VCU in the project area are combined, all VCUs have enough acres designated as either OGR or non-development acres to meet or exceed the minimum Forest Plan acre requirements for small OGRs.

Other OGRs

As a result of the Sealaska land conveyance the small OGRs in VCU 5450 and VCU 5460 need to be slightly modified by an interagency review team (IRT). This process is currently being addressed in the proposed Forest Plan Amendment. The modifications to these OGRs proposed by the IRT would not affect any activity in the proposed project; likewise, the proposed project would not affect the modified OGRs.

Direct, Indirect, and Cumulative Effects

All OGRs and combination of OGRs and other non-development areas would meet or exceed Forest Plan standard and guideline requirements in each VCU. The action alternatives propose to treat approximately 708 acres of past harvest which occurred in OGRs, beach buffers, and other non-development LUDs on Kosciusko Island to increase forage production and attempt to re-establish old-growth characteristics (gaps with forage production interspaced with clumps to provide cover, thereby providing a beneficial result to wildlife).

Since there would be no negative direct or indirect effect to OGRs from any action alternative, there would be no cumulative effect.

Threatened, Endangered, and Sensitive Species

Humpback whales are the only federally listed species occurring in the marine environment adjacent to the Kosciusko Project area (see Wildlife BA/BE). They are regularly sighted in the coastal waters of Southeast Alaska (NMFS 1991) and have been observed in the waters around Kosciusko Island.

National Forest management activities that have an effect on whale habitats or populations generally fall into the categories of habitat degradation, acoustic disturbance, and potential for ship strike. Activities that can contribute to habitat degradation include: development and use of LTFs and associated camps, movement of log rafts from LTFs to mills, and potential development of other docks and associated facilities for mining, recreation, or other Forest uses and activities. Acoustic disturbance sources include project related marine vessels and low-flying aircraft associated with helicopter yarding. Tugs towing log barges or rafts along with other project related boating could increase the possibility of ship strike.

Direct and Indirect Effects

Alternative 1: The No Action Alternative would have no direct or indirect effects on humpback whales. There would be no acoustic disturbance since no timber harvest or log shipment would occur. The MAF would not be reconstructed as part of the project.

Alternatives 2, 3, and 4: All action alternatives would harvest 64 acres of old growth. Potential effects would be similar, but could vary slightly in duration depending upon alternative selected. For example, Alternatives 3 and 4 may require a longer operating period than Alternative 2 because of the differences in young-growth volume and harvest prescriptions.

Habitat degradation can occur from the reconstruction and use of the Forest Service MAF and dock and from related camps, particularly if the purchaser utilizes a floating camp. Impacts to the marine environment would be limited to the MAF reconstruction and activities would comply with all permit requirements and BMPs for limiting erosion and maintaining water quality. Operation of all MAFs 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 MAF construction and operation maintain water quality in the specific facility locations and that marine circulation and flushing are maintained. Strict adherence to water quality standards and hazardous material containment and spill guidelines would limit the potential for contamination from associated MAFs. Additionally, stream monitoring has not shown any significant detrimental impacts from sedimentation caused by previous logging, and Forest Plan Standards and Guidelines for riparian management would be applied. Therefore, effects to habitat and prey species are expected to be immeasurable and discountable.

Potential acoustic disturbance includes noise generated from project related boating, barging or rafting logs to a mill or export site, and from equipment during the reconstruction of the MAF. Measurement of acoustic disturbance is an evolving scientific field with conflicting methodology and results (Ellison *et al*. 2011, Clark *et al*. 2009). Whale response to noise varies and is correlated to size, behavior, location, and composition of the whales at the time of disturbance (2008 Forest Plan FEIS, Appendix F). Response varies from no apparent response, to pod dispersal, sounding, breaching, evasive underwater maneuvers, and maintaining distance from vessels. Responses have ranged from leaving or avoiding feeding and nursery areas to becoming habituated to vessel traffic and its noise. Logging operations would generate acoustic noise in the marine environment and could temporarily displace humpback whales from the immediate project area during MAF reconstruction and active logging of the sale, but is not anticipated to affect the remainder of the project area. The daily volume of boat traffic from the project is not expected to be distinguishable from baseline conditions. Therefore, project related acoustic disturbance would be insignificant and discountable when compared to baseline conditions.

The potential for ship strike is expected to be insignificant and discountable because all permitted watercraft are required to follow Marine Mammal Protection Act (MMPA) regulations and stay at

least 100 yards from any marine mammal. 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 (MMPA), Endangered Species Act (ESA), and National Marine Fisheries Service (NMFS) regulations for approaching whales, dolphins, and porpoise. “Taking” of whales is prohibited; “taking” includes harassing or pursuing, or attempting any such activity (Forest Plan WILD4.B p. 4-99). 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). Actual barge routes and frequency are undetermined at this time and would depend upon purchaser and export approvals.

Cumulative Effects

Cumulative effects include the proposed activities on lands in other ownership. The State of Alaska currently owns land to the east of the project area. The State is proposing to log these acres in the next five years. To facilitate this planned logging the State is also building a new MAF at Edna Bay. The Sealaska Corporation also owns land on Kosciusko Island, to the west of the project area, with plans to log these acres in the near future.

ESA - All Alternatives: Cumulative effects, as defined by ESA Section 7, are not anticipated.

NEPA - All Alternatives: Cumulative effects under NEPA include the consideration of past timber harvest and related road activities, and recreational and commercial boating activities. All are part of the current condition and contribute to acoustical disturbance and potential temporary displacement of humpback whales. Barge traffic would occur from the planned logging activities on both State land and Sealaska land, but would be temporary in nature. The proposed project and associated effects are limited in size and scope (as compared to past sales and the marine habitat for humpback whales). No long-term effects are anticipated. Previous logging operations on Kosciusko Island have not precluded humpback whale use of the surrounding waters.

Determination

A determination of “No effect” is made for Alternative 1. A determination of “May affect, not likely to adversely affect” is made for humpback whales for Alternatives 2 through 4. When compared to available habitat in the surrounding marine waters, short-term effects of the proposed logging is not likely to adversely affect humpback whales. All Forest Service permit holders or permitted activities are required to follow MMPA, ESA, and distance regulations. As a result, effects to humpback whales are expected to be insignificant and indistinguishable from other vessel traffic using the marine waters around Kosciusko Island.

Region 10 Sensitive Species

Four Region 10 Sensitive Species were chosen for detailed analysis in the Wildlife BA/BE. Steller sea lions are regularly sighted in the Inside Passage and coastal waters of Southeast Alaska (NMFS 1991). Yellow-billed loons are occasionally sighted in Southeast Alaska inside waters during the winter months. Over the years, members of the public have reported goshawk sightings in the vicinity of Edna Bay.

Steller Sea Lion (*Eumetopias jubatus*)

Certain factors are affecting or have the potential to affect the dynamics of Steller sea lions of the eastern Distinct Population Segment (DPS): subsistence harvest by coastal Alaska Natives, illegal

harvest, incidental take associated with commercial fisheries, entanglement in marine debris, predation by killer whales and sharks, parasitism and disease, toxic substance contamination, global climate change, reduced prey quantity and quality, intentional shooting, and coastal development and disturbance. At present, the most likely threats to the eastern DPS are development, increased disturbance and habitat destruction, increases in the magnitude or distribution of commercial or recreation fisheries, and environmental change. None of these factors separately or combined appear to be at a level sufficient to keep the eastern DPS from continuing to recover or preclude delisting (Federal Register 2013a).

Except for potential habitat degradation and project related disturbance, none of the identified threats are regulated by or within the jurisdiction of the Forest Service.

Direct and Indirect Effects

Alternative 1: Alternative 1 would have no direct or indirect effects on Steller sea lions or their habitat. No habitat disturbance would occur since the MAF would not be reconstructed. Likewise, there would be no project related barge or rafted log traffic.

Alternatives 2, 3, and 4: Kosciusko Island and the project area occur within the eastern DPS boundary. The designated critical habitat on Coronation Island is about eight miles from the project area and would not be affected by any alternative.

Disturbance from increased human use of remote areas in Southeast Alaska represent a potential threat in the future but little is known about the potential impacts from changes to the physical environment, disturbance from vessel traffic, and tourism related activities. 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). NFMS (2012) reviewed the above threats and concluded that “the eastern DPS of Steller sea lion is not likely in danger of extinction throughout all or a significant portion of its range, nor likely to become so in the foreseeable future due to the present or threatened destruction, modification, or curtailment of its habitat or range”.

There may be incidental disturbance to Steller sea lions (eastern DPS) from MAF reconstruction and barging or rafting logs but the travel routes would not be near critical habitat. Short-term displacement could occur during the MAF reconstruction, but would be minimal. Long-term effects are not anticipated due to past history of the area. Past construction and use of the MAFs and log rafting/barging have not precluded sea lion use of the area. None of the proposed activities would degrade the marine environment long-term due to regulatory controls. Acoustic disturbance would be temporary and indistinguishable from baseline conditions.

Forest Plan Standards and Guidelines 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 MMPA, ESA, 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.

NMFS concluded that following delisting, regulatory requirements and protection measures under the MMPA and other laws will provide a variety of regulatory measures designed to provide protection from unauthorized disturbance, and will ensure any such taking occurs only through a regulated process, so as to ensure the eastern DPS Steller sea lion continues to recover and remain

a fully functional part of the marine ecosystem. Protection measures for western DPS Steller sea lions remain in effect and take of western DPS Steller sea lions is prohibited under the ESA "regardless of where the animal is found" (Federal Register 2013a). As part of delisting of the eastern DPS, NMFS is to consider whether additional protection is needed for western DPS Steller sea lions in those parts of their range east of 144 degrees west longitude.

Cumulative Effects

All Alternatives: Cumulative effects under NEPA would be similar to those discussed under humpback whales. All Forest Service permit holders or permitted activities are required to follow MMPA, ESA, and distance regulations as stated under direct effects above.

Determination

Alternative 1 has a determination of "No impact" on Steller sea lions. A determination of "May adversely impact individuals, but not likely to cause a trend to federal listing or a loss of viability in the Planning Area" is made for Steller sea lions under Alternatives 2, 3, and 4. MAF reconstruction and log barging or rafting operations could cause temporary displacement of Steller sea lions within the immediate project area and cause intermittent short-term acoustic disturbance. Disturbance and/or displacement would be minor relative to the amount of available habitat.

Yellow-billed loon (*Gavia adamsii*)

Yellow-billed loon populations are vulnerable due to a combination of low starting population size, low reproductive rate, and very specific arctic tundra breeding habitat requirements (USFWS 2006a). Conservation concerns (*i.e.*, threats) in the north and western Alaska breeding range include gravel extraction, road construction, proposed natural gas extraction with accompanying power infrastructure on the Kobuk River Delta and oil spills, subsistence harvest, climate-induced water level changes, and fishing by-catch; other threats include marine pollution in wintering habitat in Asia. A substantial level of subsistence harvest of yellow-billed loons occurs relative to their population, but exact harvest numbers are uncertain (USFWS 2009). None of these threats apply to the Kosciusko Project area. Migration and wintering habitat quality are also important to yellow-billed loon conservation, especially adequate food fish populations and low pollution levels (USFWS 2006).

Direct and Indirect Effects

Alternative 1: There would be no impact to yellow-billed loons or any habitat under the No Action Alternative. All existing migration and winter habitat would be maintained in its current condition. Although nesting is unlikely based upon past records, area lakes would remain available and no project related disturbance would occur.

Alternatives 2, 3, and 4: There is no tundra nesting habitat anywhere on or near Kosciusko Island. There are no documented breeding by yellow-billed loons in Southeast Alaska. Lake buffers would be implemented under all alternatives in accordance with Forest Plan Standards and Guidelines (Forest Plan RIP2.1.A pp. 4-50 and 4-51 and Forest Plan Appendix D, p. D-17). These Guidelines would minimize disturbance to loons if they did occur. Yellow-billed loons may occur in the marine waters around Kosciusko Island during the winter, but effects of the proposed alternatives or interrelated or interdependent activities would be negligible. Logging operations generally do not occur during the winter season when loons may be present in the marine environment. Logging activities would not affect winter habitat quality, nor would they contribute to any of the identified threats. Likewise, MAF reconstruction would occur during the normal

operating season so would not impact wintering loons. Forest Plan Standards and Guidelines are in place to minimize disturbance to wintering waterfowl, including loons (Forest Plan WILD1.XII.A.6 and WILD1.XII.B, p. 4-94). Purchasers are required to comply with all Alaska Department of Environmental Conservation (ADEC) camp, hazardous waste, and water quality permit stipulations.

Cumulative Effects

All Alternatives: None of the past, present, or foreseeable future federal or non-federal actions in the project area would alter tundra breeding habitat or affect continued use of the marine environment by migrating or wintering yellow-billed loons. Threats are primarily associated with impacts to breeding grounds which do not occur within the action area.

Determination

A determination of "No impact" is made for yellow-billed loons under all alternatives. The project area is outside known nesting range, only accidental occurrence during the operating season has been noted, and disturbance would be avoided during the winter.

Queen Charlotte Goshawk (*Accipiter gentilis laingi*)

Intensive logging has the potential to modify habitat to such a degree that Queen Charlotte goshawks could be excluded from large portions of their range, leading to extinction of the subspecies from Southeast Alaska (Federal Register 2007). Threats identified in the Federal Register were primarily related to the loss of nesting and foraging habitat and declines in prey populations due to timber harvest. Some uncertainty may exist with respect to the ability of Forest Plan conservation measures to contribute sufficient habitat to sustain well-distributed, viable populations of goshawks throughout Southeast Alaska (Smith 2013).

Disease and predation also contribute to population declines, especially in the presence of other stress factors such as prey shortages, but there is no indication that goshawks have experienced any significant problems with disease or predation in Alaska (Federal Register 2007). Goshawks are also susceptible to human disturbance during nesting period. Low reproductive rate makes recovery slow.

Direct and Indirect Effects

Timber harvest affects goshawks by reducing the amount of suitable nesting habitat, and impacting prey abundance, and/or prey availability (USFWS 2007). Nest habitat is affected in two ways: direct removal of higher volume, structurally diverse habitat and increased fragmentation. Nests tend to be located in the least fragmented areas of individual home ranges and nest areas in large patches of old or mature forest are used more consistently than those in small patches (multiple studies summarized in USFWS 2007). Logging within and near nest stands has been implicated in nest site abandonment, although effects on productivity are varied (USFWS 2007).

Clearcut logging substantially degrades habitat for the Queen Charlotte goshawk by creating large forest openings devoid of prey (USFWS 2007). Young growth may support some prey species, but prey are generally unavailable until stands approach maturity since stand structure is generally too dense to allow goshawks to hunt effectively (USFWS 2007). Logging removes both foraging cover and perches; young growth often lacks adequate visibility and adequate space for flight. Goshawks hunt by alternating short flights with a period of watching from a perch, then attacking prey from the perch. This method of hunting relies on cover to conceal the predator's approach, perches from which to observe and attack, adequate visibility for spotting prey, and

adequate space between trees to allow for flying between perches and attacking prey (USFWS 2007). Low prey diversity results in higher sensitivity to habitat modification which may further reduce prey diversity and abundance (see the hairy woodpecker and red-breasted sapsucker analysis in the Wildlife Report). Longer foraging distances increase energy demands on adults and increase risk of nest abandonment and decrease protection of chicks from adverse weather or predation. Thus, habitat quantity and quality is a function of the amount and distribution of POG through space and time (USFWS 2007). Clearcutting may also favor open habitat competitors or predators such as red-tailed hawks, barred owls, and great-horned owls (USFWS 2007).

Uneven-aged silviculture treatments that removes groups of trees has less effect on goshawks because it retains some older trees for nesting, maintain relatively high-value foraging habitat in a variety of areas across the landscape, and maintains habitat for a diverse suite of prey (Iverson *et al*. 1996). Partial harvest is likely to have less impact on goshawk foraging than clearcuts, provided that the remaining trees have branches adequate to support goshawk perching (Detrich and Woodbridge 1994 as cited in USFWS 2007).

Timber harvest, and subsequent lack of habitat, could increase competition by other raptors, increase predation, reduce life expectancy, and reduce nesting success.

Table 14: Impact to Goshawk Nesting Habitat (Acres) in WAA 1525.

Scale	Historical 1954 Acres	Current Acres	Percent Change 1954 to Current	Alt 1 Acres	Percent Change from Current	Alts 2, 3, 4 Acres Post-treatment	Percent Change Current to Post-treatment
NFS Land	17,227	8,698	-50%	8,698	0%	8,665	-1%
All Lands	27,755	11,733	-42%	11,733	0%	11,700	-1%

Note: Nesting habitat = HPOG ≤1,000 feet elevation.

Table 15: Impact to Goshawk Foraging Habitat (Acres) in WAA 1525.

Scale	Historical 1954 Acres	Current Acres	Percent Change 1954 to Current	Alt 1 Acres	Percent Change from Current	Alts 2, 3, 4 Acres Post-treatment	Percent Change Current to Post-treatment
NFS Land	22,987	14,392	-37%	14,392	0%	14,334	-1%
All Lands	34,607	18,519	-46%	18,519	0%	18,460	-1%

Note: Foraging habitat = POG ≤1,500 feet elevation.

Alternative 1: The No Action Alternative would have no direct or indirect impacts on goshawks because no timber harvest activities would occur. All existing nesting and foraging habitat would remain intact to support current levels of goshawks and prey (see Tables 14 and 15). Natural processes such as weather and fluctuations in prey would continue to influence whether goshawks nest in any given year.

Alternatives 2, 3, and 4: The action alternatives would all directly reduce goshawk nesting habitat including the availability of nest trees by 33 acres or by an average of 1 percent or less in WAA 1525. A total of 64 acres of old-growth harvest is proposed under all action alternatives. Of these 64 acres, about 57 percent (37 acres) of these 64 acres would be harvested using uneven-aged harvest prescriptions which could maintain suitable nesting and foraging habitat.

