BIOLOGICAL EVALUATION FOR PLANTS

Tongass National Forest Plan Amendment

SIGNATURE

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INTRODUCTION

Forest Service policy requires that a review of programs and activities through an effects analysis be conducted to determine their potential effect on threatened and endangered species, species proposed for listing and Regional Forester designated sensitive species. The purpose of this document is to present the analysis and determination of effects of the alternatives on federally listed species (endangered, threatened, and proposed) and Forest Service sensitive species (Forest Service Manual [FSM] 2670.31-2670.32).

For threatened and endangered species and species proposed for listing, the analysis and document are referred to as a Biological Assessment, or BA. No plants federally listed or proposed by the U.S. Fish and Wildlife Service are known or suspected to occur in the Alaska Region; therefore, there will be no further discussion of federally listed or proposed plants.

For sensitive species, the analysis and document are referred to as a Biological Evaluation or BE (FSM 2670.3). Preparation of a BE as part of the National Environmental Policy Act (NEPA) process ensures that sensitive species receive full consideration in the decision-making process. Sensitive plants are those plants identified by the Regional Forester for which population viability is a concern on National Forest System (NFS) lands within the region. A viability concern is identified by either a significant existing or predicted downward trend in population numbers or density, or a significant existing or predicted downward trend in habitat capability that would reduce a species' existing distribution. The objective of the Forest Service Sensitive Species Program (FSM 2600) (USDA Forest Service 1991) is to ensure that species numbers and population distributions are adequate so that no federal listing will be required and no extirpation will occur on NFS lands. Revisions to the Regional Forester's Sensitive Plant Species list are periodically completed based on new information derived from recent publications, fieldwork, and laboratory analysis. The Alaska Region Sensitive Species list was updated in 2009 (Goldstein et al. 2009). Seventeen plants are designated as sensitive in the Alaska Region; 13 of these are known to occur on the Tongass National Forest (Tongass N.F. or Forest), with an additional two suspected to occur. One sensitive lichen species is also designated as sensitive and is known to occur on the Tongass. The 15 sensitive plants and one lichen known or suspected to occur in the Tongass National Forest are listed in Table 1. This table includes a general range and habitat description for each species.

PROJECT DESCRIPTION

The 2016 Forest Plan Amendment describes and analyzes proposed changes to the current Tongass National Forest Land and Resource Management Plan (Forest Plan; USDA Forest Service 2008) to accomplish the transition to young-growth management as provided in the Secretary of Agriculture, Thomas Vilsack's Memorandum 1044-009, *Addressing Sustainable Forestry in Southeast Alaska* (USDA 2013). The Final Environmental Impact Statement (FEIS; USDA Forest Service 2016) evaluates which lands will be available for timber harvest, especially young-growth timber stands, and any changes or additions to management direction needed to promote and speed the transition

to young-growth management while maintaining a viable timber industry in Southeast Alaska. The 2016 FEIS also describes and analyzes proposed changes related to renewable energy development, and other changes suggested in the 2008 Forest Plan Five-Year Review and internal and external scoping, as warranted. The scope of the analysis is limited to these proposed changes. The currently approved Forest Plan (USDA Forest Service 2008) includes forest-wide multiple-use goals and objectives that guide the overall management for the Forest and establish the desired conditions for implementing the Plan.

The FEIS (2016) analyzes in detail four alternatives for amending the Plan in addition to the No-Action Alternative. Please see Chapter 2 of the 2016 FEIS for complete description of alternatives.

ALTERNATIVES

Alternative 1 (No Action)

The No Action Alternative represents current management direction (2008 Forest Plan) and includes the application of the Roadless Area Conservation Rule (2001 Roadless Rule) (36 Code of Federal Regulations 294 Subpart B). Alternative 1 would result in the largest old-growth harvest among the alternatives over both 25-year and 100-year periods. Under this alternative, timber harvest would occur at a rate of 46 million board feet (MMBF) per year (equivalent to the harvest needed to meet the projected timber demand). It would emphasize young growth and minimize old growth while maintaining 46 MMBF per year. As such, it is expected to produce about 7 MMBF of young growth and 39 MMBF of old growth per year during the first 10 years. From Year 10 through Year 25, this alternative is projected to produce about 10 MMBF of young growth and 36 MMBF of old growth per year. At about Year 33, the young-growth harvest is expected to increase to about 41 MMBF and the old-growth harvest would be decreased to 5 MMBF per year. The young-growth harvest is expected to continue to increase at a rapid rate after Year 33 and is expected to reach an upper limit of about 129 MMBF in about Year 38. The old-growth harvest rate would be held at 5 MMBF per year to support small and micro sales. Timber management would be restricted to the development Land Use Designations (LUDs) and no commercial harvest would be allowed in beach and estuary buffer or Riparian Management Areas (RMAs). The 2008 Forest Plan management direction would be followed.

For Alternative 1, over 80 percent of the Forest would remain in a natural state, including inventoried roadless areas (IRAs). Old-growth conditions would prevail on lands within these roadless areas. Old-growth harvest would continue at a declining rate, compared with current conditions, while young growth harvest would increase as young-growth stands mature and become increasingly economic. Recreation, tourism, and subsistence opportunities emphasize natural setting types, although roaded opportunities expand slightly from current conditions due to construction of additional roads outside of IRAs.

Alternative 2 (Proposed Action)

Alternative 2 would differ substantially from Alternative 1 in terms of young-growth harvest. Young-growth management would be allowed in both development and non-development LUDs (except for Congressionally designated and administratively withdrawn areas, such as Wilderness, and islands less than 1,000 acres in size), in beach and estuary buffer, RMAs outside of Tongass Timber Reform Act (TTRA) buffers, and high-vulnerability karst. No harvest would occur in IRAs that have not been roaded. However, the portions of IRAs that were roaded before the 2001

Roadless Rule and during the 2001 Roadless Rule exemption period for the Tongass would be available for young-growth and old-growth harvest after rulemaking.

Young-growth management may include clearcutting in all areas, except in RMAs and on high-vulnerability karst, where only commercial thinning (up to 33 percent basal area removal) would be allowed. After 15 years, clearcutting would not be allowed in the beach and estuary buffer and only commercial thinning would be allowed.

This alternative would harvest timber at a rate of 46 MMBF per year (equivalent to the harvest needed to meet the projected timber demand), emphasizing young growth and minimizing old growth. However, among the action alternatives, Alternative 2 would provide the largest amount of timber volume (old growth and young growth combined), including the largest amount of young-growth volume from lands suitable for timber production. It would result in the smallest amount of old-growth timber volume over both 25-year and 100-year periods. As such, this alternative is expected to produce an average of about 22 MMBF of young growth and 24 MMBF of old growth per year during the first 10 years. From Years 11 through 15, Alternative 2 is projected to produce an average of 61 MMBF of young growth and 5 MMBF of old growth per year. Alternative 2 would likely reach a full transition harvest of 41 MMBF of young growth about Year 12. Young-growth harvest is expected to continue to increase at a rapid rate after Year 12 and is expected to reach an upper limit of about 120 MMBF in Year 17. The old-growth harvest rate would be held at 5 MMBF per year to support small and micro sales.

Over 80 percent of the Forest would remain in a natural state under Alternative 2. The portions of the IRAs that were roaded before the 2001 Roadless Rule and during the 2001 Roadless Rule exemption period for the Tongass would be available for harvest after rulemaking. Old-growth conditions would prevail on forest lands within IRAs that have not been roaded. Young growth may be harvested by clearcutting and other prescriptions in natural setting LUDs and beach and estuary buffer, but only commercial thinning (33 percent basal area removal) would occur in RMAs outside of TTRA buffers. A small old-growth based industry would continue after transition with an annual volume of about 5 MMBF being offered through the small and micro sale programs. A mixture of old growth, recently harvested areas, and various ages of young growth would occur within the roaded IRAs. Recreation, tourism, and subsistence opportunities would continue to emphasize natural setting types, although some additional roaded opportunities would be developed.

Alternative 3

Alternative 3 would allow old-growth harvest only in Phase 1 of the existing timber sale program adaptive management strategy (USDA Forest Service 2008a). Alternative 3 identifies lands suitable for young-growth timber production in both development and natural setting LUDs (except for Congressionally designated areas such as Wilderness, and administratively withdrawn areas and islands less than 1,000 acres in size), as well as in beach and estuary buffer and high-vulnerability karst, but not in RMAs outside of TTRA buffers. Young-growth management may include clearcutting in all areas, except in beach and estuary buffer and on high-vulnerability karst, where only commercial thinning is allowed.

Among the action alternatives, Alternative 3 would provide the second largest amount of timber volume (old growth and young growth combined). It would result in the second lowest harvest of old growth over both the 25-year and 100-year periods. This alternative would harvest timber at a rate of 46 MMBF per year. As such, it is expected to produce an average of about 20 MMBF of young growth and 26 MMBF of old growth per year during the first 10 years. From Year 11

through Year 15, this alternative is projected to produce an average of 50 MMBF of young growth and about 5 MMBF of old growth per year. Alternative 3 would likely reach a full transition harvest of 41 MMBF of young growth at about Year 13. Young-growth harvest is expected to continue to increase at a rapid rate after Year 13 and is expected to reach an upper limit of about 117 MMBF in Year 17. The old-growth harvest rate would be held at 5 MMBF per year to support small and micro sales.

Over 80 percent of the Forest would remain in a natural state. Old-growth conditions would prevail on forest lands within the IRAs. Young-growth harvest would be increasingly emphasized during a transition period over the next 10 to 15 years. Young growth would be harvested by clearcutting and other prescriptions in non-development LUDs, but only commercial thinning would occur in beach and estuary buffer. A small old-growth based industry would continue after transition with an annual volume of about 5 MMBF being offered through the small and micro sale programs. A mixture of old growth, recently harvested areas, and various ages of young growth would occur within roaded areas. Recreation, tourism, and subsistence opportunities would continue to emphasize natural setting types, although some additional roaded opportunities would be developed.

Alternative 4

Like Alternative 3, this alternative would allow old-growth harvest only in Phase 1 of the existing timber sale program adaptive management strategy. Similar to Alternative 1, this alternative includes the application of the 2001 Roadless Rule.

Alternative 4 would allow young-growth management only in the development LUDs except for riparian management areas (RMAs) outside of TTRA buffers and high-vulnerability karst. Young growth management may not include clearcutting in beach and estuary buffer and on high-vulnerability karst, where only commercial thinning is allowed.

Among the action alternatives, Alternative 4 would provide the lowest amount of timber volume (old growth and young growth combined) and the smallest amounts of young-growth volume in the suitable base. It would result in the second highest harvest of old growth during both the 25-year and 100-year periods. This alternative would harvest timber at a rate of 46 MMBF per year (equivalent to the harvest needed to meet the projected timber demand). It would emphasize young growth and minimize old growth while maintaining 46 MMBF per year. This alternative is expected to produce an average of about 11 MMBF of young growth and 35 MMBF of old growth per year during the first 10 years. From Year 11 through Year 15, it is projected to produce an average of 26 MMBF of young growth and about 20 MMBF of old growth per year. Alternative 4 would likely reach a full transition harvest of 41 MMBF of young growth about Year 16. Young-growth harvest is expected to continue to increase at a rapid rate after Year 16 and is expected to reach an upper limit of 87 MMBF about Year 18. The old-growth harvest rate would be held at 5 MMBF per year to support small and micro sales.

Over 80 percent of the Forest would remain in a natural state; including the 2001 Roadless Rule IRAs. Old-growth conditions would prevail on forest lands within the IRAs. Young growth would be harvested only by commercial thinning in beach and estuary buffer and on high-vulnerability karst. A small old-growth based industry would continue after transition with an annual volume of about 5 MMBF being offered through the small and micro sale programs. A mixture of old growth, recently harvested areas, and various ages of young growth would occur within IRAs. Recreation, tourism, and subsistence opportunities would continue to emphasize natural setting types, although some additional roaded opportunities would be developed.

