Chapter 3

Environment and Effects

Introduction

This chapter provides information concerning the existing environment of the Logjam project area, and potential consequences to the environment as a result of this project. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2. Each resource potentially affected by the proposed action or other alternatives is described by its current condition and uses.

Chapter 3, describes the environment that may be modified by the selected alternative and the environmental effects associated with the significant issues. These issues include: effects to aquatic habitat, wildlife and subsistence use, timber supply and sale economics, and Inventoried Roadless Areas. Other concerns that were expressed during public scoping, which are not significant issues, or fall within other laws or regulations are also discussed in this chapter. All effects, including direct, indirect and cumulative effects are disclosed. Effects are quantified where possible, and qualitative discussions are also included. The means by which potential adverse effects would be reduced or mitigated are described in this chapter and in Appendices B and C. Other environmental considerations are also addressed in this chapter.

The discussions of resources and potential effects use existing information included in the Forest Plan, other project environmental analyses, project-specific resource reports, agency and scientific studies, and related information. Where applicable, such information is briefly summarized and referenced to minimize duplication. The planning record for the Logjam project area includes all project-specific information, including resource reports, documentation of field investigations, and information resulting from public involvement efforts. The planning record is located at the Thorne Bay Ranger District office in Thorne Bay, Alaska and is available for review during regular business hours. Information from the record is available upon request.

Ecological and Administrative Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the different resources and allow analysis of how they may be affected by Forest Plan and project-level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. The allocations of Forest Plan land use designations (LUDs), discussed in Chapter 1 are one such division. See Map 2 in Chapter 1. Other divisions important for the effects analysis are described briefly here.

3 Environment and Effects

Value Comparison Units (VCUs)

These are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow major watershed divides. VCUs generally subdivide the LUDs into logical analysis units. See Map 2 in Chapter 1.

Wildlife Analysis Areas (WAAs)

These are land divisions used by the Alaska Department of Fish and Game (ADF&G) for wildlife analysis and regulating wildlife populations. The project area corresponds with designated land division WAA 1421. Information estimated by WAA is used in the wildlife and subsistence analyses.

Project Area

The project area was mapped by the Interdisciplinary Team (IDT) to define the boundary of the area in which the project will occur. The project area is approximately 56,133 acres in size, of which 12,732 acres are considered suitable for timber management. Also included in the project area are 1,129 acres of non-NFS land which is not available for timber management by the National Forest.

Watershed

Watershed refers to the area that contributes water to a drainage or stream and to the portion of a forest in which all surface water drains to a common point. Watersheds can range from tens-of-acres that drain a single, small intermittent stream, to many thousands-of-acres for a stream that drains hundreds of connected intermittent and perennial streams. Twelve watersheds were analyzed in the Logjam project area (see Map 8 below).

Inventoried Roadless Area (IRA)

Inventoried roadless areas (IRAs) are undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or Forest planning. The Logjam Timber Sale project falls within two Inventoried Roadless Areas: Thorne River #511 and Sarkar #514 IRAs.

Biogeographic Province

This designation refers to 21 ecological subdivisions of Southeast Alaska that are identified by generally distinct ecological, physiogeographic, and biogeographic features. Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces. Historical events (such as glaciers and uplifting) are important to the nature of the province and to the barriers that distinguish each province. Logjam is located in Biogeographic Province 14, the North Central Prince of Wales province. Effects of management at this scale are analyzed as part of the Forest Plan.

Analyzing Effects

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) includes the following specific categories to use for the analysis of environmental consequences.

Direct, Indirect and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Reasonably foreseeable actions are those that are currently planned or scheduled to occur.The5-year timber sale plan is the instrument through which future timber sales are scheduled. Therefore, for the purpose of this analysis, reasonably foreseeable future actions are considered to be those that will occur within the next 5 years.

In the environmental consequences sections, the direct and indirect effects are presented first, followed by cumulative effects. For the purpose of evaluating cumulative effects, the IDT considered all lands in the project area. For some resources, an expanded boundary was evaluated.

Under CEQ regulations and for the purposes of this analysis, “impacts” and “effects” are synonymous and are interchangeable.

Known Projects in the Logjam Project Area

Appendix D provides summary of past, ongoing and future activities that have been considered in the cumulative effects sections of each resource in this chapter.

Catalog of Past Harvests

Appendix D contains a summary of past harvests in the Logjam Project Area, and a catalog of past harvests can be found in the project record.

Other Resources

Several resources and uses of the project area are likely to remain unaffected by the Proposed Action or alternatives, or will not be affected to a significant degree. Even though significant effects are not anticipated, these resources can be discussed in the sections of this chapter which follow the introduction, to the extent that measurable effects or differences between alternatives are present. Resources or uses for which no measurable effects were identified are discussed briefly here.

Air Quality

No significant effects on global carbon sequestration levels are expected under any of the alternatives considered for the 2008 FEIS. Therefore, it is reasonable to conclude that small

changes (project level) in carbon sequestration on the Tongass, whether beneficial or adverse, would have a minor effect on atmospheric carbon levels. All of the action alternatives proposed for this timber sale would have limited, short-term effects on ambient air quality. Such effects, in the form of vehicle emissions and dust, are likely to be indistinguishable from other local sources of airborne particulates, including other motor vehicle emissions, dust from road construction and motor vehicle traffic, residential and commercial heating sources, marine traffic, and emissions from burning at sawmills. The action alternatives could result in short-term supplies of raw wood products to local mills. It is the responsibility of the mill owner or sort yard operator to ensure that mill emissions are within legal limits. Air quality is discussed in the Old Growth and Biodiversity Resource Report in the Project record, as well as the section entitled, "Probable Adverse Environmental Effects that Cannot be Avoided."

Heritage Resources

Forest Plan Standards and Guidelines for the identification of heritage (historic and archaeological) resources apply. A sample-based survey of the project area as described in the programmatic agreement (PA) between the Forest Service Alaska Region, the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (USDA FS 2002, as amended 2007) was completed for the Logjam project area. Analysis of the survey results produced a determination of "no historic properties affected" for all alternatives. Under the terms of the PA the Forest Service may proceed with the undertaking. The project report will be submitted to SHPO for programmatic review.

Land Status

Under the Alaska Statehood Act of 1959, the State of Alaska is entitled to a certain amount of Federal land. The State was also allowed to identify for selection more acreage than would ultimately be conveyed to State ownership. There are 1,097 forested acres of non-Forest Service land, selected but not conveyed, within the project area but excluded from the proposed project and alternatives. There is no other State land selected but not conveyed in the project area. Other legislation granted Alaska Native corporations similar selection rights. There are no Alaska Native land selections or claims within the project area.

Plans of Other Agencies

The CEQ regulations implementing NEPA require a determination of possible conflicts between the Proposed Action and the objectives of Federal, State, and local land use plans, policies, and controls for the area. The major land use regulations of concern are the State of Alaska's Forest Practices Act. State compliance is also discussed at the end of Chapter 1.

Environment and Effects of Key or Significant Issues

The Council on Environmental Quality (CEQ) issues guidance to Federal agencies to determine the significant issues concerning any proposal, and to eliminate those issues that are not significant, or that are outside the scope of this document (40 CFR 1508.27). With the

help of the public and other agencies, the IDT identified four issues to be examined in detail for the proposed project. The following sections describe the environmental effects of each of the alternatives as they relate to these four issues. Other resources for which effects may occur are also discussed in this chapter. The environmental effects of timber harvest and road construction on water quality, hydrological function, fish habitat, wildlife habitat, visual quality, soils, wetlands and other resources within the project area are summarized in the sections below, and discussed and analyzed in the specialist reports located in the Administrative Record for the Logjam DEIS. All resource reports prepared for this project are incorporated herein by reference.

Issue 1: Effects to Aquatic Habitat

Issue Statement: Cumulative effects of past and proposed harvest and existing and proposed roads in the Logjam project area may increase sedimentation and impact aquatic habitat.

Project scoping responses expressed concerns about the intensity of past harvest in the Logjam project area and its effects on watersheds and fish. The interdisciplinary team developed Issue 1 in response to this concern. The analysis (and development of Alternative 3) emphasized Sweetwater, Logjam, and Trumpeter watersheds because they comprise most of the project area. These watersheds have high fisheries values and the highest levels of harvest and road construction. The units of measure used to evaluate the effects of the proposal and compare alternatives include:

- Watersheds with more than 20 percent basin area harvested from 1979 to present (young growth thirty years of age or younger)
- Total miles of new road construction
- New Class I and II stream crossings

Affected Environment

The Logjam project area encompasses roughly 56,000 acres of north Prince of Wales Island in Southeast Alaska near Coffman Cove. Elevation ranges from sea level to over 2500 feet in the headwaters of Logjam Creek. Annual precipitation may exceed 100 inches, with the highest rainfall occurring during October and lowest in June. Individual storms vary dramatically over short distances and can produce intense rainfall and high winds.

The project area contains two distinct Ecological Subsections: Central Prince of Wales Till Lowlands and Volcanics. The majority of the project area is characterized as Central Prince of Wales Till Lowlands, especially in the vicinity of Sweetwater Lake and its estuarine outlet. This subsection developed gently undulating terrain under continental ice lobes. Slow moving palustrine and floodplain channel types are common on this landscape (Nowacki et al. 2001). The headwaters of Logjam Creek and Trumpeter Creek are characterized as Central Prince of Wales Volcanics. This terrain originated as rugged volcanic mountains. Subsequent glaciation carved steeply sloped U-shaped valleys (Nowacki et al. 2001).

Map 8 displays the twelve potentially affected watersheds. These include the Sweetwater Lake watershed and its major tributaries: Logjam, Hatchery, and Trumpeter Creeks. Sweetwater Lake is a freshwater lake with tidal influence. The Gold and Galligan Lagoon and Barnes Lake are downstream of Sweetwater Lake and flow into Clarence Strait north of Coffman Cove. Table 4 displays watersheds and basin areas. See Watershed Resource Report for more detailed watershed descriptions.

Map 8. Watersheds within the Logjam Project Area

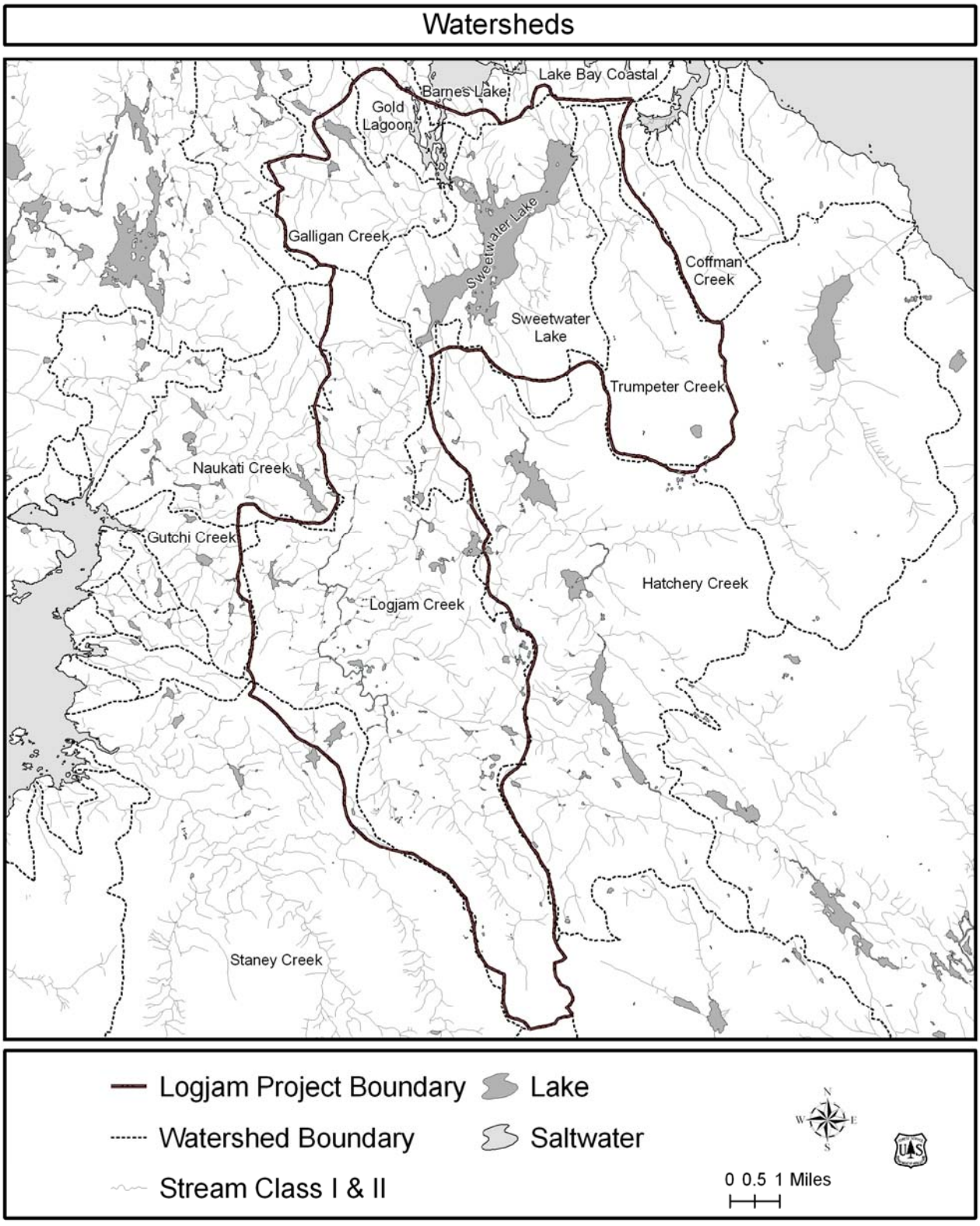


Table 4. Watersheds and basin areas affected by Logjam Timber Sale alternatives

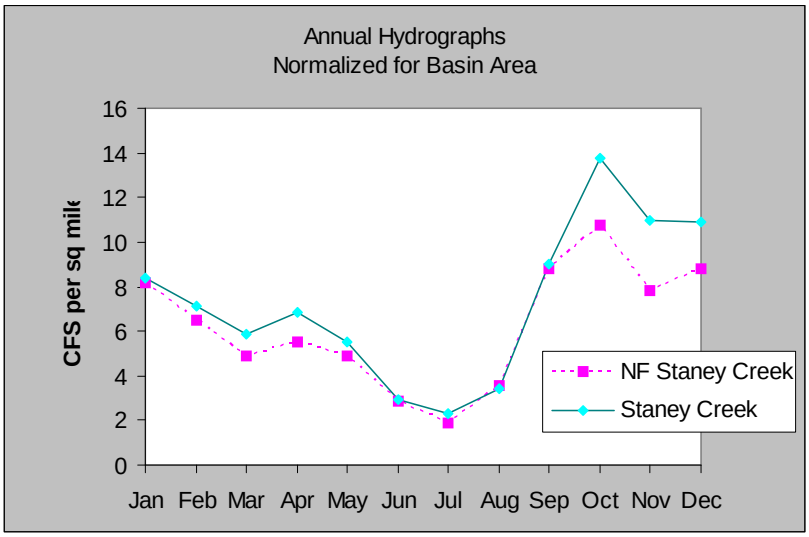
Watershed Name	Hydrologic Unit Code 5th, 6th and 7th Level (all in Unit 19010103)	Total Watershed Size (acres)	Total Watershed Size (square miles)	Percent of Watershed in Logjam Project Area
Barnes Lake	01 03 03	2,700	4.2	12
Coffman Creek	03 05 09	3,200	5.0	12
Galligan Creek	01 03 02	5,630	8.8	80
Gold Lagoon	01 03 04	2,760	4.3	69
Gutchi Creek	09 08 04	3,170	5.0	7
Hatchery Creek	01 02 00	29,060	45.4	5
Lake Bay Coastal	03 05 11	3,560	5.5	5
Logjam Creek	01 01 00	27,790	43.4	97
Naukati Creek	09 05 00	8,240	12.9	4
Staney Creek	09 06 00	39,550	61.8	4
Sweetwater Lake	01 03 01	11,350	17.7	95
Trumpeter Creek	01 03 01	7,790	12.2	99

The following section will describe the existing conditions for streamflow, water quality, sediment and turbidity, temperature, stream habitat and Lake Habitat.

Streamflow

US Geological Survey (USGS) stations provide the only available long term streamflow records near the project (USGS 2008). Hydrographs (Figure 1) display mean monthly streamflow in cubic feet per second (CFS) normalized for contributing basin area of the two stations, one near the mouth of Staney Creek (51 square miles) and one in the headwaters of the North Fork of Staney Creek (3 square miles). The hydrographs represent the typical annual streamflow regimes observed in all the affected watersheds. A small snowmelt peak in spring is followed by low flows during drier summer weather when groundwater storage is depleted. Large rainstorms in fall produce the highest peak flows. Peak flows also occur in winter during rain-on-snow events.

Figure 1. Typical streamflow regime in watersheds affected by Logjam Timber Sale alternatives



Timber harvest changes streamflow by altering processes that control the amount and timing of water delivered to streams. The direct removal of forest canopy affects rain interception (Prussian 2008, Banner et al, 2005), snow storage, snow melt, and soil moisture. After harvest is completed, soil moisture and transpiration changes continue in response to uptake and use of water by remaining and regenerating vegetation.

No baseline (pre-harvest) streamflow data exists for most of the affected watersheds, therefore the IDT used a conservative threshold of cumulative harvest suggested by Bosch and Hewlett (1982) to assess the potential for current change in streamflow resulting from past management: watersheds with at least 20 percent area in young growth less than thirty years of age (as shown in the right hand column of Table 5) may have experienced streamflow changes. Climate cycles also influence streamflow and probably confound most of these studies, which have not occurred over long enough timeframes to account for climate shifts (Neal et al. 2002, USGS 2000).See Watershed Resource Report for other studies considered.

Peak flow increases in the affected watersheds are probably more likely than low flow increases, based on most of the studies in the Pacific Northwest. The Agency assumes that forest canopy recovery occurs in 30 years and would be instrumental in recovery of pre-harvest rainfall interception (Hicks et al, 1991b, Jones, 2000). See Watershed Resource Report for more information on these studies.

Coffman, Naukati, and Trumpeter watersheds (shaded in Table 5) began exceeding this threshold between 1989 and 1992. These streams may currently have increases in peak flows, especially when considering the combined effects of stream network extension by roads (Table 5) in these watersheds. If no further harvest at all occurs in these watersheds, they would reach a state of hydrologic recovery, based on forest canopy, by the early 2020s.

Gutchi and Staney watersheds began exceeding this threshold in the 1970s, but may have attained recovery of forest canopy beginning in about 2002.

Table 5. Past harvest in watersheds affected by Logjam Timber Sale Alternatives

Watershed Name	Total Harvested (acres)	Total Harvested (% basin area)	Total Harvested since 1979 (acres)	Total Harvested since 1979 (% basin area)
Barnes Lake	351	13%	40	1%
Coffman Creek	1115	35%	852	27%
Galligan Creek	463	8%	463	8%
Gold Lagoon	4	<1%	4	<1%
Gutchi Creek	1084	34%	469	15%
Hatchery Creek	3740	13%	2236	8%
Lake Bay Coastal	633	18%	303	9%
Logjam Creek	5445	20%	4726	17%
Naukati Creek	2779	34%	2011	24%
Staney Creek	14756	37%	4256	11%
Sweetwater Lake	1688	15%	947	8%
Trumpeter Creek	1953	25%	1565	20%

In summary, past harvest may have caused increased streamflow at the watershed scale in five of the affected watersheds. Three of these (including Trumpeter) may currently experience increased flows. The increase could be large, but the body of supporting science on this issue has contributed to variable conclusions and it is unlikely that the increase could be measured since baseline data is lacking, except for Staney Creek.

Water Quality

Beneficial Uses of Waters on the Project Area

Water bodies in Alaska are protected for all uses; the most stringent numeric criteria apply in accordance with Alaska Water Quality Standards (ADEC 2006). For stream temperature the most stringent criteria is aquatic life; for turbidity it is drinking water. Existing uses of water from these watersheds include aquatic life and limited contact recreation. There are no public water systems or water supply uses.

pH and Heavy Metals

In 2007, the Federal Highway Administration (FHA) began investigating low pH observed in first and second order fish streams influenced by the Coffman Cove Road (NFS Road 3030000) reconstruction project in the Sweetwater Lake watershed. Geochemical analysis identified acid rock drainage and metals leachate originating from pyritic fill material in the road. High iron, aluminum, copper and chromium levels were discovered in the leachate from the fill. Sampling of two streams in spring 2008 attributed lack of fish downstream of the road to the effects of this leachate. FHA is currently identifying the extent of effects and developing remediation measures to mitigate effects in collaboration with regulatory agencies (FHA 2008). In general, water quality in the affected streams is in a downward trend until remediation measures are implemented.

Sediment and Turbidity

No sediment data are available for the affected watersheds. Limited turbidity and stream temperature data have been collected in some watersheds and are summarized here.

Gomi, et al. (2005) reviewed the effects of timber harvest on sediment relevant to the affected watersheds. Sediment is introduced into streams by channel erosion, roads, landslides and debris flows, and rain splash on bare soils. Increased peak flows could result in stream channel erosion in Coffman, Naukati, Trumpeter, Gutchi and Staney Creeks. Stream bank erosion was only noted in one Proper Functioning Condition (PFC) stream reach assessment in Logjam Creek, and not at all in Trumpeter Creek (Walters 2005). Headwater sediment transport processes are further discussed below under Stream Habitat.

Road construction in Southeast Alaska requires substantial ground disturbance, producing short term increases in sediment transport (Paustian 1987). Road reconstruction, maintenance, and storage activities also mobilize sediment. These periodic short-term increases would have occurred in each of the affected watersheds from the 1950s through 2007; most recently from reconstruction (road re-alignment, widening, and drainage structure replacement) on the entire length of the Coffman Cove Road through the affected watersheds (Logjam, Hatchery, Sweetwater, Trumpeter, and Coffman).

Landslide inventories were completed in the project area, but not in all affected watersheds. Logjam and Trumpeter are the steepest watersheds and therefore have a higher percentage of unstable soils than other watersheds (Saari 2008). More landslides (73) are attributed to natural causes than to roads or harvest (62), and affect more area (141 acres compared to 22 acres). These results are similar to the results from other landslide inventories on the Tongass (ibid). Some landslides are connected to streams and have transported sediment. Natural and management-induced landslides and other sediment sources are described by Walters (2005) and in field reconnaissance notes summarized in the Fisheries Resource Report.

Studies in Southeast Alaska have correlated higher rates of road erosion with heavy traffic and poor quality rock surfacing (Kahklen and Hartsog 1999). In Washington's Olympic Peninsula, Cederholm et al. (1980) found that accumulation of fine sediment in streambeds was highest in basins where the road area exceeded 2.5 percent of the basin area. None of the affected watersheds have total road area exceeding 2.5 percent basin area. Naukati Creek and Gutchi Creek have the highest road densities (see Watershed Resource Report for more information).

Based on minimum clearing widths and road surface specifications, the Agency used a width of 40 feet to estimate area of road surface and cut slope contribution to erosion and sediment. Table 6, which follows, summarizes existing roads in watersheds affected by the Logjam timber sale alternatives.

Table 6. Existing roads in watersheds affected by Logjam Timber Sale Alternatives

Watershed Name	Total Basin Size (acres)	Total Existing Road (miles)	Total Existing Road (acres)	Percent of Basin as Roads
Barnes Lake	2,700	0.07	0.3	<0.1
Coffman Creek	3,200	9.76	47.3	1.5
Galligan Creek	5,630	6.49	31.5	0.6
Gold Creek	2,760	0	0	0
Gutchi Creek	3,170	13.51	65.5	2.1
Hatchery Creek	29,060	47.77	231.6	0.8
Lake Bay Coastal	3,560	2.65	12.8	0.4
Logjam Creek	27,790	82.62	400.6	1.4
Naukati Creek	8,240	36.99	179.4	2.2
Staney Creek	39,550	147.21	713.7	1.8
Sweetwater Lake	11,350	28.70	139.2	1.2
Trumpeter Creek	7,790	23.57	114.3	1.5

Road Condition Surveys in the project area were completed in 1998. In 2003, nearly all of the NFS roads except Forest Roads 2300, 3000, and 3030 were surveyed. The surveys were completed and site-specific sediment sources were identified on numerous NFS roads (Walters, 2005).

Walters summarized eight qualitative riparian PFC assessments in the affected watersheds and concluded that sediment deposition was contributing to a downward trend in one stream reach (in Hatchery Creek). All other reaches were rated as properly functioning or functioning at risk with an upward trend (including Logjam and Trumpeter Creeks) (ibid).

Alaska Water Quality Standards state that "Turbidity may not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than a 10 percent increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU" (ADEC 2006).

Turbidity data were collected at fourteen sites along the Coffman Cove Road (Road 3030) during 2002 and 2003. Turbidity was generally below 5 NTU except during storm events (Prussian 2003). During storm events, turbidity reached at least 250 NTUs (the instrument maximum). Continuous turbidity monitoring at other locations on Prince of Wales Island suggests that background turbidity, even in a heavily harvested watershed, is consistently near 0 NTUs, but can peak near 200 NTUs in both unharvested and harvested watersheds during storm events (Thompson and Tucker 2007). The available data suggests that turbidity ranges in the affected watersheds are within ranges observed in unmanaged watersheds and within the criteria established by the state.

In summary, inherent and management-induced sediment sources have been identified in the affected watersheds at site and stream reach scales. However, the best available information

suggests that sediment transport and turbidity within these watersheds are not degrading watershed condition. An exception might be Hatchery Creek which may be experiencing a downward trend (PFC) related to sediment and riparian harvest in at least one reach.

Temperature

Alaska Water Quality Standards state that stream temperatures "may not exceed 20°C at any time. The following maximum temperatures may not be exceeded, where applicable:

- Migration routes 15°C
- Spawning areas 13°C
- Rearing areas 15°C
- Egg and fry incubation 13°C

For all other waters, the weekly average temperature may not exceed site-specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms" (ADEC 2006).

Removal of streamside vegetation shade can increase stream temperature. In coastal British Columbia, daily maximum temperature in summer increased in streams with no buffer, while water temperature in streams with buffers did not (Gomi et al 2006). Riparian harvest was prevalent in all of the affected watersheds prior to 1991, even along fish streams (Table 7). Although past riparian harvest probably resulted in stream temperature increases during warm weather, recovery of at least deciduous (alder) shade has occurred in most harvested riparian areas.

Table 7. Past riparian harvest in watersheds affected by Logjam Timber Sale Alternatives

Watershed Name	Total Riparian (acres)	Total Riparian Harvested (acres)	Percent Riparian Harvested
Barnes Lake	292	54	18
Coffman Creek	437	156	36
Galligan Creek	1119	36	3
Gold Lagoon	372	3	1
Gutchi Creek	629	144	23
Hatchery Creek	5048	451	9
Lake Bay Coastal	254	27	11
Logjam Creek	5349	500	9
Naukati Creek	1810	315	17
Staney Creek	8897	2798	31
Sweetwater Lake	3640	283	8
Trumpeter Creek	1079	295	27

Stream temperature data were collected in Hatchery Creek at the Coffman Cove Road bridge downstream of Hatchery Lake from 1999 to 2002. Several periods of maximum stream temperature exceeding 15°C were recorded in June, July or August. Generally temperatures recovered to less than 15°C overnight, but in each summer continuous temperatures

exceeding 15°C endured from one to three weeks. These extended periods of warm stream temperature are driven by radiant heat gains in water stored in the upstream ponds and lakes, and not attributed to timber harvest effects. Evaluation of stream temperature data from both harvested and un-harvested watersheds on Prince of Wales Island showed no predictive relationship between harvest and high stream temperatures, which are likely to occur during low flows resulting from warm, rainless weather (USDA Forest Service 2004, Walters and Prefontaine 2005).

Stream Habitat

The Fisheries Resource Report describes the distribution and characteristics of fish habitat throughout the affected watersheds. The process groups used to classify and map streams in the project area reflect knowledge about inherent stream channel functions and processes affecting fish habitat (Paustian et al 1992). The process groups also aid in the understanding of the effects of past practices.

Hatchery, Logjam, Staney, and Sweetwater watersheds contain many large woody debris (LWD) dependent channels. In these channels, stream habitat complexity is dependent on a continuous supply of large wood from conifer riparian forests. Wood provides essential cover and primary productivity. It is a key agent in scouring and maintaining stable pools in low gradient gravel bed streams (Maser and Sedell 1994).

Wood is also influential in fishless high gradient headwater streams, storing sediment and releasing it to downstream reaches over time (May and Greswell 2000, Gomi et al 2001). These headwater streams are also important sources of organic material which supplies food to downstream fish populations (Wipfli and Gregovich 2002).

Prior to 1991, timber harvest in the riparian area resulted in a young stand of red alder and conifer mix. Although alder provides shade and leaf litter important to primary productivity, it does not provide long lasting large wood (Johnson and Edwards 2002). Natural recovery of large wood in harvested riparian areas could take hundreds of years.

Coffman, Staney and Trumpeter Creeks have the highest proportion of harvested riparian areas (Table 7). Staney, Logjam and Hatchery Creeks have the most riparian harvest along LWD-dependent stream channels (Brigham 2008).

Currently, stream reaches in the project area with past riparian harvest contain adequate legacy (large wood already in stream) LWD. In the future, lack of riparian LWD may contribute to a downward trend in stream habitat conditions.

Lake Habitat

Lakes play an important role in the affected watersheds. They moderate streamflow by storing water during dry periods, they provide important fish habitat, and they act as sinks for sediment. Sweetwater Lake, about 2000 acres surface area, is the largest lake in the affected watersheds. Numerous other lakes and ponds occur primarily in the Hatchery and Logjam watersheds. See Fisheries section in this chapter for more details on lakes in the project area.

Methodology

The analysis area for direct, indirect, and cumulative effects includes all watersheds with any proposed ground disturbance in any alternative.

Forest Service watershed and fisheries staff conducted field reconnaissance of the proposed roads and units between 2000 and 2007, resulting in updates to the streams layer and a very detailed record of erosion features, windthrow, and other relevant observations. In 2003, riparian PFC assessments were conducted by Forest Service watershed and fisheries staff in eight stream reaches in the project area

GIS queries were used to evaluate effects and compare alternatives, and provide surrogate measures of effects, supported by the literature cited. Harvest and road thresholds are used for analysis purposes only, and are not prescribed by the Forest Plan. For more information on methodology, refer to Hydrology Resource Report.

Road miles and harvest unit acres were estimated from the current State Five Year Schedule of Timber Sales (ADNR 2007) and included in calculations of cumulative harvest and roads in affected watersheds.

Environmental Consequences

Direct, indirect and cumulative effects for all affected watersheds are estimated using quantifiable measures for actual effects (e.g., stream crossings are a measure for increased sediment) as supported by the literature cited. The following three measures are used to estimate effects:

- Changed streamflow: watersheds with more than 20 percent basin area harvested from 1979 to present (young growth thirty years of age or younger)
- Increased sediment: total acres of new road construction
- Changed stream habitat: new Class I and II stream crossings

The level (magnitude and intensity) of effects is also characterized by descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last. Descriptors of effects are:

- Negligible: Effects would be undetectable or if detected, would be considered slight, detectable only at the site, and last less than a day.
- Minor: Effects would be measurable, although the changes would be small, localized to the site or affected stream reach, and last less than a week.
- Moderate: Effects would be measurable at the stream reach or subwatershed scale, and last more than a week.
- Major: Effects would be readily measurable at the watershed scale and would last for years.

Exceptions to these descriptors are noted as applicable, since they are not a perfect fit for all effects.

3 Environment and Effects

Streamflow

Table 8 displays watersheds harvested and road acres since 1979, by alternative. These watersheds may experience increased peak flow.

Effects on streamflow in Logjam Creek and Trumpeter Creek could be moderate; but it is unlikely that streamflow increases could be measured. Logjam alternatives are unlikely to increase peak flows in any of the other watersheds. No harvest is proposed in the Staney watershed.

Road effects on streamflow may not recover until flow paths are reclaimed during road decommissioning. The existing extent of road in some affected watersheds, combined with the knowledge that some roads have failed drainage structures and ditch or road surface erosion, suggests that additional road construction will compound the effects of extended stream networks until progress is made on road storage and decommissioning. Alternative 2 in particular stands out as increasing road miles in the Logjam watershed (Table 9) and could result in moderate (though difficult to measure) impacts if existing roads are not stored and decommissioned with practices specifically focused on restoring natural drainage patterns. All alternatives will include pre-haul maintenance on existing roads and would repair some road drainage problems, but not all. All new temporary roads will be decommissioned. All new NFS roads will be put in storage after timber harvest is complete.

Water Quality

pH and Heavy Metals

The source of the pyritic fill material used by the FHA in the Coffman Cove Road project has been identified; all rock sources for roads will be approved and controlled to exclude further use of this fill material during the Logjam Timber Sale. As a result of this, no effects to water quality are anticipated.

Acid rock drainage is occurring on the Coffman Cove road, in part, because the rock is placed in fills up to 15 feet thick, and within the zone of the fluctuating water table. NFS roads constructed for timber sales typically use 2 feet of rock fill over a slash mat. In almost all cases, the rock fill is placed above the fluctuating water table.

Sedimentation and Turbidity

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, would minimize erosion and sediment transport to streams (Rashin et al 2006).Where Class IV streams are within harvest units, disturbance would be minimized through BMPs described on unit cards. Tongass National Forest monitoring data indicate that harvested areas are consistently within the established standard of less than 15 percent detrimental soil disturbance (USDA Forest Service 2005). This finding suggests that ground disturbance during timber harvest alone is probably not a direct source of sediment. Timber harvest would have negligible direct effects on water quality. Increased peak flows could result in stream channel erosion in Logjam and Trumpeter Creeks. The incremental change is unlikely to be detected and is considered negligible. Road construction, including bridge and culvert installation, is expected to temporarily increase sediment delivery to streams (Paustian 1987).