Alternatives 2, 3, and 4 would all impact 64 acres of foraging habitat of which 37 acres (57 percent) would be partial cut. Suitability as foraging habitat in partial cuts would depend upon the availability of perching trees and prey abundance. With impacts to foraging habitat, goshawks may spend more time foraging and forage further distances which could impact chick survival and condition. The proposed harvest could also minimally affect the prey base as some of the preferred species are linked to old-growth habitat. Available prey has been shown to have direct influence on whether goshawks nest or not.

Cumulative Effects

All Alternatives: Additional impacts to goshawks come from the past timber harvest on all ownerships. Current high levels of fragmentation and impacts on nesting habitat (50 percent reduction from historical levels on NFS lands and 42 percent on all lands) could be affecting goshawk use of the area and limiting nesting. Research in British Columbia suggests that landscapes that should be managed to retain at least 40 to 50 percent mature old-growth forest to provide adequate nesting and foraging habitat for Queen Charlotte goshawks (Doyle 2005, Northern Goshawk Recovery Team 2008). WAA 1525 would retain 50 percent of the historical POG on NFS lands, and 58 percent when considering lands in all ownerships.

1997 Forest Plan

The 1997 Forest Plan included a Standard and Guideline for goshawk habitat. This Standard and Guideline stated that up to 33 percent of the productive old-growth in a watershed or VCU in early seral stage (*i.e.*, at least 67 percent old growth) was considered capable of sustaining goshawks (Iverson *et al.* 1996, 1997 Forest Plan Appendix N pages N-38 through N-41). Harvesting at a rate exceeding this and creating an excess amount of early-seral (0 to 100 year-old) forest could increase the risk of not sustaining goshawks (1997 Forest Plan FEIS, p. 3-393). Habitat alteration and fragmentation can affect goshawk survival and productivity at the population level if it decreases foraging habitat quality across the landscape (USFWS 2007).

2008 Forest Plan

The 2008 Forest Plan replaced the goshawk Standard and Guideline with the Legacy Forest Structure Standard and Guideline. The intent of the Legacy Standard and Guideline is to ensure that sufficient residual trees, snags, and clumps of trees remain in timber harvest units within VCUs that have had concentrated past timber harvest activity and are at risk for not providing the full range of matrix functions, in order to meet the intent of the conservation strategy while providing flexibility to address on-the-ground implementation issues (USFS 2008a).

The Legacy Standard applies to VCUs where 33 percent or more of historical (1954) total POG has been harvested (67 percent or less total POG remaining), or where more than 67 percent of the total POG is projected to be harvested by the end of the Forest Plan planning horizon. The Legacy Standard and Guideline applies to the remaining VCUs where past harvest has reduced the amount of historical total POG by more than 33 percent.

Currently project area VCUs 5440, 5450, and 5460 have had more than 30 percent of the historical (1954) POG harvested and are listed in the 2008 Forest Plan as VCUs where the Legacy Standard and Guideline applies; however, the 2008 Forest Plan Legacy Standards and Guidelines does not apply to the current Kosciusko Project because the planned harvest in the VCUs where the Standard and Guideline would apply is all young-growth harvest (USDA Forest Plan 2008b, WILD1.IV.D., pp. 4-90 and 4-91). The proposed old-growth harvest occurs in a VCU that is not on the Legacy Forest Standard and Guideline list in the Forest Plan.

Determination

A determination of “No impact” is made for goshawks under Alternative 1. A determination of “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” is made for goshawks for Alternatives 2, 3, and 4. The proposed project does not change the percent reduction of POG from what has already occurred.

Black Oystercatcher (*Haematopus bachmani*)

Black oystercatchers breed along the high tide margin of the inter-tidal zone and includes mixed sand and gravel beaches, cobble and gravel beaches, exposed rocky headlands, rocky islets, and tidewater glacial moraines within close proximity to dense mussel beds; they avoid brushy and forested habitats. They are rare visitors that breed along the exposed shorelines of Southeast Alaska (Heinl and Piston 2009). There would be no impact to black oystercatchers from the proposed activities.

Direct and Indirect Effects

Alternative 1: Alternative 1 would have no direct or indirect effects on the black oystercatcher or their habitat. No habitat disturbance would occur since the MAF would not be reconstructed. Likewise, there would be no project related barge or rafted log traffic.

Alternatives 2, 3, and 4: No direct or indirect effects would be anticipated due to the preferred habitat for this species being protected by the beach buffer Standard and Guideline in the Forest Plan. The MAF footprint already exists therefore the reconstruction should result in minimal if any additional impact to black oystercatchers.

Cumulative Effects

All Alternatives: No cumulative effects are anticipated due to the preferred habitat for this species being protected by the beach buffer Standard and Guideline in the Forest Plan.

Determination

A determination of “No impact” is made for black oystercatchers under all alternatives. The project area includes habitat for this species but this habitat is protected under the current Forest Plan beach and estuary buffer Standard and Guideline.

Management Indicator Species and Species of Concern

The Forest Plan identifies 13 management indicator species (MIS). Ten MIS are known to occur on Prince of Wales and Kosciusko Islands. Habitat exists for Sitka black-tailed deer, Alexander Archipelago wolf, American marten, black bear, river otter, Vancouver Canada goose, bald eagle, red-breasted sapsucker, hairy woodpecker, and brown creeper on Kosciusko Island (see Table 16). The brown bear, mountain goat, and red squirrel do not occur on Kosciusko Island and are not discussed in this document.

The river otter, Vancouver Canada goose, and bald eagle were not selected as MIS to be analyzed in detail for this project because they inhabit beach, estuary fringe, and riparian habitats where no activities are proposed and where Forest Plan Standards and Guidelines are applicable. The proposed action alternatives are expected to have negligible effects to these species due to the implementation of best management practices or other avoidance and minimization measures (see the Wildlife Report for more information).

MIS are those species whose responses to land management activities reflect responses of other species with similar habitat requirements. Under the MIS concept, the responses to management activities of relatively few species are studied and monitored, in order to predict the impacts to entire assemblages of species and associated habitats. MIS are used to assess population viability and biological diversity. All of these management indicator species are associated either directly or indirectly with old-growth forests. The Prince of Wales flying squirrel is included on the list for analysis because it is a species of concern on Prince of Wales and neighboring islands. The U.S. Fish and Wildlife Service and the Forest Service identify species of concern, which are species are not currently listed as threatened or endangered.

Table 16: Management Indicator Species Selected for Detailed Analysis for the Kosciusko Project.

Species	Basis for Selection
Sitka black-tailed deer	Important subsistence and game species
Alexander Archipelago wolf	Species of concern on POW and important furbearer
American marten	Important furbearer
Hairy woodpecker, brown creeper, red-breasted sapsucker	Snag dependent and associated with large old-growth trees
Black bear	Important game species and a species of concern on POW
Marbled murrelet	Associated with old-growth forests
Prince of Wales flying squirrel	Species of concern on POW
Neotropical migratory birds	Migratory Bird Treaty Act (MBTA)

Sitka Black-tailed Deer

The Sitka black-tailed deer is an important game and subsistence species and is at least seasonally associated with old-growth forests. Research conducted in Southeast Alaska indicates that high-volume mature forests at low elevations are needed during severe winters (Yeo and Peek 1992).

There is increasing evidence on the importance of spring, summer, and fall habitats (non-winter) for maintaining healthy populations of deer, deer reproduction, and population recovery following severe winters (Stewart *et al*. 2005), in addition to forage availability in winter. These habitats include all vegetation types, except young-growth in the stem exclusion phase. In the absence of snow, fat accumulated from foraging on high-quality summer and autumn ranges may make it possible for deer to survive, regardless of the quality of winter habitat (Kie *et al*. 2003, Stewart *et al*. 2005).

Optimum habitat during a deep snow winter is low-elevation, old-growth forest on south facing slopes. The majority of the Kosciusko Project area falls within deep snow deer winter range where the elevation is less than 800 feet and the aspect is not north. Although the deer in Southeast Alaska are generally considered to be an old-growth dependent species (Suring *et al*. 1992b and Kessler 1982) they will forage in young-growth forests, especially in mild winters (DellaSalla *et al*. 1993) and spring and summer (Kessler 1982).

In both average and deep snow areas the proposed thinning objectives would be to:

1. Increase forage production
2. Provide cover
3. Facilitate travel between areas of forage production with slash treatments

Deer Habitat – Existing Condition and Affected Environment

Within WAA 1525 and 1526, average snow winter habitat and deep snow winter habitat for deer has been reduced (see Table 17).

Table 17: Acres of Deer Habitat on NFS Lands.

Scale	Deep Snow Habitat			Average Snow Habitat			Non-winter Habitat		
	1954 Acres	Current Acres	Percent Change	1954 Acres	Current Acres	Percent Change	1954 Acres	Current Acres	Percent Change
WAA 1525	2,895	1,358	-53%	22,571	13,976	-38%	28,611	20,057	-30%
WAA 1526	5,315	4,320	-19%	37,569	35,086	-7%	-	-	-
Kosciusko Island	8,210	5,678	-31%	60,321	49,062	-19%	-	-	-

Direct and Indirect Effects

There would be no direct effects to deer and negligible indirect effects in WAA 1526 as no activities are proposed in this area.

Average Snow Habitat: In WAA 1525, the action alternatives would result in a direct effect of an estimated one percent reduction in average snow habitat and an indirect effect of about one percent at stem exclusion in WAA 1525.

Deep Snow Habitat: In WAA 1525, there would be about a two percent reduction in deep snow habitat as a result of any of the action alternatives. Indirectly, at stem exclusion, there would be an estimated two percent reduction in deep snow habitat. The No Action Alternative would result in a one percent reduction at stem exclusion.

Non-winter Habitat: In WAA 1525, the direct effect of the action alternatives would result in an increase in non-winter habitat. This increase would range from five percent in Alternative 2 to seven percent in Alternatives 3 and 4. Indirectly, about one percent of non-winter habitat would be reduced at stem exclusion.

Cumulative Effects

In WAA 1526, there would be no direct or indirect effects of any component of this project; thus, there would be no cumulative effects.

Deep Snow Habitat: In WAA 1525, considering past, present, and reasonably foreseeable future projects, this project would have negligible cumulative effects, reducing deep snow habitat by about one percent.

Non-winter Habitat: The amount of non-winter habitat would be reduced by about one percent, cumulatively, when considering past, present, and reasonably foreseeable future projects across all land ownerships, when newly treated stands reach stem exclusion stage.

Deer Model and Deer Habitat Capability (DHC)

The interagency deer habitat capability model was used to assess existing habitat capability in WAAs 1525 and 1526. The deer model assumes a linear relationship between habitat capability and habitat values. The current deer model does not take into account juxtaposition of habitats and only accounts for average winters.

At the biogeographic province scale (cumulative effects analysis area for wolves), the entire land area of WAAs intersecting the biogeographic province was included even though some WAAs extended beyond the province boundary (an exception was WAA 1003 because all the acres within the province were saltwater). No predation was included.

Past timber management activities (mostly clearcut timber) on all ownerships within the WAAs has had the greatest impact on deer habitat and, therefore, the greatest impact on carrying capacity. Existing conditions reflect the cumulative effect of all past and present activities.

Historical (1954) and current deer habitat capability for lands in all ownerships is presented in Table 18. According to the current interagency deer model, prior to large-scale logging, the WAAs on Kosciusko Island, particularly WAA 1525, had some of the best DHC on Tongass NF.

Deer Habitat Capability – Existing Condition and Affected Environment

Currently, WAA 1525 has about 59 percent of the estimated deer habitat capability available in 1954 while WAA 1526 still has almost 91 percent of the 1954 habitat capability remaining. The Forest Plan estimated that with full implementation on National Forest System land, WAA 1525 would maintain 46 percent of the historical 1954 DHC and WAA 1526 would retain about 89 percent; therefore, effects of the action alternatives would still be within the deer habitat capability predicted by the Forest Plan (Table 3.10-9, USDA 2008, p. 3-284).

When considering the entire Island, the deer habitat capability has decreased an estimated 25 percent (75 percent remaining). At the scale of the biogeographic province an estimated 73 percent of the habitat capability still remains. The percent changes from 1954 to current when considering just NFS lands are very similar to the changes on all lands.

Direct and Indirect Effects

Deer habitat capabilities would increase as a result of the action alternatives because the activities proposed would result in currently stem-excluded acres moving either back into the stand initiation stage or towards more old-growth characteristics. For more information, see the discussion on young growth that follows below. Eventually, after approximately 25 years, there would be a decrease in deer habitat capability as harvested stands reach stem exclusion. These reductions could lead to a decline in the deer population, particularly following severe winters.

The direct effects of Alternative 2 would include increasing deer habitat capability by five percent. Alternatives 3 and 4 would both result in an increase of seven percent. Indirectly, deer habitat capability would decline by about one percent under all alternatives at stem exclusion, including the No Action Alternative (see Table 18).

Table 18: Deer Habitat Capability, Historically and Under All Action Alternatives.

Scale	1954 DHC	Current DHC	DHC at Stem Exc.	Alt 2 DHC	DHC at Stem Exc.	Alt 3 DHC	DHC at Stem Exc.	Alt 4 DHC	DHC at Stem Exc.
WAA 1525	2257	1327 (-41%)	1320 (-1%)	1387 (+5%)	1314 (-1%)	1420 (+7%)	1314 (-1%)	1421 (+7%)	1314 (-1%)
WAA 1526	2411	2191 (-9%)	2191 (-0%)	2191 (-0%)	2191 (-0%)	2191 (-0%)	2191 (-0%)	2191 (-0%)	2191 (-0%)
Kosciusko Island	4668	3518 (-25%)	3511 (-1%)	3578 (+2%)	3505 (-1%)	3611 (+3%)	3505 (-1%)	3612 (+3%)	3505 (-1%)

Source: numbers from deermodelfullbatch; Island numbers sum of both WAAs; GI run May 28, 2015.

Cumulative Effects

Existing conditions reflect the cumulative effects of past and present activities. Cumulatively there would be no changes to deer habitat capability in WAA 1526.

In WAA 1525, as a result of the action alternatives in combination with reasonably foreseeable future actions, the estimated deer habitat capabilities would increase. This is due to the fact that most of the activities proposed would result in acres in stem exclusion being moved from stem exclusion either back into stand initiation or towards more old-growth-like characteristics. On lands in all ownership, the cumulative effects in WAA 1525 of Alternative 1 at stem exclusion would result in deer habitat capability decreasing from 1327 to 1320, and all other alternatives from 1327 to 1314. As a result of the proposed project, at the stem exclusion stage there would be no measurable change from the current DHC; the estimated DHC would remain at about 58 percent of what was calculated to be present in 1954 (see Table 19).

Table 19: Deer Habitat Capability Under All Alternatives.

WAA 1525	DHC	Percent of Current	Percent 1954
1954 (Historical)	2257	-	-
Current and Alt 1	1327	-	59%
Alt 1 at Stem Exclusion	1320	99%	58%
Alt 2 Post-treatment	1387	104%	61%
Alt 2 at Stem Exclusion	1314	99%	58%
Alt 3 Post-treatment	1420	107%	63%
Alt 3 at Stem Exclusion	1314	99%	58%
Alt 4 Post-treatment	1421	107%	63%
Alt 4 at Stem Exclusion	1314	99%	58%
Kosciusko Island	**DHC**	**Percent of Current**	**Percent 1954**
1954 (Historical)	4668	-	-
Current and Alt 1	3518	-	75%
Alt 1 at Stem Exclusion	3511	99%	75%
Alt 2 Post-treatment	3578	102%	77%
Alt 2 at Stem Exclusion	3505	99%	75%
Alt 3 Post-treatment	3611	103%	77%
Alt 3 at Stem Exclusion	3505	99%	75%
Alt 4 Post-treatment	3612	103%	77%
Alt 4 at Stem Exclusion	3505	99%	75%

Conclusion - Deer Habitat Capability

Most of the effects to the deer habitat capability have occurred on the landscape due to past activities. The proposed project would directly increase the estimated deer habitat capability; however, the indirect result, at the stem exclusion stage, would result in deer habitat capability decreasing slightly (about one percent) as a result of the project.

Both WAA 1525 and WAA 1526 are within the amounts of Deer Habitat Capability estimated by the Forest Plan (Forest Plan Table 3.10-7, p. 3-270).

Deer - Young-growth Stands and Past Intermediate Treatments

The first ten years or so immediately after an area has been clearcut there is usually a dramatic increase in the production of forage (Suring *et al*. 1992b). After about 25 years these cleared areas begin to close off, forming dense canopies resulting in a rapid reduction of nutritious understory forage available to deer. The understory begins to develop again in these areas only when they reach the age of 140 to 160 years (Alaback 1982).

Productive forest lands vary in their capability to provide deer forage and thermal cover and have been categorized into four stages of development based on age class (Alaback 1984): a seedling–sapling stand initiation stage (1 to 25 years after harvest), a stem exclusion stage (26-150 years), an understory re-initiation stage (150 to 250 years); and an old-growth stage (more than 250 years).

The difference between pre-commercial thinning and commercial harvest is the production of a commercial product. Pre-commercial thinning (PCT) is an option for older stands where stand conditions do not yet allow for commercial treatments. Thinning of older young-growth stands with larger trees without slash removal may produce unacceptable levels of slash, which can persist for about 10 years and longer. This may inhibit forage maintenance or reestablishment. Various methods of reducing slash depth or amounts have proven to be expensive, often doubling the cost of thinning operations.

The use of open areas by deer may increase the risk of predation. Important factors in influencing predation include slope, flat terrain, and a north aspect. These factors combined with an increase in predation in open areas means managers should avoid creating large openings on flat or gently rolling terrain. A significant portion of stands proposed for treatment under this project are on gently sloping or nearly flat terrain, and therefore predation should be considered when designing treatments.

In young-growth stands, generally less than 25 years old, the most common intermediate treatment is PCT. PCT removes excessive regeneration through the cutting of less desirable trees while leaving the most desirable trees in a free-to-grow condition. PCT can be performed to various residual stand densities depending on overall resource objectives. None of the acres on any lands in this age class have been previously treated.

Stands in older age classes may offer an opportunity for commercial treatments depending on tree size and accessibility.

Limited surveys conducted showed that previously thinned stands are producing substantial amounts of forage that should be available for deer and other wildlife. Old-growth stands are producing devils club, skunk cabbage, ferns, and five-leaved bramble more than the young-growth stands; however, the older young-growth stands were producing more *Vaccininum* species (Kosciusko DEIS 2002 p. 3-42).