Alternative 5 (Preferred Alternative)

Alternative 5 is the Forest Service Preferred Alternative. This alternative would allow old-growth harvest only within Phase 1 of the timber sale program adaptive management strategy. As in Alternatives 1 and 4, the 2001 Roadless Rule would apply and no old-growth or young-growth harvest would occur.

Alternative 5 differs from Alternative 1 in terms of young-growth harvest in that it would allow young-growth harvest in all three phases of the timber sale adaptive management strategy. It would allow young-growth management in development LUDs and in the Old-growth Habitat LUD including harvest in beach and estuary buffer and RMAs outside of TTRA buffers within these same LUDs. However, harvest in Old-growth Habitat LUD, beach and estuary buffer, and riparian management areas (RMAs) outside of TTRA buffers would be allowed only during the 15 years after Plan approval. In the Old-growth Habitat LUD, beach and estuary buffer (outside of a 200-foot buffer), and RMAs outside of TTRA buffers only group selection (up to 10-acre openings) or commercial thinning are allowed.

Among the action alternatives, Alternative 5 would provide the second smallest amount of timber volume (old growth and young growth combined), but the second largest amount of young-growth volume in the suitable base. This alternative would harvest timber at a rate of 46 MMBF per year (equivalent to the harvest needed to meet the projected timber demand). It would emphasize young growth and minimize old growth while maintaining 46 MMBF per year. As such, this alternative is expected to produce an average of about 12 MMBF of young growth and 34 MMBF of old growth per year during the first 10 years. From Year 11 through Year 15, it is projected to produce an average of 28 MMBF of young growth and about 18 MMBF of old growth per year. Alternative 5 would likely reach a full transition harvest of 41 MMBF of young growth about Year 16. Young-growth harvest is expected to continue to increase at a rapid rate after Year 16 and is expected to reach an upper limit of 98 MMBF about Year 18. The old-growth harvest rate would be held at 5 MMBF per year to support small and micro sales.

Over 80 percent of the Forest would remain in a natural state, including IRAs. Old-growth conditions would prevail on forest lands within the IRAs. Young-growth harvest would be increasingly emphasized during a transition period over the next 10 to 15 years. Young growth is harvested only by patch cutting or commercial thinning in non-development LUDs, beach and estuary buffer, and RMAs outside of TTRA buffers. A small old-growth based industry would continue after transition with an annual volume of about 5 MMBF being offered through the small and micro sale programs. A mixture of old growth, recently harvested areas, and various ages of young growth would occur within roaded areas. Recreation, tourism, and subsistence opportunities would continue to emphasize natural setting types, although some additional roaded opportunities would be developed.

FOREST-WIDE DESIGN STANDARDS AND PROTECTIONS

Design standards and protections that will mitigate project effects on sensitive plants remain the same as described in the 2008 Forest Plan. No changes have been made to Forest-wide desired conditions for sensitive plants (see 2008 Forest Plan Amendment, page 2-1), goals and objectives (see 2008 Forest Plan Amendment, pages 2-4 and 2-5), or standards and guides for Plants (see 2008 Forest Plan Amendment, page 4-41). These include the following:

- Sensitive plants known to occur outside a future project footprint shall be left undisturbed.

- Collecting plants or plant parts shall not be allowed except by permit issued by the Forest Supervisor for scientific or educational purposes.
- Partial cutting, directional felling, and partial retention of trees shall be considered in some areas and will help to avoid known sensitive plant populations.

KNOWN AND SUSPECTED SENSITIVE PLANTS INCLUDED IN THE ANALYSIS

Seventeen vascular plants and one lichen are designated by the Regional Forester as sensitive in the Alaska Region (Appendix A). The following 15 sensitive plants and 1 lichen are known or suspected to occur on the Tongass National Forest:

(*Aphragmus eschscholtzianus*) Eschscholtz's little nightmare – Suspected
(*Botrychium spathulatum*) Spatulate moonwort – Known
(*Botrychium tunux*) Moosewort fern – Known
(*Botrychium yaaxudakeit*) Moonwort fern, no common name – Known
(*Cirsium edule* var. *macounii*) Edible thistle – Known
(*Cypripedium montanum*) Mountain lady's slipper – Known
(*Cypripedium parviflorum* var. *pubescens*) Large yellow lady's slipper – Known
(*Ligusticum calderi*) Calder's lovage – Known
(*Lobaria amplissima*) lichen, no common name – Known
(*Papaver alboroseum*) Pale poppy – Suspected
(*Piperia unalascensis*) Alaska rein orchid – Known
(Platanthera orbiculata) Lesser round-leaved orchid – Known
(*Polystichum kruckebergii*) Kruckeberg's swordfern – Known
(*Romanzoffia unalaschcensis*) Unalaska mist-maid – Known
(*Sidalcea hendersonii*) Henderson's checkermallow – Known
(*Tanacetum bipinnatum* subsp. *huronense*) Dune tansy – Known

Review of Existing Information

Sensitive plant surveys have not been conducted across all landscapes on the Tongass National Forest; therefore, our understanding of sensitive plant distributions in the Planning Area is limited because most botanical surveys that are conducted focus on specific project areas. Sensitive plant surveys are ongoing as part of project planning to identify populations or habitats of sensitive species within specific project areas. A review of existing information concerning the plants listed above is based on the most recent data and literature for each species (USDA Forest Service 2015). This review included the Regional Forester's Sensitive Species List, Alaska Region's rare plant database (NRIS-TESP), Alaska Natural Heritage Program (ANHP) data base records, ARCTOS database, and Consortium of Pacific Northwest Herbaria records. Additional literature reviews include those references cited in USDA Forest Service (2015).

Table 1 provides a general range and habitat description for each sensitive plant and lichen species.

Table 1
2009 Alaska Region Sensitive Plants Known or Suspected to Occur on the Tongass National Forest[1]

Common Name (*Scientific Name*)	Range and Habitat[2]
Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*)	This plant grows in southern Alaska and adjacent Canada in a band extending from the Aleutians through the southwest Yukon. There are also disjunct populations on the Seward Peninsula and in the Brooks Range. It is **suspected** to occur in mountainous areas on the northern mainland of the Tongass. It grows in moist mossy areas, seeps, heaths, and scree slopes in subalpine and alpine areas. Because the plant is so small, it is easily overlooked. This plant is suspected on, but has not been documented on the Tongass.
Spatulate moonwort (*Botrychium spathulatum*)	This plant is distributed from the upper Great Lakes east to southeastern Quebec, as well as in the mountains of northern Montana and Idaho to the Wrangell-St. Elias Range in Alaska. In southeastern Alaska, populations are **known** from Kruzof Island (on lands managed by the state of Alaska, which is surrounded by the Tongass) and a small population on Chicagof Island on the Tongass (USDA-FS 2015). Habitat includes coastal forests, stabilized coastal dunes, upper beach meadows, well-drained open areas, alpine habitats, and riparian forests.
Moosewort fern, no common name (*Botrychium tunux*)	Moosewort fern grows on upper beach meadows, coastal dunes, stream terraces, river bars and subalpine and alpine slopes. There are nine **known** occurrences of this species on the Tongass; seven on the Yakutat Ranger District, one on the Wrangell Ranger District, and one in the Admiralty National Monument.
Moonwort fern, no common name (*Botrychium yaaxudakeit*)	Wrangell St. Elias Range to Glacier bay, southwest across Canada to Alberta; with disjunct alpine populations in Montana, Oregon and California. Across its range, this fern grows on upper beach meadows, beach dunes, coastal outwash plains, abandoned fields and roadsides. There are 11 **known** occurrences in Alaska (ANHP 2015), including five occurrences in beach meadows on the Yakutat Ranger District.
Edible thistle (*Cirsium edule* var. *macounii*)	This plant ranges from southern southeast Alaska, disjunct to southern British Columbia, to the Cascades and Olympics of Washington and northern Oregon. It grows in moist to dry open meadows, open forests in the upper montane to lower alpine zone, on scree slopes and talus slopes, and along glacial streams and lakeshores. There are 2 **known** occurrences of edible thistle on the Tongass, both on the Ketchikan-Misty Fiords Ranger District.
Mountain lady's slipper (*Cypripedium montanum*)	This orchid ranges from California north to British Columbia and east to the Rockies of Alberta, Idaho, and Montana. In Alaska, it is **known** from Glacier Bay, the Haines area and Etolin Island. Habitat includes upper beach meadows, areas along the beach-forest ecotone, open forests, muskegs, and wet meadows. It is often found on calcareous substrates. There is one **known** population on the Tongass; on Etolin Island in the Wrangell Ranger District.
Large yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens*)	This plant's range is discontinuous and extends across boreal North America and south to Montana. On the Tongass, this orchid grows in peatlands on calcareous substrates (USDA Forest Service 2015). There are two **known** occurrences of large yellow lady's slipper on the Tongass, both on northern Prince of Wales Island.
Calder's lovage (*Ligusticum calderi*)	This plant is endemic to coastal British Columbia and southeast Alaska and is known from Vancouver Island north through the southern part of the Tongass (Dall and Prince of Wales Islands). Habitat includes alpine and subalpine meadows, boggy slopes, open mixed conifer forests, and rocky areas. There are 24 **known** occurrences on the Tongass; 23 on the Craig Ranger District and one on the Thorne Bay Ranger District.
Lichen, no common name (*Lobaria amplissima*)	In North America, this lichen is known primarily from Alaska, although one occurrence has been documented from California. There are 30 **known** occurrences on the Tongass. This lichen grows on trunks and main branches of Sitka spruce, Pacific crab apple (*Malus fusca*), and western hemlock in old-growth beach buffer forest (Dillman 2004 as cited in Goldstein et al. 2009)).

Table 1
2009 Alaska Region Sensitive Plants Known or Suspected to Occur on the Tongass National Forest[1] (continued)