Table 8. Proposed harvest by Logjam Timber Sale Alternatives in affected watersheds

Watershed	Current Condition		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Harvest since 1979 (acres)	Harvest and roads since 1979 (% basin area)	Harvest since 1979 (acres)	Harvest and roads since 1979 (% basin area)	Harvest since 1979 (acres)	Harvest and roads since 1979 (% basin area)	Harvest since 1979 (acres)	Harvest and roads since 1979 (% basin area)	Harvest since 1979 (acres)	Harvest and roads since 1979 (% basin area)
Barnes	40	1%	49	2%	40	1%	40	1%	40	1%
Coffman	852	29%	857	29%	858	29%	852	29%	858	29%
Galligan	463	8%	573	10%	509	9%	513	9%	538	10%
Gold	4	<1%	4	<1%	4	<1%	4	<1%	4	<1%
Gutchi	469	16%	492	17%	500	17%	500	17%	532	18%
Hatchery	2,236	8%	2,317	8%	2,251	8%	2,251	8%	2,308	8%
Lake Bay	303	12%	303	12%	303	12%	303	12%	314	12%
Logjam	4,726	18%	6,137	23%	5,685	21%	5,382	20%	5,944	22%
Naukati	2,011	26%	2,016	26%	2,020	26%	2,020	26%	2,020	26%
Staney	4,256	12%	4,256	12%	4,256	12%	4,256	12%	4,256	12%
Sweetwater	947	9%	1,751	16%	1,590	15%	1,550	14%	1,788	16%
Trumpeter	1,565	21%	2,014	27%	1,822	24%	1,662	22%	1,891	25%

Numbers from Brigham 2008. Percentage column includes road acres as well as harvest. 50% retention units adjusted to 50% acreage, 75% retention units adjusted to 25% acreage

Table 9. Proposed road construction by Logjam Timber Sale Alternatives in affected watersheds

Watershed	Existing Roads		Proposed Miles of Road for each Alternative							
			Alt.2		Alt. 3		Alt. 4		Alt. 5	
	miles	% basin in roads	miles	% basin in road	miles	% basin in road	miles	% basin in road	miles	% basin in road
Barnes	0.07	0.0	<0.1	0.0	0	0.0	0	0.0	0	0.0
Coffman	9.76	1.5	0	1.5	0	1.5	0	1.5	0	1.5
Galligan	6.49	0.6	1.3	0.7	0.4	0.6	0.4	0.6	0.6	0.6
Gold	0	0	0	0.0	0	0.0	0	0.0	0	0.0
Gutchi	13.51	2.1	0.5	2.1	0.5	2.1	0.5	2.1	0.6	2.2
Hatchery	47.77	0.8	1.2	0.8	0.1	0.8	0	0.8	0.6	0.8
Lake Bay	2.65	0.4	0.3	0.4	0	0.4	0	0.4	0	0.4
Logjam	82.62	1.4	15.8	1.7	6.8	1.6	5.3	1.5	8.7	1.6
Naukati	36.99	2.2	0.7	2.2	0.5	2.2	0.5	2.2	0.5	2.2
Staney	147.21	1.8	0.3	1.8	0	1.8	0	1.8	0	1.8
Sweetwater	28.70	1.2	5.8	1.5	3.3	1.4	4.2	1.4	4.8	1.4
Trumpeter	23.57	1.5	3.5	1.7	2.3	1.6	1.8	1.6	2.6	1.6
Total			29		14		13		18	

This table includes all roads in available GIS covers (system, temporary, and unauthorized). Proposed miles of road include system and temporary. Totals are rounded to nearest whole number.

Table 10. Proposed road –stream crossings by Logjam Timber Sale Alternatives in affected watersheds

Watershed	Class I, II, and III Road-Stream Crossings by Alternative																			
	Existing				Alt. 2 proposed				Alt. 3 proposed				Alt 4. proposed				Alt. 5 proposed			
	I	II	III	total	I	II	III	Combined[3] Total	I	II	III	Combined Total	I	II	III	Combined Total	I	II	III	Combined Total
Barnes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coffman	3	1	0	4	0	0	0	4	0	0	0	4	0	0	0	4	0	0	0	4
Galligan	6	3	8	17	0	0	1	18	0	0	0	17	0	0	0	17	0	0	0	17
Gold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutchi	6	8	3	17	0	0	0	17	0	0	0	17	0	0	0	17	0	0	0	17
Hatchery	18	13	44	75	2	0	0	77	0	0	0	75	0	0	0	75	1	0	0	76
Lake Bay	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Logjam	58	39	29	126	8	10	7	151	4	1	1	132	3	1	0	130	4	3	1	134
Naukati	26	17	15	58	0	0	1	59	0	0	0	58	0	0	0	58	0	0	0	58
Staney	103	54	245	402	0	1	0	403	0	0	0	402	0	0	0	402	0	0	0	402
Sweetwater	28	14	20	62	1	5	6	74	0	1	0	63	1	2	6	71	1	2	6	71
Trumpeter	7	13	30	50	0	0	2	52	0	0	1	51	0	0	0	50	0	0	2	52
Total	255	163	394	812	11	16	17	856	4	2	2	820	4	3	6	825	6	5	9	832

Note: This table includes all crossings in affected watersheds.

[3] The Combined Total is the alternative's proposed Road-Stream Crossings added to the Existing Road-Stream Crossings for each watershed.

Provisional results of a case study[4] underway on Prince of Wales Island suggest that turbidity (and sediment) increases during and after road construction, and during log haul, were temporary and recovered to baseline levels without degrading water quality (Thompson and Tucker 2007). Likewise, results of grab sample turbidity monitoring during drainage structure installation suggests that under typical construction conditions, BMPs are effective in achieving water quality criteria within a couple of days following completion of instream work (Thompson 2002). Another provisional study of turbidity during sixteen culvert installations near the Logjam project area found that mean turbidity levels measured 40 meters downstream of installation recovered to less than 25 NTUs (the state water quality criteria for aquatic life) within two hours of installation (Konopacky 1996).

Sediment increases across alternatives are compared using number of proposed road-stream crossings in each alternative (Table 10). Class IV stream crossings are not included in this comparison because it is likely that many have not been field verified to date. Alternative 2 proposes the most road-stream crossings (42 Class I, II, and III streams); and the most road-stream crossings would be in Logjam Creek watershed (25 Class I, II, and III streams).

None of the alternatives exceed the analytical threshold (Cederholm, et al 1980) of 2.5 percent basin area in roads (Table 9), even when considering foreseeable roads constructed for state harvest. Gutchi, Naukati, and the North Fork Staney are approaching this threshold, which may be a concern for cumulative effects, especially with the upcoming Staney Timber Sale.

More problematic is the cumulative effects of un-maintained older roads in these watersheds combined with the addition of new roads for the Logjam Timber Sale. The effects of road-related sediment sources at the watershed scale probably cannot be measured, but they represent a chronic source of sediment and do not meet road management objectives at some sites (Walters 2005). It is the intent to repair drainage and reduce erosion during road reconstruction and pre-haul maintenance through the Logjam Timber Sale where roads are used for the timber sale.

Road reconstruction would occur on a total of 3.2 miles of road in the Staney Creek, Sweetwater Lake, and Trumpeter Creek watersheds in Alternative 2, a total of 0.8 miles in Sweetwater in Alternative 4, and a total of 2.8 miles in Sweetwater and Trumpeter in Alternative 5. No road reconstruction is proposed in Alternative 3. Reconstruction would occur on Road 2000530 (Staney watershed), Road 3030710 (Sweetwater watershed), and Road 3030720 (Trumpeter watershed). Each of these roads has inventoried sediment sources related to maintenance needs (Walters 2005, Gier 2008) that will be repaired during reconstruction. All are proposed for storage, consistent with the ATM (Jacobson 2008).

Road construction and reconstruction will have unavoidable short term, minor effects on water quality. All roads constructed in the action alternatives will be decommissioned or put

[4] Thompson and Tucker 2007 is cited with qualification: This is a case study, with provisional results, and cannot be considered representative of all watersheds or all road construction conditions across the forest. In particular, road construction in the case study watershed occurred during dry weather across gently sloping terrain with bridges instead of culverts in fish stream crossings. Nonetheless, Shaheen Creek (the case study watershed) is located in the same Central Prince of Wales Volcanics ecological subsection found in the Logjam Project Area, with similar geology and stream conditions. Road construction conditions observed in Shaheen are not unusual, and may well be similar to road construction conditions in the Logjam Timber Sale, but they do represent the best case scenarios for weather and terrain.

in storage. The effects are not expected to degrade water quality or fish habitat. BMPs, described in road cards, would maintain state water quality standards.

Temperature

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, would maintain cool stream temperatures (Gomi et al 2006). No effects to stream temperature are anticipated as a result of implementation of any of the action alternatives.

Stream Habitat

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, will avoid direct impacts to stream habitat. Effects would be negligible and limited to road-stream crossing corridors. Table 10 provides alternative comparison for numbers of stream crossings, including fish streams.

Units with high wind risk have been identified and will receive consideration for reasonable assurance of windfirm buffer design during unit layout (Sheets 2008). Recent Forest Plan monitoring results have shown that "post harvest windthrow is present in 84 (33 percent) of the 253 buffers monitored and associated with harvest units harvested during the 7 years from 2000 through 2006. The average amount of windthrow in the buffers is 3.7 percent. The amount of windthrow is expressed as the cumulative number of trees windthrown divided by the original number standing trees in a buffer. The cumulative windthrow mortality in the buffers is highly variable and ranges from 0 to 73 percent. Eighty-four percent of the buffers have had less than 5 percent windthrow mortality to date (McDonell 2007).

Lake Habitat

Lake riparian buffers and other BMPs would avoid effects on lake habitat. Effects on lake habitat would be negligible.

The three measures for Issue 1 are compared below and are detailed in Table 8 through Table 10.

Alternative 1 Direct and Indirect Effects—Issue 2— Effects to Aquatic Habitat

Since no activities are proposed in this alternative, no direct or indirect effects would occur. Post harvest vegetation recovery would continue in all watersheds. No pre-haul or post-haul maintenance would occur as a result of the Logjam Project. Therefore, sediment sources and other road maintenance issues would not be remediated.

Cumulative Effects

Because there are no direct or indirect effects, there are no cumulative effects. Effects of past activities are described in the affected environment. Effects of foreseeable future activities are described above. It is anticipated that there would be a continued downward trend in stream habitat below the Coffman Cove Road where acid rock drainage is occurring. Federal Highway Administration is developing plans for remediation as this document is being written. Until remediation occurs, the downward trend will continue.

Additional harvest of NEPA-cleared units and state lands in the affected watersheds do not result in additional cumulative streamflow increases (based on percent basin area harvested). The Staney Timber Sale is likely to result in moderate streamflow increases in Gutchi, Naukati, and Staney Creeks. Cumulative harvest in the past 30 years in these basins could increase to as much as 50 percent of basin area.

Alternative 2 Direct and Indirect Effects—Issue 2— Effects to Aquatic Habitat

Alternative 2 would result in minor effects on sedimentation and aquatic habitat. Alternative 2 would increase the percent basin area harvest since 1979 in Logjam and Trumpeter Creeks to 23 and 27 percent of the basin, respectively. Streamflow may increase in Logjam and Trumpeter Creeks, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat (Table 8). Alternative 2 would not increase any other watershed percent basin harvested over the 20 percent threshold.

Alternative 2 would construct 29 total miles of road and 27 Class I and II road-stream crossings, resulting in minor effects on sedimentation and aquatic habitat in all watersheds (Table 10). Compared to other alternatives, Alternative 2 would have the most effects on sedimentation and aquatic habitat.

Cumulative Effects

Watershed effects from past practices are described in the affected environment. Because reasonably foreseeable activities are consistent across all alternatives, Alternative 2 would result in the highest level of cumulative effects on sedimentation and aquatic habitat in all watersheds.

In the Logjam watershed, Alternative 2 would construct 15.8 miles of road and could result in moderate (though difficult to measure) impacts when combined with past and anticipated road construction.

Per appendix D, additional harvest is anticipated in Coffman, Gutchi, Lake Bay, Logjam, Naukati, Staney and Trumpeter watersheds. When combined with harvest proposed under Alternative 2 and past harvests, Coffman, Logjam, Naukati and Trumpeter watersheds will exceed or continue to exceed the 20 percent in 30 year threshold.

It is anticipated that there would be a continued downward trend in stream habitat below the Coffman Cove Road where acid rock drainage is occurring. Federal Highway Administration is developing plans for remediation as this document is being written. Until remediation occurs, the downward trend will continue.

Alternative 3 Direct and Indirect Effects—Issue 2— Effects to Aquatic Habitat

Alternative 3 would result in minor effects on sedimentation and aquatic habitat. Alternative 3 would increase the percent basin area harvest since 1979 in Logjam and Trumpeter Creeks to 21 and 24 percent basin, respectively. Streamflow may increase in Logjam and Trumpeter Creeks, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat (Table 8). Alternative 3 would not increase any other watershed percent basin harvested over the 20 percent threshold.

Alternative 3 would construct 14 total miles of road and 6 Class I and II road-stream crossings, resulting in minor effects on sedimentation and aquatic habitat in all watersheds (Table 10). Compared to other alternatives, Alternative 3 would have the least effects on sedimentation and aquatic habitat.

Cumulative Effects

Watershed effects from past practices are described in the affected environment. Because reasonably foreseeable activities are consistent across all alternatives, Alternative 3 would result in the least cumulative effects on sedimentation and aquatic habitat in all watersheds.

Per appendix D, additional harvest is anticipated in Coffman, Gutchi, Lake Bay, Logjam, Naukati, Staney and Trumpeter watersheds. When combined with harvest proposed under Alt. 3 and past harvests, Coffman, Logjam, Naukati and Trumpeter watersheds will exceed or continue to exceed the 20 percent in 30 year threshold.

It is anticipated that there would be a continued downward trend in stream habitat below the Coffman Cove Road where acid rock drainage is occurring. Federal Highway Administration is developing plans for remediation as this document is being written. Until remediation occurs, the downward trend will continue.

Alternative 4 Direct and Indirect Effects—Issue 2— Effects to Aquatic Habitat

Alternative 4 would result in minor effects on sedimentation and aquatic habitat. Alternative 4 would increase the percent basin area harvest since 1979 in Logjam and Trumpeter Creeks to 20 and 22 percent, respectively. Streamflow may increase in Logjam and Trumpeter Creeks, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat (Table 8). Alternative 4 would not increase any other watershed percent basin harvested over the 20 percent threshold.

Alternative 4 would construct 14 total miles of road and 7 Class I and II road-stream crossings, resulting in minor effects on sedimentation and aquatic habitat (Table 10). Compared to other alternatives, Alternative 4 would have effects similar to Alternative 3 on sedimentation and aquatic habitat.

Cumulative Effects

Watershed effects from past practices are described in the affected environment. Because reasonably foreseeable activities are consistent across all alternatives, Alternative 4 ranks third in cumulative effects on sedimentation and aquatic habitat in all watersheds.

Per appendix D, additional harvest is anticipated in Coffman, Gutchi, Lake Bay, Logjam, Naukati, Staney and Trumpeter watersheds. When combined with harvest proposed under Alt. 4 and past harvests, Coffman, Logjam, Naukati and Trumpeter watersheds will exceed or continue to exceed the 20 percent in 30 year threshold.

It is anticipated that there would be a continued downward trend in stream habitat below the Coffman Cove Road where acid rock drainage is occurring. Federal Highway Administration is developing plans for remediation as this document is being written. Until remediation occurs, the downward trend will continue.

Alternative 5 Direct and Indirect Effects—Issue 1— Effects to Aquatic Habitat

Alternative 5 would result in minor effects on sedimentation and aquatic habitat. Alternative 5 would increase the percent basin area harvest since 1979 in Logjam and Trumpeter Creeks to 22 and 25 percent, respectively. Streamflow may increase in Logjam and Trumpeter Creeks, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat (Table 8). Alternative 5 would not increase any other watershed percent basin harvested over the 20 percent threshold.

Alternative 5 would construct 18 total miles of road and 11 Class I and II road-stream crossings, resulting in minor effects on sedimentation and aquatic habitat (Table 10). Compared to other alternatives, Alternative 5 would have the second highest level of effects on sedimentation and aquatic habitat, compared to Alternative 2.

Cumulative Effects

Watershed effects from past practices are described in the affected environment. Because reasonably foreseeable activities are consistent across all alternatives, Alternative 5 ranks second in cumulative effects on sedimentation and aquatic habitat in all watersheds.

Per appendix D, additional harvest is anticipated in Coffman, Gutchi, Lake Bay, Logjam, Naukati, Staney and Trumpeter watersheds. When combined with harvest proposed under Alternative 5 and past harvests, Coffman, Logjam, Naukati and Trumpeter watersheds will exceed or continue to exceed the 20 percent in 30 year threshold.

It is anticipated that there would be a continued downward trend in stream habitat below the Coffman Cove Road where acid rock drainage is occurring. Federal Highway Administration is developing plans for remediation as this document is being written. Until remediation occurs, the downward trend will continue.

Issue 2: Wildlife and Subsistence Use

Issue Statement: The proposed action combined with past harvest may affect deer winter range, habitat fragmentation, productive old-growth (POG) habitat, and subsistence use and road density.

Public comments expressed concerns about subsistence use and wildlife in the project area. The comments included the availability of suitable winter range for deer, which is a factor influencing deer populations, (deer rely on high-volume, mature forests at lower elevations for winter habitat); deer for subsistence users; and the amount of timber harvest in low-elevation habitat. The comments also expressed concerns about the intensity of past harvest in the Logjam project area and its effects on wildlife. The interdisciplinary team developed Issue 2 in response to this concern. Alternative 4 responds to this issue by reducing the amount of productive old growth harvested, the impact to high value deer habitat, road densities by Wildlife Analysis Area (WAA) (an access concern related to subsistence use and wolf mortality), and the intensity of harvest in travel corridors (which are tied to POG patch sizes). The Logjam project area corresponds closely with WAA 1421.

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

- Acres of POG remaining
- Acres of deer winter range harvested
- Road density by WAA
- POG patch size remaining

Methodology

A variety of methods were used to identify and analyze potential effects of the Logjam Timber Sale Project on wildlife: the methods include, field reconnaissance, aerial photo interpretation, professional knowledge, wildlife computer models, geographic information system (GIS) analysis, and other database processing.

Some wildlife species were documented by incidental sightings during the required field surveys. The observations during field surveys may not be accurate representations of wildlife species in the area due to timing and length of survey. Local knowledge of and scientific literature were used for further information regarding species occurrence in the project area and habitat requirements. Wildlife sightings by other field crews working in the project area were also documented. Scientific literature is included in the reference section of the wildlife resource report.

Several different scales were used in the wildlife analysis. Some wildlife are discussed or measured at the project area level, some by VCU, some by WAA. Some species are discussed at even larger scales, such the biogeographic province, the ecological subsection or the forest level. The level chosen for the analysis is based on the species habitat needs.

An interagency model (Suring et al. 1992) developed to evaluate potential winter habitat capability was updated during the 1997 Forest Plan revision. The approved interagency model (1997) (deer model) was used to assess the effects of the alternatives compared to past, present, and future habitat suitability and capability within WAA 1421.

The Thorne Bay Ranger District conducted small mammal transects from 30 September through 2 October 1997 and 7 October to 9 October 1997. Previous transects were conducted in October of 1994 and 1996. A total of six transects with 25 stations and 2 traps per station account for 900 trap nights. In the North Thorne area 35 *Peromyscus maniculatis* (deer mice) were captured in 1997 and 37 in 1996. Five flying squirrel (*Glaucomys sabrinus griseifrons*) traps were set as well, but were unsuccessful (Letter to the file October 31, 1997. A Russell). In 2000 small mammal trapping was done for the Logjam project. Trapping was done on 29 August, 18 September, and 19 September 2000 for a total of 389 trap nights. Trapping was done in units 577-01, 577-20, 577-43, 577-25, and 577-41.

Flying squirrel densities in Southeast Alaska are highest in POG forest, and since this is where timber harvest occurs, the acres of timber harvest are an appropriate measure of relative effects of the alternatives to the Prince of Wales flying squirrel (Forest Plan 2008 p. 3-287).

Affected Environment

The Logjam project area is in Wildlife Analysis Area (WAA) 1421 and Value Comparison Units (VCUs) 5730 and 5770. There are also portions of other VCUs within the project area boundary and these are summarized in Chapter 1.

Wildlife Analysis Areas (WAAs) are geographical divisions created by the Alaska Department of Fish and Game (ADF&G) to monitor and manage wildlife populations. WAAs generally encompass multiple VCUs and are an appropriate scale for evaluating direct, indirect, and cumulative effects to deer and wolf (USDA Forest Service 2008c). VCUs are used for evaluating potential impacts to old growth and marten habitat (USDA Forest Service 2008c). The project area covers most of WAA 1421. The original project area boundary was changed slightly to include small sections of proposed road that were actually outside the project area. As a result of this change, a very small portion of WAA 1422 is now in the project area. The project area is approximately 56,133 acres (approximately 87.7 square miles).

VCUs 5730 and 5770 are designated for timber production, and meet the criteria for the inclusion of Old Growth Reserves (OGRs) (USDA Forest Service 2008b).

Road densities for wildlife are calculated on the WAA scale. WAA 1421 is approximately 136 square miles in size. The current number of National Forest Service (NFS) road miles estimated to be in WAA 1421 is 184 (there are also 6 miles of Non-NFS roads for a total of 190). Logjam is located in Biogeographic Province 14, the North Central Prince of Wales province. Effects of management at this scale are analyzed as part of the Forest Plan.

Management Indicator Species

Management Indicator Species (MIS) are those wildlife species whose responses to land management activities reflect responses of other species with similar habitat requirements.

Under the MIS concept, the responses to management activities of relatively few species are studied and monitored, in order to predict the impacts to entire assemblages of species and associated habitats. MIS are used to assess overall populations and biological diversity. They are also used to help establish management goals for game species and other species of public interest.

The 2008 Tongass Land and Resource Management Plan (Forest Plan) Final Environmental Impact Statement (FEIS) identifies 13 MIS (USDA Forest Service 2008c). Ten MIS are known to occur on Prince of Wales Island. Deer, Alexander Archipelago wolf, American marten, black bear, river otter, Vancouver Canada goose, bald eagle, red-breasted sapsucker, hairy woodpecker, and brown creeper all potentially inhabit the project area. Brown bear, mountain goat and red squirrel are not known to occur in the project area. The Prince of Wales flying squirrel and spruce grouse are species of concern on Prince of Wales Island.

The following section describes the current affected environment for Alaska Region MIS, and other species of concern. The reasoning behind the MIS chosen for the Logjam project is shown in Table 11. The Alaska Region sensitive plant species are covered in the botany section of this EIS. Threatened, endangered, proposed, and sensitive animal, bird, and fish species are covered in the biological assessment/biological evaluation (BA/BE), which is available in the project record. The marbled murrelet and neotropical migratory birds are also discussed in the BA/BE.

Table 11. Management Indicator Species chosen for the Logjam Project

Species	Basis for Selection
Sitka Black-tailed Deer	Important subsistence and game species
Alexander Archipelago Wolf	Important furbearer
American Marten	Important furbearer
Hairy Woodpecker, Brown Creeper, Red-breasted Sapsucker	Snag dependent species associated with large, old-growth trees

Sitka Black-tailed Deer

The Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) was chosen as an MIS because it is a game and subsistence species and is seasonally associated with old-growth forests. From this point forward, Sitka Black-tailed deer will be referred to as "deer." Research conducted in Southeast Alaska indicates that high-volume mature forests at low elevations are needed to sustain deer populations during severe winters (Yeo and Peek, 1992). These mature old-growth stands intercept snow, provide thermal cover, and support the largest biomass of herb and shrub forage for deer (Alaback 1982; Schoen et al. 1984). Following clearcut harvest, deer winter habitat is impacted by the combination of increased snow accumulation that reduces forage availability and the conversion of winter habitat to young-growth stands. Closed-canopy young-growth (generally 25 to 30 years old) and older stands, if left untreated, provide little to no forage in any season due to the lack of light penetration to the forest floor, which limits shrub and herb growth. The quantity and quality of winter habitat is considered the most important limiting factor for deer in Southeast Alaska.

On Prince of Wales Island, the average annual home range for female deer is about 72 hectares (180 acres). They use a core area of about 9.1 hectares (23 acres). Winter deer home

ranges are slightly smaller averaging between 40 and 50 hectares (100-125 acres). Deer may only use 5-10 hectares (13-25 acres) during heavy snow years (D. Person, in conversation with C. Mlodik 2004). Optimum habitat during a deep snow winter is low elevation, old growth forest on south facing slopes.

Deer Model

The interagency deer model calculates habitat suitability indices (HSIs) based on aspect, elevation, and typical snowfall. The model incorporates snow conditions, the presence of predators, aspect and elevation, the characteristics of the vegetation including volume class, second growth (25 to 150 years), and clearcuts (less than 25 years). HSI values range from 0.0 in areas that have no winter habitat value to 1.3 in optimal habitat (south facing slopes, with high volume timber below 800 feet in elevation and in areas of little snow). The model assumes low-elevation, high-volume old-growth stands with southern aspects and in low snowfall areas provide the best quality deer winter habitat. Areas above 1500 feet in elevation are assumed to have no value as deer winter habitat. The scores developed by the model were used to calculate and compare habitat capability and to estimate changes in habitat capability that would result from timber harvest. Habitat capability is the theoretical number of deer that particular habitat types can be expected to support. The estimated habitat capability does not reflect actual known deer numbers but is used only for comparing potential impacts of the alternatives. The model estimates habitat capability based on the condition of previously harvested stands and stands proposed for harvest (i.e., stand initiation or stem exclusion) compared to the habitat capability that existed prior to large-scale timber harvest (1954).

The deer HSI model is most appropriate for analysis over large planning areas such as the entire Tongass National Forest, or at the scale of a WAA, or number of WAAs, where data are coarse and have limitations when applied at the watershed or project planning level. This geographic level is large enough to allow the model to work as designed but small enough to recognize substantial changes to deer habitat because of the large area that deer utilize as their home range. The Logjam project is comprised mostly of WAA 1421. The deer model for the Logjam project was run at the single WAA scale (WAA 1421) and the two surrounding WAAs (WAA 1420 and WAA 1422).

The deer model assessed young growth stands by two age groups: 0-25 years (stand initiation phase) and 26-150 years (stem exclusion phase). Stands in the initiation phase have forage available but this food supply may be covered with snow in the winter, and therefore stands in this phase receive low scores in all but the lowest snow areas. Stands in the stem exclusion phase may provide cover but have little or no forage available and therefore receive the lowest non-zero scores (i.e., little value as deer winter range).

The deer model has limitations, for example, it does not account for treatments such as thinning or pruning, in young growth stands that postpone the stem exclusion phase. These treatments increase tree growth and plant diversity and limit the duration of the stem exclusion phase, thus providing better habitat, forage, and more rapid stand development than untreated young stands. The deer model tends to overestimate the reduction of habitat capability (i.e. effects) because it assumes that all proposed timber harvest is accomplished using traditional clearcut silvicultural systems. For the Logjam project the silvicultural

systems used in helicopter yarding retain 50 to 70 percent of the basal area (see silvicultural section).

Deer winter habitat is further defined by high value habitat. High value habitat is defined by grouping HSI values above zero into four categories (quartiles) of winter range. The highest quartile has an HSI greater than 0.63, which represents the high value deer winter habitat. Table 12 shows the amount of 4th quartile habitat estimated to be present in 1954 in WAAs 1420, 1421 and 1422 combined and the amount currently in this area.

Table 12 Current HSI Scores for WAAs 1420, 1421, and 1422 combined

HSI score	Quality	Acres 1954	Acres 2008	% change
>.63 (4th Quartile)	High	41,481	14,929	-64%

High Value Deer Winter Habitat

There are currently 3,894 acres of high value deer winter habitat existing in WAA 1421. This is 56 percent of the habitat (7,124 acres) that was assumed to be present in 1954. High value deer winter habitat has been reduced by approximately 44 percent as a result of timber harvest and road building. Table 13 shows the amount of high value deer winter range estimated to be present in 1954 in WAA 1421 and the amount currently in this area.

Table 13 Acres of High Value Deer Winter Range for WAA 1421

	1954 acres	Current acres	% Change
High value deer winter range	7,124	3,984	-44%

Deer Habitat Capability

Habitat capability is the theoretical number of deer that particular habitat types can be expected to support it does not reflect actual deer numbers because population dynamics are more complex than habitat capability.

In general, higher value habitat drops in quality when harvested and again at stem exclusion stage. In contrast, lower value habitat may increase in value following harvest because of increased forage, but values drop below pre-harvest level once stem exclusion occurs.

In 2006, the deer habitat capability occurring in WAA 1421 was 74 percent of what was estimated to be present in 1954. Clearcut harvest (even-aged harvest), would have the greatest impact on POG forest, compared to uneven aged and two aged harvest, and therefore the greatest impact on deer habitat. The removal of more than half of the basal area can result in significantly different plant community structure compared to unharvested areas (Deal and Tappeiner 2002). Table 14 shows the estimated changes in deer habitat capability for the two WAAs surrounding the project area (1420 and 1422), as well as WAA 1421 (the project area) from what has been calculated to be present in 1954, to what was available as of 2006.

Table 14 Deer Density for WAAs 1420, 1421 and 1422

WAA	% of 1954 habitat capability in 2006
1420	52%
1421	74%
1422	60%

2008 Forest Plan Table 3.10-7, page 3-270

Young Growth Stands and Deer Forage Production

The purpose of young growth management to wildlife is to reduce the amount of time the stand is in the stem exclusion phase. Deer forage availability is at its lowest during this time due to the lack of light reaching the understory. Activities such as thinning, girdling, and pruning open the forest canopy and result in an increase in the amount of forage available to deer. Since 1970, the Tongass has treated, mostly by pre-commercial thinning, about 168,000 acres. Approximately 16,000 of these acres were treated specially for wildlife (USDA Forest Service 2008b).

The project area had experimental site preparation burning (approximately 545 acres), as well as release and weeding (approximately 460 acres). Release and weeding is a treatment where trees that were inadvertently left standing during the regeneration harvest are removed to reduce the chance of mistletoe or disease infection in the young upcoming stand. Site preparation burning was an experimental treatment done to prepare the stand for planting in an attempt to control hemlock regeneration and promote a high spruce component in the new stand. The practice was discontinued due to the high cost and what appeared to be delayed regeneration of the stand. The stands that were burned are currently well stocked and growing with good understory for deer browse. The wildlife benefits currently evident in the burned areas are an outcome that was not anticipated at the time of the treatment.

About 67 stands in the project area, totaling nearly 4,500 acres (about 43 percent of the past harvest acres), have been pre-commercially thinned. A fixed spacing with variance to pick the best leave tree was implemented in these stands with good success. Pre-commercial thinning is a treatment, which not only redistributes stand growth on selected stems but it also delays canopy closure and extends the time that forage is available for wildlife. Within the project area, approximately 1,267 acres (of the total 4,500) have been thinned to promote riparian and wildlife habitat to date.

Older second growth stands are typically poor deer winter habitat because they generally have a more closed canopy that shade out understory species of plants that deer use for forage during the winter.

Table 15 shows the breakdown of past harvest by age class for the Logjam project area.

Table 15 Acres of past harvest by age class for the Logjam project area

Age Class	Acres
0-25	6,176
26-150	4,121
Total	**10,297**

Alexander Archipelago Wolf

The Alexander Archipelago wolf (*Canis lupus ligoni*) is a subspecies of the gray wolf. It was selected as an MIS because it is a species of concern and an important furbearer. In Southeast Alaska, the Alexander Archipelago wolf inhabits the mainland and most large islands south of Frederick Sound.

The primary food of most Southeast Alaskan wolves is deer. They also feed on beaver and spawning salmon, when available. Wolves on islands in southern Southeast Alaska consume an average of 26 deer per wolf per year (Person et al., 1996). Wolf habitat capability is believed to be directly tied to deer habitat capability.

The Draft Interagency Wolf Habitat Management Assessment (September 1999) estimated that the average wolf population in GMU 2 (Prince of Wales Island) ranged from 250 to 300 wolves. The state has a 30 percent harvest cap rule in place and can issue an emergency closure to the wolf season when it is ascertained this limit has been reached. The State of Alaska did have an emergency closure on the wolf season in 1999/2000 season. At this time the existence of this harvest cap precludes wolf mortality concerns.

Wolves—Trapping and Road Density

A standard and guideline that changed in the 2008 Forest Plan relates to the relationship of road density and wolves. The 1997 Forest Plan EIS acknowledged that open road access contributes to excessive mortality by facilitating access for hunters and trappers. More recent information indicates that wolf mortality is related not only to roads open to motorized access, but to all roads, because hunters and trappers use all roads to access wolf habitat, by vehicle or on foot. The standard and guideline has been modified to ensure that a range of options to reduce mortality risk will be considered in these areas, and to specify that total road densities of 0.7 to 1.0 mile per square mile or less may be necessary. The amended Forest Plan requires participation in cooperative interagency monitoring and analysis to identify areas where wolf mortality is excessive, determine whether the mortality is unsustainable, and identify the probable causes of the excessive mortality. The wolf standard also requires that both access management on National Forest System lands, and harvest regulations for hunting and trapping, be considered in relation to wolf management objectives.

The Forest Plan recommended that where analysis has indicated that road access is contributing to unsustainable wolf mortality, access management may be implemented. At this time, ADF&G has not indicated a wolf mortality concern due to road access at the WAA scale. ADF&G reports indicate that in WAA 1421 in the last 9 years (1997-2005) a total of 22 wolves have been harvested. Table 16 shows the wolf harvest in WAA 1421.

Table 16 Wolf Harvest in WAA 1421

Year	Wolves
1997	3
1998	15
1999	1
2000	1
2001	1
2002	No Data
2003	No Data
2004	No Data
2005	1
Total	22

* Data from ADF&G, personal communication November 13, 2007.

Current road density for WAA 1421 is about 1.36 miles per square mile for all National Forest System (NFS) roads on Forest Service lands. When including non NFS roads the total road density changes to about 1.37 miles per square mile. Both of these densities are above the guideline in the current Forest Plan. Table 17 shows the road density calculated for WAA 1421.

Table 17 Road density in WAA 1421

Miles of all existing roads	190
Existing total road density-all roads	1.37
Existing total road density-FS roads only	1.36
Existing open road density-FS roads only	0.6

The Forest Plan states that where data suggests that wolf mortality exceeds sustainable levels the Agency would work with ADF&G to identify probable sources of mortality. There is no guideline for road densities when wolf mortality has not been identified as a concern. Where wolf mortality concerns have been identified road closures may be implemented as a measure to reduce mortality caused by increased road access. Person and Russell (2008) indicate that most wolves (57%) on POW are taken from the beach. Person and Russell (2008) in the same study go on to state that a large portion of the variance in the average total harvest rate, was not explained by the density of roads, or distance from the ocean (Person and Russell 2008).