Direct and Indirect Effects

All action alternatives would result in a positive direct effect to deer by converting stem excluded stands with little to no forage into stands with more forage available. The indirect effect, after approximately 25 years, in all alternatives would result in about a one percent decrease in the DHC once the stands reach the stem exclusion stage again. See more specific effects to deer habitat capability in the previous section.

In Alternatives 3 and 4 the overstory canopy would be opened by cutting corridors and thinning adjacent to the corridors, to encourage understory vegetation for deer forage. The wildlife objective is to produce deer forage over time, distributed throughout the winter range, in proximity to cover.

All PCT prescriptions would be designed to meet multiple objectives. On average, a standard spacing designed to enhance timber production and wildlife habitat would be prescribed. In most stands, both Alaska yellow-cedar and western redcedar would be given preference for retention over Sitka spruce and western hemlock. Within non-development LUDs, beach fringe, and other areas where timber production is not an objective, pre-commercial thinning treatments would usually be more variable and designed primarily to increase stand diversity and wildlife habitat as well as promote the development of old-growth forest structure.

Cumulative Effects

Existing conditions reflect the effects of past and current activities. The ongoing and reasonably foreseeable future projects considered during analysis of cumulative effects of young-growth activities on deer are documented in detail in the Wildlife Report, in the Silviculture section of this document beginning on page 35, and the *Past, Present and Reasonably Foreseeable Future Activities in the Kosciusko Project Area* document, available in the project record.

The proposed State of Alaska Parlay Timber Sale and the ongoing University of Alaska Timber Sale are both located on the southern half of Kosciusko Island. The State of Alaska Sale will adjoin the University of Alaska Sale along the entire northern boundary. These harvests may result in a continuous even-aged harvest opening of approximately 3,100 acres. Harvest on Sealaska lands is projected to exceed 8,000 acres over the next 10 years. The Forest Service stands proposed for harvest are between the State and University harvests and the potential Sealaska harvests. This project would adjoin the western edge of the State and University harvest in the vicinity of Survey Creek. The Kosciusko Project will also adjoin the southern extent of potential Sealaska harvests in the central portion of the Island.

State and private land harvest must comply with the Alaska Forest Resources and Practices Act and Regulations, rather than the Tongass Forest Plan Standards and Guidelines. There are no regulations regarding opening size in the Alaska Forest Resources and Practices Act.

There is a high likelihood that significant changes will occur in the project area as a result of cumulative large-scale State and private timber harvest within the next 10 years.

The young growth expected to be harvested on State and private lands currently range from stem exclusion to understory re-initiation stand structure. The harvesting of these areas using even-aged management would convert these areas to stand initiation structure. This would initially bring a flush of understory plants followed by tree regeneration and canopy closure and then eventually back to stem exclusion structure. The time these areas spend in stand initiation and stem exclusion in the future would depend on the productivity of the sites and if the areas are pre-commercially thinned. Overall it would be expected the stem exclusion structure would take about 25 to 30 years to return and it could take 50 to 150 years or more before these stands begin to move into understory re-initiation stage.

Conclusion - Deer - Young-growth

Harvest on NFS lands as described for Alternative 2 of the Kosciusko Project would result in an additional 887 acres of stand initiation structure located between the State and University harvests

to the west of Edna Bay and the Sealaska parcels in the center of the island. There would be the potential for the University, State, Forest Service, and Sealaska harvest areas to essentially coalesce into one expanse of homogenous stand structure approaching 12,000 acres in size.

Alternatives 3 and 4 offer opportunities to influence stand structure on NFS lands in ways that would mitigate the creation of that large-scale homogenous stand structure in the project area.

Since even-aged management is expected, harvest on State and private lands in the project area would not be anticipated to have appreciable negative effects to forest health and productivity, regeneration and species composition or windthrow risk.

Alexander Archipelago Wolf

Forest Plan Standards and Guidelines require, where possible, to provide sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support a minimum of 18 deer per square mile (using habitat capability model outputs; USDA Forest Service 2008a). However, other factors (*e.g.*, local knowledge of habitat conditions) are to be considered by the biologist as well, rather than solely relying upon model outputs. Road densities and harvest of wolves (legal and illegal take) also affect wolf populations (Person and Logan 2012).

Existing Condition and Affected Environment

Wolves on Kosciusko Island occupy a wide range of habitats, from the beach to the interior forests. Analyses of wolf habitat are linked strongly to deer density and habitat. See discussions above of deer density, habitat and management of young growth.

Much of the reported wolf harvest has occurred in WAA1526 with access from the beach.

At the WAA scale, Person and Logan (2012) suggested that WAAs 1525 and 1526 may have periodically experienced unsustainable harvest (annual harvest rates greater than or equal to 3 wolves per 300 square kilometers [116 square miles] for more than 3years) during the time frame of 1985-2009. Person and Logan also suggested that WAA 1526 may have experienced chronic unsustainable harvest (*i.e.*, unsustainable harvest at least five times between 1985 and 2009). Moreover, WAA 1526 has experienced harvest at levels with the potential to result in pack turnover or pack depletion (annual harvest rates greater than or equal to 7 wolves per 300 square kilometers [116 square miles]). Note that these harvest rates are conservative in that they do not take into account illegal take or unreported harvest, which may represent a substantial portion of total annual mortality of wolves (close to 50 percent according to Person and Russell 2008). To take into account illegal or unreported harvest, the reported harvest numbers for years 2003 to 2013 were increased by 50 percent and then doubled (see Person and Russell 2008 for discussion on illegal take). Person and Logan (2012) stated that the occurrence of unsustainable and pack depletion harvests peaked prior to 1999.

Table 20: Wolf Take in WAAs 1525 and 1526.

Year	WAA 1525			WAA 1526		
	Reported Take	50 Percent Added	Doubled Take	Reported Take	50 Percent Added	Doubled Take
2003	0	0	0	2	3	4
2004	0	0	0	2	3	4
2005	1	1.5	2	0	0	0
2006	2	3	4	0	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	1	1.5	2	0	0	0
2010	4	6	8	0	0	0
2011	0	0	0	0	0	0
2012	6	9	12	0	0	0
2013	2	3	4	6	9	12
2014*	0	0	0	0	0	0
12-year Total	16	24	32	19	28.5	38
Avg Take per Year	1.2	1.8	2.4	1.4	2.2	2.9

Source: 2014 numbers from e-mail from S. Bethune, ADF&G, March 30, 2015.

The reported take in WAA 1525 was greater than 3 only in two years of the past 12 (see Table 20) which equates to periodic unsustainable harvest (Person and Logan 2012). When the reported take is increased by 50 percent to try to account for illegal take, WAA 1525 had a take of greater than 3 in four years. These values again meet the Person and Logan criteria for periodic unsustainable harvest as well as having one year that met the criteria for risk of pack depletion. When the reported take was doubled to try to account for illegal take again the criteria for periodic unsustainable harvest is met and there are now 2 years where WAA 1525 met the criteria for risk of pack depletion. In these 12 years WAA 1525 never meets the criteria for chronic unsustainable harvest.

Table 21: Wolf Take on Kosciusko Island.

Year	Kosciusko Island (combined WAAs 1525 and 1526)		
	Reported Take	50 Percent Added	Doubled Take
2003	2	3	4
2004	2	3	4
2005	1	1.5	2
2006	2	3	4
2007	0	0	0
2008	0	0	0
2009	1	1.5	2
2010	4	6	8
2011	0	0	0
2012	6	9	12
2013	8	12	16
2014	0	0	0
12-year Total	26	39	52
Avg Take per Year	2.7	3.25	4.3

Direct, Indirect, and Cumulative Effects

There would be no direct effects to wolves resulting from any activities proposed. Indirectly, there would be a negligible reduction (one to two percent) in deer average and deep snow habitat and an increase of five to seven percent in non-winter habitat across all action alternatives. This would have a negligible effect on wolves within the project area because the equilibrium between deer populations and wolves would be affected very little. About 25 years post-treatment, in all alternatives, there would be an about a one percent decrease in the Deer Habitat Capability once the stands reach the stem exclusion stage. See more specific effects to deer habitat capability in previous section.

All PCT prescriptions would be designed to meet multiple objectives. On average, a standard spacing designed to enhance timber production and wildlife habitat would be prescribed. In most stands, both Alaska yellow-cedar and western redcedar would be given preference for retention over Sitka spruce and western hemlock. Within non-development LUDs, beach fringe and other areas where timber production is not an objective, pre-commercial thinning treatments would usually be more variable and designed primarily to increase stand diversity and wildlife habitat as well as promote the development of old-growth forest structure.

The estimated deer density when calculated on NFS land as result of the proposed project and at stem exclusion, are above the current Forest Plan standard and guideline in both WAAs included in the project area, the Island, and the province. This suggests that based on modeled deer densities alone, the individual WAAs, the Island, and the province (on NFS lands) are likely capable of sustaining wolves. On NFS lands the estimated deer densities are expected to remain above the recommended 18 deer per square mile under all alternatives, at all scales even at stem exclusion.

The estimated deer density when calculated on lands in all ownerships drops slightly below the recommended 18 deer per square mile at stem exclusion. Under Alternative 1 the estimated deer density at stem exclusion would be 17.8 deer per square mile and under all other alternatives it would be 17.7 deer per square mile. At stem exclusion the estimated deer densities would be

about 17.6 deer per square mile under all action alternatives. At the Island scale on lands in all ownerships the estimated deer density is 19.5 deer per square mile. At the scale of the entire biogeographic province the estimated deer density on all lands is 15.1 deer per square mile. This suggests that based on modeled deer densities alone, the individual WAAs and the Island (on lands in all ownerships) are likely capable of sustaining wolves. At the scale of the province, for lands in all ownership, the modeled deer densities the number are below that which is generally considered necessary to support both wolves and humans.

Road Density: Calculated road densities at or below 1,200 feet in elevation in WAA 1525 are above the recommended number of 0.7 miles per square mile, where wolf mortality concerns have been identified. When the densities of the two project area WAAs are combined (equating to the Kosciusko Island scale), the resulting density is only 0.8 miles per mile squared for on NFS land and on all lands the density is 1.1 miles per mile squared.

There are factors which will benefit wolf sustainability on Kosciusko Island including the fact that wolves are highly mobile and move between WAAs (Person and Logan 2012), the potential benefits of young-growth management for deer habitat, road management for controlling hunter access, the presence of the 56,546 acre Mt Calder/Mt Holbrook LUD II area adjacent to the project area, the isolation of the area (the road system here is not connected to any other road systems), and the very low human population on the island, which is estimated to be about 42.

Marten

Marten populations fluctuate greatly over time in response to habitat conditions, prey densities, and trapping pressure. Timber harvest reduces habitat quality for marten through the removal of forest cover, fragmentation of old-growth habitat, reductions in habitat for some prey species, and road building associated with timber harvest, which increases access for trappers. In Southeast Alaska, marten prefer POG (Flynn 2006, Flynn and Schumacher 2001). Research on nearby Chichagof Island showed 82 percent of marten use was in forest habitat. Marten selected large multi-storied and medium multi-storied habitats during the winter with 63 percent of winter locations occurring at less than 820 feet elevation (Flynn and Schumacher 2001, Flynn 2004 Appendix B). However, Flynn and Schumacher recommended using 1,500 feet elevation for winter analysis due to the number of locations (32 percent) between 800 and 1,500 feet elevation. Additional marten research is currently underway on nearby Kuiu Island (Flynn *et al*. 2012 and 2013 progress reports).

Coastal habitats (beach fringe) and riparian areas have the highest habitat value for marten, followed by upland forested habitats below 1,500 feet in elevation (USDA Forest Service 2008a). Marten favor large- and medium-sized old-growth forests because they intercept snow, provide cover and denning sites, and provide habitat for marten prey species (Flynn and Schumacher 2001). These forests are also used by deer during winter, and winter-kill carcasses of deer represented a significant portion of marten diet in winter (Ben David *et al*. 1997). Large, contiguous patches of old growth, particularly below 800 feet elevation during winter, provide the highest quality habitat for marten, and marten densities are typically higher in these areas than in fragmented habitats (Hargis *et al*. 1999, Flynn *et al*. 2004). Consequently, the quantity and quality of winter habitat is likely the limiting factor for marten in Southeast Alaska. Therefore, the availability of deep-snow marten habitat, defined as high-volume POG (SD 5N, 5S, and 67) below 800 feet in elevation, provides a measure of habitat quality for marten. Year-round marten habitat is defined as HPOG below 1,500 feet in elevation.

Existing Condition and Affected Environment for Habitat

Deep Snow Habitat: On NFS lands within the WAAs, the historical (1954) amount of deep snow marten habitat has been reduced by 50 percent in WAA 1525 and 19 percent in WAA 1526; year-round marten habitat on Kosciusko Island (combined WAAs) as a whole has been reduced by 37 percent.

Year-round Habitat: On NFS land within the WAAs, the historical (1954) amount of year-round marten habitat has been reduced by 46 percent in WAA 1525 and 14 percent in WAA 1526; year-round marten habitat on Kosciusko Island (combined WAAs) as a whole has been reduced by 30 percent.

Direct, Indirect, and Cumulative Effects

Habitat: Direct, indirect, and cumulative effects of the proposed action alternatives would be about a one percent reduction in deep snow and year-round marten habitat in WAA 1525 with no change in WAA 1526.

Connectivity: Marten travel easily through many habitat types. The areas that are likely to provide refugia (non-development LUDs) appear to be connected through some means except for the buffer connection between VCUs 5450 and 5460 and the OGRs in VCUs 5440 and 5450. The connection between the OGRs in 5440 and 5450 is an area identified as a priority for thinning in the action alternatives, which should improve connectivity in this area. The Forest Plan conservation strategy provides habitat and connectivity for marten on NFS lands (USDA Forest Service 2008a).

Roadless refugium from harvest and the presence of old-growth for foraging and denning, between large, contiguous patches of old-growth is important to this species. The adjacent 56,546 acre Mt Calder-Mt Holbrook LUD II area, as well as other OGR and non-development LUD areas, provides refugia for marten.

Roads: Roads can indirectly affect marten by facilitating trapper access. Habitat suitability for marten begins to decline when road density reaches 0.2 miles per square mile. Extensive roading can result in marten home ranges being intercepted by roads which can result in the entire population being vulnerable to overharvest (Suring *et al*. 1993). Although the existing estimated road densities at all scales are all above 0.2 miles per square mile, according to the ADF&G 2010 harvest report marten populations appear to be stable and the harvest sustainable for GMU 2. The fact that the road system on Kosciusko Island is not connected to any other road system or large communities would help mitigate the effect of the road density on marten populations. There are no road density thresholds identified for marten in the current Forest Plan.

Black Bear

In Southeast Alaska black bears are present throughout the mainland and on the islands south of Frederick Sound (USDA Forest Service 1997b). Black bears in Southeast Alaska are part of a population of the Alexander Archipelago black bears endemic to coastal British Columbia and Southeast Alaska, except Admiralty, Baranof, and Chichagof islands (Stone and Cook 2000; Peacock *et al*. 2007).

The measurement criteria for analyzing direct and indirect effects on the black bear include denning habitat equal to acres of POG, and POG within 500 feet of Class I streams to address the importance of riparian habitat.

Direct, Indirect, and Cumulative Effects

Preferred habitats for black bears, which include coastal, estuarine, and riparian areas, are protected by the Forest Plan. Therefore, none of these areas are expected to be substantially affected by the proposed project. The proposed project would result in about a one percent reduction in both black bear habitat within 500 feet of Class I streams and denning habitat in WAA 1525 on both NFS lands and lands in all ownerships. On lands in all ownerships, including NFS lands, denning habitat would increase about one percent as well. Denning habitat and habitats along Class I streams would be reduced by about one percent.

The effect of the proposed treatments to the young-growth acres would increase light to the forest floor thereby increasing forage. Many wildlife species, including bears, would benefit from the increased forage. Proposed riparian thinning treatments would likely result in long-term improvements to the habitat around Class I streams.

As a result of this project and past projects the cumulative reduction in black bear habitat on lands in all ownership within 500 feet of Class I streams would be one percent. The cumulative effect to black bear denning habitat on lands in all ownership is that this project would reduce bear denning habitat by about one percent (see Table 22).

Table 22: Cumulative Effects on Black Bear Habitat in WAA 1525.

Habitat	1954 Acres (Historical)	Current Acres and Percent Change from 1954	Alts 2, 3, 4 and Percent Change from 1954
Denning Habitat[1]	34,607	18,519 (-46%)	18,461 (-47%)
POG within 500 feet of Class I streams	4,966	3,407 (-31%)	3,397 (-32%)

Source: GI run May 25, 2015.
[1]all POG

Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper

Maintenance of habitat for the red-breasted sapsucker, hairy woodpecker, and brown creeper is provided by the Forest Plan conservation strategy (USDA Forest Service 2008a) and Forest Plan Standards and Guideline Reserve Tree/Cavity Nesting Habitat (WILD1.V.A). The intent of this Standard and Guideline is to leave snag and reserve trees within units, beyond buffers and other exclusions. The Standard and Guideline directs the Forest Service to provide habitat for cavity-nesting wildlife species in all LUDs and provides guidance on the selection and retention of reserve trees. The action alternatives would result in a one percent reduction in acres of any of the POG forest types, which would not be a substantial impact to interior forest habitat or species. In addition, young-growth treatments may provide additional foraging opportunities for cavity nesters due to the increase of downed wood and decaying slash.

Interior Habitat: The acres of interior forest habitat have been reduced due to past harvest. Action alternatives would affect 1.1 acre of interior forest habitat which is unlikely to have an effect on species such as the brown creeper. Therefore this project would not have a substantial impact to interior forest habitat or species.

Patch Size: The old-growth patch size habitat for both hairy woodpeckers and red-breasted sapsuckers would not change as a result of this project.

Marbled Murrelet

The Forest Plan includes Standards and Guidelines for murrelet nests; however, there are no Forest Plan Standards and Guidelines for murrelet habitat. Acres of HPOG were used as the unit of measure for effects to marbled murrelet habitat. Due to the amount of past harvest on Kosciusko Island, there has been a reduction in the acres of HPOG (54 percent reduction in WAA 1525 since 1954). This decrease has likely resulted in a reduction in marbled murrelets.