Common Name (*Scientific Name*)	Range and Habitat[2]
Pale poppy (*Papaver alboroseum*)	Pale poppy is distributed from Kamchatka and northern Kurile Islands; across the Aleutians to south central Alaska, Alaska Rangeland the east side of the Juneau Icefields in north central British Columbia. This plant grows in open, well-drained areas, in rocky tundra of ridges and mountain summits, ash and cinder slopes, and in sand and gravel of glacial outwash and river floodplains (FNA 2014). Occasional disturbance can create or maintain habitat; infrequent (versus continuous) disturbances (e.g., stabilized roadsides, railroad track beds) by humans can create habitat (Goldstein et al. 2009). Although **suspected** to occur on the Tongass, there are no known occurrences on the Tongass. This plant is no longer listed on the ANHP rare plant list.
Alaska rein orchid (*Piperia unalascensis*)	The range extends disjunctly from Unalaska east to southeastern Alaska, south into northern California, along the Sierra Nevadas into Mexico, and south along the Rocky Mountains into Utah. There are also disjunct populations in Colorado, New Mexico, Montana, South Dakota and Newfoundland. This plant is **known** from 18 occurrences on the Tongass. Habitat includes dry open sites, under tall shrubs in riparian areas, mesic meadows, drier areas in coniferous and mixed evergreen forests, and bogs and heath habitat from low to subalpine elevations. On the Tongass, this plant generally grows in low-productivity forests at lower elevations in poorly drained soils (Dillman 2011).
Lesser round-leaved orchid (*Platanthera orbiculata*)	This plant is widely distributed across North America from southeastern Alaska disjunctly across boreal and north temperate North America to Tennessee and South Carolina. Throughout its range, it occurs in a variety of habitats including temperate, boreal, deciduous, and wetland forests (Dillman 2008). In Alaska, it grows in low elevation forested wetlands, medium to high volume old-growth hemlock forests with high bryophyte cover and a red cedar component, forest edges or near gaps in shady forests, and near muskegs, open water, or boggy areas (Dillman 2008). There are 291 distinct occurrences, comprising 61 distinct populations **known** on the Tongass (USDA Forest Service 2015).
Kruckeberg's swordfern (*Polystichum kruckebergii*)	This fern's range includes disjunct populations in southeast Alaska, the Cascades and Coast Range of British Columbia, mountains of northern California, and the Rockies (centered on Idaho). There are nine **known** occurrences comprising three distinct populations in southeast Alaska; one in a development LUD (Timber Production) on the Ketchikan-Misty Fiords Ranger District, one within a non-development (Wilderness) LUD on the Sitka Ranger District, and one on non-National Forest lands. Habitat includes open ultramafic rock outcrops.
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	This plant ranges from the Aleutian Islands through Prince William Sound, disjunct to the Tongass. It grows on ledges and crevices in rock outcrops and in gravelly areas along stream banks, often along coasts. There are two **known** occurrences on the Tongass; both on the Thorne Bay Ranger District.
Henderson's checkermallow (*Sidalcea hendersonii*)	Endemic to the Pacific Northwest from Oregon to British Columbia with a disjunct population in Alaska. Its habitat includes wet meadows, estuaries, and tidal flats (Douglas et al. 1999). On the Tongass, the one **known** population grows at the upper edge of an upper beach meadow near the edge of a hemlock and spruce forest (USDA Forest Service 2015). This population was located on the Juneau Ranger District; however, during surveys of the site conducted in 2013, the population was not located (USDA FS 2015).
Dune tansy (*Tanacetum bipinnatum* subsp. *huronense*)	This species is distributed disjunctly across boreal and arctic North America and disjunctly south along the Pacific coast to California. Habitat for this species includes upper beaches, sand dunes, and well drained and calcareous soils. There is one **known** occurrence of this species on the Tongass, on a sandy beach of Kruzof Island on the Sitka Ranger District.

[1] Sensitive Plant list updated February 2009.
[2] Range, habitat, and occurrence information, unless otherwise noted, based on Goldstein et al. 2009; Nawrocki et. al. 2013; USDA Forest Service 2012; and USDA Forest Service 2014

EFFECTS ANALYSIS

Spatial Context for Effects Analysis

The management area for this analysis includes all areas that would be directly and indirectly affected by the proposed actions associated with timber harvest, thinning treatments, road construction, and renewable energy development where habitat alteration can reasonably be expected.

The species to be addressed include all 15 sensitive plants and one lichen on the Regional Forester's Sensitive species list (see above) that are known or suspected on the Tongass National Forest.

The analysis area for this BE is the Tongass National Forest (e.g., the Planning Area), which includes all biological populations existing in whole or in part of the management area. The analysis area is that area where we consider how direct effects of management actions will influence population viability.

The cumulative effects area is Southeast Alaska, including both NFS and non-NFS lands and includes those management actions from past, present and the near future that may have affected or have the potential to affect individuals, populations, and the reproductive and dispersal capabilities of sensitive plants or their habitats.

Temporal Context for Effects Analysis

Temporal context for direct effects is immediately or shortly after an action is made that may influence sensitive plants. Indirect and cumulative effects may be measured in years since it may take a long time before deleterious effects are evident in relation to sensitive plant numbers or populations.

Past Projects

Past projects considered in the cumulative effects analysis generally are physically located on the Forest, such as roads and landings, rock quarries and harvest units. Examples of past projects include timber harvesting of old-growth forests, thinning of young-growth forests, communication sites, hydroelectric projects, watershed restoration, recreation development, road construction and maintenance, log transfer facilities (LTF) site construction, housing and building development and dispersed private lands, and Forest Highway improvements. See Appendix C, Table C-1 of the FEIS (2016) for a complete listing of past projects on the Tongass National Forest. From about 1991 to the present, Forest Service activities have recommended protection of known sensitive plants from direct, indirect and cumulative effects if present in the Planning Area.

Present and Reasonably Foreseeable Projects

Present and future actions include old-growth timber harvest, young-growth treatments (thinning), road construction and maintenance, renewable energy development, and others. Reasonably foreseeable future projects are those projects, which currently have a proposed action. Appendix C-1 of the FEIS (2016) presents a summary of these projects.

Direct, Indirect and Cumulative Effects

Direct effects to sensitive plants due to project activities include:

Physical Damage—Plants may be destroyed or damaged through crushing by logging equipment and activities associated with tree felling and yarding. Road building would completely bury or remove plants or entire populations if they were located in the roadbed and could damage plants or populations of plants that are located along the perimeter of the road embankment. Individual tree species will be harvested and removed from the forest. Other trees may be knocked over or broken due to logging practices.

Construction of renewable energy projects and associated utility lines would also involve temporary and permanent removal of vegetation within the path of the road or construction footprint. Additionally, if a hydroelectric power project involves creation of a reservoir, inundation would result in the permanent removal of vegetation within the inundation zone. These activities could affect sensitive plants that inhabit the specific habitat found within the location of a new road, renewable energy project facility or utility line corridor. Roads and utility lines can be constructed in many types of habitat, depending on the need for access for forestry activities or energy transmission.

Indirect effects to sensitive plants due to project activities may include the following:

Hydrology—Road building can alter the hydrology, as surface and ground water may be redirected and channelized by roadside ditches, altering the hydrologic regime. Increased water levels may result in the death or decline in vigor of plants not adapted to a high water table. Conversely, plants adapted to wetland conditions may become desiccated by a decrease in water availability.

Light Levels—Partial or complete removal of the tree canopy or changes in vegetation structure results in an increase in the light levels in the understory, resulting in light levels beyond the tolerance for shade dependent species. Once the stand regenerates, light levels will decrease with increasing canopy cover due to high density of small conifers. This too may alter normal light requirements for many species, including sensitive plants.

Other – Several other types of indirect effects may result from proposed actions, including herbivore or pollinator behavior, soil structure and fertility changes, fragmentation of habitat, and competition from other native species plants as well as invasive and other non-native plants.

Some indirect effects, such as changes in sunlight or moisture, can be beneficial or harmful depending on the effect and the species' life history. For example, if a plant has habitat requirements of partial sun, then increasing the size of a forest opening may benefit that species, however, that same opening may be harmful to a plant that requires shade.

Cumulative effects to sensitive plants due to project activities may include the following:

The cumulative effects analysis includes the sum of the direct and indirect effects from current projects, past projects, or project that are expected to occur in the near future. Individually, these effects may be minor, but together they can result in cumulative effects over time.

ENVIRONMENTAL CONSEQUENCES

The alternatives described in Chapter 2 of the FEIS (2016) differ in the locations, type, and extent of timber harvest. Effects from the proposed alternatives will mainly apply to productive old-growth (POG) and young-growth forests. Although there will be effects on unproductive forest, non-forest or other vegetation types, these effects will be limited since these vegetation types will not be the focus of any proposed action. Renewable energy projects and road construction activities

(construction, reconstruction and maintenance) will affect unproductive forest, non-forest and other vegetation types. This section compares effects of the five alternatives on sensitive plants. There would be no effects to threatened or endangered plants because none are known on the Tongass.

Effects Common to All Alternatives

Direct effects of the proposed alternatives on sensitive plants during timber harvest would include physical damage by cutting, trampling, or crushing them with vehicles, other machinery, foot traffic, or felled trees. Severe impacts may cause mortality, or inhibit the vigor and reproductive capability of the plants.

Construction of new roads and construction of renewable energy projects and associated utility lines would also involve temporary and permanent removal of vegetation within the path of the road or construction footprint. Additionally, if a hydroelectric power project involves creation of a reservoir, inundation would result in the removal of vegetation within the inundation zone. These activities could affect sensitive plants that inhabit the specific habitat found within the location of a new road, renewable energy project facility or utility line corridor. Roads and utility lines can be constructed in many types of habitat, depending on the need for access for forestry activities or energy transmission.

Road reconstruction maintains the original investment, makes the road suitable and safe for the intended use, and typically involves the rehabilitation of the original roadbed. It can include cleaning ditches, replacing drainage structures, re-installing bridges, and grading and shaping. The roadbed was created and used (compacted) in the past and, in general, no longer supports sensitive plants; however, newly exposed bedrock in unique geological areas could create new habitat for some sensitive plants. Road maintenance can include reconditioning the original road template, grading the road surface, cleaning roadside ditches, and removing vegetation that may encroach upon the road or block vision. Because the maintenance activities remain in the existing road prism, these activities would be unlikely to have an effect on sensitive plants or their habitat.

Indirect effects to sensitive plants from timber harvest, road construction, and construction of renewable energy projects and associated utility lines involves alteration of habitat, such as changes in sunlight and moisture availability, herbivore or pollinator behavior, soil structure and fertility, vegetation structure, fragmentation of habitat, and competition from other native plants as well as invasive plants. Some indirect effects, such as changes in sunlight or moisture, can be beneficial or harmful depending on the effect and the species' life history. For example, if a plant has habitat requirements of partial sun, then increasing the size of a forest opening may benefit that species; however, that same opening may be harmful to a plant that requires shade. Activities likely to cause indirect effects to sensitive plants include removal or reduction of tree canopy, road construction, changes in hydrology associated with road construction, reservoir creation or flow diversion, increased competition from invasive plants, increased off-road vehicle use, increased access, and increased use and associated trampling by recreationists.

A project-level BE will be conducted as part of the site-specific environmental analysis for individual project proposals. This type of sensitive plant review is required to include sufficient detail to determine how any proposed action may affect each sensitive species. The intensity and scope of inventories selected to provide information for effects analysis is required to be commensurate with the potential risk of a proposed project to sensitive plant species. The review is used to evaluate project-level impacts to sensitive plants in order to ensure that proposed project activities do not contribute to population or habitat declines that could lead to federal listing or loss

of viability in the Planning Area (the Tongass National Forest). In addition, existing Forest-wide standards and guidelines would be applied to avoid or minimize impacts to those sensitive plants and their habitat.

The Forest-wide standards and guidelines include a provision for reviewing the implementation and effectiveness of conservation actions for sensitive plants. This review provides information to improve conservation efforts and reduce the likelihood of negative effects to sensitive plant species due to management actions.

Effects Specific to Each Alternative

General impacts to sensitive plant species from timber harvest, road construction, and renewable energy development, as well as species-specific impacts to the 15 sensitive plants and one lichen known or suspected to occur on the Tongass under each alternative are discussed in the sections below.

Timber Harvest and Road Construction

In general, alternatives with fewer acres of timber harvest and miles of road construction would have less risk of direct and indirect adverse effects to sensitive plants. Alternatives with more acres proposed for harvest and miles of road construction would have more risk of adverse effects. Other activities related to timber harvest, such as LTF construction, would increase with elevated amounts of timber harvest.

Table 2 displays the maximum acres of timber harvest and miles of road construction that would occur under each alternative. Based on the proposed maximum acres of timber harvest and miles of road construction after 100 years for each alternative, Alternatives 2 and 3 would have a higher risk of direct and indirect effects to sensitive plants due to harvest and road work than the other alternatives. Alternative 1, the No Action Alternative, would result in the least amount of timber harvest (maximum harvest of 263,416 acres over 100 years), but would result in the greatest acreage of old-growth timber harvest (Table 2). Alternatives 4 and 5 propose fewer acres of harvest than Alternatives 2 and 3; however, Alternatives 4 and 5 would harvest more acres of old-growth than either Alternatives 2 or 3.