The ADF&G currently permits hunting of 5 wolves per person in the GMU 2 from September 1 to March 31 (*Management Regulations for the Harvest of Wildlife on Federal Public Lands in Alaska,* effective July 1, 2008 –June 30, 2009. p. 29). Trapping season on wolves is from November 10 to April 30 and there is no limit on wolves for individual trappers. (*Management Regulations for the Harvest of Wildlife on Federal Public Lands in Alaska,* effective July 1, 2008 –June 30, 2009. p. 132). Hunting and trapping efforts fluctuate year-to-year depending on fur prices, fuel prices, winter weather conditions, the current economy, and the wolf population. In Southeast Alaska harvested wolves must be sealed with the State within 30 days of harvest. ADF&G would use this data and employ a harvest cap in GMU 2

(POW), when more than 30 percent of the estimated fall population of wolves has been harvested. This measure would ensure that a sustainable wolf population is maintained (Forest Plan 2008. p. 3-238). The State has not issued an emergency closure since the 1999/2000 season.

Alaska National Interest Lands Conservation Act (ANLICA)

The U.S. Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska with the passage of the Alaska National Interest Lands Conservation Act (ANILCA, or Public Law 96-487). ANILCA (Section 803) defines subsistence as:

> "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of non-edible by-products of fish and wildlife resources taken for personal or family consumption; and for customary trade."

ANILCA provides for the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on federal public lands. The Act also states that customary and traditional subsistence uses of renewable resources shall be the priority consumptive uses of all such resources on the public lands of Alaska. All rural communities within Game Management Units 1A, 2 and 3 have a customary and traditional use determination. Rural residents are provided a preference for the taking of subsistence resources on public lands.

Minimum Land Necessary

The amount of public land involved to implement the Logjam project (considering sound multiple use management of public lands) is the minimum necessary to accomplish the purpose of the project. One or more communities use each island within the Tongass National Forest for subsistence deer hunting purposes. It is not possible to lessen timber harvest in one area and concentrate it in another locale without impacting one or more rural communities' important subsistence use areas. In addition, harvestable populations of subsistence wildlife species could not be maintained in a natural distribution across the forest if harvest were concentrated in specific areas.

A well-distributed population of species is required by the National Forest Management Act (NFMA) and is one of the objectives of the Forest Plan. The Forest Plan allocated many of the important subsistence use areas to land use designations that do not allow timber harvest. Other areas that are important to subsistence use were protected through standards and guidelines such as the 1,000-foot beach and estuary buffers and the streamside Riparian Management Areas (RMAs) that do not allow timber harvest.

Each alternative provides a sound location and design for harvest units, and uses short temporary roads from the existing road system to access harvest areas. The minimum amount of land was used to resolve resource concerns while meeting the purpose and need for this project in a practical and efficient manner. Resources are protected to the maximum extent practicable and the project meets or exceeds the Forest Plan Standards and Guidelines.

The Forest Plan took considerable steps to minimize adverse impacts to subsistence uses and resources (USDA Forest Service 2008c). Reasonable steps taken to minimize adverse impacts to subsistence resources include: the overall Forest Plan land use designation strategy, the old-growth habitat reserve strategy, travel and access management planning, Forest Plan Standards and Guidelines for stream, beach and estuary buffers, and the use of silvicultural systems that maintain components of overstory tree canopy. Most of the standards and guidelines are designed to maintain fish and wildlife habitat productivity while meeting timber harvest objectives. The project reflects a reasonable balance between the projected need for timber from the project area to help meet the Forest Plan, ANILCA, and TTRA timber-related objectives, and the continued protection of subsistence uses and resources. Impacts on subsistence resources have been minimized throughout the design and location of the individual harvest units, and through the formulation of the alternatives. Reasonable measures to minimize impacts on subsistence have been adopted, to the maximum extent practicable while still meeting the purpose and need for this project.

Types and Amounts of Resources Gathered

Subsistence use areas and the levels of harvest were estimated from a variety of sources. Alaska Department of Fish and Game records the level of community harvests for selected species, such as deer, black bear, wolf, and otter, within WAA 1421. The Alaska Department of Fish and Game harvest data and Tongass Resource Use Cooperative Survey (TRUCS) maps reveal subsistence use areas for deer, salmon, and other fish within the project area. The 2008 Forest Plan FEIS displays estimated subsistence resource use (in pounds per year) by Coffman Cove, Craig, Haines, Hollis, Hydaburg, Kasaan, Klawock, Metlakatla, Myers Chuck, Naukati, Petersburg, Point Baker, Thorne Bay, Whale Pass and Wrangell residents, as reported by the ADFG. Deer, black bear, and furbearer hunting and trapping occur in the project area. The road system in the Logjam project area is tied to other road systems on Prince of Wales Island.

Communities Traditionally Using the Logjam Project Area

Types and Amounts of Resources Gathered

Subsistence use areas and the levels of harvest were estimated from a variety of sources. Alaska Department of Fish and Game records the level of community harvests for selected species, such as deer, black bear, wolf, and otter, within WAA 1421. The Alaska Department of Fish and Game harvest data and Tongass Resource Use Cooperative Survey (TRUCS) maps reveal subsistence use areas for deer, salmon, and other fish within the project area. The 2008 Forest Plan FEIS displays estimated subsistence resource use (in pounds per year) by Coffman Cove, Craig, Haines, Hollis, Hydaburg, Kasaan, Klawock, Metlakatla, Myers Chuck, Naukati, Petersburg, Point Baker, Thorne Bay, Whale Pass and Wrangell residents, as reported by the ADFG. The road system in the Logjam project area is tied to other road systems on Prince of Wales Island. Fish and shellfish comprise a large portion of the diet of most residents in Southeast Alaska, Coffman Cove (302 and 24 pounds), Hydaburg (759 and 177 pounds), Craig (102 and 92 pounds), Hollis (197 and 122 pounds), Kasaan (519 and 196 pounds), Klawock (518 and 142 pounds), Point Baker (286 and127 pounds), Thorne Bay (368 and 73 pounds), Whale Pass (222 and 95 pounds) (Turek et al., 2004).

Fish and Shellfish—Subsistence Use

Communities traditionally using the Logjam project area for subsistence use include: Coffman Cove, Craig, Haines, Hollis, Hydaburg, Kasaan, Klawock, Metlakatla, Myers Chuck, Naukati, Petersburg, Point Baker, Thorne Bay, Whale Pass and Wrangell. Subsistence use of fish by these communities occurs in the project area.

Fish and Shellfish—Abundance and Distribution

The Sweetwater Lake drainage system is a highly productive area for fish (salmon, trout, char). The fish produced in the Sweetwater Lake drainage system are important to the culture and lifestyle of the residents of the area. Streams and lakes within the Logjam project area provide habitat and contribute to the production of fish that support the local subsistence, sport, guided (both freshwater and saltwater), and commercial fisheries of the area. There is a subsistence sockeye and coho fishery that occurs on Hatchery Creek which is in the project area.

Fish and Shellfish—Access

Historically, most of the access to the project road system has been from the mainline road system on Prince of Wales. In addition, a 0.5 mile boardwalk trail was constructed from Forest Road 3030850 to Hatchery Falls. This accessible trail was installed to protect resources disturbed by fishermen traversing the wetlands between the road and the falls. The Hatchery Creek Trail has improved access to the salmon fishery on Hatchery Creek.

Fish and Shellfish- Competition

Competition for fish and shell fish are currently are not a concern. Although the Hatchery Creek Trail has improved access to Hatchery Creek Falls, which may have increased the competition at this particular site, there are several less accessible fishing locations on Hatchery Creek for subsistence fishing. Shellfish gathering occurs primarily from boats and on the beach.

Upland Birds and Waterfowl-Subsistence Use

Upland birds and waterfowl do not contribute a large percentage of the foods for the people of Coffman Cove (2.78 ponds), Hydaburg (1.7 pounds), Craig (1.68 pounds), Hollis (1.14 pounds), Kasaan (.71 pounds), Klawock (1.98 pounds), Point Baker (5.25 pounds), Thorne Bay (3.28 pounds), Whale Pass (2.14 pounds) (Turek et al. 2004).

Upland Birds and Waterfowl-Abundance and Distribution

Spruce grouse is the only type of upland bird distributed across Prince of Wales Island (see spruce grouse this document). Waterfowl are known to utilize the area during the spring and fall migration.

Upland birds and Waterfowl-Access

Historically, most of the access to the project road system has been from the mainline road system on Prince of Wales.

Upland Birds and Waterfowl-Competition

Competition for upland birds and waterfowl should not be affected by any of the proposed activities.

Food Plants-Subsistence Use/Abundance/ Access and Competition

Subsistence plant foods consist of a variety of species. Some of the most sought after types include kelp, seaweed, goose tongue, mushrooms and berries. Data indicate that plant foods make up eight percent of the harvest in Hydaburg, seven percent of the harvest in Craig, six percent of the harvest in Klawock, and four percent of the per capita harvest of the household subsistence harvests in Thorne Bay (Turek et al. 2004). Roads and previous timber harvest areas within the project area are excellent berry harvest locations since many berry species thrive on the open exposed slopes (Alaback 1982). Most traditional gathering of other plants and foods occurs near beach and estuarine areas and along roads.

Personal Use Timber- Subsistence Use/ Access/Abundance and Competition

Each Alaska resident is entitled to 10,000 board feet of sawtimber and 25 cords of firewood annually for personal use, regardless of rural or non-rural residency status. Most traditional gathering of firewood and personal use wood occurs near beach and along roads.

Marine Mammals- Subsistence Use/ Abundance/Access and Competition

There is no marine environment in the Logjam project area.

Management Indicator Species (other than Deer and Wolves)

American Marten

The American marten (*Martes americana*) was selected as an MIS because of its association with old growth and importance as a furbearer. According to reports from Alaska Department of Fish and Game, marten are abundant in Game Management Unit 2 (GMU 2).

Marten are dependent on high-quality winter habitat that includes low-elevation, high-volume POG forest, especially in coastal and riparian areas. These habitats intercept snow, provide cover and denning sites, and provide habitat for prey species. Marten are generalist predators and will vary their diet seasonally. In Southeast Alaska, marten eat winter-killed deer carcasses during the spring; squirrels, birds and berries during the summer; and salmon carcasses and small rodents during the fall (Flynn et al. 2004; Ben-David et al. 1997).

Two morphological groups of marten have been recognized, the widespread *americana clade* and the *caurina clade*. The level of distinction between subspecies has been debated (Stone, Flynn and Cook, 2002). The *caurina clade* is not known to occur on Prince of Wales Island.

The *americana clade* is widespread throughout the mainland and many islands of Southeast Alaska, including Prince of Wales Island (ibid).

American marten historically occurred on the mainland of Southeast Alaska and on Kuiu, Kupreanof, and Revilla Islands. Between 1930 and 1950, marten were transplanted to Baranof, Chichagof, and Prince of Wales Islands.

Coastal habitat (beach fringe) and riparian areas have the highest value to marten followed by upland habitats below 1500 in elevation. American marten are closely associated with forested habitats with complex physical structure near the ground (Buskirk and Zielinski 1997). These habitats intercept snow, provide cover and denning sites, and provide habitat for prey species. Historically, there was an estimated 26,099 acres of high value marten habitat in the project area. There currently are 16,886 acres of high value marten habitat in the project area. This is a decrease of about 35 percent (Table 18).

Table 18 Acres of High Value Marten Habitat in the Logjam Project Area

	Project Area Acres	% Change from 1954
High Value Marten Habitat-1954*	**26,099**	**NA**
High Value Marten Habitat-current**	**16,886**	**-35%**

* There was an additional 977 acres of high value marten habitat on non-national forest lands in 1954.
** Currently there are an additional 532 acres of high value marten habitat on non-national forest lands.

There is a list of VCUs that qualify for the Legacy Forest Standard and Guideline on page 4-90 and 4-91 of the 2008 Forest Plan. Neither VCU 5730 or 5770 are on this list. The Legacy Forest Standard and Guideline states that in harvest units greater than 20 acres, leave 30 percent of the entire unit (based on the area) in legacy forest structure. The unit is defined as the original logging system/transportation analysis (LSTA) boundary. The project does have one proposed unit, 5710-43, that has a portion of the acres located within VCU 5710. VCU 5710 is the only VCU (on the list in the 2008 Forest Plan) requiring the Legacy Forest Standard and Guideline, for this project. This unit is proposed as 20 acres in Alternatives 3, 4 and 5. As the proposed unit is not greater than 20 acres, the legacy standard and guideline does not apply.

Marten — Trapping and Road Density

The ADF&G currently permits unlimited trapping of marten in the GMU 2 from December 1 to February 15. Trapping efforts fluctuate year-to-year depending on fur prices, fuel prices, winter weather conditions, the current economy, and marten populations.

The Forest Plan (USDA Forest Service 2008b) states that where data suggests that mortality exceeds sustainable levels work with ADF&G to identify probable sources of mortality. Where marten mortality concerns have been identified, road closures should be implemented as a measure to reduce mortality caused by increased road access. ADF&G reports that 1 to 57 marten were harvested annually in WAA 1421 from 1997 to 2005 (See the Subsistence section for more information on furbearers). There have been no official concerns expressed by ADF&G that this level of harvest threatens the stability of the marten population in the project area.

The 2008 Forest Plan discusses marten and roads on page 4-96 and 4-97. The Forest Plan states that where marten mortality concerns have been identified, the Forest Service and the State should work together to maintain long term marten populations. When road access has been determined, through analysis, to be the significant factor to unsustainable marten mortality, this information needs to be incorporated into travel management planning with the objective being to reduce mortality. Other factors to consider besides road densities include the local knowledge of habitat conditions and the spatial location of the roads.

Snag Dependent Species

The hairy woodpecker (*Picoides villosus*), brown creeper (*Certhia americana*), and the red-breasted sapsucker (*Sphyrapicus ruber*) were chosen as MIS to represent old-growth associated species and snag dependent species. Habitat for these species is protected in several ways:

- Old-growth reserves
- Old growth in other non-development LUDs and buffers
- Cavity nester standards and guidelines (USDA Forest Service 2008b) and
- Legacy Forest Structure guidelines (USDA Forest Service 2008b)

The brown creeper, hairy woodpecker, and sapsucker rely on old growth forest habitat for nesting and foraging. The brown creeper is associated with high-volume stands that include large-diameter, old trees that provide abundant prey. The hairy woodpecker and sapsucker are primary cavity excavators that use snags and partially dead trees for nesting and foraging. The availability of suitable habitat for roosting and foraging is an important constraint on the habitat suitability for these species.

These species would all be affected by the reduction in POG forest. Brown creeper and hairy woodpecker would be most affected by harvest activities that reduce the number of large diameter trees and snags for nesting and large trees for foraging. All harvest methods, including helicopter harvest, would reduce the number of large trees (coarse canopy). Based on the removal of large trees and snags, clearcut harvest would result in the greatest overall habitat reduction of coarse canopy and helicopter harvest would have the least reduction. Single tree selection harvest may maintain open habitat preferred by sapsuckers. For more information on these species see the Wildlife Resource Report in the project record.

Species of Concern

The U.S. Fish and Wildlife Service and the Forest Service have identified the following species as species of concern. These species are not currently formally listed as threatened, endangered or sensitive.

Marbled Murrelet

Marbled murrelets nest on land or in trees. They usually nest in mature trees ranging in diameter at breast height from 35 to 210 inches. Nests are normally located high above the ground with good overhead protection. Murrelets seem to prefer trees with high broad platforms for nesting and take-off, and stands with sufficient canopy openings to permit

access (DeGange 1996). Murrelets often nest in thick moss on branches of old-growth conifers in Southeast Alaska.

Any nests located during field reconnaissance or unit layout will be protected from timber harvest and the risk of blowdown with a 600-foot buffer around each nest. Disturbance activities would be minimized during the nesting season and the buffer zone would be maintained and monitored for at least two nesting seasons following discovery. If the nest remains inactive for more than two years, the buffer protection may be removed.

The 2008 Forest Plan states that Southeast Alaska is one of three areas with the greatest abundance of marbled murrelets. According to the Forest Plan the marbled murrelet population in Southeast Alaska is estimated to be 144,190 birds (2008 Forest Plan p. 3-242). Population trends in Southeast Alaska have exhibited an overall decline between the early 1990s and 2001. This decline is thought to be due to a combination of factors, including the harvest of POG forests. The Forest Plan includes many of the conservation measures included in the conservation assessment for marble murrelets, such as the OGRs and the use of uneven aged management in areas of timber harvest. The Logjam project proposes to harvest between 7 to 13 percent of the POG currently within the project area boundary.

Prince of Wales Flying Squirrel

The Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) is associated with old-growth forest and is genetically distinguishable from all other flying squirrel populations (Bidlack and Cook, 2001). Landscape connectivity is an important factor for flying squirrels because this species exhibits limited mobility.

The Conservation Strategy of the Forest Plan (2008) was designed to meet the habitat needs of old-growth associated species, including the flying squirrel.

The Prince of Wales flying squirrel is an island endemic[5] associated with old-growth forests. Island endemics are particularly vulnerable to risks of extinction because of restricted ranges, small population sizes, minimal genetic variation, and susceptibility to random events. The 2008 Tongass Land and Resource Management Plan include standards and guidelines for reducing extinction risks to island endemics. The density of flying squirrels in the Alexander Archipelago of Southeast is among the highest documented in North America. Research has documented flying squirrel densities in peat-land mixed conifer forests that were comparable with, or greater than, densities reported for several unmanaged and managed forest types in the Pacific Northwest (Smith and Nichols 2003).

Flying squirrels may be a good indicator of landscape connectivity and second-growth management on the Tongass National Forest. Future evaluation of this relationship could be useful for land management needs. However, because population concerns are not apparent, this species is not recommended for listing as MIS at this time.

The standard and guideline for endemic terrestrial species in the 2008 Forest Plan reads "the objective is to maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique

[5] The Federal ESA (Endangered Species Act) defines endemic as "a species native and confined to a certain region; having comparatively restricted distribution" 2008 Forest Plan p. 3-248

populations with restricted ranges." It states to use existing information on the distribution of endemic mammals to assess project level effects. If existing information is lacking, surveys for endemic mammals may be necessary prior to any project that proposes to substantially alter vegetative cover. Surveys are only necessary where information is inadequate to assess project level effects. Many surveys for the Prince of Wales flying squirrel have been done on POW Island.

Prince of Wales flying squirrel is also present on other islands including the Barrier Islands, Dall Island, Suemez Island, Heceta, Orr, Tuxekan, Kosciusko, and El Capitan Islands (Cook et al. 2001).

Spruce Grouse

Spruce grouse are resident across much of northern North America, occurring from Alaska to Labrador southward into New England and into the northern states of the western U.S. The Prince of Wales spruce grouse is a subspecies that is endemic to Prince of Wales and nearby islands in southern Southeast Alaska. Spruce grouse in Southeast Alaska appear to be living in isolated and scattered low density populations, which fluctuate overtime (Boag and Schroeder 1992). These small and isolated populations are particularly vulnerable to overexploitation associated with advancing roads and settlements. In addition, travel barriers created by development may reduce the exchange between neighboring populations, making it difficult for isolated populations to recruit new breeders. Though they are closely associated with conifer forests, the highest densities of spruce grouse are supported by areas with a mosaic of older coniferous habitats interspersed with areas of young growth trees. Changes in forest structure, (e.g., timber harvest or windthrow) associated with fragmentation may lead to population declines if open areas are too large or forested patches are spread too far apart to enable spruce grouse to move between them.

Spruce grouse have historically inhabited forests showing a disturbance-related patchwork of various stages of regeneration. Timber harvest can produce similar patterns, but only if clearcut areas are small and if sufficient quantities of forested habitat are preserved. Spruce grouse inhabit some of the most highly modified landscapes on the Tongass (e.g., Prince of Wales Island) where additional timber harvest could threaten the long-term survival of these highly isolated and scattered low-density populations. This has particularly important conservation implications since the subspecies that occurs in Southeast Alaska is endemic. Conservation measures including a system of non-development LUDs and standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) are essential to facilitating dispersal and interchange between isolated populations. Spruce grouse are also vulnerable to hunting and exploitation, correlated with road access, because they are not wary of humans, though viability is not an immediate concern given the level of grouse harvest permitted in this area.

Spruce grouse are an important prey species for goshawks and marten. In a study of goshawk diet during the breeding season birds (including spruce grouse) comprised a larger proportion of goshawk diet on Prince of Wales Island due to the limited number of prey species, many of which are sensitive to timber harvest activities (Lewis et al. 2006). This study concluded that the ability of goshawks to successfully reproduce in Southeast Alaska and on Prince of Wales Island, in particular, appears to be affected by the extensive landscape alteration in this region

in combination with the restricted prey base. Thus, alteration of spruce grouse habitat could have a resonating effect on predator populations. In GMUs 1, 2, 3, 4, and 5, the ADF&G permits taking of spruce grouse between August 1 and May 15, with a bag limit of five per day.

Conservation Strategy, Old Growth Reserves and Biodiversity

The forest wide network of OGRs was first developed for the 1997 Forest Plan. The network includes large, medium and small OGRs. The OGRs within this network were reviewed by an interagency team before the 2008 Forest Plan was completed. When appropriate the OGRs were updated to meet Forest Plan criteria. The specific criteria for each size OGR can be found in the 2008 Forest Plan Appendix K. These updates were incorporated into the 2008 Forest Plan Record of Decision. The OGRs in the Logjam project area were included in the review of the OGRs for the 2008 Forest Plan. The Forest Plan standard and guidelines require small OGRs to have a contiguous landscape of at least 16 percent of the National Forest Land area of each VCU and that at least 50 percent of this should be productive old growth (POG).

POG forest is defined as having a timber volume of greater than 8,000 board feet per acre. It is defined as volume strata low, medium, and high in the GIS database. Volume strata use timber volume, soil, and slope information as an indicator of productive forest habitat to assess POG forest (see Silviculture section this document). Table 19 summarizes POG in the project area.

Table 19 Productive Old Growth (POG) in the Logjam the Project Area

POG Acres 1954	POG Acres 2008	Percent Harvested	Percent Remaining
35,176	**25,891**	**26%**	**74%**

The Conservation Strategy in Appendix D of the FEIS (USDA Forest Service 2008c) has two components; the first is a forest-wide network of old growth reserves (OGRs) and the second component is management of the area outside reserves (the "matrix") that is subject to management within development LUDs.

Matrix

Some management protections within the matrix are spatially explicit, such as the 1,000-foot beach and estuary fringe, and the riparian buffers for maintaining the integrity of the aquatic, riparian ecosystems and non-development LUDs such as Research Natural Areas and Wilderness In addition, other forest-wide standards and guidelines preclude or limit timber harvest in areas of high hazard soils, steep slopes, karst terrain and visually sensitive travel routes and use areas. Finally, a number of species-specific standards and guidelines provide additional protection to old growth within the matrix, such as raptor nest and wolf den buffers.

3 Environment and Effects

Biodiversity

To quantify potential effects on biodiversity, the alternatives can be compared in terms of their ability to maintain a functional and interconnected old-growth ecosystem (this includes connectivity- unfragmented, contiguous blocks of old growth).

Functional ecosystem refers to the ability to maintain or contribute to the maintenance of populations that use it, and to contribute to the diversity and productivity of other ecosystems. Examples of ecosystem functions include providing habitat for organisms, climatic buffering, soil development, and the maintenance of soil productivity through inputs of coarse woody debris, nitrogen fixation, spread of biotic and abiotic disturbance through landscapes, and nutrient cycles. The interconnectedness of an ecosystem is a measure of the extent to which the landscape pattern of the old-growth ecosystem provides for biological and ecological flows to sustain old-growth associated animal and plant species across the Tongass and Southeast Alaska. Connectivity does not necessarily mean that old-growth areas need to be physically joined in space because most associated species can disperse across areas that are not in old-growth ecosystem conditions. Landscape features affecting connectivity of old-growth ecosystems include the distances between old-growth reserve areas and forest conditions in the areas between the reserve areas (matrix lands).

There are two main VCUs included in the project area; VCUs 5730, and 5770. Both VCUs have old growth reserves (OGRs) located within their boundaries.

Connectivity and Fragmentation

The two main types of connectivity considered in the Forest Plan are 1) landscape connectivity and 2) elevational migration connectivity.

Landscape Connectivity

The objective of the landscape connectivity is to maintain corridors of old growth forest among Old-growth (OG) LUDs and other natural setting LUDs at the landscape scale (USDA Forest Service 2008b, Appendix K). Because shoreline is a prominent feature across the Forest and is of high value to many species, beach and estuary buffers provide important corridors that aid in maintaining landscape connectivity. Beach fringe is low elevation habitat that can provide an important connectivity during the winter months. Forest Plan standards and guidelines to protect the 1000 foot beach fringe (USDA Forest Service 2008b) and various width riparian zones depending on stream class referred to as Riparian Management Areas (USDA Forest Service 2008b) aid in maintaining landscape connectivity.

Elevational Connectivity

The objective of elevational connectivity is to provide corridors of old growth forest habitat between high and low elevation habitats; this is particularly important for deer. Higher elevations (over 1,500 feet) are typically used by deer during the summer months where alpine and subalpine plants are especially nutritious (Hanley 1984). Schoen and Kirchhoff (1985) found that roughly three-fourths of the deer in their study made distinct migrations between low elevation winter range and high elevation summer range. Mid-elevation habitat is also used during mild winters. Elevational migration corridors are primarily used by deer,

but receive some use by bear. Other species show less elevational movement, but may utilize the corridors as old growth habitat.

Connectivity along riparian areas and between habitats at different elevations has been reduced by past harvest. In some areas, especially outside of OG LUDs, past harvest has created contiguous stands of second growth with only narrow strips of POG forest (corridors) remaining. In areas where past harvest has compromised connectivity, additional connectivity should be examined during project planning and should be of a sufficient width to minimize edge effects and provide interior habitat conditions.

Landscape connectivity was considered early in this project design. The location of the small OGRs, distribution of POG forest, beach, estuary, riparian and other buffers were reviewed to assess habitat connectivity.

Fragmentation

The term fragmentation is used to describe a process in which larger blocks of forest become divided into smaller more isolated blocks. Fragmentation has the potential to isolate small populations, contribute to decreased population distribution, and increase the likelihood of local extinction (USDA Forest Service 2008). Patches of old growth forests are usually described as having two components the edge and the interior. Interior forest habitats retain moisture, temperature, and vegetation conditions that are unique. Old growth dependent species generally thrive in these interior forest habitats and tend to be sensitive to the encroachment of the forest edge habitat, or edge effect. The edge effect can extend 100 meters or more into the forest (Concannon 1995). When fragmentation occurs, there is an increase in the amount of edge forest habitat and a decrease in the interior forest habitat thereby making patches of a certain size or less, less suitable for old growth dependent species.

Fragmentation associated with habitat loss results in smaller sizes of habitat blocks or patches available to a species, increased distances among habitat patches, and increased amounts of matrix conditions in which habitat patches are embedded, and altered spatial distribution of habitat types (Haufler 2006). These factors are strongly tied to the structural and functional connectivity of the landscape, and thus the ability of the landscape to support well-distributed and viable wildlife populations. By maintaining a functional and interconnected old-growth ecosystem, it can be assumed that various components of biodiversity, including structural diversity (within-stand and landscape level), connectivity (unfragmented, contiguous blocks of old growth), stand age and species composition (including understory species), and ecological processes (e.g., tree establishment, disturbance, and nitrogen fixation) will also be maintained. The amount and distribution of POG after 100 years of Forest Plan implementation can serve as a relative indicator of the functioning and interconnectedness of the old-growth ecosystem and the potential effects on biodiversity under each alternative (2008 Forest Plan alternatives). In addition, effects on biodiversity can be measured by the degree of change expected to occur in the composition and distribution of the old-growth ecosystem relative to its historic composition and distribution. It can be assumed that the more an alternative changes the natural distribution and composition of old-growth ecosystems, the greater are its effects on biodiversity. Therefore, the effects of the alternatives on the distribution and composition of old-growth forests can be evaluated by examining the representation of POG and specific types of POG across the Tongass, with reference to

historical representation. At the same time, the analysis examines the old-growth Conservation Strategy of each alternative and the degree to which it maintains old-growth function, interconnectedness, and representation. Another measure of the effects of the alternatives on landscape fragmentation can be obtained by evaluating the degree to which the alternatives would result in converting large, relatively pristine watersheds to a modified state.

Table 20 shows the number of patches by size classes that were present in the project area in 1954 and that are currently present in the project area.

Table 20 Number of Old Growth Patches by Size Class Present in the Logjam Project Area

Patch size (acres)	1954	Current (2008)
0-25	132	196
26-100	87	174
101-500	0	1
500+	26	29*

* There are more patches in the 500+ size class in 2008 due the fact that some of the patches in 1954 were greater than 1000 acres; the reduction in size to less than 1000 acres results in more patches greater than 500 acres in size.

At a landscape level across the project area, the natural distribution of POG forest is quite patchy and is linear in many areas, with fragmentation created by muskeg, forested wetlands, and alpine areas. On a small scale, single-tree gaps within 400-year-old Sitka spruce stands provide habitat for forest interior birds such as the hairy woodpecker. On a broader scale, large patches of wind disturbance of 10 acres or more may create nesting habitat for migratory songbirds, or increase the growth of understory forage for some species such as deer.

Patches of old-growth forest sometimes serve as the only habitat in a landscape for many lichens, fungi, bryophytes, plants, and small animals, all of which contribute to the biodiversity and productivity of the forest ecosystem. These patches may be critical for species that are locally endemic, occur only in very specific conditions of forest structure or soil, or have limited dispersal capabilities.

Travel Corridors

The habitat corridors or dispersal routes, between habitats blocks, or patches, across the landscape may be just as important to maintaining habitat diversity as the size of the block themselves. Several different types of connectivity exist across the landscape and may include low elevation passes, beach fringe, and riparian areas. Corridors can function in a variety of ways depending on their width and other characteristics. The width of a corridor can be important because some species do not migrate through extensive lengths of unsuitable habitat (Forman and Gordon 1986). In the Logjam project area corridors along streams, and between habitats at different elevations have been reduced by past harvest activities.

The corridors between habitat blocks in the landscape may be at least as significant to maintaining habitat diversity as the size of the blocks (Noss 1983). Low elevation passes, beach fringe and stream corridors provide natural connections between forested areas.

Landscape connectivity is the degree to which the landscape facilitates or impedes movement among habitat patches or the functional relationship among habitat patches (Tischendorf and Fahrig 2000). The 2008 Forest Plan only requires connectivity between medium and large old

growth reserves. Many old-growth associated species across the Tongass can move or be carried across areas not in old-growth conditions (USDA Forest Service 2008c). The 2008 Forest Plan also recognized that corridors may be the only link between habitats and need to function as breeding habitat for species with limited dispersal capabilities, such as lichens, fungi, mosses, plants, and small animals. Wider corridors are considered to be more effective at facilitating species movements. A functioning corridor should be continuous and maintain a minimum width along its entire length. The corridor must also contain suitable habitat for the species that are expected to move within it. Several of the corridors that now link the key patches were historically part of the interior habitat. Past harvest and road building have fragmented these areas, creating openings and small patches of old growth edge habitat in place of interior habitat. These patches of old growth edge habitat now serve primarily as corridors between the remaining patches of interior forest. Many of these corridors are low elevation (less than 800-feet) and include productive old-growth forest. An area becomes very valuable habitat for wildlife, such as goshawk and brown creeper, when it is located at low elevation and contains high volume old-growth. The Forest Plan has identified stream buffers as corridors between habitat patches. Minimum corridor width along a fish stream is identified in the Forest Plan as 200-feet (100-feet on either side of the stream). There are no specific travel corridor/dispersal routes standards in the 2008 Forest Plan.

Travel corridors throughout the project area have been disrupted by past management activities that have increased the fragmentation of the landscape. Table 10 indicates the changes in the patch size classes from 1954 to what is currently on the landscape.

Threatened, Endangered and Sensitive Species

No federally listed threatened, endangered, or proposed species occur in the Logjam project area and therefore no discussion or effects analysis for threatened, endangered or proposed species is needed in this EIS.

Two sensitive animal species, the northern goshawk and trumpeter swan, are known to occur in the project area. There is one known goshawk nest in the project area, and trumpeter swans are known to use the larger lakes within the project area during the winter. The goshawk nest has the required 100-acre buffer on it. Lakes within the project area are also buffered.

A federal determination of, "may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species," was made by the USFWS for the goshawk and trumpeter swans. There would be no impact on remaining sensitive animal species.

River otter, Vancouver Canada goose, Black bear, Bald eagle

The river otter (*Lutra canadensis*), Vancouver Canada goose (*Branta canadeisis fulva*), black bear (*Ursus americanus*), and bald eagle (*Haliaeetus leucocephalus*) were not selected as MIS for this project because they inhabit beach, estuary fringe, and riparian habitats where no activities are proposed. The beach, estuary, and riparian areas are protected under specific standards and guidelines in the 2008 Forest Plan (USDA Forest Service 2008b). These species will not be discussed in this document.

3 Environment and Effects

Environmental Consequences

Sitka Black-tailed Deer

The deer model was run to assess the effects of action alternatives on the existing condition (2008) of deer habitat, the condition of deer habitat as it existed prior to large-scale harvest (1954), and 100 years after proposed harvest is expected to begin (2109). The year 2109 is used to represent the future condition to assess the effects of past and proposed harvest, where harvested stands have reached the stem exclusion stage, on deer habitat capability. No thresholds for effects have been defined in the Forest Plan or by the research.

Although a flush of vegetation after timber harvest provides summer forage for deer, it is not likely available during the winter due to snow accumulation. Over time, as the rapid development of conifers reaches the stem exclusion stage, understory plant abundance would decline. Thinning of these stands would increase forage availability. Activities such as thinning, girdling, and pruning open the forest canopy and result in an increase of the understory biomass thereby increasing the amount of forage available to deer.

Stand structural diversity and plant diversity and abundance are much greater in single tree selection stands than in young-growth stands developing after clearcut harvest (Deal 2001; Deal and Tappeiner 2002).

The acres of deer winter range in WAA 1421 were estimated to be 7,124 acres in 1954. The current acreage of deer winter range in WAA 1421 is 3,984. This is a decline of approximately 44 percent (Table 21).

Alternative 1—Direct/Indirect Effects— Sitka Black-tailed Deer

Alternative 1 would have no direct effects to deer habitat; however, there may be indirect effects over time. Over time the habitat capability would decline as existing second-growth stands move into the stem exclusion stage. Therefore, over time this alternative would have a slight affect to the deer habitat capability in the WAA.

This alternative does not propose to harvest any acres of high value deer winter range. The amount of deer winter range would remain at approximately 56 percent of what has been estimated to have been present in 1954 (Table 21).

The deer habitat capability would remain at about 74 percent of the calculated capability in 1954 (Table 22).

There is currently a 64 percent reduction in the high value (4th quartile) deer HSI since 1954 (Table 23).

Cumulative Effects

Habitat capability would be reduced as natural and harvest associated windthrow occur and past second growth stands, and proposed and future harvest units reach the stem exclusion stage. Approximately 4,000 acres of second growth stands are planned for thinning in the Logjam project area, over the next 5 years. Second growth stands would continue to be scheduled for thinning as they reach the appropriate age.