Direct, Indirect, and Cumulative Effects

On lands in all ownerships and NFS lands in WAA 1525, there would be a one percent decline in habitat from proposed action alternatives. The project would have no effect on HPOG in WAA 1526.

The acres of interior forest habitat have also been reduced due to past harvest. The action alternatives would affect 1.1 acre of interior forest habitat which is unlikely to have an effect on species such as the marbled murrelet. Action alternatives would not have a substantial impact to interior forest habitat or species.

Forest Plan Standards and Guidelines pertaining to marbled murrelets include maintaining a 600-foot radius no-cut buffer zone around identified murrelet nests (Forest Service 2008a). If at any time a marble murrelet nest is discovered Forest Plan Standards and Guidelines would be applied.

Prince of Wales Flying Squirrel

There are no Forest Plan Standards and Guidelines associated with the Prince of Wales flying squirrel. Densities of flying squirrels are linked to structural features common in POG forests such as large-diameter downed woody debris, snags, and tall trees (Smith *et al*. 2004) and abundance has been shown to be reduced by forestry practices that influenced the structure or age of residual stands (Smith *et al*. 2011). All action alternatives propose to harvest 64 acres of old-growth forest.

Due to the amount of past harvest on Kosciusko Island, there has been a reduction in the acres of POG. This change has likely resulted in a reduction in the number of flying squirrels. Past harvest on Kosciusko Island has also resulted in a reduction in connectivity and an increase in fragmentation. This has likely resulted in the reduction of these areas to facilitate recolonization of vacant areas. Past timber harvest has likely affected flying squirrel populations where clearcut size is larger than their maximum gliding range, or where scattered tall conifers in large cuts have not been retained as cover and for travel across the open spaces. These conditions may hinder dispersal and result in the creation of isolated populations.

Direct, Indirect, and Cumulative Effects

The two-aged and uneven-aged harvests proposed in Alternatives 3 and 4 would likely benefit flying squirrels over the short-term by increasing canopy height and creating more open space in the midstory, creating conditions which facilitate efficient gliding (Scheibe *et al*. 2006). Over the long-term, two-aged and uneven-aged harvests proposed in all action alternatives would promote stand development toward conditions capable of supporting breeding flying squirrels and improve the functional connectivity between old-growth reserves (Smith *et al*. 2011).

Although the connectivity has been impacted by past harvest activities which has likely impacted flying squirrels, current connectivity is still provided between the OGRs and SAs in most places. Treatments proposed under the current project would improve connectivity in the area.

Cumulatively there would be about a one percent POG reduction, when actions across all land ownerships are considered. In WAA 1526 there would be no change to POG acres. At the Island scale there would be no change to the current amount of POG. Activities on adjacent private lands may result in the reduction of some connectivity in the area.

Prince of Wales Spruce Grouse

There are no Forest Plan Standards and Guidelines associated with the spruce grouse.

It is assumed that alternatives that harvest the most POG would result in the greatest effects to spruce grouse; all alternatives propose to harvest 64 acres of old-growth habitat.

Direct, Indirect, and Cumulative Effects

Two-aged and uneven-aged treatments would encourage structural and horizontal diversity beneficial to grouse in previously harvested stands.

Effects to spruce grouse are similar to effects to other species. See Wolf and Marten sections for discussion on road densities. See the Biodiversity section for discussion on POG and Fragmentation. See the Red-breasted Sapsucker, Hairy Woodpecker and Brown Creeper section for discussion on interior forest acres.

The Forest Plan conservation strategy maintains connectivity within matrix lands that help facilitate dispersal and interchange between isolated spruce grouse populations.

Migratory Birds

Direct, Indirect, and Cumulative Effects

Effects to migratory birds are similar to effects to other species. See Biodiversity section for discussion on changes to POG. All action alternatives propose to harvest 64 acres of old growth, thus having minimal effect to migratory birds. It is unknown what the effect of fragmenting large stands of young growth would be to migratory birds; see the Fragmentation section for changes to patch sizes. Migratory bird old-growth habitat is maintained by the Forest Plan conservation strategy.

Subsistence

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many residents on Prince of Wales and surrounding islands. Reasons given for the participation in subsistence activities include the ability to provide food or supplemental income, the perpetuation of cultural customs and traditions, and the importance of values associated with self-reliance (USDA Forest Service 2008b).

The effects of landscape changes caused by timber harvest on the availability of wild game are important when the harvest of wild game is a critical cultural practice, food source, and recreational activity. Timber harvest may influence the abundance and distribution of subsistence resources (through changes in suitable habitat), access to subsistence resources (through changes in habitat and through road development or management), and competition for subsistence resources (through changes in abundance or access). *Alaska National Interest Lands Conservation Act* (ANILCA) requires that the analysis of potential effects on subsistence uses focus on these factors.

Abundance and Distribution of Resources

Subsistence resources in the vicinity of the project include terrestrial mammals (deer, wolves, black bears, furbearers, and small game), upland birds and waterfowl, marine mammals, salmon and other fin fish, marine invertebrates, plants, berries, bark, and firewood.

Access to Resources

Road networks connecting local communities provide access to subsistence resources in WAA 1525. Road building associated with timber harvest can provide access to previously inaccessible areas, providing greater opportunities for subsistence harvest; disperse hunting and fishing pressure; and create the potential for increased competition. Changes in access can affect the level of effort required, time involved, and the effectiveness of the hunt, as well as potentially increase competition for subsistence resources (if associated with increased hunter success; USDA Forest Service 2009).

Competition for Resources

Competition for subsistence resources may occur when resources are abundant and accessible to local and non-local communities. Increased competition can occur between different subsistence user groups and between subsistence hunters and sport hunters.

Subsistence Communities

The communities that either currently or have historically used WAAs 1525 and 1526 for subsistence use include Edna Bay and Meyers Chuck (USDA Forest Service 2008b). There are records of subsistence use of these WAAs by other communities, but either the levels of use are generally low or the community does not qualify as a Federal subsistence community. Therefore, these communities have not been included in this assessment.

Sitka Black-tailed Deer

Alternative 1 would have no direct effects on subsistence resources as no project-related activities would occur. Abundance of, access to, and competition for subsistence resources under Alternative 1 would be similar to existing conditions. However, there would be indirect effects to deer habitat over time as existing previously harvested stands move into the stem exclusion stage thereby reducing the abundance of the resource.

Abundance and Distribution

As described in the deer section, implementation of the action alternatives would initially increase deer winter habitat capability, but over the long-term could result in a slight reduction in deer numbers. All action alternatives would result in a temporary increase in deer over what is currently estimated to be present. This is due to the fact that the majority of the project would be in young-growth forest. The treatments proposed would move acres of deer habitat back into the stand initiation stage or into a stand with more old-growth-like characteristics. Both of these effects would provide better habitat than what is currently available, resulting in an increase in deer numbers.

Access

Expansion of the road system would result in increased access to both subsistence and non-subsistence hunters. The greatest increase in road access would occur during project implementation when temporary roads are in use. Road access would decrease as road closures are applied, making them no longer available for use by motorized vehicles. Historical access

would remain available under all the alternatives. Under all action alternatives, there would be temporary restrictions in road access to subsistence during active logging operations as a safety precaution.

Timber harvest would also increase access to deer over the short term, due to the clearing of dense vegetation which makes them more visible to hunters. Young-growth management that is proposed in all action alternatives may locally improve hunter access to deer.

Competition

The project area is not commonly used by subsistence hunters from other communities for harvesting deer and other subsistence resources, although it does occur. The road network on Prince of Wales Island does not connect to Kosciusko Island; therefore, the project area is not connected to the communities on Prince of Wales Island and does not allow these communities easy access to the area for hunting and other subsistence activities. Non-subsistence users (*e.g.*, those from Ketchikan and Juneau, as well as out-of-state hunters) also may hunt in the project area on Kosciusko Island.

Timber harvest can influence competition for resources through new road construction, particularly near communities potentially generating competition from outside communities with lower abundance of the same resources. Habitat alterations 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 but available subsistence resources are diminished. Indirectly, displacement of subsistence hunters from areas with active timber harvest operations could temporarily increase competition in other subsistence use areas. 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.

Other Species

The project would have no effect to the abundance or distribution of, access to, or competition for marine fish and invertebrates; waterfowl; furbearers using estuary, riparian, or coastal habitats; or marine mammals. Therefore, the project would make no contribution to cumulative effects to these species. The amount of land in other ownership combined with the effects on NFS lands have likely had cumulative effects on the abundance and distribution, access to, and competition for some subsistence species such as waterfowl and furbearers.

The marten (furbearer) could be affected by reductions in POG habitat and/or increased road densities and related effects associated with increased human access. Other timber harvest projects would contribute to these effects. The project would result in temporary increases in the abundance and distribution of edible plants, and temporary increases in access to edible plants, personal use timber, and freshwater fish. Ongoing and foreseeable future timber harvest (through increases in early seral forest and road densities) would further contribute to these effects.

Subsistence Findings

Section 810 (a)(3) of ANILCA requires that when a use, occupancy, or disposition of public lands may result in a significant possibility of a significant restriction, a determination must be made whether (1) such a restriction is necessary, consistent with sound management principles for the utilization of public lands, (2) the proposed activity involves the minimum amount of public lands necessary to accomplish the purposes of the use, and (3) reasonable steps will be taken to minimize adverse impacts on subsistence uses and resources resulting from the actions. The

alternatives were evaluated for potential effects on subsistence uses and needs, and a significant possibility of a significant restriction in subsistence opportunities is not expected to occur from implementation of any alternative (see Wildlife Report for more information).

Soils

This section provides a summary of the effects to soil resources in the Kosciusko Project area. Forest-wide Standards and Guidelines for this resource are on pages 4-64 through 4-67 of the Forest Plan. The environmental consequences are based upon analysis of proposed harvest unit and road locations, and for cumulative effects, analysis within the project area boundary. For detailed discussion of the soil resource in the Kosciusko Project area, see the Soils and Wetlands Report.

Timber harvest has the potential to adversely affect the soils resource by disturbing, displacing, or burying the nutrient-rich forest floor and exposing mineral soils to erosion.

For all action alternatives, detrimental soil disturbances within individual harvest units and across the analysis area would be well within the Region 10 Soil Quality Standards and Guidelines. This finding is based on analysis summarized in the Soils and Wetlands Report, as well as over 20 years of soil quality monitoring data collected on the Forest and documented in numerous soil quality monitoring reports, the most pertinent of which are: Landwehr and Nowacki 1999, and Landwehr *et al*. 2012 (see the Soils and Wetlands Report for full citations). The monitoring data indicate that about three percent of harvest units yarded with cable or shovel system incur detrimental soil conditions. Temporary roads and landslides are also considered detrimental soil conditions. Existing detrimental soil disturbance (including temporary roads and landslides) was estimated for each young-growth unit using aerial photography taken shortly after harvest. All proposed activities would meet Region 10 Soil Quality Standards.

Best management practices and site-specific recommendations for soil in harvest units and road segments are or would be based on field data. Project-wide analysis was completed using soil survey data in GIS and aerial photos, and is summarized in the Soils and Wetlands Report.

Environmental Consequences

There are no proposed roads located on slopes greater than 67 percent and no harvest units located on slopes greater than 72 percent in the Kosciusko Project area.

Direct and Indirect Effects

Alternative 1

Under Alternative 1, no timber harvest or road building would take place and no soil disturbances would be caused by new management activities. Vegetation in harvested areas would continue to grow. Existing detrimental soil conditions occupy about 756 acres, or about 1.4 percent, of the Kosciusko Project area. That areal extent of detrimental soil conditions is within Region 10 Soil Quality Standards.

Alternative 2

New temporary road construction and associated rock pits and landings would disturb about 12 acres of soil. About 30 acres of soil disturbance would occur in new harvest units.

Alternative 3

New temporary road construction and associated rock pits and landings would disturb about 12 acres of soil. About 46 acres of soil disturbance would occur in new harvest units.

Alternative 4

New temporary road construction and associated rock pits and landings would disturb about 10 acres of soil. About 46 acres of soil disturbance would occur in new harvest units.

The direct and indirect effects to soils under Alternatives 2, 3, and 4 are not considered significant because the estimated amount of detrimental soil conditions resulting from the proposed activities is well within Region 10 Soil Quality Standards.

Cumulative Effects

The cumulative effects analysis area for soils is the Kosciusko Project area. Reasonably foreseeable future projects considered for analysis of the soils resource include the University of Alaska timber sales, Sealaska Corporation timber sales, State of Alaska timber sales, the State of Alaska rock pit expansion, the State of Alaska LTF construction, and Forest Service free use and micro-sales.

Detrimental soil disturbance anticipated from the Kosciusko Project, along with foreseeable actions and existing conditions, would total approximately 2.4 percent of the project area under Alternatives 2, 3, and 4, and 2.3 percent under Alternative 1. The Region 10 Soil Quality Standards would be met for all alternatives at the project-area scale. Details regarding the methods of the analysis and the results are in the Soils and Wetlands Report.

Wetlands

The analysis area for direct and indirect effects includes areas where timber harvest or road construction are proposed. For cumulative effects the analysis area includes the entire Kosciusko Project area. The analysis from the cumulative effects for the wetlands resource also includes the foreseeable actions listed in the project record. The key indicators identified for measuring project effects on wetlands include:

- Acres of wetland altered by road construction, and
- Acres of timber harvest on forested wetlands.

All action alternatives propose some level of timber harvest and road construction on forested wetlands. The effects of timber harvest on forested wetlands (primarily increased soil moisture levels) are expected to be temporary. All harvested sites are expected to regenerate naturally based on many decades of regeneration surveys. However, trees are expected to grow slower on wetland sites. The detailed effects are described in the Soils and Wetlands Report.

The effects of road building on wetlands may vary based on the substrate, or soil type, and the landscape position of the wetland. Regardless of the type and location, road construction on wetlands results in an overall loss of wetland acreage. Hydrologic effects beyond the disturbed soil (road) corridor are expected to be limited to within a few meters of the road. The analysis is based on pertinent pieces of literature discussed in the Soils and Wetlands Report, including Glaser 1999, Kahklen and Moll 1999, McGee 2000, and Landwehr 2011.

Due to the preponderance of wetlands and the interspersed nature of wetlands with uplands in the project area, complete avoidance of wetlands from proposed road construction activities is not practicable. All proposed roads would be constructed according to State-approved BMPs as required by 33 CFR 323. All roads through wetlands would also follow the 15 baseline provisions provided in 33 CFR 323.

The effects of the watershed improvement activities proposed in the Kosciusko Project (such as weed pulling, karst dam extractions, pre-commercial thinning, and watershed restoration) are all expected to have minor or negligible effects to the wetland resource. All these projects would follow the Tongass Forest Plan, R10 Soil Quality Standards, National BMPs, R10 BMPs, Executive Order 11990: Protection of Wetlands, 40 CFR 230 Section 404, 33 CFR 323.3b, the Clean Water Act Section 404b, and US Corps of Engineers Wetlands Delineation Manual (1987).

Direct and Indirect Effects

Alternative 1

No wetlands would be impacted under Alternative 1 due to no harvest or road construction as a result of the Kosciusko Project. Vegetation on forested wetlands harvested in the past would continue to grow toward hydrologic maturity; many stands have already reached this stage. Wetlands impacted by roads in the past would continue to be impacted. Vegetation would occupy ditch lines and, in the case of closed roads, the roadbed may be occupied by red alder. The road prism would remain in an upland condition. Road ditches, where present, support a variety of upland and wetland vegetation depending on local conditions and seed sources.

Alternatives 2, 3, and 4

Alternatives 2, 3, and 4 propose to harvest timber from approximately 26 acres of forested wetland and 4 acres of forested wetland/emergent short sedge wetlands. Road construction under these alternatives would result in conversion of wetland to road on approximately one acre of forested wetlands.

Cumulative Effects

Present and reasonably foreseeable projects (as described on page 17) are analyzed with this proposed project for the purpose of determining cumulative effects.

No planned roads are associated with Forest Service micro- and salvage sales. The State of Alaska rock pit expansion would not impact any wetlands. It is unknown if the proposed future timber harvest and road building on state and private lands (such as the University of Alaska, State of Alaska, and Sealaska timber sales) would convert wetland to roads. The State of Alaska Log Transfer Facility (LTF) is located on upland soils and does not impact any wetlands.

Alternative 1

Cumulatively, approximately 1,139 acres of timber have been harvested from wetlands in the project area, including 686 acres of forested wetland and 453 acres of forested wetland/emergent sedge complex. Vegetation on the oldest harvested wetland areas is 30 to 60 years old and typically consists of vigorous young-growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

About 54 acres of forested wetland and 59 acres of forested wetland/emergent short sedge complex have been converted to road surfaces, ditches, and fill slopes in the project area. Open,

drivable roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation would likely colonize the road surfaces.

About 93 percent of wetlands in the project area would remain in a natural condition.

Alternatives 2, 3, and 4

Cumulative effects following implementation of Alternatives 2, 3, or 4 would be approximately 1,169 acres of timber harvest from wetlands in the project area (outside of roads), including 712 acres of forested wetland and 457 acres of forested wetland/emergent sedge complex. This equates to approximately 6 percent of the wetlands on the project area.

Implementation of Alternative 2, 3, or 4 would result in cumulative impacts of about 114 acres of wetland converted to road surfaces, ditches, and fill slopes in the project area, consisting of 55 acres of forested wetland and 59 acres of forested wetland/emergent sedge complex.

Under Alternative 2, 3, or 4, about 93 percent of wetlands in the project area would remain in a natural condition.

Implementation of the action alternatives would not have a significant effect due to the compliance with the Section 404 of the Clean Water Act, Executive Order 11990, National and Regional BMPs, and the Forest Plan.

Watersheds

Watersheds are hydrologically defined geologic areas that are drained by or contribute water to a stream, lake, or other waterbody. Within a watershed there are many physical, chemical, and biological components whose functioning is complexly interrelated. On Kosciusko Island, annual precipitation may exceed 100 inches, with the highest rainfall occurring during October and the lowest in June. Individual storms vary dramatically over short distances and can produce intense rainfall and high winds. Because the project area boundary does not coincide with topographic watershed boundaries, the analysis area for direct, indirect, and cumulative effects includes only watersheds with proposed ground disturbance in the action alternatives.