Table 2
Maximum Acres of Harvest and Maximum Miles of Road Construction by Alternative

	Alternative				
	1	**2**	**3**	**4**	**5**
Maximum Acres Likely to be Harvested after Full Implementation of the Forest Plan (acres after 100+ years)					
Productive Old Growth	62,413	30,017	31,198	42,831	43,167
Young Growth	201,003	330,517	304,792	223,813	261,850
Total Acres	**263,416**	**360,534**	**335,990**	**266,644**	**305,017**
Maximum Miles of Road Likely to be Constructed (miles after 100+ years)					
New Road Construction	253	120	146	167	166
Road Reconstruction	1,170	1,924	1,774	1,303	1,524
Total Road Work (includes reconstruction)	**1,423**	**2,044**	**1,920**	**1,470**	**1,690**

Source: Tongass National Forest GIS database

Alternative 1, the No Action Alternative, would result in the fewest miles of road construction and reconstruction combined; however, it would result in more miles of new road construction than any of the other alternatives. As stated above, road construction has more adverse effects to sensitive

plant species than road reconstruction. Following Alternative 1, Alternative 4 proposes the fewest miles of road construction and reconstruction, approximately 47 more miles than Alternative 1. However, Alternative 4 proposes 86 less miles of new road construction than Alternative 1 (Table 2). Alternative 2, proposes the most miles of road construction and reconstruction (2,044 miles); however, it proposes the fewest miles of new road construction (120 miles). Alternatives 3 and 5 are in the middle of the alternatives in terms of miles of road construction. Although Alternative 1 proposes the least acres of timber harvest and miles of road construction and reconstruction, it proposes more acres of old-growth harvest and new road construction (versus road reconstruction) than the other alternatives. Increased harvest of productive old-growth and new road construction could increase the risk of adverse effects to sensitive plant species as compared to harvest of young-growth and road reconstruction activities.

A species distribution is limited to areas that can meet the species-specific physical and biological needs. Due to the limited scope of surveys conducted within the Tongass, exact distributions of plants and their habitat are unknown. Although it is not possible to predict the exact distribution of each species, knowing the preferred habitats for sensitive plants can aid in assessing the risk for each species from timber harvest, road construction, and other activities under the proposed alternatives. Therefore, in addition to the number of acres of timber harvest and miles of road construction, the locations of these activities may increase or decrease the risk of adverse effects to sensitive plant species.

Table 3 below display the acres of projected young-growth and old-growth timber harvest in beach buffer, RMAs, Old-Growth Reserves (OGRs), other Non-development LUDs, and 2001 Roadless Areas under each alternative. Harvest of young growth and old growth would not occur in any of these areas under Alternative 1, the No Action Alternative. This represents the current condition from the 2008 Forest Plan Amendment. Old-growth harvest would not occur in beach buffers, RMAs, OGRs, or other Non-development LUDs under any of the other alternatives and would only occur in 2001 Roadless Areas under Alternatives 2 and 3 (Table 3). Projected harvest of young-growth would be greatest in RMAs, OGRs, and other Non-development LUDs under Alternative 2. Projected harvest of young-growth would be greatest in beach buffers and 2001 Roadless Areas and second greatest in OGRs and other Non-development LUDs under Alternative 3. Under Alternative 4, young-growth harvest is only projected to occur in beach buffers. Under Alternative 5, young-growth harvest would occur in beach buffers, RMAs, and OGRs. Alternative 1 would have the lowest risk of direct and indirect effects to sensitive plant species found in beach buffers, RMAs, OGRs, other Non-development LUDS, and 2001 Roadless Areas compared to the other alternatives. Alternative 2, followed by Alternative 3, would have the highest risk of direct and indirect effects to sensitive plant species found in these habitats compared to the other alternatives.

Table 3
Projected Harvest of Young-growth[1] and Old-growth in Beach Buffers, RMAs, Old-growth Reserves, other Non-Development LUDs, and 2001 Roadless Areas by Alternative

Conservation Strategy Component	Estimated Acres of Harvest over 100 Years									
	Alt 1		Alt 2[1]		Alt 3[2]		Alt 4[3]		Alt 5[4]	
	YG	OG	YG	OG	YG	OG	YG	OG	YG	OG
Harvest in Beach Buffer	0	0	21,871	0	30,769	0	11,114	0	3,903	0
Harvest in RMA	0	0	26,030	0	0	0	0	0	1,089	0
Harvest In OGR Habitat LUD	0	0	31,640	0	26,186	0	0	0	1,811	0
Harvest in other Non-Development LUD	0	0	12,868	0	12,857	0	0	0	0	0
Maximum Harvest in 2001 Roadless Areas	0	0	9,118	2,171	11,810	17,037	0	0	0	0

[1] Alt 2 Prescriptions: Young Growth – Clearcutting is permitted in Beach Buffer for first 15 years; thereafter, only Commercial Thinning is permitted. Only Commercial Thinning is permitted in RMAs. Clearcutting is permitted in OGRs, non-development LUDs, and Roadless Areas, unless otherwise restricted. Old Growth – Clearcutting is permitted in Roadless Areas.
[2] Alt 3 Prescriptions: Young Growth – Only Commercial Thinning is permitted in Beach Buffers. Clearcutting is permitted in OGRs, non-development LUDs, and Roadless Areas, unless otherwise restricted. Old Growth – Clearcutting is permitted in Roadless Areas.
[3] Alt 4 Prescriptions: Young Growth – Only Commercial Thinning is permitted in Beach Buffers.
[4] Alt 5 Prescriptions: Young Growth – Group Selection and Commercial Thinning are permitted in Beach Buffers, OGRs, and RMAs for first 15 years; thereafter, No Harvest is permitted.

Renewable Energy Site Development

Development of renewable energy sites would occur under all alternatives; however, Alternatives 2, 3, 4, and 5 would include new management direction (i.e., plan components) in the Forest Plant that improves flexibility in renewable energy development. Alternative 1 would not facilitate the development of renewable energy sites to the extent that Alternatives 2, 3, 4, and 5 would. Therefore, these alternatives could result in greater impacts to sensitive plant species than Alternative 1 from development of renewable energy sites. Under all alternatives, however, renewable energy site development would be subject to site-specific environmental analysis under NEPA.

Species-Specific Effects

Effects to the 15 sensitive plants and one lichen known or suspected to occur on the Tongass National Forest under each of the alternatives are discussed below. In addition to assessing impacts to sensitive species based on locations and acres of timber harvest and miles of road construction, impacts to known occurrences of sensitive plant species can be estimated by looking at the proportion of occurrences of each sensitive plant in areas suitable for young-growth and old-growth harvest, and the percent of harvest expected in each of these suitable areas under each alternative. Table 4 below displays the proportion of known occurrences of the three sensitive species expected to be in old-growth or young-growth harvest units after 100 years.

Table 4
Proportion[1] of Known Occurrences of Sensitive Plants with the Potential to be in Old-Growth or Young-Growth Harvest Units after 100 Years

	Known Occurrences Estimated in Harvest Units by Alternative									
	1		2		3		4		5	
Species	**OG**	**YG**	**OG**	**YG**	**OG**	**YG**	**OG**	**YG**	**OG**	**YG**
Lobaria amplissima	0	0	0	0.9	0	0.9	0	0.9	0	0
Piperia unalascensis	0.6	0	0.3	0	0.1	0	0.3	0	0.4	0
Platathera orbiculata	16.6	17.6	8	27.7	5.2	28.5	9.4	14.3	11.5	18.8

Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*):
This species grows in moist mossy areas, seeps, heaths, and scree slopes in subalpine and alpine locations; areas where timber harvest and renewable energy development would likely not occur. Additionally, very little access to timber (i.e., road construction) through its preferred habitat (alpine or subalpine areas) would likely occur under any of the alternatives. Although suspected to occur on the Tongass, no populations of Eschscholtz's little nightmare have been documented; therefore, no known populations of this species would be impacted by timber harvest, road construction, or renewable energy development under any of the alternatives. If previously undocumented populations of this species are located during project surveys, Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species on the Tongass. Because this species is not currently documented on the Tongass, because it may receive protection from existing Forest-wide standards and guidelines, and because there is a very low chance of impacting populations or habitat for Eschscholtz's little nightmare, there is a very low chance that any alternative would impact this species.

Spatulate moonwort (*Botrychium spathulatum*):
Across its range, habitat for this species includes coastal forests, riparian forests, stabilized coastal dunes, maritime and upper beach meadows, well-drained open areas, limestone, alpine habitats and areas historically disturbed by humans such as roadsides. On the Tongass, this species is currently only known from one population located on a calcareous, subalpine ridge (USDA Forest Service 2015) which would likely not be impacted by timber harvest, road construction, or renewable energy and utility line projects under any of the alternatives. Additionally, no known occurrences of spatulate moonwort are expected in old-growth or young-growth harvest units under any of the alternatives. However, due to the small stature of this species and the difficulty of correct

[1] Estimates calculated by comparing the suitable YG and OG locations with known sensitive plant locations. A ratio is developed by calculating acres of suitable YG and OG and dividing those acres by the area planned for YG/OG harvest and then multiplying that ratio by the number of known sensitive plant occurrences in the suitable YG/OG. For example: If 5 occurrences of a sensitive plant species are in suitable YG/OG, but we plan to harvest only 50% of the suitable, then the estimate is 2.5 occurrences affected. If all of the suitable YG and OG was expected to be harvested, then the numbers in the table would be whole numbers. However, we plan to harvest less; therefore, the numbers are not whole.

identification, spatulate moonwort has likely been overlooked or misidentified; therefore, it is likely those additional populations of this species exist on the Tongass (USDA Forest Service 2015).

Under the No Action Alternative, timber harvest would not occur in the beach buffer and RMAs: two of the preferred habitats where this species may occur. Under Alternatives 2 and 5, young-growth timber harvest would be allowed in the beach buffer and in RMAs suitable for timber production and, under Alternatives 3 and 4, timber harvest would be allowed in the beach buffer (Table 3). Alternatives 2 through 5; therefore, would result in increased chance of adverse effects to undocumented occurrences of spatulate moonwort compared to Alternative 1. Alternatives 2 and 3 would have the greatest projected timber harvest in RMAs and beach buffers; therefore, they would have a greater chance of effects to undocumented occurrences of spatulate moonwort from timber harvest than all the other alternatives. Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would have a greater chance of effects to spatulate moonwort from road construction and reconstruction than the other alternatives.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species if populations are located during pre-project surveys. Because spatulate moonwort may receive protection from existing Forest-wide standards and guidelines and because there is a very low chance of affecting the one known occurrence of this species, there is little chance that any alternative would impact this species.

Moosewort fern (*Botrychium tunux*):
Across its range, habitat for moosewort fern includes upper beaches, beach meadows, coastal dunes, riparian forests, stream terraces, and river bars. Habitat on the Tongass also includes subalpine and alpine rocky slopes (USDA Forest Service 2015). Due to the small stature of this species, it has likely been overlooked and there may be additional populations on the Tongass National Forest (USDA Forest Service 2015). On the Tongass, eight of the nine known occurrences of moosewort fern are in non-development LUDs, including seven occurrences on beach meadows (within non-development LUDs) in the Yakutat area. One known occurrence of this species is located in a nonforested area of a Timber Production LUD on the Wrangell Ranger District. However, no known occurrences of moosewort fern are expected in old-growth or young-growth harvest units under any of the alternatives.