Activities such as thinning, girdling, and pruning open the forest canopy and result in an increase of the understory biomass, there by increasing the amount of forage available to deer.

The cumulative effects of thinning second growth are not completely understood. Slash depth is the biggest concern for deer. As second growth is thinned, deer movement patterns may temporally shift due to their inability to move through thinned areas that have excessive slash. Designing thinning units with no-cut travel corridors would help to mitigate the cumulative effects that thinning could have on deer movement patterns. Over time, the slash would settle and deer would be able to move through the remainder of these thinned stands.

Although the Forest Plan Conservation Strategy maintains a viable deer population, there may be a cumulative reduction of elevational connectivity in association with a cumulative reduction in deer habitat capability as a result of past, proposed and future harvest activities.

Alternative 2—Direct/Indirect Effects— Sitka Black-tailed Deer

Alternative 2 would have direct and indirect effects to deer. The direct effects to deer would result from the reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain to maintain the species.

This alternative proposes to harvest 487 acres of high value deer winter range, a 12 percent decrease from what is currently available (Table 21).

Alternative 2 would result in a reduction in deer habitat capability of about 6 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 2 would result in about a four percent reduction in the fourth quartile of the deer HSI (Table 23).

Cumulative Effects

Alternative 2 would result in a total reduction of 51 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 2 would result in a total reduction of 32 percent in the deer habitat capability for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22).

Alternative 2 would result in a four percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 68 percent since 1954 (Table 23).

Alternative 3—Direct/Indirect Effects— Sitka Black-tailed Deer

Alternative 3 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 356 acres of high value deer winter range. The estimated deer habitat would be reduced by nine percent from current levels (Table 21).

Alternative 3 would result in a reduction in deer habitat capability of about 5 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 3 would result in a three percent reduction in the high value deer HSI (Table 23).

Cumulative Effects

Alternative 3 would result in a total reduction of 49 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 3 would result in a total reduction of 32 percent in the deer habitat for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22).

Alternative 3 would result in a three percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 67 percent since 1954 (Table 23).

Alternative 4—Direct/Indirect Effects— Sitka Black-tailed Deer

Alternative 4 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population, but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 286 acres of high value deer winter range. The estimated deer habitat would be reduced by 7 percent from current levels and by 48 percent total (Table 21).

Alternative 4 would result in a reduction in deer habitat capability of about 4 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 3 percent (Table 22).

Alternative 4 would result in a two percent reduction in the deer HSI (Table 23).

Cumulative Effects

Alternative 4 would result in a total reduction of 48 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 4 would result in a total reduction of 31 percent in the deer habitat capability for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer density would be a 38 percent decrease (Table 22).

Alternative 4 would result in a two percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 66 percent since 1954 (Table 23).

Alternative 5 —Direct/indirect effects— Sitka Black-tailed Deer

Alternative 5 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and

connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 492 acres of high value deer winter range. The estimated deer densities would be reduced by 12 percent from current levels (Table 21).

Alternative 5 would result in a reduction in deer habitat capability of about 6 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 5 would result in a four percent reduction in the deer HSI (Table 23).

Cumulative Effects

Alternative 5 would result in a total reduction of 32 percent in the deer habitat capability for WAA 1421 from 1954.For the three WAAs combined the total reduction in deer habitat capability would be a 38 percent decrease (Table 22). Alternative 5 would result in a total reduction of 51 percent in the deer winter habitat for WAA 1421 from 1954 (Table 22).Alternative 5 would result in a four percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 68 percent since 1954 (Table 23).

Table 21 Acres of Deer Winter Range harvested by Alternative for WAA 1421

	1954 acres	Current acres	Proposed harvest acres	Post project acres	% change from current	Total % change
Alt 1	7,124	3,984	0	3,984	0%	-44%%
Alt 2	7,124	3,984	487	3,497	-12%	-51%
Alt 3	7,124	3,984	356	3,628	-9%	-49%
Alt 4	7,124	3,984	286	3,698	-7%	-48%
Alt 5	7,124	3,984	492	3,492	-12%	-51%

Table 22 Changes in deer habitat capability

	WAA 1421	All WAAs Combined
Existing Condition/Alt 1 % change from current	-0%	-0%
% change from 1954	-28%	-33%
Alt 2 % change from current	-6%	-4%
% change from 1954	-32%	-38%
Alt 3 % change from current	-5%	-3%
% change from 1954	-32%	-38%
Alt 4 % change from current	-4%	-3%
% change from 1954	-32%	-38%
Alt 5 % change from current	-6%	-4%
% change from 1954	-32%	-38%
2019	-32%	-38%

Table 23 Changes in acres of 4th quartile habitat for combined WAAs

1954	41,481 acres
Existing (2008)	14,929 acres
% change since 1954	-64%
Alternative 1	14,929 acres
% change	0
Total % change since 1954	-64%
Alternative 2	14,358 acres
% change	-4%
Total % change since 1954	-68%
Alternative 3	14,459 acres
% change	-3%
Total % change since 1954	-67%
Alternative 4	14,683 acres
% change	-2%
Total % change since 1954	-66%
Alternative 5	14,342 acres
% change	-4%
Total % change since 1954	-68%

Conclusion

Currently (2006), the deer winter habitat occurring in WAA 1421 is at 74 percent of the historic (1954) deer winter range. All action alternatives will result in a decrease of deer winter range. Alternatives 2 and 5 have very similar impacts to deer habitat. Alternatives 2 and 5 will have the greatest impact to deer habitat. Alternative 4 would result in the least impacts to deer habitat.

All alternatives will result in a decrease in deer habitat capability and in the 4th quartile HSI.

With implementation of the Forest Plan the deer winter habitat in WAA 1421 would be reduced to 63 percent of the 1954 value (USDA Forest Service Forest Plan FEIS 2008). The analysis predicts that 12 percent of WAA 1421 will be harvested with the implementation of Alternative 2 or 5. This is within one percent of the predictions of the Forest Plan. Therefore, this analysis tiers to the analysis found in the 2008 Forest Plan FEIS.

Environmental Consequences —Alexander Archipelago Wolf

Since the primary food of most Southeast Alaskan wolves is deer, estimated impacts to wolves are tied directly to the estimated impacts to deer. To date, wolf mortality is not a concern by State of Alaska biologists. Road densities are displayed herein; however there is no guideline for road densities when wolf mortality has not been identified as a concern.

Alternative 1—Direct/Indirect Effects— Alexander Archipelago Wolf

Alternative 1 would have no direct effects to deer habitat (and therefore no direct effects to wolves); however there may be indirect effects over time. In time, there may be indirect

effects to the wolf due to deer habitat capability declining as existing second-growth stands move into the stem exclusion stage.

This alternative would keep the project area in its current condition. Total road densities (for NFS roads only) would remain at 1.36 miles per square mile (Table 24).

Cumulative Effects

Over time, this alternative would affect deer habitat capability in the WAA, and therefore, would affect the wolf.

This alternative would keep the project area in its current condition. Total road densities (for NFS roads only) would remain at 1.36 miles per square mile.

Alternative 2—Direct/Indirect effects— Alexander Archipelago Wolf

Alternatives 2 would have direct and indirect effects to deer and as a result an indirect effect to wolves. As previously discussed, effects to deer would result from a reduction in habitat capability, high value winter habitat. Overtime, proposed activities would likely result in a decline in the deer population, but sufficient habitat would remain functional to maintain the species at a level high enough to sustain wolves.

Alternative 2 would result in a reduction in deer habitat capability of about 6 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 2 would result in a total road density of NFS roads of 1.57 miles per square mile (Table 24) an increase of 0.21 miles per square mile over what is currently there and is not expected to result in a direct or indirect effect to overall wolf populations.

Alternative 2 proposes construction of approximately 8 miles of NFS road (Table 25)

All new construction would be from the existing road system. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 21 miles of temporary road. In addition, approximately 3 miles of decommissioned temporary roadbed would be used as a road base for new construction. All temporary roads would be decommissioned after timber haul is complete, and 3.2 miles of road would be reconstructed (Table 25).

Cumulative Effects

Alternative 2 would result in a reduction in the deer in the habitat capability of 6 percent. Alternative 2 would result in a total reduction of 32 percent in the deer habitat for WAA 1421 from 1954. For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22) since 1954.

Alternative 3—Direct/Indirect Effects— Alexander Archipelago Wolf

Alternative 3 would have direct and indirect effects to deer and as a result to wolves. Alternative 3 would result in a reduction in deer habitat capability of about 5 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 3 would result in a total road density of NFS roads of 1.46 miles per square mile (Table 24) an increase of 0.1 miles per square mile over what is currently there and is not expected to result in a direct or indirect effect to overall wolf populations.

Alternative 3 proposes construction of approximately 2 miles of new NFS road (Table 25). All new construction would be from the existing road system. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 13 miles of temporary road. In addition 1.5 miles of decommissioned temporary roadbed would be used as a road base for new construction. All temporary roads would be decommissioned after timber haul is complete. No reconstruction is proposed with this alternative.

Cumulative Effects

Alternative 3 would result in a reduction of deer in habitat capability of 5 percent. Alternative 3 would result in a total reduction of 32 percent in the deer habitat for WAA 1421 from 1954. For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22) since 1954.

Alternative 4—Direct/Indirect Effects— Alexander Archipelago Wolf

Alternative 4 would have the least direct and indirect effects to deer and therefore, the least impact to wolves.

Alternative 4 would result in a reduction in deer habitat capability of about 4 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 3 percent (Table 22).

Alternative 4 would result in a total road density of NFS roads to 1.44 miles per square mile (Table 24) an increase of 0.08 miles per square mile, over what is currently there and is not expected to result in a direct or indirect effect to overall wolf populations.

Alternative 4 proposes construction of approximately 3 miles of new NFS road (Table 25). All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 10 miles of temporary road; in addition approximately 1 mile of decommissioned temporary roadbed would be used as a road base for new construction. All temporary roads would be decommissioned after timber haul is complete. Approximately 1 mile of road would be reconstructed.

All temporary roads would be decommissioned after timber haul is complete.

Cumulative Effects

Alternative 4 would result in a reduction in the deer in the habitat capability of 4 percent. Alternative 4 would result in a total reduction of 31 percent in the deer density for WAA 1421 from 1954 levels (Table 22). For the three WAAs combined the total reduction in deer density would be a 38 percent decrease since 1954.

Alternative 5—Direct/Indirect Effects— Alexander Archipelago Wolf

Alternative 5 would result in a reduction in the deer in the habitat capability of 6 percent (Table 22).

Alternative 5 would increase the total road density of NFS roads to 1.49 miles per square mile (Table 24), an increase of 0.13 miles per square mile over what is currently there. The open road density would increase to 0.92 miles per square mile, an overall increase of only 0.22 miles per square mile from what is currently there.

Alternative 5 proposes construction of about 4 miles of new NFS Road (Table 15). All new construction would be from the existing road system. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 14 miles of temporary road; in addition about 3 miles of decommissioned temporary roadbed would be used as a road base for new construction. All temporary roads would be decommissioned after timber haul is complete. Reconstruction would include approximately 3 miles of road.

Although Alternative 5 ranks second to Alternative 2 in terms of road density, this alternative would result in an increase of 0.13 miles per square mile in total road density, and is not expected to result in a direct or indirect effect to overall wolf populations.

Cumulative Effects

Alternative 5 would result in a total reduction of 32 percent in the deer habitat capability for WAA 1421 from 1954 (Table 22). For the three WAAs combined the total reduction in deer density would be a 38 percent decrease since 1954.

Conclusion

All alternatives will result in an increase in the road density of WAA 1421. Both the current road density and the road density as a result of this project are above the standard and guidelines when wolf mortality has been identified as a concern (0.7 to 1.0 miles per square mile); however wolf mortality has not been identified as a concern by the State of Alaska in WAA 1421.

Of the action alternatives Alternatives 2 and 5 have the greatest (and very similar) effects to wolves. Alternative 4 has the least impact on the wolf and the effects of Alternative 3 are in between.

Table 24 Road Density for Logjam Project Area in WAA 1421 by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total road density miles per square mile	1.36	1.57	1.46	1.44	1.49
Open road density miles per square mile	0.7	1.0	0.89	0.88	0.92

Table 25 Miles of Proposed New Road Construction and Reconstruction by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
NFS Road	0	8	2	3	4
Temporary Road	0	21	13	10	14
Total❖	0	29	15	13	18
Reconstruction	0	3	0	1	3

❖Numbers have been rounded

Alaska National Interest Lands Conservation Act (ANLICA)

Effects to Communities Traditionally Using the Logjam Project Area

Use of most subsistence resources (fish, marine invertebrates, food plants, upland game birds, timber personal use) is not expected to be affected by any of the alternatives. However, subsistence use of deer may be affected to the point that some restriction in hunting may be necessary over the long term.

Additional road development under the alternatives would improve access but may increase competition with other non-local hunters. The level of road development is already relatively high in these WAAs. Existing open road densities are 1.1 and 0.7 miles per square mile and existing total road densities are 1.8 and 1.3 miles per square mile in WAAs 1420 and 1421, respectively (for all ownerships combined). Long-term (100+ years) road development would vary by alternative and would result in estimated maximum total road densities ranging from 1.6 to 2.0 miles per square mile in these WAAs under 2008 Forest Plan Alternative 1, to 2.0 to 2.2 miles per square mile in these WAAs under 2008 Forest Plan Alternative 7 (for all ownerships combined). Under the proposed ATM plan the total road density for Forest Service roads in WAA 1421 is project to be 1.3 miles per square mile and open road density will be 0.6 miles per square mile.

Additional road development under the alternatives would improve access and may increase competition with other non-local hunters; however, this change in access is not expected to result in a change to the subsistence fishery that occurs on Hatchery Creek. None of the proposed harvest for the Logjam project will change distribution of or the habitat for fish in this area. All proposed roads will have either log culverts or bridges at all fish crossings.

Abundance and Distribution of Deer

The evaluation of deer is based on a comparison of supply and demand. The deer habitat capability model, developed as part of the 1997 Forest Plan and carried over into the 2008 FEIS, was used in this analysis to provide an estimate of the potential number of deer available for harvest that the habitat, within WAA 1421, and within the area of WAAs 1420, 1421, and 1422 combined, can support over time.

The 1997 deer analysis was much in line with the earlier (1991, 1992, and 1996) analyses, which also used the 10 and 20 percent harvest cutoffs and the same land units. It indicated that deer habitat capabilities in several portions of the Tongass may not be adequate to sustain the current levels of deer harvests, and that implementation of any Forest Plan alternative could, therefore, be accompanied by the possibility of a significant restriction on the

abundance and/or distribution of subsistence uses of deer. Sport hunting restrictions would, however, occur first, followed by selective subsistence reductions, based on ANILCA Section 804.

Under the alternatives analyzed in the 2008 FEIS, the possibility of a significant restriction, resulting from a change in abundance or distribution, would be the same as or less than the possibility under Alternative 11 of the 1997 Forest Plan Revision Final EIS for five of the seven alternatives. It should be noted that actual timber harvest has been much lower under the current Forest Plan, than the levels projected under 1997 Forest Plan, Alternative 11.

Deer Subsistence Use

The 2008 FEIS assumed communities that currently use the project area for subsistence resources would continue do so in the foreseeable future. Approximately ten percent of the deer population can be harvested on a sustained basis if the population is near carrying capacity (USDA Forest Service 2008c). Currently the deer harvest, for all hunters, in WAA 1421 is estimated to be at nine percent of the habitat capability (Table 26).

Table 26 Projected Deer Demand all Hunters

WAA	Projected deer demand 2005	Total harvest as a percent of 2005 capability	Projected deer demand 2095	Total harvest as a percent of 2095 capability
1421	222	9%	398	18.2%

1997 Forest Plan, H-65 and 66

The Sitka black-tailed Deer section of the Affected Environment in this document describes the deer habitat capability model that was used to estimate the effects of the proposed timber harvest on deer habitat.

Table 27 shows the number of deer harvested for WAA 1421 (the Logjam Project Area) as well as the two surrounding WAA (1420 and 1422).

Table 27 Deer Harvest Data for Logjam

Year	WAA 1420	WAA 1421	WAA 1422
1996	196	58	323
1997	278	39	284
1998	202	45	336
1999	226	28	348
2000	234	142	330
2001	344	61	221
2002	136	162	261
2003	86	73	219
Total	1702	608	2322
Average	213	76	290

Data from ADF&G Harvest Reports

Alternative 1—Direct/Indirect Effects— Deer Subsistence Use

Alternative 1 would have no direct effects to deer habitat; however, there may be indirect effects over time. Over time the habitat capability would decline as existing second-growth stands move into the stem exclusion stage. Therefore, over time this alternative would have a slight affect to the deer habitat capability in the WAA.

This alternative does not propose to harvest any acres of high value deer winter range. The amount of deer winter range would remain at approximately 56 percent of what has been estimated to have been present in 1954 (Table 21).

The deer habitat capability would remain at about 74 percent of the calculated capability in 1954 (Table 22).

There is currently a 64 percent reduction in the high value (4th quartile) deer HSI since 1954 (Table 23).

Cumulative Effects

Habitat capability would be reduced as natural and harvest associated windthrow occur and past second growth stands, and proposed and future harvest units reach the stem exclusion stage. Approximately 4,000 acres of second growth stands are planned for thinning in the Logjam project area, over the next 5 years. Second growth stands would continue to be scheduled for thinning as they reach the appropriate age.

Activities such as thinning, girdling, and pruning open the forest canopy and result in an increase of the understory biomass, there by increasing the amount of forage available to deer.

The cumulative effects of thinning second growth are not completely understood. Slash depth is the biggest concern for deer. As second growth is thinned, deer movement patterns may temporally shift due to their inability to move through thinned areas that have excessive slash. Designing thinning units with no-cut travel corridors would help to mitigate the cumulative effects that thinning could have on deer movement patterns. Over time, the slash would settle and deer would be able to move through the remainder of these thinned stands.

Although the Forest Plan Conservation Strategy maintains a viable deer population, there may be a cumulative reduction of elevational connectivity in association with a cumulative reduction in deer habitat capability as a result of past, proposed and future harvest activities.

Alternative 2—Direct/Indirect Effects— Deer Subsistence Use

Alternative 2 would have direct and indirect effects to deer. The direct effects to deer would result from the reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain to maintain the species.

This alternative proposes to harvest 487 acres of high value deer winter range, a 12 percent decrease from what is currently available (Table 21).

Alternative 2 would result in a reduction in deer habitat capability of about 6 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 2 would result in about a four percent reduction in the fourth quartile of the deer HSI (Table 23).

Cumulative Effects

Alternative 2 would result in a total reduction of 51 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 2 would result in a total reduction of 32 percent in the deer habitat capability for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22).

Alternative 2 would result in a four percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 68 percent since 1954 (Table 23).

Alternative 3—Direct/Indirect Effects— Deer Subsistence Use

Alternative 3 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 356 acres of high value deer winter range. The estimated deer habitat would be reduced by nine percent from current levels (Table 21).

Alternative 3 would result in a reduction in deer habitat capability of about 5 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 3 would result in a three percent reduction in the high value deer HSI (Table 23).

Cumulative Effects

Alternative 3 would result in a total reduction of 49 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 3 would result in a total reduction of 32 percent in the deer habitat for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer habitat would be a 38 percent decrease (Table 22).

Alternative 3 would result in a three percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 67 percent since 1954 (Table 23).

Alternative 4—Direct/Indirect Effects— Deer Subsistence Use

Alternative 4 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population, but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 286 acres of high value deer winter range. The estimated deer habitat would be reduced by eight percent from current levels and by 48 percent total (Table 21).

Alternative 4 would result in a reduction in deer habitat capability of about 4 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 3 percent (Table 22).

Alternative 4 would result in a two percent reduction in the deer HSI (Table 23).

Cumulative Effects

Alternative 4 would result in a total reduction of 48 percent in the deer winter habitat for WAA 1421 from 1954 (Table 21).

Alternative 4 would result in a total reduction of 31 percent in the deer habitat capability for WAA 1421 from 1954 (Table 22).

For the three WAAs combined the total reduction in deer density would be a 38 percent decrease (Table 22).

Alternative 4 would result in a two percent decrease in the fourth quartile (high value) deer habitat (for a total decrease of 66 percent since 1954 (Table 23).

Alternative 5 —Direct/indirect effects— Deer Subsistence Use

Alternative 5 would have direct and indirect effects to deer. Effects to deer would result from a reduction in habitat capability, high value winter habitat, high use summer habitat, and connectivity. Proposed activities would likely result in a decline in the deer population but sufficient habitat would remain functional to maintain the species.

This alternative proposes to harvest 492 acres of high value deer winter range. The estimated deer densities would be reduced by 12 percent from current levels (Table 21).

Alternative 5 would result in a reduction in deer habitat capability of about 6 percent from current levels in WAA 1421, and for the three WAAs combined a reduction of approximately 4 percent (Table 22).

Alternative 5 would result in a four percent reduction in the deer HSI (Table 23).

Cumulative Effects

Alternative 5 would result in a total reduction of 32 percent in the deer habitat capability for WAA 1421 from 1954.

For the three WAAs combined the total reduction in deer habitat capability would be a 38 percent decrease (Table 22).

Alternative 5 would result in a total reduction of 51 percent in the deer winter habitat for WAA 1421 from 1954 (Table 22).

Alternative 5 would result in a four percent decrease in the fourth quartile (high value) deer habitat for a total decrease of 68 percent since 1954 (Table 23).

Conclusion

Abundance and Distribution

Deer numbers in localized areas could temporarily increase because of increased food availability in harvest units. Roads can affect subsistence by providing access, dispersing hunting pressure, and creating the potential for increased competition. Project related activities would not restrict current access to deer for subsistence use. New proposed roads would be closed to vehicle use after timber harvest activities in all alternatives. Additional roads would not increase the number of hunters, but would extend access from existing roads into new areas. Increased access could increase hunter success.

Deer abundance would eventually decline in proportion to the intensity of harvest. This could lead to increased competition between rural and non-rural hunters as deer become harder to find. The distribution of deer would change in response to changes in habitat capability. Once second growth stands reach stem exclusion stage, they would not support the number of deer they did before timber harvest. Vegetation treatment of existing second-growth stands in the project area would help reduce the effects of stem exclusion on deer populations and distribution by increasing or maintaining understory vegetation.

Currently (2006), the deer winter habitat occurring in WAA 1421 is at 74 percent of the historic (1954) deer winter range. All action alternatives will result in a decrease of deer winter range. Alternatives 2 and 5 have very similar impacts to deer habitat. Alternatives 2 and 5 will have the greatest impact to deer habitat. Alternative 4 would result in the least impacts to deer habitat.

All alternatives will result in a decrease in deer habitat capability and in the 4th quartile HSI. According to the Forest Plan upon full implementation of the Forest Plan the deer winter habitat in WAA 1421 will have be reduced to 63 percent of the 1954 value (USDA Forest Service Forest Plan FEIS 2008). The Logjam DEIS predicts that 12 percent of WAA 1421 will be harvested with the implementation of Alternative 2 or 5. This is within one percent of the predictions of the Forest Plan. Therefore, this analysis tiers to the analysis found in the 2008 Forest Plan FEIS.

Competition

Competition for resources generally occurs where resources are accessible to a large number of people. Refer to Forest Plan FEIS for an in-depth discussion. A deer population at carrying capacity should be able to support a hunter harvest of about ten percent of the winter habitat capability to be sustainable and provide a reasonably high level of hunter success. Hunter success can be expected to decline in areas where demand is greater than ten percent of winter habitat capability. Deer harvest in WAA 1421 is currently estimated to be at approximately 9 percent of the habitat capability.

Access

All alternatives will result in an increase in the road density of WAA 1421. These changes are not expected to result in an overall change in access to deer.

After the implementation of the Access and Travel Management (ATM) plan the total road density (all roads) would be 1.4 miles per square mile; open road density (all roads) would be 0.6 miles per square mile; total road density (FS roads only) would be 1.3 miles per square mile and open road density for Forest Service roads only would be 0.6 miles per square mile.

Roads can affect subsistence by providing access, dispersing hunting pressure, and creating the potential for increased competition. Project related activities would not restrict current access to deer for subsistence use. New proposed roads would be closed to vehicle use after timber harvest activities in all alternatives.

The direct effects of the alternatives do not present a significant restriction on subsistence uses of deer. Competition for deer may increase after harvest units enter stem exclusion. Deer hunting on federal land on Prince of Wales Island is already restricted.

The potential foreseeable and cumulative effects from implementing the Forest Plan through the entire rotation period, including the no-action and action alternatives in the project area presents a significant possibility of restriction to subsistence use of deer at the end of rotation in 2095.

Under the alternatives analyzed in the 2008 FEIS, the possibility of a significant restriction, resulting from a change in abundance or distribution, would be the same as or less than the possibility under Alternative 11 of the 1997 Forest Plan Revision Final EIS for five of the seven alternatives. It should be noted that actual timber harvest has been much lower under the current Forest Plan than the levels projected under 1997 Forest Plan Alternative 11.

Direct/Indirect and Cumulative Effects-All alternatives—Subsistence (other than deer)

Fish and Shellfish— Subsistence Use

The timber harvest activity prescribed by this project is not expected to change the distribution, abundance or use of these resources in the Logjam area. Forest Plan Standards and Guidelines for Riparian Areas would be followed to maintain habitat productivity for fish and shellfish. All alternatives are consistent with Forest Plan standards and guidelines and result in minor effects on fish habitat. The Forest Service maintains that the Logjam Timber Sale will not affect Freshwater EFH or Marine EFH. All the action alternatives would only have minor effects to fish habitat that will last less than a week at the time of the activity. There would be no cumulative effects to Fish and Shellfish subsistence use from this project.

Fish and Shellfish—Abundance and Distribution

Protective stream buffers as defined in the Forest Plan Standards and Guidelines would minimize adverse effects to fish habitat. The risk of impact to fish populations due to timber harvest would be minimal because of Tongass Timber Reform Act (TTRA); stream buffers; Forest Plan Riparian Standards and Guidelines, and road construction bumps. No measurable effects on shellfish populations are expected for all action alternatives. All alternatives are consistent with Forest Plan standards and guidelines and result in minor effects on fish habitat. There would be no cumulative effects to Fish and Shellfish abundance and distribution from this project.

Fish and Shellfish— Access

Additional road development under the alternatives would improve access and may increase competition; this change in access is not expected to result in a change to the subsistence fishery that occurs on Hatchery Creek. The Logjam Timber Sale is not likely to have any effect on the use of the Hatchery Creek Trail and its access to subsistence resources. No measurable effects on shellfish populations are expected for all action alternatives. There would be no cumulative effects to Fish and Shellfish access from this project.

Fish and shellfish—Competition

Additional road development under the alternatives would improve access and may increase competition; this change in access is not expected to result in a change to the subsistence fishery that occurs on Hatchery Creek. Since no change is anticipated to the access and competition generated by the Hatchery Creek Trail, the overall competition to salmon subsistence fishing in Logjam area is not expected to change. There would be no cumulative effects to competition for Fish and Shellfish subsistence use from this project.

Upland Birds and Waterfowl—Subsistence Use

The timber harvest activity prescribed by this project is not expected to change the distribution, abundance, or use of these resources in the Logjam area. There would be no cumulative effects to upland birds subsistence use from this project.

Upland Birds and Waterfowl—Abundance and Distribution

No measurable effects on upland bird and waterfowl populations are expected for any action alternatives. There would be no cumulative effects to upland birds subsistence use from this project.

Upland birds and Waterfowl—Access

None of the proposed Logjam alternatives will result in a significant change in access to upland birds and waterfowl. There would be no cumulative effects to upland birds subsistence use from this project.

Upland Birds and Waterfowl— Competition

Short term competition for upland birds and waterfowl may be slightly affected by the proposed activities. The number of hunters in the area may temporarily increase during active logging operations, but long-term competition would not be affected. There would be no cumulative effects to upland birds subsistence use from this project.

Food Plants- Subsistence Use/Abundance/Access and Competition

None of the alternatives are expected to negatively affect subsistence plant gathering for food based on a projected increase of berries due to timber harvest and the locations of the potential activities. Reasonably foreseeable effects of the action alternatives on the abundance and distribution of food plants would be minimal and favorable. There would be no cumulative effects to food plants subsistence use from this project.

Personal Use Timber -Subsistence Use/ Access/ Abundance and Competition

None of the action alternatives are expected to have an impact on personal use of timber in the Logjam project area. There would be no cumulative effects to personal use timber subsistence use from this project terms of abundance and competition.

Marine Mammals— Subsistence Use/ Access/ Abundance and Competition

Currently, there is no evidence to suggest that timber harvest and related development activities have any impact on marine mammals. No marine environment occurs in the Logjam project area therefore no significant restriction to the subsistence use of marine mammals is expected under any alternative. There would be no cumulative effects marine mammal subsistence use from this project.

Environmental Consequences to MIS (other than Deer and Wolves)

American Marten

Marten populations would be expected to decline in direct proportion to the amount of high value marten habitat that is harvested.

Although closed roads would still facilitate access (e.g., off-highway vehicle, pedestrian), open roads would receive the highest and most consistent use and therefore would likely have the greatest effect on marten. Where marten mortality concerns have been identified road closures should be implemented as a measure to reduce mortality caused by increased road

access. There have been no official concerns expressed by ADF&G on the stability of the marten population in the project area.

Alternative 1 —Direct/Indirect/Cumulative Effects— American Marten

Alternative 1 would have no direct or indirect effects to marten because there would be no change to current habitat in the area.

Marten habitat would remain at approximately 65 percent (a decline of 35 percent) of the historic (1954) level (Table 28).

Total road densities (for NFS roads only) would remain at 1.36 miles per square mile (Table 24).

Alternative 2 —Direct/Indirect/Cumulative Effects— American Marten

Alternative 2 would have direct and indirect effects to marten. The effects of Alternative 2 are very similar to the effects of Alternative 5. Both Alternative 2 and 5 have the greatest effects to marten.

Alternative 2 is proposing to harvest 2,938 acres (-17 percent) of the current high value marten habitat (Table 28).

Alternative 2 would result in a total road density of NFS roads of 1.57 miles per square mile, and an increase of 0.21 miles per square mile in total road density (Table 24).

Cumulative Effects

Alternative 2 would reduce marten habitat by 47 percent from historical levels (Table 28).

Alternative 3 —Direct/Indirect/Cumulative Effects— American Marten

Alternative 3 would have direct and indirect effects to marten. Alternative 3 is proposing to harvest 2,230 acres of the current high value marten habitat, resulting in a decrease of 13 percent of current habitat (Table 28).

Alternative 3 would increase the total road density of NFS roads to 1.46 miles per square mile; and open road density to 0.89 miles per square mile (Table 24).

Alternative 3 results in an increase of 0.1 miles per square mile in total road density and is not expected to result in a direct or indirect effect to overall marten populations.

Cumulative Effects

Alternative 3 would reduce marten habitat by 44 percent from historical levels (Table 28).

See Wildlife Resource Report in the project record for information about Conservation Strategy and the finding of the 2008 Forest Plan that this is maintaining sufficient habitat for species.

Alternative 4 —Direct/Indirect/Cumulative Effects— American Marten

Alternative 4 would have the least amount of direct and indirect effects to marten. Alternative 4 is proposing to harvest 1,462 acres (-9 percent) of the current high value marten habitat.

Alternative 4 would result in a total road density of NFS roads of 1.44 miles per square mile, an increase of 0.08 miles per square mile but is not expected to result in a direct or indirect effect to overall marten populations (Table 24).

Cumulative Effects

Alternative 4 would reduce marten habitat by 41 percent from historical (1954) levels (Table 28).

Alternative 5 —Direct/Indirect/Cumulative Effects— American Marten

Alternative 5 would have direct and indirect effects to marten similar to Alternative 2. Alternative 5 is proposing to harvest 2,791 acres of the current high value marten habitat, which is a 17 percent reduction from current habitat (Table 28).

Alternative 5 would result in a total road density of NFS roads of 1.49 miles per square mile; an increase of 0.13 miles per square mile (Table 24).

Cumulative Effects

Alternative 5 would reduce marten habitat by 47 percent from historical levels (Table 28).

Table 28 Harvest Acres and Percent Change to High Value Marten Habitat by Alternative

Alternatives	High Value Habitat Harvested (acres)	Percent Change from Current Habitat❖	Percent Change from 1954 Habitat⬩
Alt. 1	0	0	-35%
Alt. 2	2,938	-17%	-47%
Alt. 3	2,230	-13%	-44%
Alt. 4	1,462	-9%	-41%
Alt. 5	2,791	-17%	-47%

❖ there is 16,886 acres of high value marten habitat in 2008.
⬩ there were 26,099 acres of high value marten habitat in 1954.

Conclusion

All action alternatives will result in a decrease in high value marten habitat; however, high value marten habitat does not have any guidelines. Alternative 2 and 5 would have the greatest impact on marten habitat (-47%) and Alternative 4 would result in the least impact to marten habitat (-41%).

All alternatives will result in an increase in the road density of WAA 1421 (Table 14).

Snag Dependant Species

Since many species are considered to be at least somewhat old-growth dependant, the acres are POG remaining is an important measure to all (see the discussion on the Conservation Strategy and the OGRs in the Old Growth and Biodiversity Resource Report).

The habitat for cavity nesters would be reduced in proportion to the amount of old growth harvested by alternative. The Logjam project area had an estimated 35,176 acres of POG present in 1954. Currently there is estimated to be 25,891 acres of POG in the project area, a decrease of approximately 26 percent.

Alternative 1

Direct/Indirect/Cumulative Effects

Alternative 1 would have no direct or indirect effects to brown creeper, hairy woodpecker, and sapsuckers because there would be no change to POG in the project area. Snag dependent species habitat would remain unchanged under this alternative. The project area would continue to be influenced by natural disturbance processes (i.e., periodic wind events, landslides). Wind events could have either a positive or adverse effect. Trees with broken tops would become snags over time, whereas trees that are completely blown over would represent a future loss. POG forest may be reduced slightly as a result of current small timber sales, personal use wood harvest, and as natural and harvest associated windthrow occurs. These minimal reductions of POG would have negligible cumulative effects to snag dependent species and their habitat. See Wildlife Resource Report in the project record for information about Conservation Strategy and the finding of the 2008 Forest Plan that this is maintaining sufficient habitat for species.

The current estimated amount of POG acres would remain at about a 26 percent decrease in the project area from the acres of POG estimated to have been in these areas in 1954 (Table 29)

Alternative 2—Direct/Indirect/Cumulative Effects— Snag Dependant Species

Snag dependant species are expected to decline in proportion to the amount of POG harvested. Alternative 2 would harvest 3,369 POG acres and would reduce snag dependant species habitat (POG) by 13 percent of POG in the project area (Table 29) with 22,522 acres of POG remaining in the project area.