A large amount of field data was compiled and synthesized for this analysis. Forest Service watershed and fisheries personnel conducted field reconnaissance of the proposed roads and units between 2000 and 2014, resulting in updates to the streams GIS layer. Ground reconnaissance for soils, landslides, and karst are explained in their respective resource reports for this project.

GIS queries were used to evaluate effects and compare alternatives. The Tongass National Forest does not have predictive models for changes in streamflow, sediment, or aquatic habitat in response to timber harvest and roads. Therefore, GIS queries provide surrogate measures of effects supported by the literature cited in the Watershed Report. Harvest and road thresholds are used for analysis purposes only. A literature threshold of 20 percent of the watershed area harvested in less than 30 years is used to establish the point at which effects of the harvest on watersheds is measurable (referred to here as the “20/30 threshold”). As a result of existing conditions and expected cumulative harvests on non-NFS lands, eight of the watersheds within the Kosciusko Project area would be expected to exceed the 20/30 threshold exclusive of the action alternatives for this project. Furthermore, none of the alternatives would push any of the remaining watersheds within the project area beyond the 20/30 threshold.

Because the project area boundary does not coincide with watershed boundaries, the analysis area for direct, indirect, and cumulative effects includes only watersheds with proposed ground disturbance in the proposed alternatives. Sections of outlying watersheds which extend into the project area but are not affected by the project are not characterized in this report. To simplify the analysis, some of the GIS watershed polygons within the project area were modified. Because existing small watersheds, together with larger watersheds, have the potential to confuse effects analysis, a lower limit near 1,000 acres was desired for HUC14 level delineation. As a result some of the smaller frontal watersheds in the final product were combined to create a more homogeneous data set.

Sealaska Corp., State of Alaska, and University of Alaska have past, present, and future harvest areas that occur in watersheds also in the Kosciusko Project area. One objective of this analysis is to answer the question of whether or not proposed alternatives, if implemented, combined with anticipated harvest on non-National Forest System land, would cumulatively constitute a measurable impact.

The following assumptions are adopted for this analysis:

- Sealaska, State of Alaska, and University of Alaska would harvest timber as delineated in GIS by the IDT. See the Watershed Report, Appendix C for these predictions which include scheduling and locations of harvest.
- Sealaska would be operating under State of Alaska Regulations and therefore be protective of water quality by State standards.
- Forest Service management practices are mitigative and subject to Forest Plan Standards and Guidelines
- Clear-cutting (even-aged management) would result in the highest risk of measurable cumulative watershed effects, based on the large continuous areas of canopy removal.

Although baseline aquatic data is limited for the affected watersheds, we have sufficient empirical information to describe their current condition. Our ability to actually measure changes in streamflow, sediment, habitat features, or other aquatic parameters in response to the Kosciusko Project is extremely limited due to the lack of baseline data and the natural range of variability of these parameters in response to climate and other factors. However, we have sufficient empirical data relative to these watersheds to provide a credible analysis of the magnitude and extent of the effects of this project. Also, see Fisheries within this Environmental Consequences section beginning on page 80 for related aquatic habitat and additional water quality analysis.

Alternative 1

Direct and Indirect Effects

Direct and indirect effects can include soil disturbance, compaction, rutting, sediment delivery to streams, stream channel disturbance, water quality changes, and damage to soils.

Since no activities are proposed in this alternative, no direct or indirect effects would occur.

Cumulative Effects

Because there are no direct or indirect effects, there would be no cumulative effects. Effects of foreseeable future activities would be as described in the previous sections.

Conclusion

Alternative 1 would have no direct or indirect effects; however, foreseeable harvest by Sealaska, State of Alaska and University would likely cause minor effects even with no additional action on NFS lands.

Actions Common to All Action Alternatives

The descriptions of Action Alternatives below pertain to the different objectives driving the alternatives, and the differences in how young-growth management would occur to meet those objectives. In addition, and common to all three alternatives, is the 1,869 acres of proposed pre-commercial thinning (PCT), which includes some riparian thinning. PCT and riparian thinning are considered a mitigation action in that they promote the return of desired old-growth-like conditions. Old-growth harvest is also proposed in all three alternatives, which would contribute to total acres treated and total volume harvested additional to what is described below. The old-growth harvest would result in about 1,051 MBF of timber from 27 acres of even-aged management and about 37 acres of uneven-aged management. Additional actions common to all alternatives are invasive plant treatments, treatments to correct blocked karst features, and in-stream treatments to address water quality and habitat issues. These actions may cause soil and channel disturbances which could result in erosion and sediment delivery to waterbodies and may result in short-term reductions in water quality and aquatic habitat; however, these results would likely be offset by long-term enhancement of the desired watershed condition.

Alternative 2

Direct and Indirect Effects

Because Alternative 2 proposes more than two times the clear-cutting (even-aged management) acres (853 acres) as compared to Alternatives 3 and 4, it would remove approximately 925 acres of forest canopy, increasing the risk of elevated peak stream flow response. As a result, Alternative 2 would result in the highest risk of measurable watershed effects. Streamflow and sediment delivery to streams may increase in the short term but the changes are not expected to result in measurable long term effects on water quality or aquatic habitat. Alternative 2 would increase the basin area harvested but would not push any other watersheds to exceed the 20 percent in 30 years threshold.

Cumulative Effects

Past and reasonably foreseeable activities that may affect watersheds are consistent across all alternatives (see Alternative 1). Alternative 2 would result in the highest level of cumulative effects because it proposes the most acres of clear-cutting with a high percentage of canopy removal. Recovery of stream response to comparable pre-harvest levels as a result of Alternative 2 is expected to be at least 10 years. The total cumulatively harvested acres proposed by Sealaska, State of Alaska, and University harvest would result in effects that would likely be measurable for greater than 10 years.

Conclusion

Alternative 2 may result in minor watershed effects when compared to other alternatives because it proposes more than double the clear-cutting which results in high canopy removal. Comparatively, Alternative 2 would result in the highest risk of long-term watershed effects. Alternative 2 would also result in the greatest risk of cumulative effects in comparison to the

other alternatives because in addition to elevated clear-cutting and canopy removal, it would contribute more-so to foreseeable effects caused by other land owners.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in negligible effects on sedimentation and aquatic habitat. Streamflow may increase in the short term but the changes are not expected to result in sustained measurable effects. Alternative 3 would not push any other watershed over the 20 percent in 30 year measurable effects threshold. Compared to Alternative 2, Alternative 3 proposes less clear-cutting which would result in less risk to water quality and aquatic habitat.

Cumulative Effects

Watershed effects from past practices are described in the Affected Environment section of the Watershed Report. Because reasonably foreseeable activities are consistent across all alternatives, fewer proposed clear-cutting acres would result in reduced risk of long-term cumulative watershed effects when compared to Alternative 2.

Conclusion

Alternative 3 would result in negligible effects to water quality and aquatic habitat.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in negligible effects on sedimentation and aquatic habitat. Because there is no clear-cutting proposed in young growth, streamflow is not likely to increase or result in measurable effects to water quality or aquatic habitat.

Cumulative Effects

Proposed reasonably foreseeable future activities are consistent across all alternatives. Alternative 4 would result in negligible cumulative effects to water quality or aquatic habitat in all watersheds when compared with Alternatives 2 and 3. However, reasonably foreseeable future harvest on non-NFS lands would likely result in measurable cumulative watershed effects.

Conclusion

Alternative 4 would result in negligible effects on sedimentation and aquatic habitat and would likely contribute to desired watershed function. Alternative 4, when compared to the other alternatives, is most similar to Alternative 1 in that it has less effect on soil and aquatic habitat. Alternative 4 would also result in reduced cumulative effects compared to Alternative 2 and 3 because it would help mitigate any resulting short-term effects. Combined harvest proposed under Alternative 4 and past harvest would not push any other watershed past the 20 percent in 30 year threshold. However, reasonably foreseeable future harvest on non-NFS lands would likely result in minor cumulative watershed effects.

Results

The likelihood of this project to contribute to cumulative watershed effects is expressed in terms of increased peak flows or stream channel degradation, or measureable contributions to erosion.

Sediment delivery to waterbodies would likely be minimal due to the small percentage of mechanically treated area within the project watersheds and the use of appropriate design features and BMPs. Proposed mechanical harvest area and canopy removal is less than 20 percent of the total combined watershed area.

Watershed analysis did not find any significant conditions, existing or potential, which would contribute to long-term detrimental effects to water quality. The small harvest/thinning area, as compared to the overall size of the watersheds, is not likely to have a perceptible effect on stream hydrography, erosion, sediment transport, or water quality. It is unlikely that any detrimental effects to water quality caused by past, present, or future projects, when added to the insignificant effects of this project, would produce a measurable cumulative adverse effect to watersheds. In fact, proposed forest thinning and restoration projects, which are assumed to improve water quality and increase watershed resiliency, would help mitigate any short-term effects while improving existing watershed condition. Watersheds associated with this project are not known to be impaired; however, it is likely that on a site-specific or stream reach basis, restoration activities may be considered necessary and appropriate.

Fisheries

Introduction

This section briefly describes the potential effects on fisheries and aquatic resources in the four project alternatives, and more detailed descriptions and analysis can be found in the Fisheries Report. Alternative 1, the No Action Alternative, provides a basis for comparing any additional effects proposed by the three action alternatives.

Direct, indirect, and cumulative effects within the watersheds affected by the project area are estimated using both quantifiable and qualitative parameters. Quantifiable parameters include:

- Existing and proposed harvest acres and percent canopy removal
    - Harvest acres are calculated as the total area of harvest units
    - Percent canopy removal is calculated as 100 percent of the harvest unit area for even-aged management, 50 percent of the harvest unit area for two-aged management, and 33.33 percent of the harvest unit area for uneven-aged management
- Existing and proposed road-acres and miles of road
    - Road-acres were included in the canopy removal analysis for each watershed
- Number of existing and proposed stream crossings and their fish passage category
- Riparian area habitat (acres and adjacent stream miles) removed or improved
- Changes, if any, to access, competition, and abundance of subsistence fisheries

The level of effects due to these conditions is estimated using qualitative descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, how long it is likely to last, and whether it is likely to require mitigation. The descriptors are “negligible”, “minor”, “moderate”, and “major”, and are further described in the Fisheries Report. Effects to fisheries resources are analyzed at the HUC (Hydrologic Unit Code) 14 watershed level, and there are 21 watersheds that intersect the Kosciusko Project area.

Canopy cover within a watershed is important for moderating stream flow. Studies have indicated that 20 to 35 percent of precipitation is intercepted by canopy in coastal temperate rainforests (Banner *et al*., 2005; see Fisheries Report for full citation). If timber harvest and road building is extensive enough to cause increases in water yield during salmon spawning seasons, spawning success may be affected. Canopy removal decreases this interception, increasing the amount of water available to streams. Changes in annual water yield following timber harvest and road building have been documented in numerous studies in the Pacific Northwest and are commensurate with the proportion of watershed harvested. Tongass NF assumes that forest canopy recovery occurs in 30 years and would be instrumental in recovery of pre-harvest rainfall interception (Hicks *et al*., 1991b, Jones, 2000; see Fisheries Report for full citations). With current road-acres, past harvest acres younger than 30 years, and anticipated harvest on non-NFS land, 8 of the 21 project watersheds exceed the 20 percent threshold in Alternative 1, the No Action Alternative. Table 23 shows the anticipated percent basin area in roads or harvest openings younger than 30 years by alternative for these 8 watersheds, and these ranges were calculated in 5 year increments from 2015 to 2055. For a more detailed analysis, consult the Fisheries Report.

Table 23: Anticipated Percent Basin Area in Roads or Harvest Openings.

Watershed	Total Basin Acres	Alt 1[1]	Alt 2		Alt 3		Alt 4	
		Basin Percent	Additional Effect from Alt 2	Total Basin Percent	Additional Effect from Alt 3	Total Basin Percent	Additional Effect from Alt 4	Total Basin Percent
19010103091003	2,142.8	37.0 - 82.5	-	37.0 - 82.5	-	37.0 - 82.5	-	37.0 - 82.5
19010103091101	951.0	80.1 - 92.5	-	80.1 - 92.5	-	80.1 - 92.5	-	80.1 - 92.5
19010103091102	1,911.3	76.7 - 84.9	5.5	82.2 - 92.5	3.8	80.5 - 88.8	2.8	79.5 - 87.7
19010103091103	682.9	15.1 - 21.6	6.2	21.3 - 27.7	8.3	26.6 - 29.8	4.9	20.0 - 26.4
Davidson Inlet-Frontal Iphigeria Bay	10,877.6	16.0 - 20.8	-	16.0 - 20.8	-	16.0 - 20.8	-	16.0 - 20.8
Headwaters Charley Creek	3,820.8	18.0 - 33.8	0.3	18.3 - 34.2	0.3	18.3 - 34.2	0.3	18.3 - 34.2
Lower Trout Creek	5,702.2	27.7 - 36.6	0.1	27.8 - 36.9	0.1	27.8 - 36.9	0.1	27.8 - 36.9
Survey Creek	6,532.3	37.3 - 50.2	5.1	42.4 - 55.3	6.0	43.4 - 56.2	4	41.4 - 54.3

[1] Anticipated harvests on Sealaska Corporation, State, and other private lands included

Studies have found that the accumulation of fine sediment in streambeds was highest in basins where the road area exceeded 2.5 percent of the basin area. When less than 2.5 percent of the basin area is road area, the amount of sediment remains near natural levels; however, when the road area exceeds 2.5 percent, the proportion of fines in spawning gravels begins to consistently

exceed natural levels. In the existing condition, only one watershed located near the southwest corner of Kosciusko Island, 19010103091102, exceeds the 2.5 percent threshold, with 2.7 percent of the basin area as road. For a more detailed analysis, consult the Fisheries Report.

Along the 159 miles of road in the project area, there are 245 stream crossings, 45 of which are fish stream crossings. The guiding criterion for culvert design is to allow for natural migration by adult and juvenile fish through the culvert during various flows. The Tongass National Forest developed a juvenile fish passage evaluation criteria matrix with an interagency group of professionals. The evaluation matrix stratifies culverts by type, and establishes thresholds for culvert gradient, stream channel constriction, debris blockages, and vertical barrier (or perch) at culvert outlet. Culvert categories are described below. Table 24 lists the 45 fish crossings by passage category and watershed.

- Green: conditions that have a high certainty of meeting adult and juvenile fish passage requirements at all desired stream flows
- Gray: conditions are such that additional analysis is required to determine juvenile fish passage ability
- Red: conditions that have a high certainty of not providing juvenile fish passage at all desired stream flows
- Black: more information is required for the analysis to determine juvenile fish passage ability

Table 24: Fish Passage in the Project Area for the 10 Watersheds with Fish Crossings.

Watershed	Green Crossings	Gray Crossings	Red Crossings	Black Crossings	Total Fish Crossings
19010103091003	2	0	0	0	2
19010103091102	2	0	1	0	3
19010103091103	1	0	0	0	1
Davidson Inlet-Frontal Iphigeria Bay	0	0	6	0	6
Fishermans Harbor-Frontal Sumner Strait	1	1	0	0	2
Hamlin Creek	3	0	0	0	3
Iphigenia Bay-Frontal Pacific Ocean	2	0	0	0	2
Lower Trout Creek	4	1	5	0	10
Survey Creek	3	1	0	1	5
Upper Trout Creek	6	3	2	0	11
Total	**24**	**6**	**14**	**1**	**45**

Effects Common to all Action Alternatives

Alternatives 2, 3, and 4 allow for the removal or replacement of the 14 “red” pipes in the project area. These activities could cause minor short-term increases in sediment, but would provide

long-term improvements to fish habitat and fish access to approximately 1,700 meters of habitat upstream of those crossings.

There is only one new stream crossing proposed in all of the action alternatives, and a full suspension crossing would be constructed over this Class I stream near Survey Creek. The construction of this crossing could cause minor short-term increases in sediment, but the crossing structure would not impede fish passage.

The action alternatives propose 1,864 acres of pre-commercial thinning treatment, with 237 acres of treatment on previously harvested RMAs, and restoration on up to 1 mile of streams with RMAs that are not functioning properly or are functioning at risk as a result of previous harvest. These activities could cause minor short-term increases in sediment, but in the long-term would help mitigate some of the riparian losses from previous harvest in the project area and anticipated harvest on non-NFS land.

Alternative 1

Direct and Indirect Effects

Since no new activities are proposed in this alternative, no direct or indirect effects are expected to occur.

Cumulative Effects

As a result of existing conditions and cumulative harvest on non-NFS land, 8 out of the 21 watersheds intersecting the project area are expected to exceed the threshold of 20 percent of the watershed in openings younger than 30 years (see Table 23). The anticipated harvest, particularly on Sealaska land, may cause moderate to major peak flow increases in these eight watersheds depending on when actual harvest occurs. The 13 other watersheds would remain below the threshold in this alternative. Within 10 to 30 years, the watershed canopy cover would approach normal levels and would reduce the effects on flow.

Riparian area habitat in the project area is likely to be affected even in Alternative 1 as a result of anticipated harvest activities on non-NFS land, primarily on Sealaska Corporation land. As private landowners, Sealaska Corporation would follow the riparian standards for private land as outlined in the State of Alaska's *Forest Resources and Practices Act* (ADF&G, Sec. 41.17.116; see Fisheries Report for full citation). Streams within private land that are confirmed anadromous (listed on the Anadromous Waters Catalog) receive a 66-foot no-harvest buffer, and in some cases may receive a 100-foot no-harvest buffer. Any stream that flows directly into a confirmed anadromous stream would receive protections similar to Forest Service Class IV streams (See Appendices 2 and 3 in the Fisheries Report). Any other stream receives minimal protection, similar to "non-stream" rills on NFS land.