Under the No Action Alternative, timber harvest would not occur in non-development LUDs, or in beach buffer and RMAs, which are the preferred habitat for this species. While access to timber through beaches may be needed under Alternative 1 if new LTFs are required, it would be infrequent. Under Alternatives 2 and 5, young-growth timber harvest would occur in the beach buffer and RMAs and under Alternatives 3 and 4 timber harvest would occur in the beach buffer (Table 3). Therefore, Alternatives 2 through 5 would result in increased chance of adverse effects to undocumented populations of moosewort fern and its habitat from timber harvest compared to Alternative 1. Alternatives 2 and 3 would have the greatest projected timber harvest in RMAs and beach buffers and; therefore, they would have a greater chance of adverse effects to moosewort fern from timber harvest than the other alternatives. Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would have a greater chance of adverse effects to moosewort fern from road construction and reconstruction than the other alternatives.

Alternatives 2 through 5 would also facilitate development of renewable energy projects and would allow their development in the beach buffer and RMAs. Therefore, Alternatives 2 through 5 would result in an increased chance of adverse effects to moosewort fern and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species if populations are located during pre-project surveys. Because moosewort fern may receive protection from existing Forest-wide standards and guidelines and because no known occurrences of moosewort fern are expected in old-growth or young-growth harvest units under any of the alternatives, there is a low chance of impacting known occurrences of this species.

Moonwort fern (*Botrychium yaaxudakeit*):
Habitat for this species includes upper beach meadows, beach dunes, coastal outwash plains, and abandoned fields and roadsides. The five occurrences of moonwort fern on the Yakutat Ranger District are located in a non-development LUD (Semi-Remote Recreation). No known occurrences of moonwort fern are expected in old-growth or young-growth harvest units under any of the alternatives.

Under the No Action Alternative, timber harvest would not occur in non-development LUDs or the beach buffer and RMAs, which are the preferred habitat for this species. While access to timber through beaches may be needed under Alternative 1 if new LTFs are required, it would be infrequent. Therefore, under Alternative 1, there is essentially no chance of impact to this species from timber harvest and road construction. Under Alternatives 2 through 5, young-growth timber harvest would be allowed in the beach buffer which could result in impacts to undocumented occurrences of moonwort fern. Alternatives 2 and 3 would have the greatest projected timber harvest in RMAs and beach buffers (Table 3). Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of effects to moonwort fern from timber harvest and road construction and reconstruction than the other alternatives.

Alternatives 2 through 5 would also facilitate the development of renewable energy projects and would allow their development in the beach buffer. Therefore, Alternatives 2 through 5 would result in an increased chance of adverse effects to moonwort fern and its habitat from renewable energy development compared to the No Action Alternative.

If populations of this species are located during project surveys, Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species. Because no known occurrences of moonwort fern would be impacted under any of the alternatives and because this species may receive protection from existing Forest-wide standards and guidelines, there is little chance that any alternative would affect this species.

Edible thistle (*Cirsium edule* var. *macounii*):
Two occurrences of edible thistle are known on the Tongass, both on the Ketchikan-Misty Fiords Ranger District. One occurs in a non-development LUD (Nonwilderness National Monument) and one occurs in a development LUD (Timber Production). The likelihood of adverse effects to this species from timber harvest and associated road construction under all alternatives is low because habitat for this plant includes open meadows, open forests in the upper montane to lower alpine zone, scree slopes, and along glacial streams and lakeshores where harvest typically would not occur. However, access to timber through these types of habitat may be needed. Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives

(Table 3); thus, these two alternatives would have a greater chance of adverse effects to edible thistle from road construction and reconstruction than the other alternatives.

Alternatives 2 through 5 would facilitate the development of renewable energy projects; therefore, Alternatives 2 through 5 may result in a slightly increased chance of adverse effects to edible thistle and its habitat compared to Alternative 1. Because this species is not likely to be impacted by timber harvest and because protection from the Forest-wide standards and guidelines would consider minimizing impacts to this plant from road construction and reconstruction and renewable energy projects under all alternatives, there is a low chance that any alternative would impact this plant.

Mountain lady's slipper (*Cypripedium montanum*):
Within its range, this species is known from a variety of habitats including upper beach meadows, areas along the beach-forest ecotone, open forests, muskegs, and wet meadows. On the Tongass, this species is currently only known from one population on Etolin Island on the Wrangell Ranger District. This population is adjacent to an existing road, which is to be reconstructed (USDA Forest Service 2015).

Under Alternative 1, timber harvest would not occur in the beach buffer. While access to timber through beaches may be needed under Alternative 1 if new LTFs are required, this would be infrequent. Under Alternatives 2 through 5, young-growth timber harvest would be allowed in the beach buffer (Table 3). Projected harvest in the beach buffer would be greatest under Alternatives 2 and 3, followed by Alternatives 4 and 5. Therefore, Alternatives 2 and 3 would have a greater possibility of adverse effects to mountain lady's slipper than the other alternatives. Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to mountain lady's slipper from road construction and reconstruction than the other alternatives.

Alternatives 2 through 5 would facilitate the development of renewable energy projects and would allow their development in the beach buffer. Therefore, Alternatives 2 through 5 would result in increased chance of adverse effects to mountain lady's slipper and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species if it is located during pre-project surveys. However, due to the single known occurrence of this species in the Planning Area, coupled with the potential for some level of impacts to this occurrence from future timber harvest and road construction, a moderate risk of adverse effects to this species exists under all alternatives.

Large yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens*):
Across its range, this species is known from scree slopes, rock outcrops, and river bluffs and is often associated with open spruce forest and aspen woodlands. On the Tongass, this orchid is known from peatlands on calcareous substrates. There are two known occurrences of large yellow lady's slipper on the Tongass; both within a Timber Production LUD on northern Prince of Wales Island. Although the habitats where this species is suspected to occur are not generally within timber harvest areas, the known occurrences of this species are located near existing roads (USDA Forest Service 2015).

Based on the limited number and small size of the occurrences on the Tongass and existing threats to known occurrences from proposed road construction, additional impacts to this species from road construction or renewable energy and utility line projects under all alternatives could affect the ability of this species to persist over time. Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to large yellow lady's slipper from road construction and reconstruction than the other alternatives. Alternatives 2 through 5 would also facilitate the development of renewable energy projects; therefore, Alternatives 2 through 5 would result in increased chance of adverse effects to large yellow lady's slipper and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines would consider minimizing the chance of adverse impacts under all alternatives. However, due to the low numbers of known occurrences of this species in the Planning Area, coupled with the potential for some level of impacts to these occurrences from future road construction, there is a moderate risk of adverse effects to this species under all alternatives.

Calder's lovage (*Ligusticum calderi*):
Habitat for this plant includes alpine and subalpine meadows, boggy slopes, open mixed conifer forest, and rocky areas. Twenty-four occurrences of this species have been documented on the Tongass, 11 within development LUDs and 13 within non-development LUDs. However, no known occurrences of Calder's lovage are expected in old-growth or young-growth harvest units under any of the alternatives.

Although the habitats where this species is suspected to occur are not generally vulnerable to timber harvest, they may be impacted by road construction activities. Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to Calder's lovage from road construction and reconstruction than the other alternatives. Alternatives 2 through 5 would also facilitate the development of renewable energy projects and would allow their development in the beach buffer and RMAs. Therefore, Alternatives 2 through 5 would result in an increased chance of adverse effects to Calder's lovage and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to the known occurrences of this species and new occurrences of this species located during pre-project surveys. Because habitat for this species is generally not vulnerable to timber harvest and because of the relatively low projected impacts from future road construction to the 24 known occurrences of this species on the Tongass, a low chance of adverse effects to this species exists under all alternatives.

Lichen, no common name (*Lobaria amplissima*):
In southeast Alaska, this lichen is only known as an epiphyte on tree trunks and branches of the forest/beach ecotone (Dillman 2011a). Forested habitat where this species grows tends to be well drained, with old growth Sitka spruce and/or western hemlock trees. Known sites of this species are also exposed to the open ocean or other large bodies of marine water (e.g., ocean entrances to bays and inlets) (Dillman 2011a).

There are 30 documented occurrences of *Lobaria amplissima* on the Tongass, 5 of which are located in development LUDs and 25 of which are located within non-development LUDs. Under

Alternatives 2, 3 and 5, timber harvest would occur in old-growth reserves and under Alternatives 2 and 3 harvest would occur in other non-development LUDs which would increase the chance of adverse effects to *Lobaria amplissima* in these areas as compared to Alternatives 1 and 4. No known occurrences of this lichen are expected within old-growth or young-growth harvest units under Alternative 1 or Alternative 5 (Table 4). Approximately 0.9 of the known occurrences are expected to be within young-growth harvest units under Alternatives 3, 4, and 5 (Table 4).

Under the No Action Alternative, young-growth timber harvest would not occur in the beach buffer. While access to timber through beaches may be needed under Alternative 1 if new LTFs are required, it would be infrequent. Under Alternatives 2 through 5, young-growth timber harvest would occur in the beach buffer (Table 3). Alternative 3 would have the greatest projected harvest in the beach buffer, followed by Alternatives 2, 4, and 5. Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to *Lobaria amplissima* from timber harvest and road construction and reconstruction than the other alternatives. Alternatives 2 through 5 would also facilitate the development of renewable energy projects and would allow their development in the beach buffer. Therefore, Alternatives 2 through 5 would result in increased chance of adverse effects to *Lobaria amplissima* and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during pre-project surveys. Because only about one of the 30 known occurrences are expected to be within young-growth harvest units, there would be a relatively low chance of adverse effects to this species under all alternatives.

Pale poppy (*Papaver alboroseum*):
Although suspected to occur on the Tongass, no populations of pale poppy have been documented; therefore, no known populations of this species would be impacted under any of the alternatives. This plant occurs in open, well-drained areas, recently deglaciated areas, rock outcrops, rocky tundra of ridges and mountain summits, sand and gravel of glacial outwash and river floodplains; areas where timber harvest would not typically occur. While road construction for access to timber through this type of habitat may be needed, it is not likely. Alternatives 2 through 5 would facilitate the development of renewable energy projects; which could affect habitat for this species. Therefore, Alternatives 2 through 5 would have a slightly increased chance of adverse effects to pale poppy and its habitat from renewable energy development compared to Alternative 1.

If previously undocumented occurrences of this species are located during project surveys, Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species. Because pale poppy is not currently documented on the Tongass, because it may receive protection from the Forest-wide standards and guidelines, and because of the very low chance of affecting potential habitat, there is a very low chance that any alternative would adversely affect this species.

Alaska rein orchid (*Piperia unalascensis*):
Habitat for Alaska rein orchid includes dry open sites, under tall shrubs in riparian zones, mesic meadows, drier areas in coniferous and mixed evergreen forests, and bogs and heath habitat from low to subalpine elevations. On the Tongass, this species often grows at the ecotone between forested and muskeg habitats and is generally found in low productivity forests at lower elevations

in poorly drained soils (Dillman 2011b). However, some of the forest stands where the species is found are managed for timber production (USDA Forest Service 2015). A few occurrences are located in the rights-of-way of forest roads; it is not known if they are remnants that have survived the disturbance, or if they have colonized the areas due to modification of habitat (USDA Forest Service 2015).

There are 18 known occurrences of Alaska rein orchid on the Tongass; eight of which occur in development LUDs and 10 of which occur in non-development LUDs. Under Alternatives 2, 3 and 5 timber harvest would occur in old-growth reserves and under Alternatives 2 and 3 harvest would occur in other non-development LUDs which would increase the chance of adverse effects to Alaska rein orchid in these areas as compared to Alternatives 1 and 4. Approximately 0.6 of the known occurrences of Alaska rein orchid are expected to be within old-growth harvest units under Alternative 1, 0.3 occurrences under Alternatives 2 and 4, 0.1 occurrences under Alternative 3, and 0.4 occurrences under Alternative 5 (Table 4).