Cumulative Effects

Snag dependent species are expected to decline in proportion to the amount of proposed POG harvest. The cumulative effects on snag dependent species would be similar to the cumulative effects to overall old-growth habitat.

Alternative 2 would result in a cumulative reduction of 36 percent in the amount of POG present in the project area from the acres of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 3—Direct/Indirect/Cumulative Effects— Snag Dependant Species

Alternative 3 proposes to harvest 2,683 acres of POG and would reduce snag dependant species habitat (POG) by 10 percent for the project area from the current levels (Table 29) with 23,183 acres of POG remaining in the project area.

Cumulative Effects

Alternative 3 would result in a cumulative reduction of 34 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 4—Direct/Indirect/Cumulative Effects— Snag Dependant Species

Snag dependent species are expected to decline in proportion to the amount of proposed POG harvest.

Alternative 4 would reduce snag dependant species habitat (POG) by 6 percent of current habitat (Table 29) with 24,232 acres of POG remaining in the project area.

Cumulative Effects

Alternative 4 would result in a cumulative reduction of 31 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 5—Direct/Indirect/Cumulative Effects— Snag Dependant Species

Snag dependent species are expected to decline in proportion to the amount of proposed POG harvest.

Alternative 5 would reduce snag dependant species habitat (POG) by 13 percent from current levels and 37 percent from historical levels in the project area (Table 29) with 22,543 acres of POG remaining in the project area.

Cumulative Effects

Alternative 5 would result in a cumulative reduction of 37 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Conclusion

All action alternatives will result in a decrease in snag dependent species; however snag dependent species habitat does not have any specific guidelines. Alternatives 2 and 5 will have similar impacts to the amount of POG in the project area. Both Alternatives 2 and 5 will result in about a 13 percent decrease in POG in the project area and a 37 percent decrease in POG since 1954. Alternative 4 will result in the least impact (-6 percent) to the amount of POG in the project area as a result of this project and a total reduction in POG of 33 percent in the project area.. Alternative 3 results in a 10 percent reduction in POG from current acres and a total reduction of 36 percent.

Species of Concern

Marbled Murrelet

Since many species are considered to be at least somewhat old-growth dependant, the acres are POG remaining is an important measure to all (See the discussion on the Conservation Strategy and the OGRs in the Old Growth and Biodiversity Resource Report).

Marbled murrelets are expected to decline in proportion to the amount of proposed POG harvest.

See Wildlife Resource Report in the project record for information about Conservation Strategy and the finding of the 2008 Forest Plan that this is maintaining sufficient habitat for species.

Alternative 1—Direct/Indirect/Cumulative Effects— Marbled Murrelet

Alternative 1 would have negligible direct or indirect effects to these species of concern because there would be no change to habitat in the area.

POG forest may be reduced slightly as a result of current small timber sales, personal use wood harvest, and as natural and harvest associated windthrow occurs. These minimal reductions of POG would have negligible cumulative effects to the marbled murrelet and their habitat.

Alternative 2—Direct/Indirect/Cumulative Effects— Marbled Murrelet

Alternative 2 would have direct and indirect effects individuals may be displaced and nesting and foraging habitat would be reduced for some species.

Alternative 2 would result in a 13 percent decrease in POG in the project area (Table 29).

Alternative 2 would have the greatest effect because it proposes to harvest the most acres of POG (3,369 acres) and proposes the most acres of clearcut harvest (2,419) (see Silviculture).

Cumulative Effects

Alternative 2 would result in a cumulative reduction of 36 percent in the amount of POG present in the project area from the acres of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 2 would have the greatest effect because it proposes to harvest the most acres of POG (3,369 acres) and proposes the most acres of clearcut harvest (2,419) (see Silviculture **section).**

Alternative 3—Direct/Indirect/Cumulative Effects— Marbled Murrelet

Alternative 3 would result in a 10 percent decrease in POG the project area (Table 29).

Alternative 3 proposes to harvest 2,683 acres of POG and includes 1,555 clearcut acres (see Silviculture section).

Cumulative Effects

Alternative 3 would result in a cumulative reduction of 34 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 3 proposes to harvest 2,683 acres of POG and includes 1,556 clearcut acres (see Silviculture section).

Alternative 4—Direct/Indirect/Cumulative Effects— Marbled Murrelet

Alternative 4 would result in a 6 percent decrease in POG in the project area (Table 29)

Alternative 4 proposes to harvest 1,659 acres of POG and 1,281 by clearcut (see Silviculture section).

Cumulative Effects

The cumulative effects on marbled murrelets would be similar to the cumulative effects to overall old-growth habitat. Alternative 4 would result in a cumulative reduction of 31 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29)

Alternative 5—Direct/Indirect/Cumulative Effects— Marbled Murrelet

Alternative 5 would result in a 13 percent decrease in POG acres in the project area (Table 29)

Alternative 5 proposes to harvest 3,345 acres of POG with 2,128 acres of clearcut (See Silviculture section).

Cumulative Effects

Alternative 5 would result in a cumulative reduction of 36 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 5 proposes to harvest 3,345 acres of POG with 2,130 acres of clearcut (see Silviculture section).

Conclusion

All action alternatives will result in a decrease in marbled murrelet habitat; however murrelet habitat does not have any specific guidelines. Alternatives 2 and 5 will have similar impacts to the amount of POG in the project area. Both Alternatives 2 and 5 will result in about a 13 percent decrease in POG in the project area and a 37 percent decrease in POG since 1954. Alternative 4 will result in the least impact (-6 percent) to the amount of POG in the project area as a result of this project and a total reduction in POG of 33 percent in the project area.. Alternative 3 results in a 10 percent reduction in POG from current acres and a total reduction of 36 percent.

Prince of Wales Flying Squirrel

The Conservation Strategy of the Forest Plan (2008) was designed to meet the habitat needs of old-growth associated species, including Prince of Wales (POW) flying squirrel. Partial cut prescriptions have been designed for all action alternatives. Maintaining forest structure components in harvest units could increase the value of the habitat for flying squirrels compared to traditional clearcutting. Flying squirrel habitat would be reduced in proportion to the amount of productive old growth (POG) harvested by alternative. The Logjam project area had an estimated 35,176 acres of POG present in 1954. Currently there is estimated to be 25,891 acres of POG in the project area, a decrease of approximately 26 percent. See Wildlife Resource Report in the project record for information about Conservation Strategy and the finding of the 2008 Forest Plan that this is maintaining sufficient habitat for species.

Alternative 1—Direct/Indirect/Cumulative Effects— Flying Squirrel

Alternative 1 would have negligible cumulative effects to the Prince of Wales flying squirrel.

POG forest may be reduced slightly as a result of current small timber sales, personal use wood harvest, and as natural and harvest associated windthrow occurs.

Currently planned and proposed thinning is designed to maintain understory vegetation and a more open overstory in second growth stands.

The current estimated amount of POG acres would remain at about a 26 percent decrease in the project area from the acres of POG estimated to have been in these areas in 1954 (Table 29).

Appendix D includes past, present and reasonably foreseeable future actions considered in this analysis.

Alternative 2—Direct/Indirect/Cumulative Effects— Flying Squirrel

Alternative 2 would have direct and indirect effects to individuals that may be displaced.

Prince of Wales flying squirrel is expected to decline in proportion to the amount of proposed POG harvest (3,369 acres). Alternative 2 would result in a 13 percent decrease in POG in the project area from current levels (Table 29).

Cumulative Effects

Alternative 2 would reduce flying squirrel habitat (POG) by 36 percent from historical (1954) levels in the project area (Table 29).

Alternative 3—Direct/Indirect/Cumulative Effects— Flying Squirrel

Alternative 3 would result in a 10 percent decrease in POG in the project area (Table 29).

Cumulative Effects

Alternative 3 would reduce flying squirrel habitat (POG) by 34 percent for the project area from historical (1954) levels (Table 29).

Alternative 4 —Direct/Indirect/Cumulative Effects— Flying Squirrel

Alternative 4 would result in a 6 percent decrease in POG in the project area (Table 29).

Cumulative Effects

The cumulative effects on the Prince of Wales flying squirrel would be similar to the cumulative effects to overall productive old-growth habitat. Alternative 4 would result in a cumulative reduction of 31 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

Alternative 5—Direct/Indirect/Cumulative Effects— Flying Squirrel

Alternative 5 would result in a 13 percent decrease in POG acres in the project area (Table 29).

Cumulative Effects

Alternative 5 would reduce flying squirrel habitat by 36 percent of habitat (POG) estimated to have been in these areas in 1954 (Table 29).

Conclusion

All action alternatives will result in a decrease in Prince of Wales flying squirrel habitat; however habitats for these species do not have any specific guidelines. Alternatives 2 and 5 will have similar impacts to the amount of POG in the project area. Both Alternatives 2 and 5 will result in about a 13 percent decrease in POG in the project area and a 37 percent decrease in POG since 1954. Alternative 4 will result in the least impact (-6 percent) to the amount of POG in the project area as a result of this project and a total reduction in POG of 33 percent in the project area. Alternative 3, results in a 10 percent reduction in POG from current acres and a total reduction of 36 percent.

Spruce Grouse

Though they are closely associated with conifer forests, the highest densities of spruce grouse are supported by areas with a mosaic of older coniferous habitats interspersed with areas of young growth trees. Changes in forest structure, (e.g., timber harvest or windthrow) associated with fragmentation may lead to population declines if open areas are too large or forested patches are spread too far apart to enable spruce grouse to move between them. Given the current level of habitat modification in areas of the Tongass occupied by spruce grouse, the greatest protection would be provided by alternatives that propose the least amount of POG harvest and those with provisions for maintaining landscape connectivity. Given the current level of habitat modification in areas of the Tongass occupied by spruce grouse, the greatest protection would be provided by alternatives that propose the least amount of POG harvest and those with provisions for maintaining landscape connectivity.

Alternative 1—Direct/Indirect/Cumulative Effects—Spruce Grouse

Alternative 1 would have negligible cumulative effects to the spruce grouse.

POG forest may be reduced slightly as a result of current small timber sales, personal use wood harvest, and as natural and harvest associated windthrow occurs.

Currently planned and proposed thinning is designed to maintain understory vegetation and a more open overstory in second growth stands.

The current estimated amount of POG acres would remain at about a 26 percent decrease in the project area from the acres of POG estimated to have been in these areas in 1954 (Table 29).

Appendix D includes past, present and reasonably foreseeable future actions considered in this analysis.

Under this alternative the number of patch sizes and the current amount of fragmentation will remain unchanged except for naturally occurring events. For this analysis the project area was used as the cumulative effects area. No direct or indirect effects are anticipated. Therefore, no cumulative effects would occur (Table 30).

Alternative 2—Direct/Indirect/Cumulative Effects—Spruce Grouse

Alternative 2 would have direct and indirect effects to individuals that may be displaced. Spruce grouse are expected to decline in proportion to the amount of proposed POG harvest

(3,369 acres). Alternative 2 would result in a 13 percent decrease in POG in the project area from current levels (Table 29).

Alternative 2 would have the greatest affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 392, the next patch size class would increase from 174 to 188, the number of patches in the 101- 500 acre patch size class would remain the same (one); the large size class would increase from 29 to 32 (Table 30).

Cumulative Effects

The spruce grouse are expected to decline in proportion to the amount of proposed POG harvest.

Alternative 2 would reduce flying squirrel and spruce grouse habitat (POG) by 36 percent from historical (1954) levels in the project area (Table 29).

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 392, the next patch size class would increase from 87 to 188; the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 32 (Table 30).

Alternative 3—Direct/Indirect/Cumulative Effects—Spruce Grouse

Alternative 3 would result in a 10 percent decrease in POG in the project area (Table 29).

Alternative 3 would have a moderate affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 305, the next patch size class would increase from 174 to 186, the number of patches in the 101- 500 acre patch size class would remain the same (one); the large size class would increase from 29 to 31 (Table 30).

Cumulative Effects

Alternative 3 would reduce spruce grouse habitat (POG) by 34 percent for the project area from historical (1954) levels (Table 29).

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 305, the next patch size class would increase from 87 to 186; the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 31 (Table 30).

Alternative 4—Direct/Indirect/Cumulative Effects—Spruce Grouse

Alternative 4 would result in a 6 percent decrease in POG in the project area (Table 29).

Alternative 4 would have the least affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 243, the next patch size class would increase from 174 to 184, the number of patches in the 101- 500 acre patch size class would remain the same (one); the number of patches in the large size class (500-1,000 acres) would remain at 29 (Table 30).

Cumulative Effects

The cumulative effects on the spruce grouse would be similar to the cumulative effects to overall old-growth habitat. Alternative 4 would result in a cumulative reduction of 31 percent in the amount of POG estimated to have been in these areas in 1954 (Table 29).

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 243, the next patch size class would increase from 87 to 184; the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 29 (Table 30).

Alternative 5—Direct/Indirect/Cumulative Effects—Spruce Grouse

Alternative 5 would result in a 13 percent decrease in POG acres in the project area (Table 29).

Alternative 5 would have similar affects to fragmentation as Alternative 2. Under this alternative the number of patches in the smallest size class would increase from 196 to 354, the next patch size class would increase from 174 to 186, the number of patches in the 101-500 acre patch size class would remain the same (one); the large size class would increase from 29 to 32 (Table 30).

Cumulative Effects

Alternative 5 would reduce spruce grouse habitat by 36 percent of habitat (POG) estimated to have been in these areas in 1954 (Table 29).

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 354, the next patch size class would increase from 87 to 186, the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 29 to 32 (Table 30).

Conclusion

All action alternatives will result in a decrease in spruce grouse habitat; however habitat for these species does not have any specific guidelines. Alternatives 2 and 5 will have similar impacts to the amount of POG in the project area. Both Alternatives 2 and 5 will result in about a 13 percent decrease in POG in the project area and a 37 percent decrease in POG since 1954. Alternative 4 will result in the least impact (-6 percent) to the amount of POG in the project area as a result of this project and a total reduction in POG of 33 percent in the project area. Alternative 3, results in a 10 percent reduction in POG from current acres and a total reduction of 36 percent.

Alternative 2, results in the greatest amount of fragmentation to the project area. Alternative 5, results in a similar, but slightly less, effect to the amount of fragmentation as Alternative 2. Alternative 4 results in the least change in fragmentation in the Logjam project area. The impacts of Alterative 3, are less than Alternatives 2 and 5 but greater than Alternative 4.

Old Growth Reserves

The old growth reserves within (OGRs) the Logjam project area were analyzed by an interagency group of scientists for the 2008 Forest Plan. The OGRs approved for the VCUs in the Logjam project area during the 2008 Forest Plan review process are the OGRs incorporated into the Logjam Timber Sale EIS. The OGRS are the same in all alternatives.

Biodiversity /Productive Old Growth (POG)

The effects of the alternatives on the distribution and composition of old-growth forests can be evaluated by examining the representation of POG. The effects analysis focuses on the project area.

POG forest may be reduced slightly as a result of current small timber sales, personal use wood harvest, and as natural and harvest associated windthrow occurs.

Alternative 1—Direct/Indirect Effects— Biodiversity / POG

Under Alternative 1 the amount of POG in the Logjam project area would remain unchanged from what is currently calculated to be present. The amount of POG estimated in the project area is approximately 74 percent of what was estimated to be present in the area in 1954 (Table 29).

Cumulative Effects

Alternative 1 would result in no net change to the amount of POG that has been harvested in the Logjam project area.

Alternative 2—Direct/Indirect Effects— Biodiversity / POG

Alternative 2 proposes to harvest up to 3369 acres of POG in the Logjam project area boundary. This harvest would result in a decrease of about 13 percent in the amount of POG that is currently present in the Logjam project area (Table 29) with 22,522 acres of POG remaining.

Cumulative Effects

Alternative 2 would result in a 37 percent decrease in POG from 1954 (Table 29).

Alternative 3—Direct/Indirect Effects— Biodiversity / POG

Alternative 3 proposes to harvest up to 2683 acres of POG in the Logjam project area boundary. This harvest would result in a decrease of about 10 percent in the amount of POG that is currently present in the Logjam project area (Table 29)) with 23,183 acres of POG remaining.

Cumulative Effects

Alternative 3 would result in a 36 percent decrease in POG from 1954 (Table 29).

Alternative 4—Direct/Indirect Effects— Biodiversity / POG

Alternative 4 proposes to harvest up to 1685 acres of POG in the Logjam project area boundary. This harvest would result in a decrease of about 6 percent in the amount of POG that is currently present in the Logjam project area (Table 29) with 24,232 acres of POG remaining.

Cumulative Effects

Alternative 4 would result in a 33 percent decrease in POG from 1954 (Table 29).

Alternative 5—Direct/Indirect Effects— Biodiversity / POG

Alternative 5 proposes to harvest up to 3345 acres of POG in the Logjam project area boundary. This harvest would result in a decrease of about 13 percent in the amount of POG that is currently present in the Logjam project area (Table 29) with 22,543 acres of POG remaining.

Cumulative Effects

Alternative 5 would result in a 37 percent decrease in POG from 1954 (Table 29).

Conclusion

Alternative would result in the greatest reduction to the amount of POG in both VCUs; Alternative 5 would be very similar to Alternative 2. Alternative 4 would result in the least amount of change to the amount of POG in either VCU.

Total change in the amount of POG for the project area since 1954 for Alternative 1, is minus 26 percent, Alternative 2 is minus 37 percent; for Alternative 3 it is minus 36 percent; Alternative 4 minus 33 percent and Alternative 5, is minus 37 percent (Table 29).

Table 29 Changes to POG in the Project Area by Alternative

Alternatives	POG Acres Harvested	% change – current❖	% change - 1954⌘	POG Acres remaining
Alt. 1	0	0	-26%	25,891
Alt. 2	3,369	-13%	-37%	22,522
Alt. 3	2,683	-10%	-36%	23,183
Alt. 4	1,685	-6%	-33%	24,232
Alt. 5	3,345	-13%	-37%	22,543

❖25,891 POG acres in 2008
⌘ 35,176 POG acres 1954

Fragmentation/Connectivity/Travel Corridors

Timber harvest operations, including road-building, add to the level of fragmentation or edge that occurs naturally. The effects of timber-harvest vary with the placement of units and their proximity to large existing forest blocks. As habitat becomes fragmented, residual habitat

patches become smaller and more isolated from each other. Whether a particular patch pattern and degree of fragmentation is beneficial or deleterious depends largely on the characteristics of the species using the landscape (Morrison et al. 1992). Some species, particularly those with limited mobility such as small mammals may view open spaces (natural or human-induced) as travel barriers.

Fragmentation may increase the risk of predation by avian and mammalian carnivores or increase isolation between other subpopulations, which in turn may increase the risk of local extirpation. Timber harvest tends to increase forest fragmentation and the amount of forest edge. The edges between different forest types, and between forested and non-forested areas, can affect the environment close to the edge. For example, forest edges tend to be warmer in the summer and cooler in the winter than interior forests (Franklin 1993). Some species increase in abundance close to an edge while others decrease in abundance. Species associated with interior forests but not with forest edges are of concern since timber harvest tends to decrease the amount of interior forest. Concannon (1995) noted that the edge effect or depth-of edge influence distance varied by such factors as forest type, tree density, site aspect, slope, solar insolation, aspect, slope, latitude, season, and edge type (e.g., peatland, shoreline). Edge effects ranged from 30 to over 200 meters (from approximately 100 feet to over 660 feet) from an edge.

Table 30 indicates the changes in the number of patches by patch size class by alternative.

Even-aged harvest would have the greatest impact on POG forest compared to two-aged harvest systems. Clearcutting generally differs from natural disturbances in that it represents a large-scale change rather than dispersed small partial blow down patches. It also differs in that nearly all trees are felled, whereas in natural disturbances many trees remain standing or partially standing. After clearcutting, rapid establishment and regeneration of conifers, shrubs and herbaceous plants are expected. Clearcutting generally results in the rapid development of conifers and a decline in understory plant abundance as a result of stem exclusion as the stand ages. The stands that subsequently develop are even-aged. The amount of harvest proposed by harvest system type for each alternative is shown in the Silviculture section.

By maintaining a functional and interconnected old-growth ecosystem, (the OGRs and the matrix between them) it can be assumed that various components of biodiversity, including connectivity (unfragmented, contiguous blocks of old growth) will also be maintained. Effects on biodiversity can be measured by the degree of change expected to occur in the composition and distribution (patch sizes) of the old-growth ecosystem relative to its historic composition and distribution. It can be assumed that the more an alternative changes the natural distribution and composition of old-growth ecosystems, the greater are its effects on biodiversity.

Timber harvest generally results in an increase in the number of the smaller patch size class and a reduction in the larger patch size class. The Logjam timber sale would result in an increase in the number of patches in the both the smallest patch size class (0-25 acres) and the patch size class of 26-100 acres. The proposed actions do not result in any change to the number of patches in the size class of 101-500 acres. The Logjam timber sale shows an increase in the number of patches in the largest patch size class (greater than 500 acres). This is possible due to the fact that some of the largest patches in this size class are reduced but still fall within this category.

All proposed action alternatives would result in an increase in fragmentation. Alternative 4 has the least increase in fragmentation. Alternative 2 has the greatest increase in fragmentation. The effects of Alternative 5 are similar to Alternative 2. The effects of Alternative 3 are greater than Alternative 4 but less than Alternative 5.

The cumulative effects to the changes in the number of patches by size class were calculated at the project area scale. Table 20 indicates the cumulative changes to the patches by patch size class for each alternative.

All action alternatives would result in a reduction in the size and/or number of travel routes in the Logjam project area. Alternative 4 was specifically designed to minimize this effect. Alternative 4 would maintain the greatest number of travel routes and thereby provides the most connectivity of any of the action alternatives. Alternatives 2 and 5 would have very similar effects to the travel routes in the Logjam project area. These two alternatives would result in the greatest change to travel routes in the area. Alternative 3 has similar effects to travel routes as Alternative 4.

A discussion on the connectivity/travel corridors in the Logjam project area on a unit by unit basis is located in the Old-Growth/Biodiversity Resource Report located in the project record. Maintaining travel corridors and dispersal routes was one of the main objectives and design criteria of Alternative 4. Another objective was to drop the units that were any unroaded or inventoried roadless areas (IRAs). Dropping these units reduced the impact to the Honker Divide area, deer, wolves, and recreation. Reducing the impact to wolves, deer, and other wildlife reduces the impact on the subsistence resources. These dropped areas also serve as areas of snag retention for cavity nesters.

All proposed action alternatives would result in an increase in fragmentation. Alternative 4 has the least impact on fragmentation. Alternative 2 has the greatest impact on fragmentation. The effects of Alternative 5 are similar to Alternative 2. The effects of Alternative 3 are greater than Alternative 4 but less than Alternative 5.

Alternative 1—Direct/Indirect/Cumulative Effects—Fragmentation

Under this alternative the number of patch sizes and the current amount of fragmentation will remain unchanged except for naturally occurring events. For this analysis the project area was used as the cumulative effects area. No direct or indirect effects are anticipated. Therefore, no cumulative effects would occur.

Alternative 2—Direct/Indirect/Cumulative Effects—Fragmentation

Alternative 2 would have the greatest affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 392, the next patch size class would increase from 174 to 188, the number of patches in the 101- 500 acre patch size class would remain the same (one); the large size class would increase from 29 to 32 (Table 30).

Cumulative Effects

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 392, the next patch size class would increase from 87 to 188; the cumulative changes to the number of patches in the 101- 500 acre patch

size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 32 (Table 30).

Alternative 3—Direct/Indirect/Cumulative Effects—Fragmentation

Alternative 3 would have a moderate affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 305, the next patch size class would increase from 174 to 186, the number of patches in the 101- 500 acre patch size class would remain the same (one); the large size class would increase from 29 to 31 (Table 30).

Cumulative Effects

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 305, the next patch size class would increase from 87 to 186; the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 31 (Table 30).

Alternative 4—Direct/Indirect/Cumulative Effects—Fragmentation

Alternative 4 would have the least affect on fragmentation. Under this alternative the number of patches in the smallest size class would increase from 196 to 243, the next patch size class would increase from 174 to 184, the number of patches in the 101- 500 acre patch size class would remain the same (one); the number of patches in the large size class (500-1,000 acres) would remain at 29 (Table 30).

Cumulative Effects

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 243, the next patch size class would increase from 87 to 184; the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 26 to 29 (Table 30).

Alternative 5—Direct/Indirect/Cumulative Effects—Fragmentation

Alternative 5 would have similar affects to fragmentation as Alternative 2. Under this alternative the number of patches in the smallest size class would increase from 196 to 354, the next patch size class would increase from 174 to 186, the number of patches in the 101-500 acre patch size class would remain the same (one); the large size class would increase from 29 to 32 (Table 30).

Cumulative Effects

The cumulative changes to fragmentation under this alternative the number of patches in the smallest size class would increase from 132 to 354, the next patch size class would increase from 87 to 186, the cumulative changes to the number of patches in the 101- 500 acre patch size class would increase from 0 to 1; the large size class (501-1000) would increase from 29 to 32 (Table 30).

Conclusion

Alternative 2, results in the greatest amount of fragmentation to the project area. Alternative 5, results in a similar, but slightly less, effect to the amount of fragmentation as Alternative 2. Alternative 4 results in the least change in fragmentation in the Logjam project area. The effects of Alterative 3 are between Alternatives 2, 5 and Alternative 4. Table 30 summarizes the changes to patch sizes as a result of the Logjam project.

Table 30 Changes to number of patches by size class for Logjam project area

Patch size	0-25	26-100	101-500	500+
1954	132	87	0	26
2008	196	174	1	29
Alt. 1	196	174	1	29
Alt. 2	392	188	1	32
Alt. 3	305	186	1	31
Alt. 4	243	184	1	29
Alt. 5	354	186	1	32

Issue 3: Timber Supply and Sale Economics

Issue Statement: The proposed action may affect socioeconomic conditions of local communities.

Timber sale economics affect the viability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies. Timber purchasers and affected communities are concerned about the quantity and quality of timber volume offered by the Forest Service, the cost of road construction, as well as the logging costs associated with the proposed logging systems and silvicultural prescriptions. The units of measure used to evaluate the effects of the proposal and compare alternatives include:

- Volume of timber by species
- Acres of harvest by logging system
- Miles of road construction and re-construction
- Logging and road costs (per MBF)
- Indicated bid value ($ per MBF)
- Number of annualized direct jobs

Affected Environment

About 74,000 people live in towns, communities, and villages located on islands and coastal lands of Southeast Alaska. The Southeast Alaska region accounts for about 12 percent of the State's population and 6 percent of the land base. Federal lands comprise about 95 percent of Southeast Alaska, 80 percent within the Tongass National Forest. Southeast Alaska communities, which are within or adjacent to the Tongass National Forest, are largely dependent on the forest to provide natural resources for employment. This includes commercial fishing, timber harvest and processing, tourism, and mining. The forest is also used for recreation and subsistence use. Appropriate management of the forest's natural resources is, therefore, important for local communities and the overall regional economy.

The population of Prince of Wales Island is spread among many small communities most of which are connected by an extensive road system. Social and economic impacts of the Logjam Project would most likely occur in communities near the project area on central and northern Prince of Wales Island. These communities use the area for subsistence and recreation. Some communities have tourism based businesses that use the project area and some have wood processing facilities that have the potential to use timber from the area. These communities are also the most likely to see increases in wood products and logging employment resulting from timber harvest in the project area. According to the Forest Plan, the Logjam project falls within the community use area for the following eight communities: Coffman Cove, Craig, Klawock, Naukati, Point Baker, Port Protection, Thorne Bay and Whale Pass. These communities are connected to the project area by road with the exception of Point Baker and Port Protection.

3 Environment and Effects

Forest Products Industry—Southeast Alaska

The forest products industry has been an important part of the economy of Southeast Alaska since the 1950s. Based on forest products employment data for the period 2002 through 2006 total timber industry employment in Southeast Alaska has dropped from 512 jobs to 421 jobs. Mill employment has also declined (Table 31).

Table 31. Forest products industry employment in Southeast Alaska, 2002 through 2006[6]

	Tongass			Other		
Year[a]	Logging[b]	Sawmill	Related Employment[c]	Sawmill	Logging	Total Industry Employment
2002	63	110	173	40	299	512
2003	108	91	199	64	298	561
2004	82	95	177	53	220	450
2005	88	96	184	52	263	499
2006	81	77	158	46	217	421

Source: Timber Supply and Demand: 2001 to 2005. Alaska National Interest Lands Conservation Act Section 706(a) Report to Congress. US Forest Service Alaska Region Report 21. In review. 2006 data on file with Alaska Region Economist, Regional Office.
Note: Numbers may not add up to the totals shown due to rounding.
[a] Reported in calendar years.
[b] Tongass National Forest logging estimated based on the ratio of Tongass timber harvest to total timber harvest in Southeast Alaska.
[c] Through 2001, assumed all sawmill and pulp mill employment was dependent upon Tongass National Forest timber supply. From 2002 to 2004, this assumption no longer held. Data from Kilborn and others (2004) and from subsequent mill studies show that Federal timber supplied 73 percent of the wood sawn in Southeast Alaska mills in 2002, 59 percent in 2003, 64 percent in 2004, 65 percent in 2005, and 62 percent in 2006. Tongass National Forest sawmill employment from 2002 through 2006 is estimated based on sawmill employment numbers and the ratio of sources of wood (Federal versus the total) reported by Kilborn and others (2004) and in subsequent mill studies by Juneau Economic Development.

Forest Products Industry—Prince of Wales Island

The communities of Prince of Wales Island have historically played a large role in the region's commercial timber production and as a result, recent reductions in the timber harvest and production have had a magnified effect on the economies of communities on Prince of Wales Island. Wood products employment in the area has decreased dramatically since 1990 while the tourism and recreation economy have shown some growth (Alaska Department of Labor, 2007). At the same time, the area has shown an increase in the poverty rate and a decrease in population (US Census, 2000).

Economic trends on Prince of Wales Island since 1990 are similar to those in Southeast Alaska as a whole, but exaggerated by the area's historic reliance on the timber industry. There are several wood processing facilities on Prince of Wales Island. Viking Lumber, one

[6] Note - Beginning in 2001, total industry employment estimates are published under a new classification system. The Standard Industrial Classification (SIC) system has been replaced by the North American Industrial (NAI) Classification system. "Sawmill" in this table is reported by the Alaska Department of Labor as "wood manufacturing," which in the NAI system includes sawmills, wood preservation, veneer, plywood, engineered wood, and other wood products. In Southeast Alaska, this category is assumed to represent only sawmill employment. Beginning in 2001, sawmill employment figures are adjusted based on regional mill studies, which take into account self employed mill owners.

of the larger remaining sawmills in the region is located between Craig and Klawock. Viking Lumber had 34 MMBF under contract with the Forest Service in January 2008. Viking had an estimated actual mill output of 18 MMBF in 2005 and 19 MMBF in 2006. This is less than 25 percent of the estimated mill capacity of 80 MMBF. (Juneau Economic Development Council 2006-2007). Although industry capacity and demand for timber are not directly synonymous, industry capacity is a determinant of the derived demand for wood.

There are a number of smaller mills on the island producing sawtimber as well as specialty and other value-added products. The project area's geographic location places it within easy reach of several small mills on the island. These mills rely on nearby, road accessible timber for their wood supply. Small timber sales generally require lower logging costs to be economically viable because fixed costs are distributed over a smaller volume of timber. Individually, these mills typically harvest and produce less than 1 MMBF per year and employ between 1 and 4 people. The number of active mills on the island varies at any given time. There are currently an estimated 15 active mills on the island and 7 inactive. The highest concentration of small mills is in the Goose Creek Industrial Subdivision of Thorne Bay, but there are also mills located in Coffman Cove, Craig, Hollis, Klawock, Naukati and Whale Pass. The 2006 mill survey conducted for the USDA Forest Service identified three of the active timber processors in Thorne Bay: Porter Lumber Company, Thuja Plicata Lumber Company, and Thorne Bay Wood Products. These mills had a combined installed production capacity of 25 MMBF and together processed approximately 1.2 MMBF in 2006 and employed about 8 people (Juneau Economic Development Council 2007). Northern Star Cedar Products, also located in Thorne Bay, was recently subdivided and sold as three separate operations, with each part now under new ownership. Other mills on the island include W.R. Jones and Son Lumber Company located in Craig. This mill with an installed production capacity of one MMBF processed approximately 600 MBF in 2006 and employed 4 people (Juneau Economic Development Council 2007). Estimated Forest Service timber volume under contract for Prince of Wales businesses other than Viking Lumber was 3.3 MMBF in January 2008.

Timber Supply and Market Demand

Determining market demand is a complex process. Detailed explanations of the rationale for considering timber harvest in the Logjam Project Area and market demand for wood products is located in Appendix A of this document. More information can also be found in the 1997 Forest Plan FEIS and the 2003 Forest Plan Supplemental EIS. The 2008 Tongass Land and Resource Management Plan FEIS, Volume 1 describes the latest timber demand analyses and projections.

Factors Affecting Timber Sale Economics

The factors affecting costs include logging systems, harvest methods; silvicultural prescriptions haul/ tow distances, as well as the miles and extent of road construction, reconstruction and maintenance. The value of the timber for sale must be sufficient to cover this cost and offer a potential for profit to purchasers. Under current Congressional direction (Public Law 110-161, House Report 110-497), no timber sale in the Alaska Region shall be advertised if the indicated rate is deficit. Sales with volumes under 250 MBF currently do not require an appraisal and can be advertised using established standard rates.

The existing road system in the Logjam Project Area allows available timber to be harvested using less expensive shovel or cable yarding systems without requiring extensive road construction. The entire project area is within 60 road miles of most Prince of Wales mills including those in Klawock and the Goose Creek Industrial Area near Thorne Bay.

Payments to the State of Alaska

Currently in FY 2008, in states with national forests, 25 percent of returns to the US Treasury from revenue producing Forest Service activities, such as timber sales, are returned to each state for distribution back to counties (or in Alaska, boroughs) having acreage within a National Forest. Those payments are called the "25 percent fund" payments and are dedicated by law for schools and roads. Under the 25 percent approach funding to the state will increase or decrease as revenue generated on the National Forest increases or decreases.

From FY 2001 through 2007, under the Secure Rural Schools and Community Self Determination Act of 2000 affected Alaska boroughs and communities chose to receive a payment amount based on the average of the highest three payments made to the state during the 14-year period between 1986 and 1999. As a result, the State of Alaska received payments of approximately $9 million per year during the 2001 through 2007 time period.