Within the Sealaska Corporation land on Kosciusko Island, there are 38.2 miles of Class I, II, and III streams, and only 5.7 miles of these streams would receive protection under the aforementioned state standards. Nine watersheds intersect Sealaska land, and three of these are predicted to lose over half of their RMAs to timber harvest: 19010103091101 (74.0 percent), 19010103091003 (63.0 percent), and 19010103091102 (53.6 percent).

Resident fish (and anadromous fish in uncatalogued streams) would likely be displaced in some of these un-buffered streams. Important riparian processes that maintain fish habitat features like

large wood, pool size and frequency, substrate, shade, hiding cover, and food may be diminished or lost in some cases.

In this alternative, important Kosciusko Project restoration options that could help mitigate some of the riparian losses from harvest on non-NFS land within the project area would not be available, and no previously harvested RMAs would receive any silvicultural treatments. Other restoration projects could be proposed in the future, but the effects from the existing condition of these RMAs would continue on for the foreseeable future.

Currently only one watershed within the project area exceeds the 2.5 percent basin area in road surface threshold (19010103091102, 2.7 percent), which is considered to result in increased sediment in streams and likely causes minor effects to fish habitat (see Table 15 in Fisheries Report). Non-project-related cumulative actions are not expected to increase road surface area to the extent of exceeding the 2.5 percent threshold in any other watersheds.

Roads would be stored or decommissioned under the Prince of Wales Access and Travel Management Plan (ATM) when funding became available, and the 14 “red” stream crossings would remain in place for the foreseeable future. Eventually, various activities including culvert replacement and removal would be conducted under ATM, and these future actions would have a beneficial cumulative effect on fish habitat.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes the lowest total area of commercial harvest units with 999 acres, and the second highest area of harvest canopy removal with 925 acres (uneven-aged harvest areas adjusted proportional to canopy removal). This alternative has the highest amount of clearcut harvest (even-aged management) at 888 acres, which is the harvest method with the highest erosion potential (see Watersheds Report). These harvest levels may increase stream flow and sediment delivery, and would result in minor effects to fish habitat.

The amount of proposed road work is similar among action alternatives. Alternative 2 proposes 5.4 miles of new temporary roads (including new roads on existing prisms and new construction), which is the lowest of the action alternatives. With an additional 18 miles of proposed road maintenance, Alternative 2 has the lowest amount of proposed road work at 27.6 miles, and would result in negligible to minor effects on fish habitat.

Cumulative Effects

Cumulative effects from past practices are described in the affected environment of the Fisheries Report. Because reasonably foreseeable future activities are consistent across all alternatives, Alternative 2 would result in the highest level of cumulative effects on fish habitat.

Cumulatively, as a result of existing conditions and foreseeable harvest, primarily on Sealaska Corporation land but also on State of Alaska and University of Alaska land, 8 out of the 21 watersheds intersecting the project area are expected to exceed the threshold of 20 percent of the watershed area in openings younger than 30 years. Alternative 2 proposes additional harvest in 5 of these 8 watersheds with the second highest amount of additional percent basin area removal among the three action alternatives (see Table 23). These harvests cumulatively may cause moderate peak flow increases in these 5 watersheds, depending on when actual harvest occurs.

Within 10 to 30 years, the watershed canopy cover would approach normal levels and would reduce the effects on flow, likely making increases from this alternative immeasurable.

Alternative 2 actions would not result in any additional watersheds exceeding the 2.5 percent basin area in road surface threshold, above which is considered to result in increased sediment in streams. Alternative 2 does not add any new roads to the watershed (19010103091102) that already exceeds the threshold.

This alternative provides silvicultural treatments and restoration options that could help mitigate some of the riparian losses from previous harvest and anticipated harvest on non-National Forest System land.

Conclusion

Alternative 2 is consistent with the Forest Plan Standards and Guidelines. Based on known effects from timber harvest and road building, this alternative would result in minor additional effects on fish habitat. Compared to other action alternatives, Alternative 2 would have the highest effects on fish habitat based on the amount of canopy removal and the higher amount of even-aged management.

Alternative 3

Direct and Indirect Effects

Alternative 3 proposes the second highest total area of harvest units with 1,526 acres, and the highest area of harvest canopy removal with 933 acres (two-aged and uneven-aged harvest areas adjusted proportional to canopy removal). This alternative has the second highest amount of clearcut harvest at 423 acres, which is the harvest method with the highest erosion potential (see Watersheds Report). These harvest levels may increase stream flow and sediment delivery, and would result in minor effects to fish habitat.

The amount of proposed road work is similar among action alternatives. Alternative 3 proposes 6.7 miles of new temporary roads (including new roads on existing prisms and new construction), which is the second highest of the action alternatives. With an additional 18 miles of proposed road maintenance, Alternative 3 has the second highest amount of proposed road work at 29.1 miles, and would result in negligible to minor effects on fish habitat.

Cumulative Effects

Cumulative effects from past practices are described in the affected environment of the Fisheries Report. Because reasonably foreseeable future activities are consistent across all alternatives, Alternative 3 results in the second highest level of cumulative effects on fish habitat.

As a result of existing conditions and cumulative harvest, primarily on Sealaska Corporation land but also on State of Alaska and University of Alaska land, 8 out of the 21 watersheds intersecting the project area are expected to exceed the threshold of 20 percent of the watershed area in openings younger than 30 years. Alternative 3 proposes additional harvest in 5 of these 8 watersheds with the highest amount of additional percent basin area removal among the three action alternatives (Table 23). This cumulative harvest may cause moderate peak flow increases in these 5 watersheds, depending on when actual harvest occurs. Within 10 to 30 years, the watershed canopy cover would approach normal canopy cover and would reduce the effects on flow, likely making increases from this alternative immeasurable.

Alternative 3 actions would not result in any additional watersheds exceeding the 2.5 percent basin area in road surface threshold, above which is considered to result in increased sediment in streams. Alternative 3 does not add any new roads to the watershed (19010103091102) that already exceeds the threshold.

This alternative provides silvicultural treatments and restoration options that could help mitigate some of the riparian losses from previous harvest and anticipated harvest on non-NFS land.

Conclusion

Alternative 3 is consistent with the Forest Plan Standards and Guidelines. Based on known effects from timber harvest and road building, this alternative would result in minor additional effects on fish habitat. Compared to other action alternatives, Alternative 3 has the second highest effects on fish habitat based on the amount of canopy removal and the higher proportion of two-aged and uneven-aged management.

Alternative 4

Direct and Indirect Effects

Alternative 4 proposes the highest total area of harvest units with 1,547 acres, and the lowest area of harvest canopy removal with 600 acres (two-aged and uneven-aged harvest areas adjusted proportional to canopy removal). This alternative has the least amount of clearcut harvest at 27 acres, which is the harvest method with the highest erosion potential (see Watersheds Report). These harvest levels may increase stream flow and sediment delivery, and would result in minor effects to fish habitat.

The amount of proposed road work is similar among action alternatives. Alternative 4 proposes 6.9 miles of new temporary roads (including new roads on existing prisms and new construction), which is the highest of the three action alternatives. With an additional 18 miles of proposed road maintenance, Alternative 4 has the second highest amount of proposed road work at 29.3 miles, and would result in negligible to minor effects on fish habitat.

Cumulative Effects

Cumulative effects from past practices are described in the affected environment of the Fisheries Report. Because reasonably foreseeable future activities are consistent across all alternatives, Alternative 4 would result in the lowest level of cumulative effects on fish habitat.

As a result of existing conditions and cumulative harvest, primarily on Sealaska Corporation land but also on State of Alaska and University of Alaska land, 8 out of the 21 watersheds intersecting the project area are expected to exceed the threshold of 20 percent of the watershed area in openings younger than 30 years. Alternative 4 proposes additional harvest in 5 of these 8 watersheds with the least amount of additional percent basin area removal among the three action alternatives (see Table 23). This cumulative harvest may cause moderate peak flow increases in these 5 watersheds, depending on when actual harvest occurs. Within 10 to 30years, the watershed canopy cover would approach normal levels and would reduce the effects on flow, likely making increases from this alternative immeasurable.

Alternative 4 actions would not result in any additional watersheds exceeding the 2.5 percent basin area in road surface threshold, above which is considered to result in increased sediment in streams. Alternative 4 does not add any new roads to the watershed (19010103091102) that already exceeds the threshold.

This alternative provides silvicultural treatments and restoration options that could help mitigate some of the riparian losses from previous harvest and anticipated harvest on non-NFS land.

Conclusion

Alternative 4 is consistent with the Forest Plan Standards and Guidelines. Based on known effects from timber harvest and road building, this alternative would result in minor additional effects on fish habitat. Compared to other action alternatives, Alternative 4 has the least effects on fish habitat based on the amount of canopy removal and the higher proportion of two-aged and uneven-aged management.

Essential Fish Habitat Assessment

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 essential fish habitat (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.

There are four main steps in the consultation process:

1. 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.
2. An EFH Assessment is prepared by the Forest Service as a component of the NEPA document and forwarded to the NMFS to initiate formal consultation.
3. The NMFS will respond in writing as to whether it concurs with the conclusion in the EFH Assessment. In addition, they may provide extra conservation recommendations to minimize effects of the action on EFH.
4. The Forest Service must provide a written response to NMFS within 30 days explaining our evaluation of the conservation recommendations. The response may include reasons for not following the recommendations.

Following our 2007 agreement with the NMFS, this EFH Assessment was developed and will be sent to NMFS for their evaluation as part of the consultation process.

Essential Fish Habitat is the water and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. For EFH, “fish” refers to federally managed fish or shellfish species and their prey. Freshwater EFH in the project area 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.

Essential fish habitat for Pacific salmon recognizes six critical life history stages: 1) spawning and incubation of eggs, 2) juvenile rearing, 3) winter and summer rearing during freshwater residency, 4) juvenile migration between freshwater and estuarine rearing habitats, 5) marine residency of immature and maturing adults, and 6) adult spawning migration. Habitat requirements within these periods can differ significantly and any modification of the habitat within these periods can adversely affect essential fish habitat.

Freshwater EFH

The Kosciusko Project area has over 350 miles of streams in 21 watersheds. Of this total, 95.6 miles are Class I streams. These streams and tributaries provide EFH for the following federally managed fish species under the jurisdiction of the North Pacific Management Council: pink salmon, chum salmon, coho salmon, sockeye salmon, and sculpin.

Features of freshwater EFH that could be adversely affected include substrate composition, water quality and temperature, channel gradient and stability, food availability, cover and habitat complexity, and recruitment of LWD to the stream channel. It is also possible that juvenile and adult migratory access and floodplain habitat complexity could be altered should slides or mass erosion occur. Unmitigated, the temporary road construction associated with project area development would increase sediment delivery to the streams, increasing turbidity and the potential for slides and decreasing dissolved oxygen and suitable spawning gravels.

The Forest Service has determined that the Kosciusko Project would have minor additional effects of fish habitat, and therefore “may adversely affect” freshwater EFH. These adverse effects on EFH would result from the alteration of riparian and upland areas that modify the delivery and routing of water, sediment, and LWD to the stream channel. To protect these habitat features, the following mitigation and conservation measures would be in place for the entire project to minimize potential impacts:

- All harvest units adjacent to Class I streams would have no-harvest riparian buffers at least 100-feet wide or wider according to Forest Plan Standards and Guidelines
- Windfirm buffers would be used where necessary to prevent windthrow within no-harvest riparian zones
- The BMPs described in the unit cards would provide assurance of water quality and aquatic habitat protection for all freshwater streams affected by the project
- Proposed new temporary roads and a stream crossing across a Class I stream would be constructed according to the Forest Plan Standards and Guidelines
- Reconstruction of existing stream crossings at Class I, II, and III streams would be in conformance with Forest Plan Standards and Guidelines

The planned mitigation practices are supported by field surveys of Class I streams and tributary systems in the project area to identify and protect stream channels and tributary systems potentially affected by timber harvest and road building activities. The Forest Service believes these mitigation measures would be effective and would minimize effects of this project on freshwater EFH.

Marine EFH

There are two Marine Access Facilities (MAF) in the project area, and a third is planned for construction: East Edna Bay, West Edna Bay, and Cape Pole. The East Edna Bay MAF is a Log Transfer Facility (LTF) under the jurisdiction of the Forest Service. It is a sloped shot rock fill with a riprap-buttressed barge loading ramp. The West Edna Bay MAF is planned for construction by the State of Alaska and it would be connected to the Kosciusko Island Edna Bay road system. It is possible that an agreement may be reached with the state for use of this facility. The Cape Pole MAF is a decommissioned facility and is not proposed for use in this project.

The following is a list of fish species that may be found in the marine environment and could be affected by the use of the MAFs for the Kosciusko Project: arrowtooth flounder (*Atheresthes stomias*), Atka mackerel (*Pleurogrammus monopterygius*), Dover sole (*Microstomus pacificus*), flathead sole (*Hippoglossoides elassodon*), Pacific cod (*Gadus macrocephalus*), Pacific Ocean perch (*Sebastes alutus*), Rex sole (*Glyptocephalus zachirus*), rock sole (*Lepidopsetta bilineatus*), sablefish (*Anoplopoma fimbria*), sculpin (*Cottidae* family), shortraker/rougheye rockfish (*Sebastes borealis*), skates (*Rajidae* family), squid (*Cephalopoda* class), walleye pollock (*Theragra chalcogramma*), weathervane scallops (*Patinopecten caurinus*), yelloweye rockfish (*Sebastes ruberrimus*), and yellowfin sole (*Limanda aspera*).

In addition, pink salmon, chum salmon, coho salmon, and sockeye salmon could be affected during estuarine juvenile, marine juvenile, marine immature, and maturing adult stages. The potential effects on marine EFH by rafting logs include diminished habitat for managed species and their prey, as well as reduced rearing capability for juvenile salmon from potential water quality impacts.

Primary prey items for the following species are based on the *Gulf of Alaska Fishery Management Plan* (NPFMC 1998; see Fisheries Report for full citation):

- Arrowtooth flounder feed in gravel-mud substrates near the seafloor. Adults feed on other groundfish. Juveniles feed on euphausiids, crustaceans, amphipods, and young pollock. Larvae feed on phytoplankton and zooplankton.
- Sablefish feed throughout the water column. Larval sablefish feed on a variety of zooplankton. Juveniles feed primarily on macrozooplankton and euphausiids. Adults are opportunistic feeders. Their main diet is other fish, including salmon fry and pollock. Other food includes benthic invertebrates, squid, jellyfish, and fishery discards.
- Sculpins mainly feed near the bottom. Prey items include crabs, barnacles, and mussels. Larger sculpins eat fish.
- Adult chum, sockeye, coho, and pink salmon are primarily fish eaters, although pelagic crustaceans and squid are also consumed (with the exception of chum), particularly by pink salmon. Juvenile salmon consume plankton and small crustaceans.
- Pacific cod are omnivorous. Adult cod feed mostly on other fish such as walleye pollock, yellowfin sole, and fisheries discard. Young cod feed mostly on invertebrates such as amphipods, crangonid shrimp, polychaete worms, and bivalves.
- Skates feed on bottom invertebrates (crustaceans, mollusks, polychaetes) and fish.
- Walleye pollock feed throughout the water column on copepods, euphausiids, young pollock, and other fish.
- Yelloweye rockfish eat primarily fish including other small rockfish, herring, sandlance, as well as caridean shrimp, small crabs, and lingcod eggs.
- Shortraker and rougheye rockfish feed primarily on shrimp, squids, and myctophids. Juveniles feed on shrimp and amphipods.
- Pacific Ocean perch are overwhelmingly planktivorous, and may eat small shrimp and squids. Juveniles eat mostly calanoid copepods and euphausiids.

Primary prey items for the following species are based on the Alaska Fisheries Science Center NOAA website:

- Atka mackerel are a schooling semi-demersal fish. Juveniles and adults eat mainly copepods and euphausiids, but have been known to eat shrimp, gastropods, annelids, and fish eggs and larvae.
- Rock sole eggs are adhesive and are laid on the bottom of the ocean. The larvae that hatch consume small zooplankton until they metamorphosis into juveniles. Juveniles are abundant in shallow, near-shore waters and feed on polychaetes and small crustaceans. Adults continue to eat small invertebrates throughout their lives.
- Yellowfin sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions feeding mainly on benthic infauna and epifauna, euphausiids, and fish.
- Flathead sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions with their diet is composed primarily of organisms living on the bottom (epibenthic) and pelagic organisms in close association with the bottom (nektobenthic). Flathead sole less than 30 centimeters total length consumed mainly mysids, gammarid amphipods, and decapod shrimps, whereas flathead sole larger than 30 centimeters total length consumed mainly ophiuroids, walleye pollock, and decapod shrimps.
- Rex sole feed almost exclusively on benthic invertebrates. Small (less than 15 centimeters Standard-Length [SL]) rex sole feed mainly on amphipods and other crustaceans. Large (15 to 45 centimeters SL) rex sole prey chiefly on polychaetes. Rex sole less than 20 centimeters SL prey primarily on euphausiids, decapod crab larvae, copepods, Oikopleura, and ostracods. Mollusks form only a minor part of rex sole diet. Euphausiids are principal prey only during summer and cumaceans and Oikopleura are more common during the winter.
- Dover sole feed almost exclusively on benthic infaunal and epifaunal invertebrates, mainly polychaetes, ophiuroids, and mollusks. Amphipods are important crustacean prey and pelecypods make up the most molluskan biomass consumed. Annelids are usually dominated in the diet of juvenile Dover sole.

The Forest Service has determined that the use of these MAFs “may adversely affect” marine EFH. The potential effects on marine EFH include diminished habitat for bottom-dwelling creatures in addition to effects on underwater vegetation used as food and potential rearing sites. All necessary federal or state permits would be obtained prior to any work for the reconstruction or maintenance of the East Edna Bay MAF. Mitigation for potential impacts to EFH is provided by:

- Adhering to the LTF Guidelines provided in the Forest Plan
- Implementing Region 10 BMPs 14.26 and 14.27, and National Core BMPs Fac-2, Fac-5, Road-6, and Road-9, which include daily LTF cleanup and erosion control

Geology, Minerals, Karst, and Cave

A full discussion of the geology of Kosciusko Island as well as minerals resources in the project area may be found in the Geology Report. The effects discussion as follows is focused on the potential impacts of the Kosciusko Project on karst and cave resources.