Under the No Action Alternative, young-growth timber harvest would not occur in RMAs; habitat preferred by Alaska rein orchid. Under Alternatives 2 and 5, approximately 36,092 and 882 acres of young-growth timber harvest would occur in RMAs, respectively (Table 3). Timber harvest in RMAs would not occur under Alternatives 3 and 4. Therefore, Alternatives 2 and 5 would result in greater chance of adverse impacts to Alaska rein orchid from young-growth timber harvest in RMAs than the other alternatives. Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to Alaska rein orchid from and road construction and reconstruction than the other alternatives.

Development of renewable energy projects would be facilitated under Alternatives 2 through 5 and these alternatives would allow their development in RMAs; resulting in an increased chance of adverse effects to Alaska rein orchid and its habitat under these alternatives compared to Alternative 1. Considering all factors, Alternative 2 would have the greatest chance of adverse effects to Alaska rein orchid.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during pre-project surveys. Because only a proportion of one of the 18 known occurrences of this species are expected to be within old-growth harvest units, there would be a relatively low chance of adverse effects to this species under all alternatives.

Lesser round-leaved orchid (*Platanthera orbiculata*):
Habitat for lesser round-leaved orchid on the Tongass includes mesic areas of coniferous forests, forested wetlands, old-growth hemlock forests with high bryophyte cover and a red cedar component, and along the edges of forest near muskegs, open water or boggy areas. There are 291 known occurrences of this species currently located at least partially on National Forest land. Of these occurrences, 205 are located within development LUDs. The 291 occurrences have recently been condensed into 61 distinct populations by the Alaska Natural Heritage Program (Fulkerson 2015 in progress). Of the total area occupied by the 61 known populations, 44 percent is located within non-development LUDs and 56 percent is located within development LUDs (USDA Forest Service 2015). The Old-growth Conservation Strategy provides for large reserves of old-growth habitat, in particular within the non-development LUDs; resulting in conservation of at least 40 percent of the known populations of lesser round-leaved orchid and their habitat across the Forest.

Approximately 50 percent of all known occurrences of lesser round-leaved orchid occur on Prince of Wales Island, with the largest of these occurrences concentrated in east-central Prince of Wales Island near Thorne Bay. A recent pilot monitoring study of population trends for lesser round-leaved orchid on Prince of Wales Island suggested a 57 percent decrease in observed population density over the two-year monitoring period (USDA Forest Service 2015). These observations emphasize the need for continued monitoring of lesser round-leaved orchid populations to understand whether the short-term pattern observed during this pilot study indicates a possible concern about the long-term persistence of this species on this portion of the Tongass where monitoring has occurred. The decrease in numbers of observed plants is uncertain and may include a number of factors, such as this species' inherent periodic dormancy (and therefore cryptic nature); lack of required specific mycorrhizal symbiont; herbivory; changes in soil moisture regime over the long term as a result of long-term climatic variation; and management impacts, such as changes in light and soil regimes as a result of timber harvest and road construction. Additional noise in interpreting these results is caused by the monitoring sample size in this pilot study, which was small, resulting in high variation among the sample plots. Thus, there is limited ability to make robust conclusions regarding trends indicated by the monitoring results. Because monitoring is focused on a small sample of known locations limited to only a portion of the Forest, inferences regarding downward trends observed over the two-year monitoring period cited in the most recently published 2015 monitoring report may only apply to populations on the portion of Prince of Wales Island where monitoring has occurred. Current monitoring does not sample populations across the full range of this species in the Planning Area (e.g., the Tongass National Forest); therefore, results should not be used to make accurate inferences or conclusions as to this species' viability status across the Tongass.

Of the 291 known occurrences, the proportion of known occurrences expected to be within old-growth harvest units under each alternative includes 16.6 occurrences under Alternative 1, 8 occurrences under Alternative 2, 5.2 occurrences under Alternative 3, 9.4 occurrences under Alternative 4, and 11.5 occurrences under Alternative 5 (Table 4). The number of occurrences expected to be within young-growth harvest units under each alternative includes 17.6 occurrences under Alternative 1, 27.7 occurrences under Alternative 2, 28.5 occurrences under Alternative 3, 14.3 occurrences under Alternative 4, and 18.8 occurrences under Alternative 5 (Table 4). Therefore, Alternative 2 has the potential to affect a greater proportion of the known occurrences of lesser round-leaved orchid than the other alternatives.

Under Alternatives 1 and 4, young-growth harvest would be restricted in non-development LUDs (Table 3). Additionally, fewer acres of timber and fewer miles of road is expected to be harvested and constructed under Alternatives 1 and 4 than under the other alternatives (Table 3). Alternatives 2, 3, and 5 would allow young-growth timber harvest in old-growth reserves and Alternatives 2 and 3 would also allow young-growth timber harvest in other non-development LUDs (Table 3). Additionally, acres of timber harvest and miles of road construction would be greatest under Alternative 2, followed by Alternative 3; therefore, Alternatives 2 and 3 would result in greater chance of adverse effects to lesser round-leaved orchid from timber harvest and road construction than the other alternatives.

Alternatives 2 through 5 would facilitate the development of renewable energy projects to a greater extent than Alternative 1. Therefore, Alternatives 2 through 5 would have greater chance of adverse effects to lesser round-leaved orchid and its habitat from renewable energy development compared to Alternative 1.

Substantial timber harvest and road construction has occurred in the past within the general range of lesser round-leaved orchid within development LUDs on the Tongass. Forest-wide standards and guides has been implemented in past, current, and ongoing project NEPA analysis and has provided protection of many lesser round-leaved orchid occurrences by buffering and avoiding known occurrences during timber layout for several timber sale areas. This illustrates a concerted effort to avoid and minimize impacts to known occurrences from timber harvest and road construction. Continued implementation of Forest-wide standards and guidelines under all alternatives is fully anticipated and would minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. Because approximately 40 percent of the known occurrences are not currently threatened by proposed management activities and because, at the most, approximately 17 known occurrences are expected to be within old-growth harvest units and another 29 known occurrences are expected to be within young-growth harvest units out of the 291 distinct occurrences on the Tongass, there would be a relatively low chance of adverse effects to this species under all alternatives.

Kruckeberg's swordfern (*Polystichum kruckebergii*):
There are nine known occurrences of Kruckeberg's swordfern comprising three distinct populations in Southeast Alaska (see Table 1): one within a development LUD (Timber Production) on the Ketchikan-Misty Fiords Ranger District, one within a non-development (Wilderness) LUD on the Sitka Ranger District, and one on non-National Forest land. On the Tongass, habitat for this species includes talus slopes and ultramafic rock outcrops, areas where timber harvest, road construction, and renewable energy development would not likely occur. While access to timber through this species' habitat may occur, it is not likely. No known occurrences of Kruckeberg's swordfern are expected in old-growth or young-growth harvest units under any of the alternatives.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. Because Kruckeberg's swordfern may receive protection from existing Forest-wide standards and guidelines and because there is a very low chance of affecting occurrences or habitat for this species, there is a low chance of adverse effects to this species under all alternatives.

Unalaska mist-maid (*Romanzoffia unalaschcensis*):
The plant grows on ledges and crevices within rock outcrops, in gravelly areas along stream banks, often along the coast; areas where timber harvest would likely not occur. Neither of the known occurrences of this species are expected in old-growth or young-growth harvest units under any of the alternatives. Habitat for this species, however, could potentially be impacted by road construction and renewable energy projects.

Both of the two known occurrences of Unalaska mist-maid on the Tongass occur within non-development (Special Interest Area) LUDs on the Thorne Bay Ranger District. Under Alternatives 1, 4, and 5, young-growth timber harvest would not occur in non-development LUDs (Table 3); whereas under Alternatives 2 and 3 young-growth timber harvest would be allowed in non-development LUDs.

Timber harvest would not occur in RMAs (preferred habitat for this species) under Alternatives 1, 3, and 4; whereas Alternatives 2 and 5 would allow approximately 36,092 and 882 acres of young-growth harvest in RMAs, respectively (Table 3). Alternatives 2 would also result in more miles of road construction and reconstruction than the other alternatives (Table 3). Alternative 2, therefore,

would result in the greatest chance of adverse impacts to this species compared to the other alternatives

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. Because Unalaska mist-maid may receive protection from existing Forest-wide standards and guidelines and because there is a low chance that any of the known occurrences will be associated with old-growth or young-growth timber harvest or other proposed activities in the future, there is a low chance that any alternative would affect this species.

Henderson's checkermallow (*Sidalcea hendersonii*):
Potential habitat for this species includes wet meadows, estuaries, and tidal flats in the lowland zone (Douglas et al. 1999). There is one known occurrence of Henderson's checkermallow on the Tongass; it is within a non-development (Semi-remote Recreation) LUD on the Juneau Ranger District. This occurrence, which is located in an upper beach meadow at the edge of hemlock and spruce forest at Howard Bay, could not be relocated during surveys in 2012 (USDA Forest Service 2015). This occurrence is not expected to be located in old-growth or young-growth harvest units under any of the alternatives.

Under Alternative 1, timber harvest would be restricted in the beach buffer, which is the preferred habitat for this species. While access to timber through beaches may be needed under Alternative 1 if new LTFs are required, this would be infrequent. Therefore, under Alternative 1, there is essentially no chance of adverse impact to Henderson's checkermallow. Under Alternatives 2 through 5, young-growth timber harvest would occur in the beach buffer which could result in impacts to undocumented occurrences of Henderson's checkermallow or its habitat. Projected timber harvest in beach buffers would be highest under Alternatives 2 and 3; therefore, these two alternatives would result in a greater chance of adverse impacts to undocumented occurrences of this species and its habitat than the other alternatives (Table 3). Additionally, Alternatives 2 and 3 would result in more miles of road construction and reconstruction than the other alternatives (Table 3); thus, these two alternatives would result in a greater chance of adverse effects to Henderson's checkermallow from and road construction and reconstruction than the other alternatives.

Alternatives 2 through 5 would facilitate the development of renewable energy projects and would allow development of renewable energy projects in the beach buffer. Therefore, Alternatives 2 through 5 would have a greater chance of adverse effects to Henderson's checkermallow and its habitat from renewable energy development compared to Alternative 1.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to the known occurrence and new occurrences of this species located during project surveys. Because Henderson's checkermallow may receive protection from existing Forest-wide standards and guidelines and because no known occurrences of this species would be impacted under any of the alternatives, there is a low chance that any alternative would affect this species.

Dune tansy (*Tanacetum bipinnatum* ssp. *huronense*):
There is only one known occurrence of this species on the Tongass, located within a development LUD (Modified Landscape) on the Sitka Ranger District. This population has been declining due to habitat loss from beach erosion (USDA Forest Service 2015). Habitat for dune tansy includes upper beaches and sand dunes on well drained and calcareous soils; areas where timber harvest activities would not likely occur. Dune tansy does not grow in old-growth or young-growth harvest units under any of the alternatives. Access to timber harvest units through beaches or sand dunes may be

needed for new LTFs; however, this need would be infrequent. If dune tansy were located during project surveys, Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species. Because of the possible protection from the Forest-wide standards and guidelines, and the very low chance of affecting the one known occurrence or unknown occurrences of this species or its habitat, there is a low chance that any alternative would affect this species.

Cumulative Effects

Potential impacts to sensitive plant habitat cannot be completely avoided since most proposed actions include some ground-disturbing activities. Therefore, the Forest Service acknowledges the importance of maintaining habitat through a network of old growth reserves and conservation areas within the Planning Area. Please see the Biodiversity section of Chapter 3 of the FEIS (2016), which describes the Conservation Strategy for the Planning Area. In addition to certain old growth forest ecosystems, this reserve system embodies the full spectrum of habitat types where sensitive plants are known or suspected to occur within non-development LUDs (e.g., wilderness areas). In addition, other areas that are protected either through legislation or by Forest-wide standards and guidelines, including TTRA buffers, RMAs and beach and estuary buffer, also represent high value habitat for some sensitive plant species. The full suite of conservation areas embodied in the Tongass Conservation Strategy contains areas of potential suitable habitat for all 15 sensitive plants and one lichen on the Regional Forester's list known to occur on the Tongass National Forest.