Methodology

The Logging System and Transportation Analysis (LSTA) for the Logjam Project Area was originally developed in 2000 based on forest lands classified as suitable and available under the 1997 Forest Plan. Analysis of the original LSTA was done using topographic maps, 1991 color stereo photos with a 1:15,840 scale and available GIS data based on past inventories. Areas containing suitable and available timber were divided into blocks or potential units comprised of one or more logging settings.

Field surveys were conducted from 2000 to 2005 to verify and collect information on the project area. Preliminary field verification of logging systems and road locations was also completed during this time. The logging system and transportation analysis was updated to reflect field data in 2004. Additional field surveys were conducted during the fall of 2007 to verify realignment of roads associated with construction of the state highway to Coffman Cove. Harvest units have been reviewed for consistency with the Tongass Forest Plan Amendment (USDA 2008).

The NEPA Economic Analysis Tool Residual Value (NEAT_R) version 2.15 was used to compare alternatives for the Logjam Project. This program uses the same logging costs and manufacturing costs developed for the Alaska Region timber sale appraisal program. Costs reflect production studies and data collected from timber sale purchasers in Southeast Alaska. Stumpage values are calculated using market data from 12 calendar quarters as well as a historic cruise database of over 40,000 trees to calculate values by species and diameter class. Timber volume estimates are based on site-specific stand exam information collected in the planned units. The harvest volumes, indicated value, costs and net stumpage values used in this document are current estimates. These estimates are useful primarily for comparing the relative differences among alternatives.

Environmental Consequences

Volume by Species

The following table summarizes the volume estimates by species and alternative. At the time of project implementation, merchantable timber within units and any road right-of-way located on National Forest System lands will be cruised to determine the quantity, quality and value of timber for the contract under which that volume of timber is offered.

Table 32. Volume Estimates by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Harvest Acres	0	3,703	2,708	1,694	3,348
Volume - Sawlog (MBF)					
Sitka Spruce	0	8,540	5,899	4,352	7,837
Hemlock	0	34,378	23,818	17,552	31,663
Western Red Cedar	0	15,302	10,648	7,847	13,979
Alaska Yellow Cedar	0	7,076	4,690	3,498	6,284
Total Sawlog Volume (MBF)	**0**	**65,296**	**45,055**	**33,249**	**59,763**
Utility Volume (MBF)	**0**	**9,534**	**6,603**	**4,867**	**8,778**

Source: J. Tilley, NEAT-R v2.15

Logging Costs and Harvest Methods

All action alternatives propose the use of shovel, cable and helicopter logging systems. Shovel and cable are referred to collectively as conventional systems and are generally less costly than helicopter yarding. Conventional systems require road access and are most efficient using even-aged harvesting methods. Costs increase with extra time and care needed to protect reserve trees. In areas that cannot be reached cost effectively using conventional methods due to excessive road construction costs or inadequate log suspension, helicopter logging is used.

Shovel yarding is the least costly yarding method and is best suited for gentle slopes and yarding distances less than 400-500 feet. This is the process of moving logs from stump to landing by repeated swinging of logs by a hydraulic, track-based log loader. Depending on slope and ground conditions, shovel yarding on steeper ground or over longer distances may be possible. Well-drained and gentle terrain found in much of the project area is well suited for shovel yarding.

Cable yarding is best suited for steeper slopes and allows longer yarding distances. This is the process of moving logs, partially suspended, from stump to landing using a cable skyline. This method is limited in that a clear path is required to the landing. Cable yarding costs increase substantially with increased retention of trees because the tower must be moved more often. This method is generally more costly than shovel yarding, but may require less road construction.

Helicopter yarding is the most costly yarding method and is most often used in Southeast Alaska to access harvest units where road construction costs are prohibitively high. This is the

process of moving logs, fully suspended, from stump to landing using a helicopter. This yarding method minimizes the need for newly constructed roads. Yarding distance, turn time,[7] and the value of timber yarded influence the economics of helicopter yarding. This method is the most flexible in the selection of trees to be harvested making it the best suited for partial-cut harvest prescriptions. Although helicopter yarding costs increase with increased remaining crown closure, that increase is not as pronounced as that for conventional systems and may be offset by the selection of trees to increase the overall pond log value of the timber yarded.

All proposed action alternatives include a mix of even-aged clearcut and two-aged silvicultural prescriptions. Units proposed for harvest using helicopter are planned for two-aged management, and units proposed for harvest using conventional systems are planned for even-aged management. Silvicultural prescriptions are designed to address resource concerns related to Forest Plan Standards and Guidelines, as well as other land management objectives including economics. Even-aged management in harvest units proposed for conventional logging allows for lower overall logging and road costs for the volume removed. Two-aged management prescriptions in helicopter settings would allow harvest of certain diameter classes of trees in order to improve harvest economics, and would allow access to areas that are inaccessible or uneconomical for access by road. See the Silviculture sections below for more information.

Road construction, reconstruction and maintenance bear substantial costs and strongly affect timber sale economics. By using the most cost-effective transportation system while maintaining the appropriate design standards to meet resource requirements, these costs can be reduced. Table 33 shows the proposed logging systems acreage and road construction mileage by alternative.

Table 33. Proposed Logging Systems and Road Construction

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Logging Systems					
Cable, Even-aged Harvest (acres)	0	876	508	445	766
Shovel, Even-aged Harvest (acres)	0	1543	1047	837	1362
Helicopter, Two-aged Harvest (acres)	0	1284	1153	412	1220
Road Construction					
Total Road Construction (miles)	0	29	14	13	18

[7] Turn time is the time it takes a helicopter during a logging operation, to make a round trip from the landing, to the unit and return for more logs.

Pond Log Values

Pond log values are the price a buyer would pay for a log at the mill site (selling value minus manufacturing costs). These values depend primarily on species and log quality and are strongly affected by regional and global fluctuations in markets. There are some measures that can be taken to increase average pond log values at implementation and create more economically viable timber sale offerings. Single tree selection prescriptions can be designed to increase the overall pond log value of the material removed. By concentrating harvest on the most valuable species and the most valuable size classes of these species, the indicated bid value will increase. This could be most effectively applied to helicopter settings. An optional removal contract provision can also increase the overall pond log values by allowing the purchaser to leave some of the lowest value logs in the harvest unit. Estimates of average pond log values for each alternative are displayed in Table 34.

Although individual harvest units may not be economical to harvest by themselves, the management of less-productive land or land containing a high percentage of defective timber helps to increase future timber yields. Harvesting units with higher value can help compensate for less economically viable harvest units.

The difference in indicated bid rates among the action alternatives can be attributed to multiple factors, including:

- Differences in species composition, volume per acre harvested, and timber quality
- Difference in harvest prescriptions
- Proportion of cable, shovel and helicopter yarding systems
- Difference in helicopter yarding distances
- Costs of road construction and reconstruction relative to the volume of timber removed
- Differences in haul distances

Table 34. Costs and Values by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Pond Log Value $/MBF[a]	$0	$344	$343	$343	$343
Logging Cost $/MBF[b]	$0	$266	$269	$258	$265
Road Cost $/MBF[c]	$0	$57	$36	$50	$39
Indicated Bid Value $/MBF	$0	$21	$38	$35	$40
Total Indicated Bid Value $	$0	$1,378,399	$1,704,881	$1,180,007	$2,369,005

Source: J. Tilley, NEAT-R v2.15

[a]Pond Log Value: Final product (lumber) values minus production costs (milling) or what a mill of average efficiency can pay for timber

[b]Logging Cost: The harvesting and transportation costs for an operator of average efficiency

[c]Road Cost: Estimated average cost of new road construction, existing road reconstruction and maintenance

3 Environment and Effects

Appraisal of Tongass National Forest timber sales changed as a result of the March 14, 2007 policy change by the Alaska Region Regional Forester that approved limited interstate shipments of unprocessed Sitka spruce and western hemlock. The policy allows shipment to the lower 48 states of unprocessed Sitka spruce and western hemlock sawlogs smaller than 15 inches in diameter at the small end of a 40-foot log, and grade 3 or 4 logs of any diameter. Shipments are limited on each sale to a maximum of 50 percent of total sawlog contract volume harvested of all species, including western red cedar and yellow-cedar, unless the Regional Forester grants an exception in advance based on case-specific unusual circumstances.

The limited interstate shipment policy increases the likelihood that timber sales in parts of the Tongass National Forest will have a positive appraisal under current market conditions. The policy may also increase the utilization of timber harvested on the Tongass. Sawmills in Southeast Alaska generally cannot profitably process the smaller diameter and low grade material eligible for interstate shipment under this policy. Under this policy, timber sale purchasers are allowed, but not required to ship such material to the lower 48.

The policy enhances opportunities for local supply to manufacturers who depend on Tongass timber by increasing the probability that sales will appraise positive as required by Section 318 (Section 416 of the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006, PL 109-54). Outputs from NEAT-R version 2.15 include the adjustments for the changes in values due to the limited interstate shipping policy (Bschor, 3/14/07).

Changes in regional and global timber markets and other factors such as fuel costs can dramatically affect stumpage values and logging costs at the time of implementation and harvest. At the time of project implementation, merchantable timber within units and any road right-of-way located on National Forest System lands will be cruised to determine the quantity, quality and value of timber for the contract under which that volume of timber is offered. The final sale appraisal will include current quarter selling values, current cost information and a normal profit and risk allowance to determine the minimum advertised stumpage value at the time of offering.

Opportunities for off island purchasers

Logging costs shown in this document are based on truck haul to Klawock for all harvest units. Transporting logs by raft or barge to a mill off the Prince of Wales Island road system would require additional expense. Truck haul to the Coffman Marine Access Facility (MAF) with raft/tow to mills in other locations was considered. However, preliminary analysis showed the total costs to be higher for all harvest units in all alternatives. Average costs for haul to the Coffman Cove MAF are lower than those for haul to Klawock, however additional barging and rafting costs would be incurred. Both barging and rafting costs from Coffman Cove to Wrangell were estimated between $50/MBF and $60/MBF for all alternatives. Costs associated with establishment and maintenance of a logging camp was not estimated because of the project's proximity to established communities and road access.

Opportunities for Small Sales

There are a number of small sawmills on the island producing sawtimber as well as specialty and other value-added products. Individually, these mills typically harvest and produce less than 1 MMBF per year. Each action alternative includes harvest units of suitable size, design and species composition for timber sale offerings of less than one MMBF. The extent of these opportunities for each alternative is correlated to the total harvest acres and more specifically to those acres proposed for harvest using conventional logging systems. The timber volume in any of the action alternatives could be administratively separated into several smaller sales.

There are 12,731 suitable timber acres that have been designated as Phase 2 by the 2008 Tongass Adaptive Management Strategy within Logjam project. In Alternative 5, one proposed unit (573-02) is partially within Phase 2 but not within an inventoried roadless area. This unit is located on FS Road 3030505 and has 19 acres within Phase 2. This unit will be offered as a small sale to provide timber for small mills on the island.

Projected Employment and Income

In Southeast Alaska, sawmilling results in 3.31 (annualized) jobs per MMBF of net sawlog volume harvested on the Tongass (Kilborn et al. 2004, Brackley et al. 2006, Alaska Department of Labor and Workforce Development). Annualized jobs means this is all the employment estimates are adjusted to be based on a full year even though some jobs may be seasonal. Each sawmilling job represents an average (2001-2005) of $31,690 per year. The income data comes from the Alaska Department of Labor (see previous reference) for sawmilling, a report included under wood product manufacturing. Sawmilling produces an average direct income of $115,250 per MMBF of net utilized sawlog volume, or $115 per MBF, for people employed in sawmilling.

Logging results in 2.31 annualized jobs per MMBF net sawlog volume harvested on the Tongass.

ANILCA 706(a) report for 2001 to 2005 (in review).

The action alternatives would have direct and indirect impacts to the economies of the local communities. Indirect employment effects are not calculated in this analysis since indirect employment coefficients are applicable for large scale analyses, such as large regional or statewide assessments and can not be determined for local scale analyses, such as individual timber sales. The potential impact to nearby communities with processing facilities that may use the timber will depend on many elements associated with the competitiveness and efficiency of individual operations. Such factors are dependent upon private business decisions as well as market conditions for forest products. The USDA Forest Service cannot predict which firms will successfully bid for a timber sale, thus potential community benefits relating to jobs and incomes associated with a sale will not be predicted specifically, but in a regional summary.

The number of sawmill jobs and related income is provided as a range in Table 35 to reflect the export options of a potential timber sale purchaser. The purchaser may elect to process all the sawlogs locally or to ship up to 50 percent of the total sawlog volume to markets outside Alaska subject to the limited interstate shipping policy (Bschor, 3/14/07). The upper end of this range assumes all Sitka spruce and western hemlock sawlog volume will be processed in

Southeast Alaska. The lower end of this range assumes that the maximum volume will be processed outside the region as allowed under current interstate shipping and export policies. The volume suitable for export under these policies is estimated by NEAT-R for each alternative using stand exam data. The number of jobs and related income will likely fall somewhere between the high and low end of this calculated range, based on factors such as timber markets and mill configuration at the time of harvest.

Table 35. Estimated Project Employment and Income by Alternative in Alaska

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Sawmilling (Direct Job-Years[a])	0	108 - 216	75 - 149	55 - 110	99 - 198
Logging (Direct Job -Years)	0	151	104	77	138
Total Direct Employment (Job Years)	0	259 - 367	179 - 253	132 - 187	237 - 336
Total Direct Income ($ million)	$0	$10.0 - $13.8	$6.9 - $9.5	$5.1 - $7.0	$9.2 - $12.6

Source: J. Tilley, NEAT-R v2.15

[a] Job Years - Annualized jobs per MMBF based on net sawlog volume sold. These jobs are shown as a range to account for export as approved by the Regional Forester.

Forest Service Financial Efficiency Analysis

Forest Service Financial Efficiency Analysis as required by FSH 2409.18 compares estimated Forest Service direct expenditures with estimated financial revenues. Average financial costs are subtracted from indicated selling values to estimate net present value. The average Forest Service costs used in the analysis were calculated from multiple years and are: $41/MBF for environmental analysis and documentation (NEPA), $23/MBF for sale preparation, $9/MBF for sale administration and $28/MBF for engineering support. Environmental analysis and documentation costs include field inventory, data analysis, public involvement, and preparation of documents that satisfy the requirements of the National Environmental Policy Act. Sale preparation costs include unit layout, cruising, appraisal and contract development. Sale administration consists of administering the timber sale contract from the time the sale is awarded until the sale is completed. Engineering support consists of planning and timber sale contract administration activities associated with new facility and road construction, use of existing facilities and road maintenance.

Although the environmental analysis cost is based on timber volume, costs fluctuate with the amount of area to be examined and the accessibility of that area. Sale preparation and administration costs increase significantly when implementing partial harvest units, as compared to clearcut harvest units. Implementation and administration of several small sales

would cost considerably more than one or two large sales. Accessibility to the units is another major cost factor. All of these factors could cause the cost estimates for the project to be higher or lower.

Table 36. Estimated Forest Service Financial Costs and Revenues

Forest Service Costs[a]					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Analysis (NEPA)[b]	$0	$2,677,128	$2,677,128	$2,677,128	$2,677,128
Sale Preparation	$0	$1,501,803	$1,036,276	$764,726	$1,374,545
Sale Administration	$0	$587,662	$405,499	$299,240	$537,865
Engineering Support	$0	$1,828,282	$1,261,554	$930,970	$1,673,359
Total Project Costs	$0	$6,594,876	$5,380,457	$4,672,064	$6,262,898
Indicated Bid Value	$0	$1,378,399	$1,704,881	$1,180,007	$2,369,005
Net Present Value	$0	-$5,216,477	-$3,675,576	-$3,492,057	-$3,893,892

Source: J. Tilley, NEAT-R version 2.15
[a] Based on Alaska Region's average budget allocation for cost centers.
[b] Analysis and documentation costs are based on the proposed action (Alternative 2).

This type of analysis does not account for non-market benefits, opportunity costs, individual values, or other values, benefits, and costs that are not easily quantifiable. This is not to imply that such values are not significant or important, but to recognize that non-market values are difficult to represent by appropriate dollar figures.

Effects on other Natural Resource-related Employment

Direct employment in natural resource-based industries include: forestry, logging, wood products, mining, recreation, tourism, seafood processing and commercial fishing. The Recreation and Scenery sections in Chapter 3 of this document provide more details about the recreation and tourism use in the project area. Refer to the Economic and Social Environment section of Chapter 3 in the 2008 Tongass Land and Resource Management Amendment FEIS for a more comprehensive discussion of the economic trends in Southeast Alaska.

Commercial Fishing

Commercial fishing and fish processing play an important part in the local economies of many Southeast Alaska and Prince of Wales communities. Implementation of the riparian, estuary and beach fringe standards and guidelines, and Best Management Practices will mitigate the affects of the proposed activities. Analysis of the effects on commercial fish species was done with the Essential Fish Habitat Assessment as required by the Magnuson Stevens Fishery Conservation and Management Act. See Fisheries section for additional information on Essential Fish Habitat. A regional analysis of the effects of timber harvest on

employment related to commercial fishing and fish processing was the Forest planning level and is included in the 2008 Tongass Forest Plan FEIS.

Recreation and Tourism

Recreation and tourism related employment is difficult to accurately quantify because visitors spend their money throughout the local economy. There are no direct measures of tourist related income or employment. Components of travel and tourism activities are partially captured in other economic sectors such as retail trade, transportation, hotels and other lodging, and amusement and recreation services. Costs and revenues associated with commercial tourism in the project area have not been estimated for each alternative, but would not likely vary by alternative. A regional analysis is done at the Forest planning level and is included in the 2008 Tongass Land and Resource Management Plan FEIS. Recreation use and possible effects are discussed in the Recreation section of this chapter.

Effects Summary

Alternative 1 Direct and Indirect Effects

No harvest would occur in the project area. There would be no additional contribution to the local or regional Southeast Alaska economy, and there would be no additional support to the local or regional forest products industry employment from this project area.

Cumulative Effects

No harvest would occur in the project area other than small sales already planned with the Control Lake EIS. This volume includes approximately 900 MBF under contract and 500 MBF scheduled for offer by the Forest Service in 2008. Some roadside salvage microsales may also become available, though none are scheduled. Planned State of Alaska timber harvest within the Project Area includes approximately 3,500 MBF scheduled for offer in 2009. There would be no additional contribution to the local or regional Southeast Alaska economy, and there would be no additional support to the local or regional forest products industry employment from this project area.

Foreseeable timber harvest within the Project Area would likely include approximately 1.4 MMBF scheduled on Forest Service land and 3.5 MMBF scheduled on State of Alaska land. There would be no additional contribution to the local or regional Southeast Alaska economy, and there would be no support of local or regional forest products industry employment from the Project Area. Additional timber volume needed to meet the estimated demand would need to be harvested from other areas on the Tongass National Forest.

Alternative 2 Direct and Indirect Effects

This alternative has the potential to produce the highest total timber volume (75 MMBF) and consequently has the highest potential to affect local and regional economies. This alternative also has the lowest indicated bid value of $21/MBF. The low bid value is largely due to higher average road costs ($57/MBF).

Between 259 to 367 direct annualized jobs would be supported in Alaska's forest products industry, providing an estimated $10.0 to $13.8 million in direct income.

Alternative 3 Direct and Indirect Effects

This alternative would produce less total timber volume (52 MMBF) than Alternatives 2 or 5, but more than Alternative 4. The indicated bid value ($38/MBF) is higher than all action alternatives except Alternative 5. This alternative is also estimated to have the highest average logging costs ($269/MBF) because of a slightly higher proportion of volume harvested using helicopter systems. These relatively high logging costs are somewhat offset by lower average road construction costs ($36/MBF).

Between 179 to 253 direct annualized jobs would be supported in Alaska's forest products industry, providing an estimated $6.9 to $9.5 million in direct income.

Alternative 4 Direct and Indirect Effects

This alternative would produce the least total timber volume (38 MMBF) of any alternative and consequently would have the least potential to affect wood products employment or local and regional economies. Total estimated sawlog volume is slightly more than half that of Alternative 2. Indicated bid value ($35/MBF) is lower only than Alternative 2. Average logging costs for this alternative are estimated to be lower than other action alternatives largely due to a smaller percentage of volume harvested using helicopter systems. These relatively low logging costs are somewhat offset by higher road construction costs ($50/MBF).

Between 132 to 187 direct annualized jobs would be supported in Alaska's forest products industry, providing an estimated $5.1 to 7.0 million in direct income.

Alternative 5 Direct and Indirect Effects

This alternative would produce more volume (68 MMBF) than Alternatives 3 or 4, but less than Alternative 2. This alternative has the highest indicated bid value ($40/MBF). The higher indicated bid value results from lower average logging and road costs relative to the other alternatives.

Between 237 to 336 direct annualized jobs would be supported in Alaska's forest products industry, providing an estimated $9.2 to $12.6 million in direct income.

Cumulative Effects for Alternatives 2, 3, 4 and 5

A stable timber industry in Southeast Alaska depends on a steady flow of economic timber sales in order for operators and processors to make investments in machinery and employ qualified workers. The volume generated from each action alternative could contribute to meeting market demand. Volume from the Logjam Project Area, in combination with other timber sales offered on the Tongass National Forest and on State land, could contribute to the long-term timber supply and stabilization of the local and regional economies. Appendix A of this DEIS includes information on the Tongass timber program.

Issue 4: Inventoried Roadless Areas

Issue Statement: Timber harvest and road construction may affect roadless area characteristics within Inventoried Roadless Areas.

Numerous comments were received from the public requesting no road construction or timber harvest within any Inventoried Roadless Area (IRA) on the Tongass National Forest. Portions of Sarkar #514 IRA and Thorne River #511 IRA are in the Logjam project area. The roadless areas were evaluated in terms of their ecological, geological, cultural, educational, managerial and scenic qualities.

Units of measure:

- Acres of timber harvest in IRA
- Miles of new road construction in IRA
- Acres of IRA retaining roadless characteristics

Affected Environment

Inventoried Roadless Areas (IRAs) are defined as undeveloped areas typically exceeding 5,000 acres that meet the minimum criteria for wilderness consideration under the Wilderness Act and were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, and with subsequent assessments and forest planning analysis. The 2003 Forest Plan SEIS inventory of roadless areas was updated in 2007 with the Forest Plan Amendment analysis.

In the 2008 decision for the Forest Plan Amendment, a Timber Sale Program Adaptive Management Strategy was developed in an effort to balance competing demands for timber production and preservation of undeveloped areas. Under this strategy, the operation of the timber sale program will be implemented in three phases, as determined by actual timber harvest levels (USDA 2008a). Phase 1 includes most of the roaded portion of the suitable land base, along with most of the lower value IRAs within development LUDs. The moderate and higher value roadless areas are excluded. Phase 2 includes Phase 1 lands as explained above and most of the moderate value roadless areas; some roaded areas are included in Phase 2 including 24,131 acres in the Logjam project area. Phase 3 includes all development LUD acres.

The Inventoried Roadless Areas within the Logjam project area have 2,640 acres classified as Phase 1 and 2,640 acres in Phase 2. The Logjam project proposes harvest in the roaded portion of the suitable land base and about 100 acres of harvest in the lower value IRA (see Timber Sale Program Adaptive Management Strategy in Chapter 1). No harvest units are planned within the Phase 2 Inventoried Roadless Areas.

IRAs within the Logjam Project Area

Portions of Sarkar #514 IRA and Thorne River #511 IRA are in the Logjam project area. Timber harvest and roads define the border for both IRAs. Within the IRAs, human disturbance is minimal with some use by hunters and fisherman. Flights to the remote cabins in the vicinity (i.e., Sweetwater Lake, Salmon Bay Lake, Red Lake, Barnes Lake, and Honker

Lake Cabins) influence the degree of solitude available in the area and reduce the pristine nature of IRAs 511 and 514.

Table 37 summarizes the acres of inventoried roadless area that overlap the project area. Overall, combining IRAs results in 24 percent of the project area described as roadless.

Table 37. Roadless areas within Logjam Project Area

Roadless Area	Total Acres	Acres in Project Area	Percent of IRA in Project Area[a]
Sarkar IRA #514	62,170	5,564	9%
Thorne River IRA #511	74,362	8,063	11%
Total IRA Acres	136,532	13,627	10%

Thorne River IRA

The Thorne River IRA occurs in the central portion of Prince of Wales Island approximately five miles northwest of Thorne Bay (Map 9). Most of the Thorne River drainage is included within the roadless area, which the Alaska Department of Fish and Game lists as a "high quality" watershed for it fisheries values (USDA Forest Service 2003a, pp. 383). The IRA is bordered by State Highway 929 to the south, State Highway 925 to the west, and other forest roads to the east and north, affording motorized access to all sides of the area. Two closed road systems provide non-motorized access to the interior of the roadless area. The Honker Divide Canoe Route provides water access through the area along Hatchery Creek and the Thorne River.

The majority of the IRA (74 percent) is allocated to non-development LUDs and the remaining 26 percent is allocated to development LUDs. Table 38 lists the size of the IRA along with acres in development and non-development LUDs, and those acres that are within the project area.

Table 38. Thorne River Inventoried Roadless Area (#511) Acres by LUD.

	Land Use Designation	IRA 511 Acres	IRA 511 Acres within Project Area
Development LUD	Timber Production	8,318	407
	Modified Landscape	7,145	0
	Scenic Viewshed	3,937	1,371
	Total Development Acres	19,400 (26%)	1,778 (22%)
Non-development LUD	Old-growth Habitat	41,381	6,285
	Scenic River	11,960	0
	Research Natural Area	1,621	0
	Total Non-development Acres	54,962 (74%)	6,285 (78%)
	Total Acre (non and development LUDS)	74,362	8,063

3 Environment and Effects

Values of the Thorne River IRA

The Forest Plan SEIS discusses all the values used to rate the wilderness potential of this IRA. The Thorne River IRA represents the typical qualities of many areas in Southeast Alaska. The following discussion focuses on the unique or outstanding qualities of the IRA. More information about this IRA is in the Forest Plan SEIS, Volume III, and Appendix C2 (USDA Forest Service 2003a).

Human Use Values

The Honker Divide Canoe Route that bisects the IRA is one of the longest canoe routes in Southeast Alaska. The route is rated "Most Difficult," and is a combination of river and lake paddles through remote and primitive areas. Visitors are unlikely to see other visitors during the entire trip. Along the canoe route is the Honker Lake Cabin, and visitors can expect to have a remote and isolated experience.

Thorne River- Hatchery Creek is a recommended Wild & Scenic River that flows partially within the Thorne River IRA. The outstandingly remarkable values associated with this river are primarily associated with recreation and recreation use of the fisheries. The recommendation is: 24 miles for Scenic River and 18 miles of Recreation River.

The Rio Roberts Research Natural Area is located in the southern part of the IRA. The area contains a variety of forest types that been used for monitoring ecological processes.

Biological Values

Most of the biological values are typical of Southeast Alaska. The biological values are generally associated with the river system which is within non development LUDs. The Thorne River has the largest steelhead run on Prince of Wales Island. Trumpeter swans use the area in the winter.

Physical Values

A drumlin field occurs within the lower Thorne River drainage outside of the project area and is considered to be a rare feature in the Alexander Archipelago.

Sarkar IRA

The Sarkar IRA occurs in the north-central portion of Prince of Wales Island. The IRA is bordered by areas of timber management on all but the northeast side, which is adjacent to saltwater (Whale Passage and Barnes Lake). Forest Road 20 separates the roadless area from El Capitan passage on the west side. The area can be easily accessed by boats and floatplanes, as well as by the road system to the south, west, and north. The Sarkar Canoe Route provides water access to the interior of the area via a chain of lakes.

The majority of the IRA (79 percent) is allocated to non-development LUDs and the remaining 21 percent is allocated to development LUDs. Table 39 lists the size of the IRA along with acres in development and non-development LUDs, and those acres that are within the project area.

Table 39. Sarkar Inventoried Roadless Area (#514) Acres by LUD

	Land Use Designation	IRA 514 Acres	IRA 514 Acres within Project Area
Development LUD	Timber Production	3,218	1
	Modified Landscape	10,056	557
	Total Development Acres	13,274 (21%)	558 (10%)
Non-development LUD	Old-growth Habitat	19,997	3,030
	Remote Recreation	15,834	0
	Recreational River	3,193	1,876
	Wild River	9,621	0
	Semi-remote Recreation	251	0
	Total Non-development Acres	48,896 (79%)	4,906 (88%)
	Total Acres	62,170	5,464

Human Use Values

Recreation and tourism potential focused on semi-primitive opportunities is high. Potential for dispersed recreation is good due to numerous methods of access to the area.

The Sarkar Canoe Route is a series of lake paddles separated by relatively short boardwalk portages through some very remote and primitive areas. The likelihood of encountering other visitors is low.

Along the canoe route is the Sarkar Lake Cabin. However, due to the proximity to the road system, visitors can expect to have a semi-primitive recreation experience. The ½ mile Deweyville Trail is located just north of the Sarkar Canoe Route trailhead.

Barnes Lake Cabin, also outside the project area, is located on a saltwater lake and is a challenge for boaters to access due to tidal fluctuations through constricted areas.

This roadless area contains what may be one of the larger known Native summer camps on Sarkar Lakes with the earliest house forms in Southeast Alaska. Historic use includes salteries along the west coast of the IRA.

Biological Values

Sarkar Lakes is a recommended Wild & Scenic River because of outstanding fisheries, wildlife, historic/cultural and scenic values. The Sarkar Lakes supports a sockeye population that is important for both commercial and sport fisheries. Trumpeter swans, a sensitive species, over-winter on the lakes. The rest of the biological values of the roadless area are typical of Southeast Alaska.

Physical Values

There are small areas of well-developed karst in the northwest corner and along the western edge.

Wilderness Potential Evaluation

In 1977, the Forest Service, along with public interest groups, developed the Wilderness Attribute Rating System (WARS), which was used to inventory the wilderness potential of roadless areas based on the key attributes of wilderness.

During the Forest Plan SEIS (USDA 2003, each IRA was evaluated and rated using the Wilderness Attribute Rating System, which assessed each area's characteristics and values. Thorne River ranks 47th from the highest, and Sarkar ranks 30th from the highest among the 109 IRAs on the Tongass.

The IRAs within the Logjam project area are centrally located in the north half of Prince of Wales Island, within the proximity of several other IRAs. These IRAs and acreages are summarized in Table 40.

Table 40. Inventoried Roadless Areas in Proximity to the Logjam Project Area

IRA	Acreage
512 Ratz	6,414
515 Kosciusko	71,578
516 Caulder	12,218
517 El Capitan	30,854
518 Salmon Bay	27,412

Unroaded Areas

Unroaded areas are generally less than 5,000 acres in size and do not meet the minimum criteria for wilderness consideration under the Wilderness Act. The inventory for the 2003 Forest Plan SEIS identified four unroaded areas that are within or partially within the Logjam project area, totaling 11,118 acres. The Forest Plan SEIS analyzed these unroaded areas and found them to have no wilderness potential due to size and/or configuration. They are surrounded by roads and all areas are less than one mile from a road and previous harvest activity. Activities occurring within the unroaded areas are similar to those taking place in the roaded.

Methodology

The analysis focuses on the impacts to the unique or outstanding biological, physical or human values and characteristics. The Inventoried Roadless Areas and unroaded areas as identified on the latest inventory for the Forest Plan was used.

Timber harvest unit acreages, where modification to the Roadless character would take place, were measured. A 600-foot "affected area" for timber harvests and a 1200-foot "affected area" for road surfaces were added to the actual unit size. The 600 feet and 1200 feet are based on how the roadless inventory was completed for the 2003 Forest Plan SEIS. In order to

calculate the added acreages, GIS was used. This added acreage around each unit account for effects to nearby acres through sound travel, visual disturbance and possible limited access. The effects analysis measurements are recorded in affected acres and acres retaining roadless characteristics.

In addition, the analysis of impacts to scenic values, recreation values, biological values, geological values, cultural/historical values, and opportunities for research were addressed.

Environmental Consequences

Alternative 1 Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects on the roadless character because no loss of acres or effects to values would occur due to timber harvest and road construction.

Cumulative Effects

The developed portions of northern and central Prince of Wales Island were used as the cumulative effects area. No cumulative effects on roadless character are anticipated under this alternative because no direct or indirect impacts would occur.

Alternative 2 Direct and Indirect Effects

Alternative 2 would reduce the amount of acres retaining roadless character within Inventoried Roadless Areas 511 and 514. The amount of reduction is shown in Table 41. Short-term impacts from timber harvest include noise disturbance and limited access to IRAs during harvest activities. Longer term impacts are the loss of roadless characteristics of a portion of the roadless area.

Alternative 2 is the only alternative that proposes timber harvest in Inventoried Roadless Areas 511 and 514. These effects are limited to development LUDs, where timber management is allowed. This alternative proposes to harvest 70 acres in IRA 511 and 29 acres in IRA 514. With the 600-foot affected area applied to these proposed harvest units, 369 acres would no longer have roadless characteristics in IRA 511 leaving 73,993 acres retaining roadless characteristics and 107 acres in IRA 514, with 62,063 retaining roadless characteristics. Of the total acres of IRA 511, 0.5 percent would be impacted and 0.2 percent of IRA 514 would be impacted.

This alternative proposes about 0.7 miles of road construction in Inventoried Roadless Area #511 and 0.3 miles of construction in Inventoried Roadless Area #514. The area of impact for this road construction would be 192 acres (IRA acres within the 1200 foot impact area) in IRA 511 and 79 acres in IRA 514. When the effects of the road construction is combined with the impacts of the harvest units a total of 561 affected acres in IRA 511, leaving 73,801 acres of retaining roadless characteristics. As for IRA 514, the total impact acreage would be 186 acres, leaving 61,984 acres retaining roadless characteristics. About 0.1 miles of this is NFS road and the remainder is temporary road. The NFS roads would be placed into storage and the temporary road decommissioned after timber haul and associated activities are complete.