Karst and Cave Resources within the Project Area

In Southeast Alaska the karst landscape can be characterized as an ecological unit found atop carbonate bedrock in which karst features and drainage systems have developed as a result of differential solution by surface and groundwater. These acidic waters are a direct product of abundant precipitation and passage of these waters through the organic-rich forest soil and the adjacent peat lands. Recharge areas may be on carbonate or adjacent non-carbonate substrate. A few characteristics of this ecological unit include: mature, well developed spruce and hemlock forests along valley floors and lower slopes, increased productivity for plant and animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and the underlying unique cave resources.

Within the project area there is approximately 38,659 acres (55.7 mi^2 or 144.3 km^2) of carbonate bedrock into which karst systems have developed. These systems have developed from sea-level to the highest flanks of Mount Francis. Under the 2008 Tongass Land Management Plan Amendment, several Geologic Special Interest Areas were created adjacent to and within the project area. These are areas of intense karst development; their unique geomorphologic characteristics, the intensity of karst features found there, and the potential and known significant caves and their associated resources warrant recognition of these areas. 9,342 acres of Geologic Special Area were created in the planning area. In 2014, the National Defense Authorization Act for Fiscal Year 2015 changed some of those Geologic Special Areas to LUDII Geologic Conservation Areas. The land ownership of some of the Geologic Special Areas was transferred to the Sealaska Corporation. Today there are 5,135 acres of LUDII Geologic Conservation Areas and 3,452 acres of Geologic Special Areas. 754 acres of the Mount Francis Geologic Special Area was transferred to Sealaska Corporation. Of the 38,659 acres of karst in the Project Area, 23,569 acres is on lands administered by the Tongass National Forest. 15,090 acres are in private or State of Alaska ownership.

The karst vulnerability of the karst lands on Kosciusko Island have been assessed multiple times and reported on in a myriad of reports; see the Geology Report for more information. The 2008 Tongass Land Management Plan Amendment, Karst and Cave Resource Standards and Guidelines and the guidance in Appendix H of that Plan were applied throughout this project.

Existing Condition

The 38,659 acres of the Project area is underlain by limestone. We assume that karst has developed on all those acres. Approximately 53.6 percent or 20,718 acres of karst in the Project Area have been harvested historically. The USFS manages some 23,569 acres of karst in the Project Area of which 62.1 percent or 14,634 acres have been harvested historically. Where karst systems have developed adjacent and beneath harvested areas, it is possible that sedimentation and slash from prior harvest washed into karst features, altering the ecology of the karst system through affecting the water chemistry and flow paths. It is also possible that in areas that have already been harvested, thickly regenerated forests are causing greatly increased interception rates resulting in less water moving through the karst systems. Without the natural flow rates through the system, sediment would remain instead of being washed out. In addition, decreased water flow downstream from these karst areas results in a reduction of fish habitat where karst streams contribute to fish streams.

Desired Condition

Maintain to the extent practical the natural karst processes and the productivity of the karst landscape while providing for other land uses, where appropriate. Strive to maintain the

productivity of the soils of the karst landscape and the quantity and quality of the waters issuing from the karst hydrologic systems. Protect the many resource values within underlying significant cave systems as per the requirements of the Federal Cave Resources Protection Act of 1988 (Forest Plan pp. 4-23 to 4-26 and pp. H-1 to H-10).

Environmental Consequences for Alternatives

Alternative 1: No Action

Indirect Effects and Cumulative Effects

The no action alternative is just as stated. If this alternative is chosen, no harvest or road building would occur within the project area and thus there would be no effects.

Alternative 2

Direct and Indirect Effects

This alternative would harvest approximately 997.1 acres of karst and pre-commercially thin 1759.6 acres of karst. This Alternative would clear cut 27 acres of mature forest and harvest an additional 37 acres through group selection up to 2 acres in size. The high-vulnerability acres would be excluded from harvest. A large portion of the acreage to be pre-commercially thinned is in Geologic Special Interest Areas or LUDII Geologic Conservation Areas and is mapped as high vulnerability. Individual features would be appropriately buffered. The delineation of karst vulnerability classes on the lands and the protection of the highly vulnerable areas are intended to protect the karst features within the units and the karst systems beneath. No adverse effects are expected to the features or karst systems. Additionally, with the proposals intended to improve karst systems (described on page 8 under “Common to All Action Alternatives”), this alternative may have beneficial direct and indirect effects to karst hydrologic function within the project area.

Cumulative Effects

This Alternative would harvest approximately 64 acres of mature forest and 933.1 acres of second growth by a variety of methods. This would increase the harvested karst by 0.27 percent, most harvest occurring on already harvested karst lands. No commercial harvest would occur on high-vulnerability lands. Since there would be no adverse direct or indirect effects to karst resources anticipated by this alternative, there would also be no adverse cumulative effects.

Alternative 3

Direct and Indirect Effects

This alternative would harvest approximately 1544.8 acres of karst and pre-commercially thin 1759.6 acres of karst. This Alternative would clear cut 27 acres of mature forest and selectively harvest an additional 37 acres. The high-vulnerability acres indicated would be excluded from harvest. A large portion of the acreage to be pre-commercially thinned is in Geologic Special Interest Areas or LUDII Geologic Conservation Areas and is mapped as high vulnerability. Individual features would be appropriately buffered. The delineation of karst vulnerability classes on the lands and the protection of the highly vulnerable areas are intended to protect the karst features within the units and the karst systems beneath. No adverse effects are expected to the features or karst systems. Additionally, with the proposals intended to improve karst systems

(described on page 8 under “Common to All Action Alternatives”), this alternative may have beneficial direct and indirect effects to karst hydrologic function within the project area.

Cumulative Effects

This Alternative would harvest approximately 64 acres of mature forest and 1480.8 acres of second growth by a variety of methods. This would increase the harvested karst by 0.27 percent, most harvest occurring on already harvested karst lands. No commercial harvest would occur on high-vulnerability lands. Since there would be no adverse direct or indirect effects to karst resources anticipated by this alternative, there would also be no adverse cumulative effects.

Alternative 4

Direct and Indirect Effects

This alternative would harvest approximately 1523.3 acres of karst and pre-commercially thin 1759.6 acres of karst. This Alternative would clear cut 27 acres of mature forest and selectively harvest an additional 37 acres. The high-vulnerability acres would be excluded from harvest. A large portion of the acreage to be pre-commercially thinned is in Geologic Special Interest Areas or LUDII Geologic Conservation Areas and is mapped as high vulnerability. Individual features would be appropriately buffered. The delineation of karst vulnerability classes on the lands and the protection of the highly vulnerable areas are intended to protect the karst features within the units and the karst systems beneath. No adverse effects are expected to the features or karst systems. Additionally, with the proposals intended to improve karst systems (described on page 8 under “Common to All Action Alternatives”), this alternative may have beneficial direct and indirect effects to karst hydrologic function within the project area.

Cumulative Effects

This Alternative would harvest approximately 64 acres of mature forest and 1459.3 acres of second growth by a variety of methods. This would increase the harvested karst by 0.27 percent, most harvest occurring on already harvested karst lands. No commercial harvest would occur on high vulnerability lands. Since there would be no adverse direct or indirect effects to karst resources anticipated by this alternative, there would also be no adverse cumulative effects.

Common to Alternatives 2, 3, and 4

Considering past, present, and reasonably foreseeable future projects (on NFS and other lands) relative to this project, the following effects would be expected:

1. If the vulnerability mapping and prescriptions are effective and remain windfirm, there would be no adverse effects to karst features or systems.
2. Projects on adjacent non-NFS lands should not affect the karst features on NFS lands that would be protected.
3. Projects on adjacent non-NFS lands may have an effect on the karst hydrology and spring flow depending on the harvest method, soil disturbance, and harvest proximal to karst features on those lands.

Roads on Karst

For all alternatives specific requirements concerning road building on moderate vulnerability (Appendix H, section III.A.4.b.ii) and high vulnerability karst (Appendix H, section III.A.4.b.ii)

are located in the Forest Plan. Road building on high-vulnerability karst would be avoided under all alternatives.

Conclusions

The harvest proposed in Alternatives 2, 3, and 4 are focused on previously harvested karst lands. No more than a 0.27 percent increase of total new harvest on karst would occur. High-vulnerability karst areas and resources would be protected and appropriately buffered. Opportunities exist to enhance karst hydrologic function and correct karst blockages and diverted water flows from past activities. Since high-vulnerability karst acres would be excluded from harvest and individual karst features would be buffered, there would be no adverse direct, indirect, or cumulative effects to karst and cave resources anticipated by any alternative.

Scenery

Scenery is evaluated from locations and routes that a visitor of the Tongass National Forest uses to gain physical and visual access. These means of access are identified as Visual Priority Travel Routes and Use Areas (VPRs) which may include waterways, roads, trails, cabins, shelters, or other facilities within dispersed recreations areas. To understand the importance of scenery as a resource, it needs to be inventoried, classified, and managed with an understanding that there are activities that occur on TNF lands where landscapes may be altered from a natural forest condition. Scenic assessment includes the analysis of landscapes that allow informed management decisions affecting scenery based on the direction contained in the 2008 Tongass National Forest Land and Resource Management Plan Scenery Standards and Guidelines.

The scenic quality for a portion of Kosciusko Island would be affected by timber harvest, vegetation management, and road development activities proposed under the action alternatives. The Forest Plan Scenic Integrity Objectives are applied to any land altering activity that has the potential to affect the scenic integrity of the landscape. SIOs are a measure of alteration to the scenic appearance of landscapes and generally coincide with management objectives for specific Land Use Designations. The effects upon the scenery resource vary by the degree of alteration of proposed activities visible from Visual Priority Travel Routes and Use Areas (Forest Plan Appendix F).

Direct and Indirect Effects

Alternatives 2, 3, and 4

The direct and indirect scenic effects within the Kosciusko Vegetation Management and Watershed Improvement project have been designed to meet to Scenery Standards and Guidelines of the Forest Plan. See Table 25 below for effects to scenic integrity of viewsheds by alternative.

Table 25: Comparison of Past and Present Activities as a Change in Scenic Integrity.

Viewshed	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Shipley Bay Cabin	No Change	Negligible Change	Negligible Change	Negligible Change
Sumner Strait	No Change	Slightly Noticeable	Slightly Noticeable	Slightly Noticeable
Sea Otter Sound to Cape Pole	No Change	Noticeable Change	Noticeable Change	Noticeable Change
Tuxekan Pass to Edna Bay	No Change	Negligible Change	Negligible Change	Negligible Change
Karheen Pass to New Tokeen	No Change	Negligible Change	Negligible Change	Negligible Change
Marble Pass	No Change	Negligible Change	Negligible Change	Negligible Change
Pole Anchorage	No Change	Slightly Noticeable	Slightly Noticeable	Slightly Noticeable
Community of Edna Bay	No Change	Negligible Change	Negligible Change	Negligible Change
Community of Pole Anchorage	No Change	Negligible Change	Negligible Change	Negligible Change

Cumulative Effects

No Action Alternative

Since the No Action alternative would not propose timber harvest and/or related activities there would be no activities proposed and therefore no cumulative effect from this alternative.

Action Alternatives

The past and proposed scenic effects would meet or achieve a higher degree of scenic quality than the Very Low SIO adopted under the FP partially visible from Sea Otter Sound to Cape Pole Travel Route (VCUs 5440 and 5450), and the Sumner Strait Travel Route and Pole Anchorage (VCU 5440). Timber harvest would not be visible from the remaining VPRs in the project area (Shipley Bay Cabin, Tuxekan Pass to Edna Bay Travel Route, Karheen Pass to New Tokeen Travel Route, Marble Pass Saltwater Use Area, and the communities of Pole Anchorage and Edna Bay). Associated activities connected to the implementation of the Kosciusko Project such as road construction, landings, and rock source development, road maintenance, and pre-commercial thinning have been incorporated into the direct effects analysis and would not contribute further to the cumulative effects.

When adding the reasonably foreseeable future effects of the expected Sealaska Corporation and University of Alaska timber harvests, combined with the present harvest of the Edna Bay Parlay Timber Sale by State of Alaska, a scenic integrity condition below that which was adopted under the Forest Plan would be expected for the Sumner Strait, Pole Anchorage, Sea Otter Sound, Tuxekan Pass to Edna Bay, and Community of Edna Bay viewsheds, if the timber on these lands were entirely removed at one time. This would occur even under the No Action Alternative.

Table 26: Comparison of Past, Present, and Future Activities Cumulatively as a Change in Scenic Integrity.

Viewshed	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Shipley Bay Cabin	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Sumner Strait	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Sea Otter Sound to Cape Pole	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Tuxekan Pass to Edna Bay	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Karheen Pass to New Tokeen	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Marble Pass	Negligible Change	Negligible Change	Negligible Change	Negligible Change
Pole Anchorage	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Community of Edna Bay	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable	Extremely Noticeable
Community of Pole Anchorage	Negligible Change	Negligible Change	Negligible Change	Negligible Change

Other projects in the Past, Present and Reasonably Foreseeable Activities listing would not further contribute to cumulative effects.

Conclusions

The direct and indirect effects would meet or achieve a higher degree of scenic integrity than defined in the Forest Plan. The cumulative effects of all action alternatives when adding the potential scenic effect of potential timber harvest proposed on Sealaska, University of Alaska, and State of Alaska non-NFS lands would not be appreciably greater than that of the No Action Alternative.

Other projects in the *Past, Present and Reasonably Foreseeable Activities* listing not mentioned above would not further contribute to cumulative scenic effect.

Sensitive and Rare Plants

The analysis area for direct, indirect, and cumulative effects for threatened, endangered, sensitive, and rare plants is Kosciusko Island since the effects of the proposed project activities are limited to the island. No federally listed threatened or endangered plants are known or suspected to occur on the Tongass National Forest; therefore, only rare and sensitive plants are addressed.

Sensitive plant species are designated by the Regional Forester because they are rare species with a viability concern due to significant current or predicted downward trends in population and/or habitat capability (FSM 2670.5.19). Two sensitive plant species populations were discovered during surveys, the lesser round-leaved orchid (*Platanthera orbiculata*) and the lichen *Lobaria amplissima*.

Alaska Natural Heritage Program (AKNHP) collaborates between State, federal, and private agencies as well as individuals to compile information on rare plants and animals in the State of Alaska. For botanical resources, this includes a rare vascular plant list and a rare lichen list, which

were updated in 2012. Some rare plants may be considered rare that do not currently have a State ranking. Other rare plants may be included based on population viability concerns on the Tongass or for plants that have been an issue because of rarity or conservation concerns through the NEPA process.

There were 13 species of rare plants found within the project area and most were located in the 1,000-foot beach buffer, within protected riparian stream corridors, or outside proposed units. There is one population of Adders-mouth orchid (*Malaxis monophyllos*) located outside but near a planned unit boundary. There are three known populations of the rare plant oniongrass (*Melica subulata*) that are located near planned units.

Surveys for the proposed project covered various habitats throughout the project area. The majority of the surveys completed on Kosciusko Island targeted proposed timber harvest in both young-growth and old-growth habitat. Most surveys conducted were a focused (intuitive controlled) type of survey, targeting suspected habitat for rare and sensitive species within the project area (see the Botany Report and Botany BE for definitions of plant survey types). Several additional surveys were completed by Meridian Environmental Incorporated in non-development land use designations to establish some baseline rare plant information for Forest Plan Monitoring.

Sensitive Plants Known to Occur and Used in the Analysis

Sensitive Plants or Lichen Species

Lobaria amplissima has been found throughout Southeast Alaska. On Kosciusko Island, *Lobaria amplissima* is known from several locations in Halibut Harbor and along the southwestern shoreline south of South Cape Pole. It has also been found on neighboring islands, including Warren and Whale Head. *Lobaria amplissima* is not ranked globally, but is ranked by Alaska Natural Heritage Program as S1S3, meaning its rarity ranges from critically imperiled to rare within the State (AKNHP 2012; see Botany BE for full citation).

Lesser round-leaved orchid (*Platanthera orbiculata*) occurs in open forest, forest edge, and forested habitats. The known location of this species is in an area that was included in the conveyance of land to the Sealaska Corporation. There are currently no known occurrences on NFS land.

For more information on the other sensitive species see the Botany BE.

Rare Plants Known to Occur on Kosciusko Island

Pacific silver fir (*Abies amabilis*), fragile rockbreak (*Cryptogramma stelleri*), and Carlott's violet (*Viola biflora* ssp. *carlottae*) are known to occur in alpine and subalpine, carbonate rock ledges and crevices, from high elevation limestone on Mount Francis which is located in the “Mt Calder-Mt Holbrook LUD II” area.

Maidenhair spleenwort (*Asplenium trichomanes*) was found on limestone cliffs and outcroppings at very low elevations, in close proximity to the beach along the southern coast of the island.

Northern golden saxifrage (*Chrysospleium tetrandrum*), Pacific ninebark (*Physocarpus capitatus*), Douglas' spirea (*Spirea douglasii*), Alaska oniongrass (*Melica subulata*) and western meadow-rue (*Thalictrum occidentale*) are known to occur along streambanks, lakeshores, fens, and beaches in the project area.

Mountain bladderfern (*Cystoperis montana*) is known to occur in timbered areas, generally associated with karst landscapes. The one population documented in the project area was found along a stream with karst influence.

Twinberry honeysuckle (*Lonicera involucrata*) was found along the beach/forest edge on the west coast of Kosciusko Island.

Adder's-mouth orchid (*Malaxis monophyllos*) was found in muskegs, fens, and beaches, as well as roadsides and ditches. It tends to be associated with a limestone substrate or calcareous influence. The known populations occur along roadsides, the beach, and along streams.

Whiteflower rein orchid (*Piperia candida*) was found in forested habitats, forest edges, and muskegs. There are known populations along muskeg and forest edges. There are known populations along muskeg and forest edges. This species was found within the project area in three locations.

For more information on the other rare species suspected to be in the project area, see the Botany Report.

Environmental Consequences

Direct and Indirect Effects

Alternative 1

Alternative 1 would have no direct or indirect impact on any of the known populations of rare and sensitive plants or lichens.