Therefore, to assess the cumulative effects of proposed actions on sensitive plants in the Planning Area, the Tongass Conservation Strategy serves as an important component to consider those species known to occur within the boundary of old-growth reserves, beach and estuary buffer, RMAs and the other non-development LUDs in relation to those occurrence known to occur in the development LUDs. The cumulative effects analysis will consider the relative amount of harvest in young growth stands within both the development LUDs and non-development LUDs by alternative as a means to compare the effects on sensitive plants.

When considering effects to sensitive plants, it is important to look at the cumulative effects of past, present, and reasonably foreseeable future activities on all land ownerships within the geographic area. Each land ownership has differences in vegetation patterns, primarily because of differences in management activities. The significance of any direct or indirect effect in contributing to the cumulative effects on sensitive plants from management activities depend on the amount and type of disturbance in the cumulative effects analysis area and how that disturbance may affect known locations of sensitive plants.

Assessing cumulative effects to sensitive plants will be done for individual projects as part of the NEPA process for the relevant analysis area. For this analysis, past plus expected harvest and road construction for forestry and other uses and development of renewable energy projects and associated utility lines on all land ownerships within the Forest boundary can be used to qualitatively compare the risk that each alternative would add to cumulative effects to sensitive plants.

Timber harvesting on state, municipal, and private land is governed by the Alaska Forest Resources and Practices Act (Alaska Statute 41.17). Alaska Forest Resources and Practices Regulations (ADNR 2013) do not address threatened, endangered, or rare plants; however, they do recommend minimizing road construction and limiting disturbance in marshes and muskegs, which would provide some protection for some of the sensitive plants.

There are no federally listed or proposed threatened or endangered plants known to occur on the Tongass National Forest; therefore, there would be no contribution to cumulative effects to threatened or endangered plants under any of the alternatives.

To compare the potential cumulative effects of harvest under the five alternatives on sensitive plants, harvest on lands of all ownerships in Southeast Alaska was analyzed. Therefore, all lands in Southeast Alaska constitute the cumulative effects analysis area for sensitive plants.

There are approximately 21.6 million acres of land in southeast Alaska. Non-Forest Service lands comprise about 4.8 million acres or 22 percent of the 21.6 million acres in Southeast Alaska; Glacier Bay National Park consists of about 2.5 million acres. Approximately 30 percent of the lands in southeast Alaska were originally productive old growth (POG). Approximately 14 percent of the POG on all ownerships has been harvested by 2015. Thus, approximately 86 percent of the original POG on all ownerships was remaining in 2015 (Table 5). The percent of POG remaining on NFS lands is higher than for non-NFS lands that lie within the Tongass National Forest boundary (92 and 70 percent, respectively) due to the concentrated timber harvest areas in the non-NFS lands. Looking at all ownerships of land in the Forest, the POG forest remaining in 100 years under full implementation of the Forest Plan would be greatest for Alternatives 4 and 5 at 83 percent. Alternatives 1, 2, and 3 would all have 82 percent of POG forest remaining in 100 years under full implementation (Table 5). Therefore, the chance of adverse cumulative effects to sensitive plants due to harvest would be slightly higher for Alternatives 1, 2, and 3 than Alternatives 4 and 5.

Table 5
Cumulative Percent of Original POG Remaining on All Ownerships in 2015 and Estimated Minimum Percent Remaining after 100+ Years[1] for All Lands within the Tongass Forest Boundary[2]

Remaining POG on All Ownerships in 2015 as a Percent of all Original POG	Remaining POG after 100+ Years as a Percent of Original POG[3]				
	Alternative				
	1	2	3	4	5
86%	82%	82%	82%	83%	83%

[1] Assumes full implementation of Forest Plan at ASQ levels plus future non-NFS harvest.
[2] Annette Island is included because it is surrounded by areas within the Forest boundary.
[3] Note that ¾ of the POG reduction is on private and state lands.
Source: Tongass National Forest GIS database.

Existing road density is greater on the non-NFS lands within the Tongass National Forest boundaries than on the NFS lands due to concentrated harvest and more populated areas within the State and private lands. It averages 0.19 mile per square mile on NFS lands and 2.19 miles per square mile for the non-NFS lands. The average for lands of all ownerships is 0.31 mile per square mile; however, those are averages over a very large area and there is great variability. The range of road density by VCU shows large variability across the Tongass as seen in Table 3 in the Fish section (percentage of VCUs by road density category for the Tongass and lands of all ownerships). All VCUs have road densities of less than 4 miles per square mile under existing condition.

Table 6 shows the average future road density for each alternative. It includes existing roads and forestry as well as other roads proposed for construction on NFS lands and reasonably foreseeable on non-NFS lands. All the alternatives would have similar maximum road densities, although Alternative 2 would have a slightly lower maximum road density for lands of all ownerships than

the other alternatives. Therefore, all alternatives have similar chance that management actions would add to cumulative effects to sensitive plants.

Table 6
Existing and Estimated Future Maximum Road Density (miles per square mile) for NFS Lands and for All Ownerships within the Forest Boundary by Alternative after 100+ Years[1]

		Alternative				
	Existing	**1**	**2**	**3**	**4**	**5**
National Forest Land	0.19	0.20	0.20	0.20	0.20	0.20
All Ownerships	0.31	0.40	0.39	0.40	0.40	0.40

[1] Assumes 100+ years of Forest Plan implementation plus future non-NFS harvest.
Source: Tongass National Forest GIS database

Other activities have occurred in the past and are reasonably foreseeable to occur in the future that have the potential to add to cumulative effects to sensitive plants in regional and local areas. They include mineral extraction, energy and utility line projects, hydroelectric projects, transportation developments, and urban and recreational site development. Existing mining is at Greens Creek on Admiralty Island, Kensington Gold Mine north of Juneau, as well as other existing locations. Potential future mining sites include the Bokan Mountain and Niblack sites on the southern end of Prince Wales Island. There are also several regional transportation projects and regional energy and utility line projects planned for construction, including the Kake to Petersburg Transmission Line Intertie Project, regional transportation development defined in the Southeast Alaska Transportation Plan and Forest Service Alaska Region Long Range Transportation Plan, road paving on Prince of Wales Island, and construction of the Angoon Airport. Urban and recreational site development includes the growth in the cruise ship and guiding industries, development of fishing lodges, other lodges, recreational cabins, and expansion of cities. Existing and foreseeable renewable energy projects within the Tongass National Forest Boundary include the potential geothermal development at Bell Island, potential hydroelectric development at Angoon, Sweetheart Lake, and Soule River, and expansion of the Swan Lake hydroelectric project.

Each of the activities described above could include clearing vegetation and disturbing habitat for construction and maintenance; therefore, they have the potential to affect sensitive plants and their habitat. These impacts would be considered in project analysis.

Changes in Alaska's climate (discussed in the Climate and Air section of the FEIS) could affect the hydrology and other habitat conditions where sensitive plants occur. While the models do not fully agree on the climate change predictions for southeast Alaska, they generally predict warmer weather with increased rainfall, and a decrease of snowfall. Recent research by Shanley et al. (2014) predicted an increase in mean annual temperature of approximately 3 to 10 degrees Fahrenheit, a 3 to 18 percent increase in mean annual precipitation, and a 22 to 58 percent decrease in snowfall by the 2080s (Shanley et al. 2014). These changes would likely result in lower soil moisture due to increased evaporation during warmer summer months. In addition, a precipitation shift from snow to rain could lead to more water running off the landscape rather than being stored as snow and feeding streams and wetlands in the late spring and summer; thus, increasing evaporation and reducing water storage. These factors could lead to drier streams, meadows, and wetlands.

Changes in temperature and hydrologic conditions would likely favor some plants and stress others. For example, predicted increase in average temperatures in southeast Alaska due to climate change

could theoretically expand the range of some sensitive plants northward on the Tongass. There has been no specific research; however, into the effects of changes in environmental conditions for any of the sensitive species; consequently, there is uncertainty as to the effect of changes in the climate on sensitive plant species known or suspected to occur on the Tongass. Recent collaboration with the ANHP is expected to provide the Tongass with better information on future climate change scenarios associated with several sensitive plants (work in progress). However, until this work is completed the future expansions or contractions in sensitive plant ranges within the Planning Area is uncertain.

RISK ASSESSMENT FOR SENSITIVE PLANTS

Determination of risks to populations of sensitive plants takes into account size, density, vigor, habitat requirements, location of the population, and consequence of adverse effect on the species as a whole within its range and within the National Forest. A risk assessment considers two factors:

Factor 1) the consequence of adverse (or beneficial) effects on the population, and

Factor 2) the likelihood or probability that these effects will occur. Levels of consequence and levels of likelihood are described in the Appendices under the heading "Criteria for Risk Assessment"

The direct, indirect, and cumulative effects of the proposed project are used to determine the level of consequence and level of likelihood (Stensvold 2011). The determination of effects is the same for all alternatives.

Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*):
The consequence of adverse effects on currently unknown populations in the Tongass would be high because of the rarity of this species in the analysis area. However, because this species is not currently known on the Tongass and because it may receive protection from existing Forest-wide standards and guidelines, the likelihood or probability that these effects will occur are low. Because there is a very low chance of affecting populations or habitat for Eschscholtz's little nightmare, there is a low risk that any alternative would affect this species or result in a loss of this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Spatulate moonwort (*Botrychium spathulatum*):
The consequence of adverse effects on currently unknown and known populations on the Tongass would be high because of the rarity of this species in the analysis area. However, because spatulate moonwort may receive protection from existing Forest-wide standards and guidelines and because there is a very low chance of affecting known occurrences of this species, there is a low risk that any alternative would affect this species or result in loss of this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Moosewort fern (*Botrychium tunux*):
The consequence of adverse effects on currently unknown and known populations within the Tongass N.F. would be high because of the rarity of this species in the analysis area. However, because moosewort fern may receive protection from existing Forest-wide standards and guidelines and because there is a very low chance of impacting known occurrences of this species, there is a low risk that any alternative would affect this species or result in loss of this species' viability.

Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Moonwort fern (*Botrychium yaaxudakeit*):
The consequence of adverse effects on currently unknown and known populations on the Tongass would be high because of the rarity of this species in the analysis area. However, because no known occurrences of moonwort fern would be impacted under any of the alternatives and because this species may receive protection from existing Forest-wide standards and guidelines, there is a low risk that any alternative would affect this species or result in loss of this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Edible thistle (*Cirsium edule* var. *macounii*):
The consequence of adverse effects on currently unknown and known populations on the Tongass would be high because of the rarity of this species in the analysis area. However, because this species is not likely to be impacted by timber harvest and because protection from the Forest-wide standards and guidelines would consider minimizing impacts to this species from road construction and reconstruction and renewable energy projects under all alternatives, there is a low risk that any alternative would affect this species or result in loss of this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Mountain lady's slipper (*Cypripedium montanum*):
The consequence of adverse effects on currently unknown and known populations on the Tongass would be high because of the rarity of this species in the analysis area. Although this species may receive protection from existing Forest-wide standards and guidelines, due to the single known occurrence in the Planning Area, coupled with the potential for impacts to this known occurrence from future timber harvest and road construction, a moderate level of risk to this species exists under all alternatives, which may result in loss of this species' viability in the Planning Area. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Large yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens*):
The consequence of adverse effects on currently unknown and known populations on the Tongass would be high because of the rarity of this species in the analysis area. However, protection from Forest-wide standards and guidelines would consider minimizing these risks under all alternatives. Due to the low numbers of known occurrences of this species in the Planning Area, coupled with the potential for some level of impacts to these occurrences from future road construction, an increased level of risk to this species' viability exists under all alternatives, which may result in loss of this species' viability in the Planning Area. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Calder's lovage (*Ligusticum calderi*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be moderate because of the low number of known occurrences of this species in the analysis area. The likelihood or probability that Calder's lovage would be affected by management activities is low, since no known occurrences are expected in old-growth or young-growth harvest units under any of the alternatives. Because habitat for this species is generally not affected by timber harvest, and because of the relatively low projected impacts from future road construction there is a low risk that any alternative would affect this species or result in loss of this species' viability. Because of

this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Lichen, no common name (*Lobaria amplissima*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be moderate because of the number of known occurrences of this species in the analysis area. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during pre-project surveys. Only one of the 30 known occurrences is expected to be within young-growth harvest units; therefore, there would be a relatively low risk to this species viability in the Planning Area. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Pale poppy (*Papaver alboroseum*):
The consequence of adverse effects on currently unknown populations in the Tongass would be high because of the rarity of this species in the analysis area. However, because pale poppy is not currently known on the Tongass, because it may receive protection from the Forest-wide standards and guidelines, and because of the very low chance of affecting habitat, there is a very low risk that any alternative would affect this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Alaska rein orchid (*Piperia unalascensis*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be moderate because of the number of known occurrences of this species in the analysis area. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during pre-project surveys. Because only a proportion of one of the 18 known occurrences of this species are expected to be within old-growth harvest units, there would be a low level of risk to this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Lesser round-leaved orchid (*Platanthera orbiculata*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be low because of the number of known occurrences of this species in the analysis area and because approximately 40 percent of the known occurrences are not currently threatened by proposed management activities. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. At the most, approximately 17 known occurrences of lesser round-leaved orchid are expected to be within old-growth harvest units, and another 29 known occurrences are expected to be within young-growth harvest units, out of the 291 distinct occurrences on the Tongass; therefore, there would be a relatively low level of risk to this species' viability. Current science evidence does not indicate a substantial concern for the capability of lesser round-leaved orchid to persist over the long-term in the Tongass plan area (USDA Forest Service 2015). Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Kruckeberg's swordfern (*Polystichum kruckebergii*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be high because of the low number of known occurrences of this species in the analysis area.

Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. Because Kruckeberg's swordfern may receive protection from existing Forest-wide standards and guidelines and because there is a very low chance of affecting occurrences or habitat for this species, there is a low risk to this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Unalaska mist-maid (*Romanzoffia unalaschcensis*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be high because of the low number of known occurrences of this species in the analysis area. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to known occurrences of this species and new occurrences of this species located during project surveys. Because Unalaska mist-maid may receive protection from existing Forest-wide standards and guidelines and because there is a low chance that any of the known occurrences will be associated with old-growth or young-growth timber harvest or other proposed activities in the future, there is a low risk that any alternative would affect this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Henderson's checkermallow (*Sidalcea hendersonii*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be high because of the number of known occurrences of this species in the analysis area. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to the known occurrence of this species and new occurrences of this species located during project surveys. Because Henderson's checkermallow may receive protection from existing Forest-wide standards and guidelines and because no known occurrences of this species would be impacted under any of the alternatives, there is a low risk that any alternative would affect this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

Dune tansy (*Tanacetum bipinnatum* ssp. *huronense*):
The consequence of adverse effects on currently unknown and known populations in the Tongass would be high because of the number of known occurrences of this species in the analysis area. Forest-wide standards and guidelines under all alternatives would consider protection to minimize impacts to this species. Because of the possible protection from the Forest-wide standards and guidelines and the very low chance of affecting the one known occurrence or unknown occurrences of this species or its habitat, there is a low risk that any alternative would affect this species' viability. Because of this plant's abundance outside the Tongass, no alternative would result in a trend toward federal listing.

The ratings for the risk assessment are in Appendix C.

DETERMINATION

Based on the rationale described above, the alternative courses of action (including Design Features and Forest Service Standard and Guidelines for sensitive plants) result in the following determinations for sensitive plants. Determinations are listed by alternative and plant taxon.

All Alternatives

In conclusion, *may affect* determinations (FSM 2670) are appropriate for all sensitive plants that are known or suspected to occur on the Tongass National Forest with two exceptions (see below) for all of the alternatives. These determinations was based on the analysis provided in this BE.

- The determination for Eschscholtz's little nightmare and pale poppy is *no effect on the species*.
- The determination for all other sensitive plants identified in this Forest Plan Amendment is *may affect the species.*

SUMMARY

Based on the rationale described above, the relative impacts from the alternatives and determinations for sensitive plant species are summarized in Table 7.

Table 7
Summary of relative impacts of the alternatives and determinations for sensitive plant fish species on the Tongass

Species	Relative Impacts of the Alternatives	Determinations				
		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Eschscholtz's little nightmare (*Aphragmus eschscholtzianus)*	1 < 4 < 5< 3 < 2	No Affect	No Affect	No Affect	No Affect	No Affect
Spatulate moonwort (*Botrychium spathulatum*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Moosewort fern (*Botrychium tunux*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Moonwort fern (*Botrychium yaaxudakeit*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Edible thistle (*Cirsium edule* var. *macounii*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Mountain lady's slipper (*Cypripedium montanum*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Large yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens)*	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Calder's lovage (*Ligusticum calderi*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Lichen, no common name (*Lobaria amplissima*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Pale poppy (*Papaver alboroseum*)	1 < 4 < 5 < 3 < 2	No Affect	No Affect	No Affect	No Affect	No Affect
Alaska rein orchid (*Piperia unalascensis*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Lesser round-leaved orchid (*Platanthera orbiculata*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Kruckeberg's swordfern (*Polystichum kruckebergii*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect

Table 7
Summary of relative impacts of the alternatives and determinations for sensitive plant fish species on the Tongass (continued)

Species	Relative Impacts of the Alternatives	Determinations				
		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Henderson's checkermallow (*Sidalcea hendersonii*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect
Dune tansy (*Tanacetum bipinnatum* ssp. *huronense*)	1 < 4 < 5 < 3 < 2	May Affect	May Affect	May Affect	May Affect	May Affect

ADDITIONAL MANAGEMENT RECOMMENDATIONS

IF ANY PREVIOUSLY UNDISCOVERED SENSITIVE PLANTS ARE ENCOUNTERED AT ANY TIME PRIOR TO OR DURING PROJECT IMPLEMENTATION, ASSESS APPROPRIATE PROTECTION MEASURES TO THE POPULATION AND SEEK TO AVOID ANY DISTURBANCE IN THE AREA CONTAINING THE POPULATION (AND SIMILAR HABITATS IN THAT VICINITY). THE DISTRICT OR FOREST BOTANIST/ECOLOGIST SHOULD BE NOTIFIED IMMEDIATELY TO EVALUATE THE POPULATION AND RECOMMEND AVOIDANCE OR OTHER MITIGATION MEASURES.

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Appendix A. Alaska Region Sensitive Plants, February 2009

Common Name	Scientific Name	Occurrence	
		CNF	**TNF**
Vascular Plant			
Eschscholtz's little nightmare	*Aphragmus eschscholtzianus*	Y	S
Moosewort fern	*Botrychium tunux*	S	Y
Spatulate moonwort fern	*Botrychium spathulatum*	S	Y
Moonwort, no common name	*Botrychium yaaxudakeit*	S	Y
Edible thistle	*Cirsium edule* var. *macounii*		Y
Sessileleaf scurvygrass	*Cochlearia sessilifolia*	S	
Spotted lady's slipper	*Cypripedium guttatum*	Y	
Mountain lady's slipper	*Cypripedium montanum*	S	Y
Large yellow lady's slipper	*Cypripedium parviflorum* var. *pubescens*	S	Y
Calder's lovage	*Ligusticum calderi*	S	Y
Pale poppy	*Papaver alboroseum*	Y	S
Alaska rein orchid	*Piperia unalascensis*	S	Y
Lesser round-leaved orchid	*Platanthera orbiculata*		Y
Kruckeberg's swordfern	*Polystichum kruckebergii*		Y
Unalaska mist-maid	*Romanzoffia unalaschcensis*	Y	Y
Henderson's checkermallow	*Sidalcea hendersonii*		Y
Dune tansy	*Tanacetum bipinnatum* subsp. *huronense*	S	Y
Lichen			
Lichen, no common name	*Lobaria amplissima*	S	Y

Y = yes, on the Forest
S = suspected on the forest

Appendix B. Survey Types.

Survey type	Description
Field Check	The survey area is given a quick "once over" but the surveyor does not walk completely through the project area. The entire area is not examined.
Cursory	A Cursory survey is appropriately used to confirm the presence of species of interest identified in previous surveys or in the pre-field analysis. By its nature, the cursory survey is rapid, and does not provide in-depth environmental information. The entire area is traversed at least once. For example, stand condition as seen in aerial photography can be verified by a cursory survey. Also, a cursory survey can be used to determine if a plant population that had been previously documented at a site remains present or intact.
General	The survey area is given a closer review by walking through the area and its perimeter or by walking more than once through the area. Most of the area is examined
Focused (Intuitive Controlled)	The Focused, or Intuitive Controlled, survey is the most commonly used and most efficient method of surveying for TES plants. During pre-field analysis, potential suitable habitat is identified for each species of interest and the survey effort is focused in those areas. This method requires adequate knowledge of suitable habitat in order to accurately select the areas of focused searching. When conducting intuitive controlled surveys, an area somewhat larger than the identified suitable habitat should be searched to validate current suitable habitat definitions.
Random	Random surveys employ an undirected, typically non-linear, traverse through a project area. They are employed either when there is inadequate natural history information about a species to discern its suitable habitat and the surveyor is simply searching for occurrences, or when a target species is very abundant within a search area and the surveyor is attempting to make estimates of population parameters such as intra-patch variations in density or the occurrence of predation or herbivory. However, a stratified random survey may be more effective in these latter cases.
Stratified Random	This survey is most often used within known population areas of target species, or when an area to be surveyed is of unknown habitat suitability and is relatively large. Stratified random surveys employ a series of randomly selected plots of equal size within a project area that are each thoroughly searched for target species. When conducting a stratified random survey, it is important to sample an adequate number of plots that are of sufficient size if statistical inference regarding the survey area is desired (discussion of sample designs, see Elzinga, C., *et al.* 1998)**.**
Systematic	Typically used in limited areas where the likelihood of occurrence of a target species may be evenly distributed throughout the survey area. Systematic surveys are often employed either within focused search areas (e.g., stratified random and intuitive controlled methods), or when a proposed project is likely to produce significant habitat alterations for species that are especially sensitive to the proposed activities.

Appendix C. Criteria for Risk Assessment (Stensvold 2011).

Factor 1. Consequence of Adverse Effect From a Particular Activity

LOW: None, or questionable adverse effect on habitat or population.
No cumulative effects expected.

MODERATE: Possible adverse effects to habitat or to population.
Cumulative effects possible.

HIGH: Obvious adverse effects on habitat or population.
Cumulative effects probable.

Factor 2. Likelihood of Adverse Effect From a Particular Activity

NONE: Activity will not affect habitat or population.
(no further risk assessment needed).

LOW: Activity controllable by seasonal or spatial restrictions.
and not likely to affect habitat or populations.

MODERATE: Activity not completely controllable or intense administration of project needed to prevent adverse effects on habitat or population. Adverse effects may occur.

HIGH: Activity not controllable and adverse effects on habitat or populations likely to occur.

@NOTE! This process serves only to document the rationale for arriving at conclusions as per WO letter dated May 12, 1992.