Map 9. Inventoried Roadless Areas and Unroaded areas within Logjam Project Area

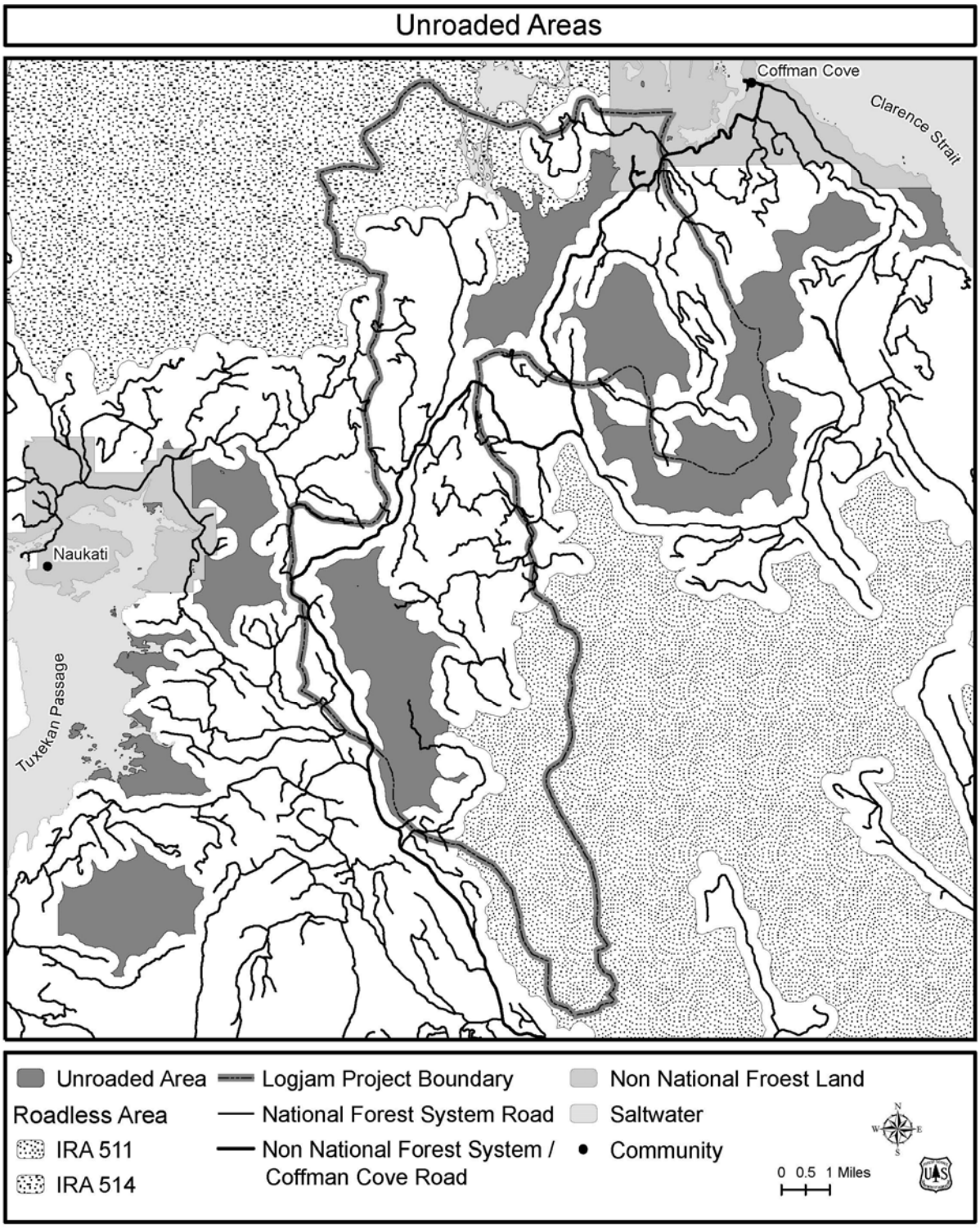


Table 41. Proposed harvest acres[a] and roads in the IRAs 511 and 514

Timber Harvest		Thorne River IRA 511	Sarkar IRA 514	Road Construction	Thorne River IRA 511	Sarkar IRA 514
Existing condition		74,362 acres	62,170 acres		0	0
Alt. 1		0	0		0	0
	Harvest Acres	70	29	Road Const. Miles	0.7 mile	0.3 mile
Alt. 2	Harvest Acres plus Affected Area (600' from boundary)	369	107	Road Const. plus Affected Area (1200' from boundary)	192 acres	79 acres
	Harvest Acres	0	0	Road Const.	0	0
Alt. 3	Harvest Acres plus Affected Area (600' from boundary)	13[b]	0	Road Const. plus Affected Area (1200' from boundary)	0	0
	Harvest Acres	0	0	Road Const.	0	0
Alt. 4	Harvest Acres plus Affected Area (600' from boundary)	0	0	Road Const. plus Affected Area (1200' from boundary)	0	0
	Harvest Acres	0	0	Road Const.	0	0
Alt. 5	Harvest Acres plus Affected Area (600' from boundary)	13[b]	0	Road Const. plus Affected Area (1200' from boundary)	0	0

[a]All harvest acres are within Phase 1 of the Tongass Adaptive Management Strategy.
[b]No harvest acres occur within the IRA boundary but the harvest unit buffer falls within 600 feet of the boundary.

Limited effects to biological values in IRAs 511 and 514 are possible due to harvest activities (see Wildlife and Fisheries sections in this chapter). Due to stream buffers, effects to fisheries resources are not likely.

No effects to the recreation resources and limited effects to scenic resources are expected for the roadless area. Remote recreation use in this area is not likely to be altered due to harvest activities. Opportunities for solitude would remain basically the same. Since harvest activities and road construction are limited to edge of the IRA, they are not likely to greatly impact opportunities for solitude within the rest of the IRA.

The physical values identified for IRA 511 are located in the southern portion of Thorne River Drainage, where timber harvest activities are not proposed. Geological features such as karst identified for the Sarkar IRA 514 are located in the western portion of the IRA. With implementation of Forest Plan Standard and Guidelines, no effects to karst and geological features are expected.

No timber harvest is proposed in proximity to known cultural and historical resources within these IRAs and will not be affected.

The Rio Roberts Research Natural Area would not be affected. Opportunities for research on undeveloped areas would be possible on 99 percent of the IRAs.

All unroaded areas are allocated to development LUDs. Approximately 1,839 acres of unroaded area would be affected by Alternative 2. The unroaded areas are all within 1 mile of an existing road and no unique characteristics of these unroaded areas were identified. Recreation activities, such as hunting and hiking are likely to continue within these unroaded areas following timber harvest activities. Foot travel activities such as hunting, hiking, and berry-picking may increase into these due to road access and harvested units. Proposed roads will be put into storage and will not be available for motorized access.

Cumulative Effects

Past timber harvest activities have reduced the overall size of the IRAs on northern and central Prince of Wales (cumulative effects area). The Forest Service has harvested approximately 10,304 acres in the Logjam project area. The current inventoried boundaries of IRAs 511 and 514 reflect these changes.

The proposed harvest acres in combination with the previous harvests are not likely to affect the roadless character of these two IRAs. The IRAs would not be split into smaller areas by harvest and the total acreage would be reduced by less than one percent. The remoteness of the IRAs would remain the same and the outstanding biological, geological, scientific, or recreation values of the IRAs are unlikely to have any effects.

The Coffman Cove Road (State Highway road improvements on roads 2300000, 3000000, and 3030000) are currently in progress in the project area. Improvements to the roads may increase visitor use to the IRAs and unroaded areas. These improvements are not likely, however, to adversely affect the roadless character of IRAs 511 and 514. Cumulative activities to unroaded areas will be the same as the direct effects since the roads will be put into storage and no additional timber harvest will occur.

Alternatives 3 and 5 Direct and Indirect Effects

Alternatives 3 and 5 do not propose any timber harvest or roads in roadless areas. The 600-foot affected area around the harvest units outside the roadless area, may impact approximately 13 acres of IRA 511 in both Alternatives 3 and 5. Since the physical impact would not take place within the IRA 511, the human, physical, biological, or research values would not be impacted.

Cumulative Effects

Cumulative effects for Alternatives 3 and 5 would be similar but less than those analyzed and disclosed under Alternative 2 since no harvest within the roadless area occurred with either of these alternatives. Cumulative activities to unroaded areas will be the same as the direct effects since the roads will be put into storage and no additional timber harvest will occur.

Alternative 4 Direct and Indirect Effects

Alternative 4 does not propose any timber harvest or roads in roadless areas. The 600-foot affected area around the harvest units outside the roadless area, may impact approximately 803 acres of IRA 511. Since the physical impact would not take place within the IRA 511, the human, physical, biological, or research values would not be impacted.

Cumulative Effects

Cumulative effects would be the similar but less than as those analyzed and disclosed under Alternative 2 since no harvest within the roadless area occurred with this alternative. Cumulative activities to unroaded areas will be the same as the direct effects since the roads will be put into storage and no additional timber harvest will occur.

OTHER RESOURCE CONSIDERATIONS

Physical Environment

KARST

Karst is a comprehensive term that applies to the unique topography, surface and subsurface drainage systems, and landforms that develop by the action of water on soluble rock (primarily limestone and marble (carbonates) in Southeast Alaska). The dissolution of the rock results in the development of internal drainage, producing sinking streams (streams that sink into the stream bed or karst features), closed depressions, sinkholes, collapsed channels, micro relief karst features (e.g. karren), and caves.

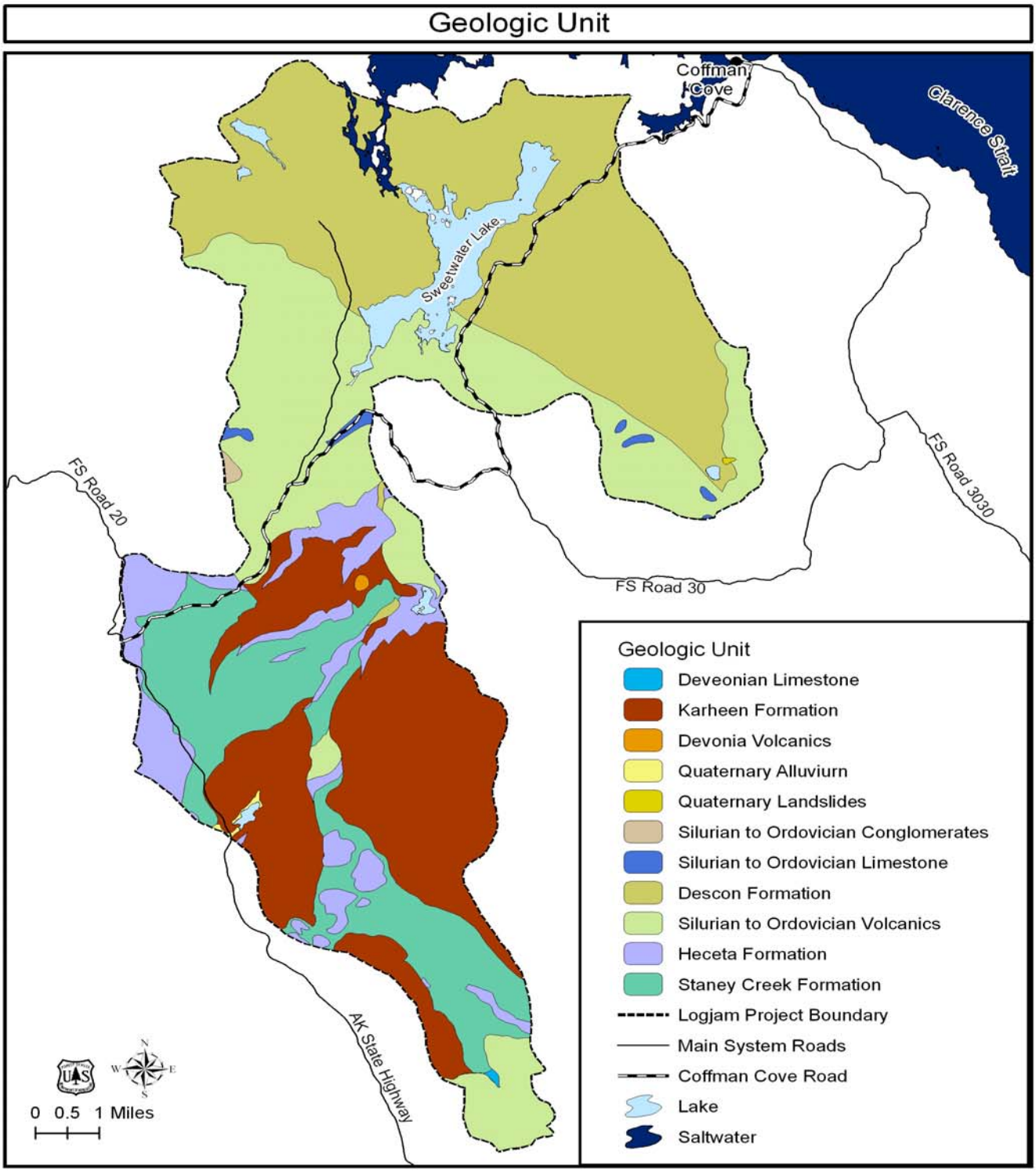
The geology and climate of Southeast Alaska are particularly favorable for karst development. Extensive areas of very pure carbonate (>95 percent $CaCO_3$) (Maas et al., 1992), approximately 537,588 acres (840 square miles), are found within the boundaries of the Tongass National Forest. This includes carbonate bedrock on private, State, and Federal lands. Because of fractures in the carbonates, high annual precipitation, and peatlands adjacent to the carbonate bedrock, karst has developed, to varying extent, within all carbonate blocks. The Tongass National Forest contains the largest known concentration of limestone dissolution caves in Alaska.

Affected Environment

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

animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and the underlying unique cave resources (Baichtal and Swanston, 1996, Wissmar et al., 1997, Bryant et al., 1998). In the Logjam project area, approximately 13 percent of the total bedrock consists of Silurian (primarily the Heceta Formation), Devonian, and Ordovician aged limestone into which low, moderate and high vulnerability karst systems have developed (Map 10).

Map 10. Geologic Map of the Logjam Project Area



Approximately 33 percent or 2,382 acres of carbonate bedrock in the Logjam project area have been harvested historically. Where timber harvest has occurred over karst systems, it is possible that sedimentation and slash from prior harvest washed into karst features, altering the ecology of the karst system by affecting the water chemistry and flow paths (Aley et al. 1993). It is also possible that in areas that have already been harvested, thickly regenerated forests are causing greatly increased interception rates resulting in less water moving through the karst systems (Prussian 2008). Without the natural flow rates through the system, slash and debris will remain instead of being washed out.

In addition, decreased water flow downstream from these karst areas results in a reduction of fish habitat where karst streams contribute to fish streams (Bryant et. al 1998). High and moderate vulnerability karst is most susceptible to these effects. High and moderate vulnerability karst exist mainly in the southern portion of the Logjam project area as resurgence springs, insurgence streams, caves, sinks, and well developed epikarst. High vulnerability karst areas would not be harvested in the Logjam project area under any alternatives; however, harvest would occur in some areas of moderate vulnerability karst.

Methodology

All data were analyzed in digital format. These included aerial photos, stream and road layers, unit boundaries with management specifications, contour lines, and finally the existing karst inventory, points, and geology layers. Proposed units were assessed for potential karst development first by analyzing the geology of the area, and then by interpreting aerial photographic data. Units that were deemed to have potential for karst development were then assessed in the field. Field assessment was conducted by karst specialists walking through each unit and visually assessing any features located and assigning them a classification of low, moderate, or high vulnerability (see Karst Resource Report) Significant features are assigned a GPS point which is used, if necessary, to create a minimum 100-foot buffer of protection as prescribed in the Forest Plan. The need for additional protection was assessed on a case-by-case basis.

Karst Vulnerability

Karst lands impose land management challenges not encountered in non-karst areas because this three-dimensional landform functions differently than other landforms. Karst resources are evaluated according to their vulnerability to land uses that may affect karst systems. Vulnerability mapping recognizes that some parts of the karst landscape are more sensitive than others to surface activities and groundwater contamination. These differences in vulnerability may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from karst groundwater systems (USDA Forest Service 2008).

Low Vulnerability

Low vulnerability karst lands are those areas where resource damage associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate.

Generally these lands are underlain by carbonate bedrock that is moderately well to well drained, most commonly internally drained, but surface streams may be present. These areas have been greatly modified by glaciation, and a deep (greater than 40 inches deep) covering of glacial till or mineral soil, and little or no epikarst showing at the surface. The epikarst may be buried and/or ground off, depending on the intensity of glaciation. These lands pose little or no threat to organic, sediment, debris, or pollutant introduction into the karst hydrologic systems beneath through diffuse recharge. Often these are areas of little or no slope (less than 20 percent).

Moderate Vulnerability

The moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands.

Generally these areas are areas underlain by carbonate bedrock which is well drained internally. Surface streams are rare. The soils of moderate vulnerability areas are a mosaic of shallow organic (20 to 40 percent, McGilvery Soils) and mineral (80 to 60 percent, Sarkar [less than 20-inch depth] and Ulloa [greater than 20-inch depth] Soils) with minor amounts of glacial till. The epikarst is moderate- to well-developed and is visible at the surface. These areas tend to be at higher elevations (i.e., greater than 500 feet, and on knobs, ridges, and on the dip-slope of carbonate bedding planes when near the surface.) The surface of these areas tends to be irregular and undulating, following the epikarst development, which is the result of solution of the bedrock surface rather than solution and/or collapse features such as sinkholes.

High Vulnerability

High vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features.

These are areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. Karst systems and epikarst are extremely well-developed and collapse karst features may be numerous. These include all collapse karst features, caves, sinking or losing streams, insurgences, open resurgences, and open grikelands (i.e., those without soil or moss infilling and with open connections to the subsurface). The highest vulnerability features are those that could produce and transport the greatest amount of sediment, debris, and/or organics if disturbed. These include till-lined sinkholes and cave entrances accepting a sinking stream, whether intermittent or not. Also considered high vulnerability would be karst lands in which the epikarst is well- or extremely well-developed and the soils are predominately (greater than 50 percent) very shallow organic (less than 10 inches deep, McGilvery) and (less than 50 percent) mineral (less than 20 inches deep, Sarkar). The subsurface drainage network is highly vulnerable to sediment, organic matter, logging debris, and other pollutants generated as the result of surface activities.

Within polygons labeled as high or moderate vulnerability, there are features that require buffering under Forest Plan standards. These buffers are shown as the minimum 100’ radius

buffer. However, these buffers will need to be designed and laid out by a karst specialist during unit layout to address specific concerns such as aspect, slope, windthrow potential, and soils.Windfirm buffers are necessary to protect high and certain moderate vulnerability karst features from additional sedimentation and debris which can result from the uprooting and toppling of wind thrown trees.

Mitigation

Units found to have high potential for karst development included 577-25, 577-32, 577-34, 577-37, 577-41, 577-43, 577-80 and 81. . High vulnerability karst had also previously been identified in unit 577-30. Detailed discussions of field studies and findings can be found in the Karst Resource Report located in the Project record. The Karst Resource Report, due to the Federal Cave Protection Act of 1988, is not subject to FOIA requests.

The following mitigation is included to minimize or eliminate impacts to the karst resource for the following units:

Unit 577-25

Under Alternatives 2 and 5, the northern portion of this unit that contains moderate vulnerability karst and is proposed for helicopter and partial suspension harvest, which meets the requirements for protection of the karst resource. Under Alternatives 3 and 4, a section of the northern portion of unit 577 – 25 is dropped, removing most of the moderate vulnerability karst from the unit. A small portion of moderate vulnerability karst remains, however it is proposed for partial suspension harvest, which meets the karst protection requirements.

Unit 577-32

Under Alternative 2, the moderate vulnerability area between the two high vulnerability areas would be helicopter harvest. Under Alternatives 3, 4, and 5 the area containing moderate vulnerability karst would be dropped.

Unit 577-34

An area surrounding the stream which flows into a cave, the karst channels and associated sinkholes and springs are considered to be high vulnerability and have been dropped from the project area. The areas between these features are considered to be of moderate vulnerability and would require at a minimum partial suspension. Non-harvest buffers are intended to be 100-foot minimum buffers. A buffer for windfirmness beyond the 100 foot minimum will be considered.

Under Alternatives 2, 3, 4 and 5, the high vulnerability karst areas have been removed, and the moderate vulnerability areas are proposed for shovel harvest – this is acceptable as enough slash would be present on the ground to protect the epikarst surface.

Unit 577-37

In this unit a small cave as well as an insurgence stream in the north eastern portion of the unit was discovered recently. This area is considered high vulnerability and 100-foot minimum buffer. A buffer for windfirmness beyond the 100 foot minimum will be considered.

Under Alternative 2, the northern section of the unit is proposed to be shovel harvested – this is appropriate in moderate vulnerability karst as enough slash will be deposited on the ground to protect the epikarst surface. The high vulnerability karst has not yet been dropped, as this is recent documentation; however, it will be dropped from the project area between draft and final EIS. The proposed road will also be reassessed between draft and final. Under Alternatives 3, 4, and 5, this entire unit has been dropped.

Unit 577-41

One draw crosses a ridge running east-west which contains several sinkholes and areas of intense epikarst. This draw or karst swale that contains the sinkholes, well-developed epikarst and shallow soils is considered to be of high vulnerability. The knob/ridge (center area portion of the unit, west of the 2052 road) with moderately shallow soils and epikarst exposed, is considered to be of moderate vulnerability and requires at a minimum partial suspension. The remainder of the unit is of low to moderate vulnerability. Non-harvest buffers intended to be 100-foot minimum buffers. Wind firmness beyond that will be considered.

Under Alternatives 2, 3 and 5 the high vulnerability karst has been dropped, and the moderate vulnerability karst is proposed for shovel harvest. This is appropriate as enough slash would be deposited on the ground to protect the surface of the epikarst. In Alternative 3, the westernmost section of moderate vulnerability has also been dropped. In Alternative 4, the entire unit has been dropped.

Unit 577 – 30

High vulnerability karst was previously discovered in this unit during field reconnaissance for another proposed timber harvest, and at that time was reserved from the timber harvest selection. This unit was revisited in 2007, and the findings were consistent with the previous report; the unit had high vulnerability karst. Due to this, the lower portion of this unit was dropped from the Logjam project. Currently, Unit 30 consists only of the northern three settings Harvest of these settings should not significantly affect the high vulnerability karst area.

Units 577 – 43, 573 - 80 and 81

These three units still require evaluation as to the vulnerability of the karst resource. An additional report will be submitted to the ID Team as soon as possible following field assessment, between draft and final EIS. There is the potential for high, moderate, or low vulnerability karst in each unit – the assessment of such areas would change the potential amount of harvest in each unit and/ or the logging prescriptions currently in effect.

Environmental Consequences

Alternative 1 Direct and Indirect Effects

If this alternative is chosen, no harvest would occur within the project area. There would be no direct or indirect effects on the karst resource by not harvesting in the Logjam project area.

3 Environment and Effects

Cumulative Effects

Effects from past harvest and natural processes in the Logjam area such as sedimentation and erosion would experience no beneficial or adverse change, but would continue at the present rate.

Alternatives 2, 3, 4 and 5

Harvest on Karst

Total harvest on karst acreages per alternative are shown in Table 42. Under no alternative is there greater than a 4.3 percent change to the existing condition of the karst resource of the project area. Due to the small effect harvest would have on karst in the Logjam project area, direct and indirect effects are described in general for harvest on moderate and low vulnerability karst, and then further discussed by alternative in the mitigation section under the proposed unit concerned. High vulnerability karst areas have been removed from proposed harvest units, as described in the mitigation section of this section. Specific harvest requirements for units containing moderate and low vulnerability karst are outlined in the unit cards (Appendix B). Harvest prescriptions are discussed alternative by alternative under the specific unit addressed in the "Mitigation" section.

Table 42. Changes to existing condition on karst for the Logjam project area

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres of Previous Harvest on Karst	2382	2382	2382	2382	2382
Percent Karst Acres Harvested Historically[a]	32.9%	32.9%	32.9%	32.99%	32.9%
Acres of Proposed Harvest on Karst [b]	0	313	306	307	314
Total Acres Harvest on Karst	2382	2695	2688	2689	2696
Percent Total Proposed Harvest on Karst[2]	0	37.3%	37.2%	37.2%	37.3%
Percent Change	0.0%	4.3%	4.2%	4.2%	4.3%

Table based on data from the Tongass geology layer and the Logjam unit layer - data current April 4th, 2008.
[a] Harvest of high, moderate and low vulnerability karst;
[b] Harvest on moderate and low vulnerability karst

Roads on Karst

The proposed roads on karst in the Logjam project area are described in Table 43. The greatest amount of road proposed for the project is in Alternative 2; however most of the roads proposed are on low vulnerability karst. Road building on high vulnerability karst would be avoided under all alternatives.

Alternatives 2, 3, 4, and 5 propose construction of 0.24-0.29 miles of road that was recently discovered to be on high vulnerability karst. The location of these road segments will be changed between the draft and final EIS to avoid impacts on high vulnerability karst. Planned

logging and transportation systems will be updated between the draft and final EIS to avoid impacts to high vulnerability karst wherever possible.

During implementation where proposed roads cross high vulnerability karst areas, the karst resource specialist would be consulted. Specific requirements concerning road building on moderate vulnerability (Appendix H, section III.A.4.b.ii) and high vulnerability karst (Appendix H, section III.A.4.b.ii) are located in the Forest Plan, as referenced.

Table 43. Proposed roads by mile on karst in the Logjam Project Area

Vulnerability	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
High	0.00	0.29	0.24	0.24	0.24
Moderate	0.00	1.76	1.23	1.03	1.35
Low	0.00	4.52	0.70	0.70	1.25
Total	0.00	6.57	2.17	1.97	2.85

Table based on data form the Tongass Karst Vulnerability layer and the prop_rds408 layer current April 13th 2008

Direct and Indirect Effects

The highest acreage of karst proposed for harvest is currently in Alternative 5, with 314 acres (Table 42). The lowest acreage of karst proposed for harvest is Alternative 3 with 306 acres. Alternative 4 proposes 307 acres of harvest on karst and Alternative 2 proposes 313 acres of harvest on karst (Table 42). The effects are expected to be minor by removing high vulnerability karst areas for proposed harvest and protecting soil and water quality in these areas and specifying suspension requirements in the unit cards. Effects could include initial increase in flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequent (approximately 5 years post harvest) decrease to flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increase to turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993).

Cumulative Effects

Past, present and reasonably foreseeable future actions considered in this analysis can be found in Appendix D.

Alaska Forest Highway 33 (the Coffman Cove Road) was paved during the summer of 2008 in the project area. This road construction would not significantly affect karst in the project area, or in affected watersheds in the project area.

Cumulative effects from harvesting additional low and moderate vulnerability karst areas in the project area would not be significant since the karst standards and guidelines will be applied as described in the unit cards (Appendix B), roads cards (Appendix C), and in the "Mitigation" section.

3 Environment and Effects

SOILS

This section provides a summary of the soil resources in the project area. Forest-wide Standards and Guidelines for this resource are on pages 4-83 through 4-85 of the Forest Plan. The analysis and results presented in the environmental consequences section are based upon proposed harvest unit boundaries and the overall project area boundary. The analysis for the soils resource uses both temporary and NFS road information. Detailed discussion of the soil and wetlands of the Logjam project area can be found in the Soil and Wetland Resources Report, 2008 in the Logjam Project record.

Timber harvest can adversely affect the soils resource by:

1. Disturbing, displacing or burying the nutrient rich forest floor and exposing mineral soils to erosion and,
2. Increasing the frequency of landslides which also displace nutrient rich soils, and increase erosion potential

Affected Environment

The topography of the Logjam project area is chiefly comprised of, infrequently dissected footslopes and alluvial fans. Frequently dissected, deeply and shallowly incised, smooth mountain slopes and gently sloping lowlands are also major topographical features in the Logjam project area. Soils range from moderately deep well-drained tills that support productive forests to very poorly drained organic soils that support muskeg vegetation. Soil productivity on the project area is primarily a function of soil drainage and in some cases soil depth. Most soils on the project area are covered with an organic mat or duff layer 4 to 8 inches thick. This organic mat prevents erosion of the underlying mineral soil from raindrop impact and supplies many nutrients available for plant growth. Keeping the organic mat in place during management activities is a key to maintaining soil productivity.

Steep slopes are underlain by somewhat poorly drained to moderately well drained soils; they are shallow to bedrock or dense glacial till at lower elevations. Windthrow is the dominant disturbance factor on slopes exposed to the southern aspects. Landslides are the dominate disturbance factors on steep wind protected slopes. Gently sloping lowlands are present along the valley bottoms and support wetland vegetation. Minor areas of karst are present in the western and southern portion of the project area (see Geology and Karst section, this chapter).

The soils on the Logjam project area are mostly in a pristine condition. Past management activities include about 10,297 acres of timber harvest and 151 miles of road construction (includes past temporary, NFS, and private road construction within the project area). The majority of soil disturbance on the Logjam project area is the result of windthrow, streambank erosion, and NFS road building. Soil disturbances (natural and management related) on the Logjam project area is summarized in Table 44.

Table 44. Existing Soil Disturbances in the Project Area

Soil Disturbance Source	Acres Affected	Project Area (percentage)
Management-related Soil Disturbances		
Past log yarding activities	309	0.5%
Existing acres of temporary road (42 miles)	217	0.4%
Existing acres of NFS and state road (109 miles)	533	0.9%
Existing rock pits (64 rock pits)	64	0.1%
Landslides from past harvest(51 slides)	18	0.03%
Landslides from road construction (11 slides)	4	0.006%
Total Soil Disturbances from Management	**1,145**	**2%**
Naturally Occurring Disturbances		
Naturally occurring landslides (73 slides)	141	0.3%
Natural mineral soil disturbances (windthrow, stream bank erosion, etc.)	512	0.9%
Total Natural Soil Disturbances	**653**	**1.2%**
Total Existing Soil Disturbances	**1,798**	**3.2%**

Management activities have caused past soil disturbances. These past disturbances are considered to be minor and currently have minimal erosion concerns. On the Logjam project area, all management related soil disturbances are within parameters found in Region 10 Soil Quality Standards. The following sections describe the natural and management-induced soil disturbances in detail.

Landslides and Other Natural Soil Disturbances

Landslides (mass wasting) are the dominant erosion process in steep forested terrain with high soil water levels in Southeast Alaska (Swanston 1969). Topographic, geologic, and soil conditions in combination with high amounts of rainfall are the major factors contributing to landslides in Southeast Alaska.

The soil mass movement index is a tool used to assess slope stability at the project scale. Mass Movement Index (MMI) hazard classes are used to group soil map units that have similar properties relative to the stability of natural slopes. Four categories of MMI soils hazard classes exist; MMI 1 (most stable) through MMI 4 (least stable). Soils with a very high Mass Movement Index (MMI 4) have the greatest probability of slope failure.

3 Environment and Effects

A landslide inventory was completed for the Logjam project area. The inventory used 1971, 1979, 1985, 1991, 2005, and 2006 aerial photography, and field observations to identify landslides. The landslide initiation points were overlaid with the mapped Mass Movement Index class to display the relationship between mapped mass movement index and actual landslide occurrence. The data is summarized in the first part of Table 45. The second part of Table 45 provides landslide data for the most recent 35 year time period. The most recent 35 year time period includes most of the management activities on the project area.

Table 45. Landslides and Acreage

Mass Movement Index Class	Acres of MMI Class	Number of Landslides	Approx. Acres of landslides
Initiated in MMI 1□	25,480	8	17 acres
Initiated in MMI 2□	1,066	0	0 acres
Initiated in MMI 3□	24,360	102	84 acres
Initiated in MMI 4□	2,122	25	62 acres
Total	**53,028■**	**135**	**163 acres[8]**
Landslides 1971 to 2006.			
Unharvested Area (non Management-related) Landslides			
Landslides occurring in POG♦, 1971-2006	25,891	49	32 acres
Landslides occurring in non-POG, 1971-2006	30,242	0	0 acres
Management-related Landslides			
Harvest Related Landslides, 1971-2006	10,297 acres of harvest	51	18 acres
Road Related Landslides, 1971-2006	151 miles of road●	11	4 acres
Thirty-Five Year Totals		**111**	**54 acres**

□ Analysis based upon landslide initiation point and soil mapping in GIS. Many of the naturally occurring landslides shown to originate in MMI 1 through MMI 3 soils are likely to occur in soil mapping inclusions of MMI 4 soils. This portion of the table does not include road related landslides. Numerous landslides that originate in MMI 4 and MMI 3 soils have disturbed MMI 1 and MMI 2 soils. Source: USDA Forest Service, Craig Ranger District, GIS Database

■ Project area acres do not match other sections of this document due to lakes and ponds which have no MMI rating.

♦ Productive Old Growth

●Includes NFS and temporary roads.

Table 45 indicates that a total of 135 landslides have disturbed nearly 163 acres across the Logjam project area. Naturally occurring landslide events account for over 86 percent of these landslide acres. The majority of these natural landslides have initiated in MMI 3 and MMI 4 soils. Between 1971 and 2006, a total of 49 landslides occurred in productive old growth (POG) disturbing about 32 acres of soils, and averaging 0.65 acres in size. In this same 35-year time period, 51 landslides occurred within previously harvested areas disturbing about 18 acres of soils, and averaging 0.35 acres in size. The occurrences of landslides in harvested areas may be attributed to a higher concentration of soil water resulting from soil disturbance caused by log yarding and felling, and less rainfall interception.

[8] Total for all landslides, including pre 1971 acres

Between 1971 and 2006, a total of 11 road related landslides occurred and impacted about 4 acres, averaging a size of 0.4 acres. Road related landslides are generally the result of ditches concentrating water and delivering it to a naturally unstable area of the slope or by excessive road fill weight on a naturally unstable slope (Landwehr, 1999).

A total of 111 landslides have occurred since the majority of the timber harvest (1971 to 2006) of which 62 are related to harvest and road activities. Management related landslides essentially account for about 0.5 acres of disturbance per year during this time frame. When the landslide inventory data is compared on a per acre basis the data indicates that landslides in harvested areas are 2.5 times more likely to occur than landslides in unharvested areas. See the Soil and Wetlands Resource Report (Saari 2008) for more information on the landslide inventory conducted on the Logjam project area.

The results reported here for the Logjam project area are similar to the results from other landslide inventories conducted on the Tongass National Forest. The findings of those inventories are summarized in the Soil and Wetlands Resource Report (Saari 2008).

Natural disturbances on the Logjam project area also include areas such as soil, erosion from overland flow, stream bank erosion, windthrow, and colluvial activity. These natural soil disturbances are estimated to occupy approximately 653 acres on the Logjam project area.

The Logjam project area is highly exposed to high wind events that lead to windthrow. Numerous areas have experienced windthrow and are at risk for future events. Windthrow may also lead to landslide activity on shallow soils present on steep forested slopes (Swanston 1967). However, windthrow may play an important role in the soil disturbance and nutrient cycling regime of some soils on the Logjam project area. Nutrients tend to accumulate and become immobilized in organic and upper layers of the soil which can lead to nutrient deficiency in areas where minimal windthrow disturbance or other soil disturbance mechanisms are present (Bormann et al. 1995). Windthrow can provide mixing and aeration of the organic and mineral soil horizons, freeing nutrients to be used by plants, thus increasing soil productivity. Conversely, Stephens et al. 1968 found that stands regenerated from windthrow had a site index that was about 20 feet less than in stands originating following clearcutting or fires.