Alternatives 2, 3, and 4

Known Sensitive Plants and Lichen Species

Alternatives 2, 3, and 4 would have no direct or indirect effects to the known populations or habitats of *Lobaria amplissima* or lesser round-leaved orchid.

Unknown Sensitive Plants and Lichen Species

Alternatives 2, 3, and 4 would have no direct or indirect effects to Unalaska mist-maid, Henderson’s checkermallow, or dune tansy because their preferred habitats are protected by buffers as outlined in the Forest Plan Standards and Guidelines or do not occur in the project area.

There may be direct or indirect effects to the unknown populations or habitat of spatulate moonwort, moosewort fern, mountain lady slipper, yellow lady's slipper, Calder’s lovage, Alaska rein orchid, and lesser round-leaved orchid. These species can be found in forested habitats, open forests, or disturbed areas in which land management activities may occur.

Rare Plants

Alternatives 2, 3, and 4 would have no direct or indirect effects to the known or unknown populations or habitats of Pacific silver fir, , maidenhair spleenwort, northern golden saxifrage, fragile rockbreak, mountain bladderfern, twinberry honeysuckle, Adder's-mouth orchid, Alaska oniongrass, Pacific ninebark, Douglas' spirea, western meadow-rue, and Carlott's violet. These species can be found in habitats that are located in non-development LUDs or habitats that are protected by buffers as outlined in the Forest Plan Standards and Guidelines.

There may be direct or indirect effects to the known populations or habitats of whiteflower rein orchid. This species can be found in forested habitats, forest edges, and muskegs in which land management activities may occur.

Cumulative Effects

Cumulative effects are the sum of direct and indirect effects from the Kosciusko Project added to effects from other projects that have occurred in the past, are presently occurring, or are expected to occur in the near future. The following activities, in addition to the proposed activities of the action alternatives, may cumulatively affect sensitive species or their habitat within the project area: road construction, road storage or decommissioning, gravel extraction, timber harvest, special use activity, and recreation (for more details on these activities, see the *Past, Present and Reasonably Foreseeable Future Activities in the Kosciusko Project Area* document, available in the project record). Individually, any effects may be minor for a species, but together could result in cumulative effects that over time impact viability.

Sensitive Plants or Lichen Species

There would be no direct or indirect effects to *Lobaria amplissima*, Unalaska mist-maid, Henderson's checkermallow, and dune tansy, due to either Forest Plan Standards and Guidelines or habitat not occurring in the project area; therefore this project would not contribute to cumulative effects to these species. The determination for these species is: "No Impact" (see Botany BE).

Lesser round-leaved orchid has been found on Kosciusko Island; therefore, unknown populations could be impacted by future management activities or on state or private land. Therefore, the determination for this species is: "May adversely impact individuals, but not likely to cause a loss of viability in the planning area nor cause a trend towards federal listing" (see Botany BE).

No known populations of spatulate moonwort, moosewort fern, mountain lady slipper, yellow lady's slipper, Calder's lovage and Alaska rein orchid would be affected; however, since road construction, and timber harvest would affect habitat and could affect some unidentified plants/populations, the effects determination is: "May adversely impact individuals, but not likely to cause a loss of viability in the planning area nor cause a trend towards federal listing" (see Botany BE).

Rare Plants

Since there would be no direct or indirect effects to the rare plant species Pacific silver fir, maidenhair spleenwort, northern golden saxifrage, fragile rockbreak, mountain bladderfern, twinberry honeysuckle, Adder's-mouth orchid, Alaska oniongrass, Pacific ninebark, Douglas' spirea, western meadow-rue, and Carlott's violet, there would be no cumulative effects of any of the alternatives on these species.

Whiteflower rein orchid can be found within habitats that are considered to be productive forest in which land management activities may occur. The potential cumulative effects to undocumented individuals or the habitats of this species would be moderate on Kosciusko Island.

Invasive Plants

The Tongass National Forest used the Alaska Natural Heritage Program's (ANHP) Weed Ranking Project results to create the Tongass National Forest High Priority Invasive Plant Species List (see Invasive Plants Report). This is a list of plants for which we are initiating control measures across

the Forest. However, there are several species – *Phalaris arundinacea* (reed canary grass), *Leucanthemum vulgare* (oxeye daisy), orange hawkweed (*Hieracium aurantiacum*), and *Taraxucum officinale* (common dandelion) – that are well established and eradication would be impossible to achieve, so these species are not a high priority for control.

The majority of Kosciusko Island is occupied by both productive and unproductive old-growth forests, intermixed with peatland, riparian, and alpine plant communities that are typically unaltered. However, on Kosciusko Island, extensive forest areas have been logged, thus their plant communities have changed to early successional types that differ in character from old-growth forests. Regeneration is rapid and most of the logged areas are covered by dense stands of 15 to 70 year-old young growth.

There is an extensive existing road system on Kosciusko Island. The road system is utilized for timber harvesting activities and recreational purposes by residents and visitors. There are two marine access facilities near the project area in Edna Bay and Cape Pole, which could be used for the transfer of logs and equipment to and from the island.

Baseline plant surveys on Kosciusko Island were completed in 2007. Since 2007 Forest Service employees have been on Kosciusko Island several times for project-level botany and invasive surveys. Additional invasive plants have been identified along open and closed roads, as well as native settings, such as stream banks, karst features, and beach edges. Ten species of invasive plants were found during botany and invasive surveys, which have a ranking of 60 points or more based on the ANHP weed ranking or have been identified for treatment by the Thorne Bay Ranger District.

Table 27: Invasive Plant Species Present in the Project Area.

Rank	Scientific name	Common name	Code	Known Locations
76	*Cirsium arvense*	Canada thistle	CIAR4	One infestation on NFS 1500000 road near Cape Pole
61	*Cirsium vulgare*	Bull thistle	CIVU	One plant on road system west of Survey Cove; one infestation at Carwash springs
56	*Crepis tectorum*	Narrowleaf hawksbeard	CRTE3	Five infestations along the NFS 1500000 road near Cape Pole and NFS 1505000 and 1510000 roads
67	*Geranium robertianum*	Robert's geranium	GERO	One infestation under an abandoned building at Cape Pole
79	*Hieracium aurantiacum*	Orange hawkweed	HIAU	Ubiquitous on the open road system; also from several natural settings including Hardscrabble and Survey Creeks
61	*Leucanthemum vulgare*	Oxeye daisy	LEVU	Ubiquitous on the open road system and several natural settings, including wetland fens and along the beach
71	*Lupinus polyphyllus* ssp. *polyphyllus*	Bigleaf lupine	LUPOP2	Two infestations in Edna Bay on private land
83	*Phalaris arundinaceae*	Reed canary grass	PHAR3	Ubiquitous on the open road system and in several natural settings, including Hardscrabble and Survey Creeks
63	*Senecio jacobaea*	Tansy ragwort	SEJA	Scattered infestations known along the road system
63	*Schedonorus arundinaceus*	Tall fescue	SCAR7	Scattered infestations known along the road system

Environmental Consequences (Overall Risk Assessment)

The overall risk of high-priority invasive plant spread in the project area as a result of any of the action alternatives is “moderate to high”. The high risk component is associated with spread of invasive plant species already in the project area along new and existing system roads. This risk level was determined based on the following factors:

- Overall increase in new temporary road corridors and landings would be low to moderate (includes temporary roads as well as reconditioned road) and about 18 miles of road maintenance.
- Traffic use on newly constructed roads during the active timber sale is anticipated to be low. After the timber sale would be complete, temporary roads would be decommissioned and are expected to eventually revegetate, forming a closed canopy that will reduce spread and minimize establishment.
- Invasive plants should remain primarily along open road corridors with implementation of mitigation measures and soil BMPs.

Risk of new invasive plant introduction and spread of existing invasive plants into natural habitats and along temporary roads is “moderate and short term”. This risk level was determined based on the following factors:

- Temporary roads and forested areas are expected to rapidly regenerate which in turn reduces light exposure, thus decreasing the susceptibility of these habitats to infestation by invasive plants.
- Mitigation and monitoring measures, including targeted control and monitoring, should prevent the spread of new high-priority invasive species and those species not yet widely distributed.
- Existing high-priority invasive plants in the project area are generally shade-intolerant.

Overall Risk by Alternative

While the project area is not an area where the oxeye daisy, orange hawkweed, and reed canarygrass are being actively controlled, the risk of spread of these invasive plants along the road corridor is high. However, with implementation of soil erosion BMPs, the risk will be lessened. For example, immediately reseeding disturbed areas in new road construction corridors with the standard weed-free seed mix should lessen the time mineral soils are exposed and open to sunlight, and therefore encouraging the establishment of non-invasive species.

Risk of spread and establishment in natural habitats is moderate and not expected to increase as a result of the action alternatives due to mitigation and monitoring measures.

Alternative 1

There is no direct increased risk of invasive plants spreading into the project area due to proposed harvest activities or road building with this alternative. The risk level for Alternative 1 is low because there would be no new ground disturbance. Indirectly, even if there are no new activities in the project area, invasive plant species currently present would continue to spread due to existing traffic and natural vectors.

Alternatives 2, 3, and 4

All the action alternatives are expected to have a high risk of the spread of existing invasive plants along new and existing road corridors. Implementation of any of the action alternatives would result in additional spread of some high-priority invasive plants. Mitigation and monitoring measures should limit the establishment and spread of invasive plants not currently in the project area and could limit the spread of some existing high-priority invasive plants not already widely distributed. Alternative 3 would have the greatest risk due to amount of road management and harvest activities and Alternatives 2 and 4 would have slightly less, equivalent risk.

Mitigation Measures

- In order to avoid the introduction of new invasive plants into and out of the project area, equipment would be cleaned before entering the area and before equipment gets transported to another road system. The contracts would include equipment cleaning provisions for off-road equipment (both harvest and road equipment) and roadside brushing machines only. These provisions would apply if equipment comes from any location other than Kosciusko Island.
- Only Forest Service approved rock sources would be used. If available, rock material free of high-priority species would be required of all new road constructions and new landings. This would require an invasive species specialist to inventory all rock sources prior to use and certify in writing that they are acceptable. Many of the existing rock quarries in the project area have already been surveyed.
- Seed sources used to revegetate the roadsides and rock quarries are no longer a vector, since the Tongass National Forest requires a seed mixture that must be certified “weed-free” or contain no more than 0.01 percent other seed, whether identified or not. This “weed-free” seeding specification would be used in all revegetation efforts (National Core BMP Road-2).
- Any new introductions of high-priority invasive plants found in the project area would be treated according to Forest Service Manual supplement (TNF 2000-2007-1), and the *Region 10 and Tongass Invasive Plant Management Plan* as part of the District’s program of work for invasive species management.
- The following specific invasive plant species have been identified for manual treatment (hand-pulling) or monitoring based on their limited distribution in the project area, potential for spread, and feasibility for treatment: Canada thistle, bull thistle, narrow-leaf hawk’s beard, and tansy ragwort.

Monitoring Measures

- Newly constructed roads, existing roads that were improved, and any active rock quarries in the project area would be monitored for at least three years after project completion for new non-native plant introductions.
- Monitor treated plant populations as noted in Invasive Plants Report and according to the Tongass Invasive Plant Management Plan and the District’s program of work.
- Prioritize the control or eradication of newly introduced high-priority invasive plant species/populations not currently in the project area after project completion and prior to closing temporary roads as part of the District five-year program of work for invasive species management.

On-Going Treatments

Independent of the mitigation and monitoring measures recommended for the project, the Forest Service also has an ongoing invasive plant program of work. This work varies from year to year, and would continue as funding allows.

Heritage

Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties eligible to the National Register of Historic Places, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. The Forest Service conducted an investigation for Heritage resources within this undertaking's Area of Potential Effect (APE). Heritage resources include the aforementioned historic properties as well as traditional cultural properties and native sacred sites. The APE is defined in 36 CFR 800 (Protection of Historic Properties) as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. To investigate the APE, the Forest Service applied the provisions of the Third Programmatic Agreement (as amended) between the Alaska Region of the USDA Forest Service, the Alaska State Historic Preservation Officer (AK SHPO), and the Advisory Council on Historic Preservation (PA). In the PA, there are two sensitivity zones in the Alaska Region recognized: high and low. Sensitivity zones are dynamic estimates or approximations based on interpretation of data from previous cultural resource investigations. Over 651 acres of the undertaking's APE was investigated which included areas of high and low sensitivity for the aforementioned resources. Twenty-three historic properties were recorded and determined potentially eligible to the National Register of Historic Places- each of which have been removed from the APE.

Direct and Indirect Effects

Alternative 1

The No Action Alternative would result in no changes to the existing condition. Recreation and subsistence uses associated with modern lake and marine shorelines, as well as activities associated with existing roads, facilitate access to locales of high sensitivity for Heritage resources. Alternative 1 would not change that situation.

Alternatives 2, 3, and 4

Based on the results of the required archaeological examination of the APE for the undertaking Alternatives 2 through 4 contain no proposed harvest units or roads that would have a direct and significant effect on extant Heritage resources. All significant Heritage resources found during the field investigation or prior to investigation were removed from the undertaking's APE. For Heritage purposes, the effects of the alternatives are "No Historic Properties Affected". For Alternatives 2, 3, and 4, there would be no direct effects.

Due to the small inhabitant population on the island relative to its size, harvest and road construction would not significantly increase access and visitation to areas of high sensitivity for heritage resources. All proposed new roads would be decommissioned or put into storage after harvest activities are complete. No indirect effects are anticipated from these alternatives.

Cumulative Effects

Based on the analysis of similar past and present timber harvests in which extant Heritage resources were removed from the project APE and looking at reasonably foreseeable future actions on NFS and other lands, there are no anticipated cumulative effects to extant Heritage resources for the proposed undertaking. In order to confirm or deny this supposition, archaeological monitoring would be conducted on the harvest while it is ongoing and after it has been completed.

Conclusion

As required by federal regulations this undertaking was investigated for potential impact to extant Heritage resources eligible to the National Register using the methodology stipulated in a Programmatic Agreement between USDA Forest Service, the Alaska State Historic Preservation Officer, and the Advisory Council on Historic Preservation. Over 651 acres of land defined as high and low sensitivity by that agreement was examined and 23 potentially eligible historic properties were found. In order to avoid an adverse effect to any of the historic properties by the undertaking each was removed from the area of potential effect. There are no anticipated direct, indirect, or cumulative effected expected from this undertaking on those Heritage resources. In order to confirm or deny this supposition, archaeological monitoring would be conducted on the harvest, while it is ongoing and after it has been completed. Each Heritage resource would be monitored during the harvest to ensure they are not affected also. The final determination for this undertaking, as per 36 CFR 800, is “No Historic Properties Affected”.

Climate Change

It is not currently feasible to reliably quantify the effects of individual or multiple projects on global climate change; therefore, determining significant effects of project alternatives on global climate change cannot be made at any scale (USDA Forest Service 2009a; see Climate Change Report for full citation). Even at the Forest Plan level, differences between alternatives in terms of the effects of climate change on the Tongass are uncertain, unquantifiable, and likely to be insignificant (especially when compared to other routine human activities in the area). This analysis provides a qualitative assessment of the possible impacts of the proposed alternatives on climate change, but does not attempt to calculate quantifiable impact values.

Direct and Indirect Effects

Alternative 1

Climate Change

The current rate of climate change would likely continue with the implementation of Alternative 1. While it is not possible to quantify changes this project might have on local, regional, or global climate change, it is reasonable to assume that this alternative would have less of an effect than the action alternatives.

Carbon Sequestration

The rate of carbon sequestration would likely continue at the current rate if this alternative was chosen.

Alaska Yellow Cedar Regeneration

Yellow cedar decline and regeneration would likely continue at the same rate if Alternative 1 was selected. Decline and regeneration of Alaska yellow cedar is directly related to seasonal snow pack (loss of snow cover at lower elevations) and thawing cycles in late winter, and the No Action Alternative is not anticipated to have an effect on either factor.

Greenhouse Gas Emissions

The carbon dioxide equivalent (CO_2e) is the unit typically used when reporting greenhouse gasses (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). Under the No Action Alternative, CO_2e emissions are anticipated to stay the same. No new construction-related CO_2e emissions would be generated; however, CO_2e production would continue on Kosciusko Island as a result of existing vehicle, aviation, and other commercial and private activity.

Alternatives 2, 3, and 4

Climate Change

The action alternatives are expected to have no measurable impact on the global, regional, or local climate. It is reasonable to assume the action alternatives would lead to slightly higher levels of CO_2e emissions related to the changes in old-growth versus young-growth forests within the project area. The increase in greenhouse gas (GHG) emissions produced as a result of the project operations is also predicted to not lead to any measurable or long-term changes in climate.

Carbon Sequestration

Mature forests in Alaska are considered carbon “sinks”, meaning these forest stands accumulate more carbon than they release (USDA Forest Service 2008a, p. 3-17; see Climate Change Report for full citation). The regeneration of trees that follow timber harvest has rapid growth relative to old-growth, which also accumulates carbon into the system.

Overall, under the action alternatives, the rate of carbon sequestration would likely continue at the current rate, and a quantifiable change from implementation of either alternative would be difficult to detect, and would not lead to measurable effects locally, regionally, or globally.

Alaska Yellow Cedar Regeneration

The action alternatives are not expected to affect the rate of Alaska yellow cedar decline and regeneration. Decline and regeneration of Alaska yellow cedar is directly related to seasonal snow pack (loss of snow cover at lower elevations) and thawing cycles in late winter, and these alternatives are not anticipated to have an effect on either factor.

Greenhouse Gas Emissions

For all action alternatives, road construction activities, timber harvest operations, and administration of the project would result in a slight and temporary increase in the emission of greenhouse gases due to CO_2e emissions from fuel combustion during sale activities.

The relative amounts of GHGs for each action alternative is proportional to the amount of road construction and harvest operations. Each alternative would have an insignificant overall contribution to GHGs at any scale.

Cumulative Effects

All Alternatives

None of the alternatives proposed in this EA, combined with any past, present, or reasonably foreseeable activities, are predicted to contribute any measurable effects to climate change, carbon sequestration, Alaska yellow cedar regeneration and decline, or greenhouse gas emissions locally, regionally, or globally.