Management-related Disturbances

Soil disturbances associated with past harvest activities have typically been the result of road construction and log yarding. Total harvest in the project area is approximately 10,297 acres. Harvest entries in the 1960's accounted for 310 acres (267 acres on Forest Service land). Since the late 1970s yarding methods have used suspension techniques that provided partial suspension of logs and full suspension in some cases. These yarding techniques greatly minimized potential for soil disturbances when compared to non-suspension techniques. Soil disturbances from past yarding activities total less than 309 acres and are considered minimal at the project scale. The acres of disturbed soil associated with past harvest are based on soil disturbance monitoring data summarized by Landwehr and Nowacki (1999).

Soil disturbances associated with road construction (includes NFS, temporary, and private roads) cover about 749 acres from 151 miles in the project area (based on a 40 foot wide disturbed soil corridor). Soil disturbances from road construction involve removing the

nutrient rich organic layer to shape cutslopes and burying some areas of productive soil under shot rock. Overlay road construction has been commonly used on nearly level or gently sloping poorly drained soils in wetland areas. Overlay road construction does not impact as large an area of soil as cut and fill road construction. To build the roads, 64 one-acre rock pits have been developed. In rock pit sites, productive soil areas are removed and bedrock exposed. Soils are removed to expose the bedrock and are stacked adjacent to the pit burying other productive soils. Existing soil disturbances are within the Region 10 Soil Quality Standards.

Between the years 1971 to 2006, 66 landslides (natural and management related) occupying nearly 13 acres have occurred in the Trumpeter Creek watershed. A total of 17 landslides occurred naturally before 1971, disturbing about 68 acres and accounting for nearly 84 percent of the total landslide disturbance of the Trumpeter Creek watershed. Between the years 1971 and 2006, 33 landslides occurred in unharvested areas (POG) disturbing 4 acres. Road related activities initiated 4 landslides, totaling approximately 0.8 acres. Twenty-nine landslides have initiated in harvest areas and account for 8.2 acres of soil disturbance. In the Trumpeter Creek Watershed, landslides in harvested and unharvested areas between 1971 and 2006 have both averaged 0.28 and 0.12 acres in size respectively. Thompson (2008) documented the existing condition of Trumpeter Creek Watershed (see also the Watersheds and Fisheries section, this Chapter).

Harvest on Slopes Greater than 72 Percent

Past harvest activities have avoided slopes greater than 72 percent gradient. The digital elevation model for the project area when overlain with the managed stands layer indicates approximately 42 acres (0.4 percent of harvested areas in the project area) of slopes greater than 72 percent gradient have been harvested.

Trumpeter Creek and Logjam Creek watersheds have the highest amount of harvest on slopes greater than 72 percent. Approximately 24 acres of slopes greater than 72 percent have been harvested in the Trumpeter Creek watershed (approximately 1 percent of the harvested areas in the watershed) and approximately 9 acres of slopes greater than 72 percent in the Logjam Creek watershed (approximately 0.1 percent of the harvested areas in the watershed).

Staney Creek, Barnes Lake, Galligan Creek, Hatchery Creek, and Naukati Creek watersheds have approximately 4.3, 3.5, 0.6, 0.4, and 0.1 acres of slopes greater than 72 percent harvested respectively.

According to GIS, no management related landslides have occurred on harvested slopes greater than 72 percent in the Logjam project area.

Environmental Consequences

The IDT identified two key indicators to measure the effects of the alternatives on the soil resource:

- Maintenance of soil productivity as measured by the amount of soils left in a detrimental soil condition
- The amount of harvest on slopes over 72 percent gradient

The analysis area for direct effects is individual harvest units. For indirect and cumulative effects the analysis are is the Logjam Project Area.

Soil Productivity

Region 10 Soil Quality Standards state that a minimum of 85 percent of an area should be left in a condition of acceptable productivity potential for trees and other managed vegetation following land management activities. Detrimental soil conditions are defined in Forest Service Manual 2554. Detrimental soil areas are areas of soil that have been altered to the point where soil productivity has been affected. Detrimental soil conditions are typically associated with road construction, log felling, and log yarding. Soil disturbances associated with NFS road construction are not counted toward detrimental soil condition because system roads are removed from the productive land base. Temporary roads are considered part of the land base and are included in the calculation of detrimental soil conditions.

Detrimental soil conditions are calculated for two activity areas, individual harvest units and the overall project area. Analysis of detrimental soil condition from temporary road construction is based upon a 40-foot wide disturbed soil corridor which equates to about five acres of disturbance per mile. Detrimental soil conditions incurred by proposed harvest activities such as tree felling and yarding include soil displacements; a loss of ground cover, compaction and soil puddling. This analysis of detrimental soil conditions in harvest units is based on soil quality monitoring data collected on the Tongass as reported by Landwehr and Nowacki (1999). The analysis assumes three percent detrimental soil condition for areas where partial suspension or shovel yarding is proposed and two percent detrimental soil condition where full suspension is proposed.

Table 46 displays the estimated acres of detrimental soil conditions resulting from the implementation of the alternatives.

Table 46. Estimated acres of detrimental soil conditions resulting from implementation of the alternatives

Action causing soil disturbance	Alternatives[a]				
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
New Temporary Road Construction (acres)[b]	0	90	51	40	61
Rock Pit Development for new road construction (acres)[c]	0	27	13	12	17
Yarding Disturbances in Harvest Units[d]	0	96	67	46	86
Management Related Landslides (acres per year)[e]	0	0.2	0.2	0.1	0.2
Total Acres of Detrimental Soil Conditions[f]	0	213	131	98	164

[a]The numbers above are rounded.
[b]Estimate of soil disturbance from new road construction based upon 40-foot road base. The temporary roads described her only include the planned temporary road not the decommissioned temporary road. The decommissioned temporary road is already addressed in the existing condition.
[c]A two-acre rock pit has been estimated for every two miles of road construction.
[d]Yarding disturbances based on estimates provided by Landwehr and Nowacki (1999).
[e]Landslide acre estimate based on landslide inventory.
[f]Detrimental soil conditions based on proposed timber harvest acres and do not include deferral acres.

Table 46 data indicate that Alternative 2 would result in the greatest impact to soil productivity while Alternatives 1 and 4 would result in the least impact to soil productivity. Of the action alternatives, implementation of Alternative 4 results in the least amount of detrimental soil conditions. A detailed analysis of estimated soil disturbance for each proposed harvest unit has been conducted and is included in the Logjam Soil and Wetland Resources Report, 2008 in the Logjam Project record. The data indicate that Region 10 Soil Quality Standards will be met in all harvest units and across the project area, thus soil productivity would be maintained on the project area under all alternatives.

Harvest on Slopes Over 72 Percent

All proposed harvest units with slopes exceeding approximately 50 percent gradient were field reviewed by a soil scientist. Boundaries were modified on many steep slope areas due to concerns about slope stability and impacts to soil productivity following harvest. Approximately 260 acres of landslide prone slopes were removed from harvest consideration to protect soil resources and prevent potential degradation of downslope resources. Approximately 346 acres of slopes greater than 72 percent were identified within unit in the project area, and nearly 225 acres were excluded from harvest. In addition, harvest prescriptions and suspension requirements were determined for other steep slope areas.

Complete details on steep slopes in harvest units are included in the soil unit resource reports and in the individual unit cards (in the Logjam project record). Approximately 121 acres of slopes greater than 72 percent gradient remain in the unit pool because they rate well below MMI 4 landslide potential. Most areas are less than 10 acres in size and consist of short steep slopes associated with rock outcrops. They are included in the proposed harvest units because they appear stable and will facilitate yarding of surrounding lesser slopes. Appropriate mitigation measures are prescribed (see unit cards Appendix B).

Table 47 displays the proposed harvest units and acres of slopes greater than 72 percent gradient that remain in the unit pool, and the proposed harvest systems on those slopes. The areas in Table 47 meet the criteria for timber harvest on slopes greater than 72 percent gradient as defined by the Forest Plan. The majority of these units are proposed for helicopter yarding with 25 or 50 percent retention. Partial cutting in these helicopter units would help ensure an adequate amount of live root mass remains intact to preserve slope stability. Less soil disturbance in a harvest unit results in less disruption of the root mat and subsequently more root strength than if the soil is disturbed (Swanston 1974). Full suspension helicopter yarding of felled trees would provide the necessary surface protection for soils during the yarding process on steep slopes.

Table 47. Proposed harvest units with areas of slopes over 72 percent gradient

Timber Unit	Alt. 2 Slopes >72% (acres)	Proposed Harvest System	Alt. 3 Slopes >72% (acres)	Proposed Harvest System	Alt. 4 Slopes >72% (acres)	Proposed Harvest System	Alt. 5 Slopes >72% (acres)	Proposed Harvest System
573-05	0.1	Shovel■	---	---	---	---	---	---
573-11	0.4	Helicopter	0.4	Helicopter	0.4	Helicopter	0.4	Helicopter
573-13	0.6	Helicopter	0.6	Helicopter	0.6	Helicopter	0.6	Helicopter
577-25	10	Cable**	10	Cable❖	10	Cable❖	10	Cable❖
577-43	7	Helicopter	---	---	---	---	7	Helicopter
573-67	7	Helicopter	8	Helicopter	8	Heli/Cable	7	Helicopter
573-68	33	Helicopter	33	Helicopter	---	---	33	Helicopter
573-75	61	Helicopter	61	Helicopter	---	---	61	Helicopter
573-79	1	Helicopter	---	---	---	---	---	---
573-80	0.2	Helicopter	---	---	---	---	---	---
573-83	0.5	Cable	---	---	0.5	Cable	0.5	Cable
573-84	0.9	Helicopter	---	---	---	---	---	---
Totals	**121.7**		**113**		**19.5**		**119.5**	

The acres above are approximate and do not include deferral areas.
■Unit 573-05 has a small cliff area less than 30 feet in height (see Unit Cards for more details).
❖ The slopes greater than 72 percent in unit 577-25 are proposed to be cable yarded with full suspension requirements (see Unit Cards for more details).

In Table 47, which shows proposed harvest units with areas of slopes over 72 percent gradient that meet Forest Plan guidelines for timber harvest by harvest unit, action alternative, and proposed harvest system; approximately 110 acres (92 percent) are proposed to be harvested with a helicopter yarding system in Alternative 2. Alternative 3 proposes approximately 103 acres (91 percent) of slopes greater than 72 percent to be harvested by helicopter yarding. In Alternative 4, approximately 8 acres (41 percent) are proposed to be harvested by a helicopter yarding system. In Alternative 5, approximately 109 acres (91 percent) of slopes greater than 72 percent are proposed with a helicopter yarding system.

The analysis area for direct and indirect effects for the soils resource is the harvest unit and associated temporary roads. The analysis area for cumulative effects for the soils resource is the project area.

Alternative 1 Direct and Indirect Effects

Under Alternative 1 no timber harvest or road building would take place and no soil disturbances would be caused by new management activities. No rehabilitation efforts involving road reconstruction, storage, and decommission would be completed on existing roads under this project but are included in the POW ATM project. Roads on the project area would continue to receive incidental use from hunters and other visitors. Landslides would continue to occur in unharvested areas and harvested areas. Vegetation in harvested areas

would continue to grow and add stability to soils on those sites. Detrimental soil conditions will remain within Region 10 Soil Quality Standards.

Cumulative Effects

See Table 44 for a summary of existing soil disturbances on the project area. Natural soil disturbances including landslides would continue to occur. Past timber harvest and road building is associated with 62 landslides totaling about 22 acres in 35 years. Most of this landslide activity is the result of road related activities and timber harvest on steep slopes before current Forest Plan standards and guidelines were implemented.

Approximately 21 acres of landslides are expected to occur in harvested areas over the next 35 years (including the anticipated harvest activities listed in Appendix D). In unharvested areas, approximately 32 acres of landslides are expected to occur over the next 35 years. Vegetation in previously harvested areas would continue to grow and add root mass and stability to the soil, thus landslide frequency would likely decline over time in the harvested areas (Landwehr 1994).

Other than landslides, erosion sources across the project area are typically small (less than 100 square feet) and include road banks, road surfaces, windthrow, and stream banks. See the Watersheds and Fisheries section for a discussion of the effects of sedimentation.

Alternative 2 Direct and Indirect Effects

Alternative 2 proposes 3,703 acres of timber harvest. Approximately 1,284 acres would be helicopter yarded, 876 acres cable yarded and 1,543 acres shovel yarded under minimum partial suspension requirements. Twenty-six miles of new planned temporary and NFS road would be built and three miles of old temporary road would be reconstructed totaling approximately 29 miles of road. Approximately 157 acres of soil would be disturbed by new planned temporary and NFS road construction and rock pit development. About 96 acres of soil disturbance would occur in harvest units and approximately 8 acres of management induced landslides are expected to occur over the next 35 years. Total area of soil with reduced productivity would be approximately 213 acres (See Table 46). All harvest units would meet Region 10 Soil Quality Standards.

Approximately 120.8 acres of slopes greater than 72 percent gradient would be harvested in Alternative 2. Alternative two includes the highest amount of timber harvest proposed on slopes greater than 72 percent of any alternative. All harvest proposed on slopes greater than 72 percent gradient have been reviewed by a soil scientist and meet the requirements set forth in the Forest Plan.

Cumulative Effects

In addition to the impacts described for Alternative 1, Alternative 2 would add the effects described in the direct and indirect effects. When combined with the harvest anticipated as a result of implementation of projects listed in Appendix D, the amount of timber harvest on the project area would increase to approximately 14,000 acres and miles of temporary and NFS road on the project area would increase to 180 miles. The number of rock pits would likely increase from 64 to 78. Detrimental soil conditions from all temporary roads, rock pits and

within harvest units would be about 825 acres. This level of disturbance is well within Regional Soil Quality Standards at the Project Area scale.

Natural soil disturbances including landslides would continue to occur. Landslides within previously harvested areas would occur at a higher frequency than unharvested areas. Vegetation in previously harvested areas would continue to grow and add root mass and stability to the soil, thus landslide frequency would likely decline over time in the harvested areas (Landwehr 1994). Alternative 2 proposes about 120.8 acres of timber harvest on slopes over 72 percent gradient. These areas have been reviewed for slope stability concerns by a soil scientist. Based on the project–wide landslide inventory, landslides would continue to average 3 slides per year across the project area. Over the next 35 years, about 29 acres would be attributed to management activities.

Across the project area, erosion sources other than landslides are typically small (less than 100 square feet) and include road banks, road surfaces, windthrow, and stream banks. See the Watersheds and Fisheries section for a discussion of the effects of soil erosion.

Alternative 3 Direct and Indirect Effects

Alternative 3 proposes 2,708 acres of timber harvest. Approximately 1,153 acres would be helicopter yarded, 508 acres cable yarded and 1,047 acres shovel yarded under minimum partial suspension requirements. In Alternative 3, about 13 miles of temporary and NFS roads would be built and 2 miles of road construction totaling approximately 15 miles of road. Approximately 72 acres of soil would be disturbed by planned temporary and NFS road construction and rock pit development. About 67 acres of soil disturbance would occur in harvest units and about 6 acres of management induced landslides are expected to occur over the next 35 years. Total area of soil with reduced productivity would be about 131 acres (See Table 46). All harvest units would meet Region 10 Soil Quality Standards.

Approximately 113 acres of slopes greater than 72 percent gradient would be harvested in Alternative 3. Alternative three includes less timber harvest proposed on slopes greater than 72 percent than Alternative 2. All harvest proposed on slopes greater than 72 percent gradient have been reviewed by a soil scientist and meet the requirements set forth in the Forest Plan.

Cumulative Effects

Alternative 3 would have cumulative effects similar to Alternative 2 but not as extensive. When combined with the harvest anticipated as a result of implementation of projects listed in Appendix D, the amount of timber harvest on the project area would increase to approximately 13,000 acres and the cumulative miles of temporary and NFS road would increase to 165 miles. The number of rock pits would likely increase from 64 to 70. Detrimental soil conditions from all temporary roads, rock pits and within harvest units would be about 743 acres. Soil conditions would be within Region 10 Soil Quality Standards.

Over the next 35 years, management related landslides would disturb about 27 acres.

Alternative 4 Direct and Indirect Effects

Alternative 4 proposes 1,694 acres of timber harvest. Approximately 412 acres would be helicopter yarded, 445 acres cable yarded and 837 acres shovel yarded under minimum partial

suspension requirements. In Alternative 4, about 10 miles of temporary and 3 miles of NFS of road construction totaling approximately 13 miles of road. Approximately 68 acres of soil would be disturbed by planned temporary and NFS road construction and rock pit development. About 46 acres of soil disturbance would occur in harvest units and about 3.5 acres of management induced landslides are expected to occur over the next 35 years. Total area of soil with reduced productivity would be about 98 acres (See Table 46). All harvest units would meet Region 10 Soil Quality Standards.

Approximately 19.5 acres of slopes greater than 72 percent gradient would be harvested in Alternative 4. Alternative 4 proposes the least amount of timber harvest proposed on slopes greater than 72 percent of an action alternative. All harvest proposed on slopes greater than 72 percent gradient have been reviewed by a soil scientist and meet the requirements set forth in the Forest Plan.

Cumulative Effects

Alternative 4 would have cumulative effects similar to Alternative 2 but not as extensive. When combined with the harvest anticipated as a result of implementation of projects listed in Appendix D, the amount of timber harvest on the project area would increase to approximately 12,000 acres and the cumulative miles of temporary and NFS road would increase to 163 miles. The number of rock pits would likely increase from 64 to 70. Detrimental soil conditions from all temporary roads, rock pits and within harvest units would be about 710 acres. Soil conditions would be within Region 10 Soil Quality Standards. Alternative 4 proposes approximately 19.5 acres of timber harvest on slopes over 72 percent gradient. These areas have been reviewed for slope stability concerns by a soil scientist. Over the next 35 years, management related landslides would disturb about 25 acres.

Alternative 5 Direct and Indirect Effects

Alternative 5 proposes 3,348 acres of timber harvest. Approximately 1,220 acres would be helicopter yarded, 766 acres cable yarded and 1,362 acres shovel yarded under minimum partial suspension requirements. Approximately 16.5 miles of new planned temporary and NFS roads would be built and approximately 1.5 mile of old temporary road would be reconstructed totaling approximately 18 miles of road. Approximately 99 acres of soil would be disturbed by planned temporary and NFS road construction and rock pit development. About 86 acres of soil disturbance would occur in harvest units and about 7 acres of management induced landslides are expected to occur over the next 35 years. Total area of soil with reduced productivity would be about 164 acres (see Table 46). All harvest units would meet Region 10 Soil Quality Standards.

Approximately 119.5 acres of slopes greater than 72 percent gradient would be harvested in Alternative 5. Alternative five proposes slightly less timber harvest proposed on slopes greater than 72 percent than Alternative 2. All harvest proposed on slopes greater than 72 percent gradient have been reviewed by a soil scientist and meet the requirements set forth in the Forest Plan.

Cumulative Effects

Alternative 5 would have cumulative effects similar to Alternative 2 but not as extensive. When combined with the harvest anticipated as a result of implementation of projects listed in Appendix D, the amount of timber harvest on the project area would increase to 13,650 acres and the cumulative miles of temporary and NFS road would increase to 169 miles. The number of rock pits would likely increase from 64 to 67. Detrimental soil conditions from all temporary roads, rock pits and within harvest units would be about 776 acres. Soil conditions would be within Region 10 Soil Quality Standards. Alternative 5 proposes approximately 119.5 acres of timber harvest on slopes over 72 percent gradient. These areas have been reviewed for slope stability concerns by a soil scientist. Over the next 35 years, management related landslides would disturb about 28 acres.

TRANSPORTATION

National Forest Transportation System roads are constructed to provide access to National Forest System (NFS) lands and are included in the Forest Development Transportation Plan (see Transportation Standards and Guidelines in Chapter 4 of the Forest Plan). They are considered National Forest System (NFS) roads as are other roads that are wholly or partially on NFS lands and are intended to be maintained for the long term (see Chapter 4 for a glossary with transportation terms). With the exception of a few administrative sites and campgrounds, most forest roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads.

The NFS roads in the analysis area were originally built for logging and the associated administration, though incidental recreational and subsistence use occurs throughout the area. Road construction in support of logging activities began in the 1960s. Road construction peaked during the 1980s in support of the pulp mill in Ketchikan.

Affected Environment

NFS roads are managed by a system of maintenance levels, depending on their intended use and suitability for various types of vehicles. These levels range between level 1 (closed), level 2 (suitable for high-clearance vehicles), level 3 (suitable for passenger vehicles, rough surface), level 4 (suitable for passenger vehicles, smooth surface), and level 5 (suitable for passenger cars, dust free, possibly paved).

Road Maintenance and Reconstruction

The maintenance and reconstruction of the existing system depend largely on the volume of timber hauled and, to a lesser extent on recreation use. Road maintenance consists of superficial periodic repairs to an existing road surface, brushing, cleaning, and repairing drainage features. 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. Grading and other maintenance would generally take place more often on a maintenance level 4 road than on a level 3 road, and would be expected to occur less often on a level 2 road. Level 1 roads are left to a self-maintaining condition that requires

little or no maintenance. These tasks are performed to keep the roads in the safe and useful condition for which they were designed. Repairs may be accomplished as annual maintenance.

Maintenance and reconditioning of existing NFS roads is an ongoing process that occurs on a periodic basis. Normally this type of work is determined to fit the category of routine repair and maintenance of roads that do not individually, or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (FSH 1909.15, 31.12). The maintenance and reconditioning of NFS roads in the project area may occur before, during, and after the project analysis. This work is done through separate service contracts to reduce the backlog of deferred maintenance, recondition roads to comply with Best Management Practices, and maintain the existing infrastructure for National Forest Management activities. The timing of this work may coincide with this projects analysis, but is not part of this project. Any effects from ongoing road maintenance and reconditioning work are included in the cumulative effects analysis for this project.

The Operational Maintenance Level (OPML) is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. It reflects the current condition and the ability to drive on the roads in the project area.

Objective Maintenance Level (OBML) is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the operational maintenance level.

The current OPML of NFS roads in the Logjam analysis area are displayed in Table 48. As described under the Methodology section below, the analysis area for the transportation system includes the project area and road segments leading into the project area.

Table 48. NFS Roads in the Logjam Analysis Area

Operational Maintenance Level	Miles
1 - Basic Custodial Care (Closed)	18
2 - High Clearance Vehicles	96
3 - Suitable For Passenger Cars	7
4 - Moderate degree of user comfort	4
Total	**125**

Source: Forest Service I-Web database

Past temporary road construction totals 46 miles. Temporary roads and trails are defined in 36 CFR 211.1 as "A road or trail necessary for emergency operations or authorized by contract, permit, lease or other written authorization that is not a forest road or trail and that is not included in the Forest Transportation Atlas." Temporary roads are decommissioned after their period of use.

Marine Access Facility

A Marine Access Facility (MAF) is an area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, Log Transfer Facility (LTF), boat ramp, or a combination of these. A LTF is used to transfer logs and timber products from land-based transportation forms to water-based transportation forms (or vice-versa). These facilities are often used for the movement of equipment needed for logging and road building. An LTF in Coffman Cove is a viable option for a timber purchaser to move logs off Prince of Wales Island. The Coffman Cove LTF is a sloped shot-rock fill with a mid-tide riprap-buttressed barge loading ramp. The last dive survey was in 2001 with a zone of deposit of 0.18 acres. The Alaska Department of Natural Resources tideland lease number is ADL 27882 expiring in 2021 was transferred to the City of Coffman Cove. The National Pollutant Discharge Elimination Permit (NPDES), AK-G70-0039 was issued on 02/07/2003. This permit has been administratively extended until a new permit can be issued. The Coffman Cove Administrative Site Conveyance Act of 2008 would convey to the City of Coffman Cove approximately 12 acres of National Forest System lands including the LTF. This bill has passed the House of Representatives on April 22, 2008 and is waiting on action from the Senate. Use of this facility would require an agreement with the City of Coffman Cove.

Other MAFs that may possibly be utilized are at Naukati and Thorne Bay. All appropriate permits will be in place prior to using these sites.

Roads Analysis Process

The minimum road system and the identification of needed and unneeded roads have been determined through the roads analysis process. The Roads Analysis Process (RAP) for the project area is a tiered science-based system of analysis. The first layer is the Forest-wide RAP, which is an analysis of the Tongass National Forest. The second layer is the Prince of Wales Roads Analysis which includes the Logjam project area. Copies of these analyses are located in the project record. These analyses recommend an Access and Travel Management Plan for all existing National Forest System roads on Prince of Wales Island. The third layer is the project level analysis, found in the Transportation report. The proposed Access and Travel Management (ATM) plan for the analysis area is in Appendix A of the Transportation report. The ATM Plan for each road in the project area is detailed in the Road Cards of the EIS and those roads selected will become part of the Record of Decision.

The Prince of Wales Access and Travel Management Plan Environmental Assessment (in process, expected publication 2009) incorporates the proposed travel management plan as detailed in the Transportation report. This plan institutes a system of routes designated for motor vehicle use including class of vehicle and if appropriate time of year for motor vehicle use. The designated route system will be shown on a Motor Vehicle Use Map. The ATM plan for the Logjam area is summarized in Table 49. The Record of Decision for the Logjam EIS will include the ATM plan for all NFS roads in the project area, and this decision will be incorporated into the POW ATM.

Table 49. Logjam Analysis Area ATM Plan

Travel Management	Miles
Open and Maintain	28
Open & Maintain With OHV	39
Motorized Trail	11
Storage	43
Decommission	2
Convert to Hiking Trail	2
Total	**125**

Descriptions of Travel Management Designations are provided in the Transportation Resource Report, which is located in the Project record.

Best Management Practices

Best Management Practices (BMPs) are used to assure soil and water resources are considered in transportation planning activities. Specific BMPs are listed by resource on the road cards in Appendix C. Effects of roads on resources are reduced through application of Standards and Guidelines and BMPs. The standards and guidelines particularly relevant to transportation can be found in the Forest Plan (USDA Forest Service 2008) beginning on page 4-80.

Methodology

The analysis area for the transportation system includes the project area and road segments leading into the project area.

Information sources for transportation analysis include the transportation GIS records which house the spatial data for road locations. An inventory of road attributes for National Forest System (NFS) roads is maintained on National Forest through the I-Web database. A complete list of road attributes and definitions of these attributes is located in the project record.

Forest Service personnel have conducted road condition surveys on many of the existing roads in the Logjam Project Area. These surveys supply site specific detailed information about each road (and section of road) surveyed, including:

- Whether the road, or a particular section of the road, is drivable;
- Number, size, and condition of drainage structures and bridges;
- Barriers to vehicle access (e.g., vegetation, barrier ditches, pulled bridges, slides);
- Maintenance requirements; and
- Barriers to fish passage through road drainage structures

This information is used to do the following: (1) identify maintenance trends, (2) provide information for problem analysis, and (3) set priorities for scheduling and funding work. The detailed road condition surveys can be found in the planning record.

Proposed new road construction routes are field reviewed by resource specialists. Specific comments and concerns along with site-specific mitigation measure are discussed in the respective resource reports and the design criteria on the road cards.

Environmental Consequences

Effects Common to all Action Alternatives

Under Alternatives 2, 3, 4, and 5, the ATM plan would be implemented. The proposed maintenance level shown in the Road Cards would be assigned to each road as the Objective Maintenance Level (OBML) and as resources and funding became available roads would be modified to match the assigned OBML. The road management objectives are detailed on the Road Cards for each NFS road in the project area. The annual Motor Vehicle Use Map would show all implemented Access and Travel Management actions. Table 50 summarizes the miles of road available for each traffic type.

Storing roads will reduce access by motorized vehicles and place them in a condition that requires minimum maintenance to protect the environment and preserve the facility for future use. This action removes all culverts on live streams, helping restore natural drainage patterns. Cross drains and ditch relief culverts will be bypassed with deep water bars to minimize the cost of re-using these roads in the future. Roads in storage will remain in a self-maintaining state making more road maintenance funds available. Having more maintenance funds available and less miles open to maintain will help maintain the roads to their operating standards and reducing deferred maintenance cost. The project area will still provide 77 miles of roads open for motorized vehicle access for administrative, recreational, subsistence and other activities with the implementation of an action alternative.

All road construction will follow the applicable BMPs and meet or exceed the Forest plan standard and guides. All newly constructed NFS road will be stored after timber haul and associated activities are complete. This will increase non-motorized access to the area for recreational and subsistence activities.

Under Alternatives 2, 3, 4, and 5, road maintenance would occur on roads used for timber haul. Maintenance activities could include road grading, brushing, ditch cleaning, and culvert cleaning. Other repairs would take place during timber haul operations on an as needed basis. Contracts, permits, road maintenance plans and project design documents will contain appropriate provisions concerning the prevention and/or spread of invasive species along the road system.

Borrow pits and quarries would be needed for road construction. Every two miles of road construction would require about a 2 acre rock pit. Where feasible existing pits will be used; however, most new road construction would require the development of new rock pits. All newly developed borrow pits would be reviewed and cleared by resource specialists prior to development.

All fish streams would be crossed with a bridge or log culvert structure. These structures would be removed after timber harvest and associated activities are complete.

3 Environment and Effects

The following tables will be referred to below in Alternative discussion, and are placed here for easy reference.

Table 50. Total Road Miles in Project Area – Existing and Proposed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total proposed road construction	0	29	15	13	18
Proposed new NFS Road	0	8	2	3	4
Existing NFS Roads	125	125	125	125	125
Total NFS roads after implementation	125	133	127	128	129
Decommissioned Temporary Roads	46	46	46	46	46
Proposed Temporary Road▪	0	21	13	10	14
Reconstruction▫	0	3.2	0	0.8	2.8

▪ Temporary roads are decommissioned after their period of use has expired; they will not be open and drivable and are not counted as part of the National Forest System (NFS) roads network.
▫ Reconstruction is to roads in the NFS roads network and are not counted in the above totals.

Table 51. Estimated Costs of Proposed Road Construction

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
NFS Road	0	$1,400,000	$350,000	$595,000	$700,000
Temporary Road	0	$2,047,000	$1,325,000	$1,023,000	$1,386,000
Reconstruction	0	$96,000	$0	$24,000	$84,000
Total	0	$3,543,000	$1,675,000	$1,642,000	$2,170,000

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

Alternative 1 Direct and Indirect Effects

Under Alternative 1, current management plans would continue to guide the management of NFS roads. All system roads would be managed as directed by the forest plan, road management objectives, and previous NEPA decisions.

Each NFS road has an assigned objective maintenance level. The current objective maintenance level assigned to the road would guide the future management of that road. As resources and funding became available roads would be stored or upgraded to match the currently assigned OBML. Table 50 summarizes the miles of road available for each type of travel.

Alternative 2 Direct and Indirect Effects

Alternative 2 proposes 29 miles of road construction of which, 8 miles is new NFS road. All new construction would be from the existing road system. Approximately, 3 miles of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 21 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete, and about 3.2 miles of road would be reconstructed. Reconstruction activities may include drainage structure replacement, roadbed and subgrade repair, and other activities required to bring the road up to the appropriate traffic service level.

Of the four action alternatives, this alternative proposes the greatest amount of new road construction (Table 50).

This alternative ranks highest in transportation development costs (Table 51). NFS roads in Southeast Alaska are more expensive to build than in other parts of the nation. The major factor that contributes to higher costs is obtaining the rock for the roadbed. Rock is obtained by blasting bedrock, which is then hauled and shaped into a road over typically soft uneven terrain. Other factors that contribute to the high cost of constructing Southeast Alaskan roads include the higher costs of shipping and labor, the numerous drainage structures needed and more complex logistics.

About 27 acres of borrow pits would be needed to obtain rock for road construction.

This alternative proposes 0.7 miles of construction in the Thorne River Inventoried Roadless Area (IRA) #511, and 0.3 miles of construction in the Sarkar IRA #514. Approximately 0.1 mile of this would be NFS road and the remainder would be temporary road. The NFS road would be stored and the temporary road decommissioned after timber haul and associated activities are complete.

New road construction would cross 27 fish streams that may require site-specific design for volume of flow, fish habitat, or other design complexity. All fish streams will be crossed with a bridge or log culvert structure. These structures will be removed during road storage after timber harvest and associated activities are complete. Road cards in Appendix C have site specific details.

Alternative 3 Direct and Indirect Effects

Alternative 3 proposes 15 miles of road construction of which, 2 miles is new NFS road. All new construction would be from the existing road system. About 1.5 miles of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 13 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. No reconstruction is proposed with this alternative.

Of the four action alternatives, this alternative proposes the third highest amount of new road construction (Table 50) and ranks third in transportation development costs (Table 51).

About 13 acres of borrow pits would be needed to obtain rock for road construction.

New road construction would cross 6 fish streams that may require site-specific design for volume of flow, fish habitat, or other design complexity. All fish streams will be crossed with a bridge or log culvert structure. These structures will be removed during road storage after timber harvest and associated activities are complete. Road cards in Appendix C have site specific details.

Alternative 4

Direct and Indirect Effects

Alternative 4 proposes 13 miles of road construction of which, 3 miles is new NFS road. All new construction would be from the existing road system. About 1 mile of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 10 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete; 0.8 miles of road would be reconstructed.

Of the four action alternatives, this alternative proposes the least amount of new road constructions (Table 50) and ranks fourth in transportation development costs (Table 51).

About 12 acres of borrow pits would be needed to obtain rock for road construction.

New road construction would cross 7 fish streams that may require site-specific design for volume of flow, fish habitat, or other design complexity. All fish streams will be crossed with a bridge or log culvert structure. These structures will be removed during road storage after timber harvest and associated activities are complete. Road cards in Appendix C have site specific details.

Alternative 5 Direct and Indirect Effects

Alternative 5 proposes 18 miles of road construction of which, 4 miles is new NFS road. About 1.5 miles of decommissioned temporary roadbed would be used as a road base for new construction. All new construction would be from the existing road system. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 14 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. Reconstruction would include 2.8 miles of road.

Of the four action alternatives, this alternative proposes the second highest amount of new road construction (Table 50) and ranks second in transportation development costs (Table 51).

About 18 acres of borrow pits would be needed to obtain rock for road construction.

New road construction would cross 11 fish streams that may require site-specific design for volume of flow, fish habitat, or other design complexity. All fish streams will be crossed with a bridge or log culvert structure. These structures will be removed during road storage after timber harvest and associated activities are complete. Road cards in Appendix C have site specific details.

Cumulative Effects

The cumulative effects analysis area for the transportation system includes the project area and road segments leading into the project area. Past, present and reasonably foreseeable actions considered in this analysis are located in Appendix D. Roads extending from within the project area and terminating outside the project area are also included as travel within the project area is required to reach these road segments.

State Highway road improvements are currently in progress on roads 2300000, 3000000, and 3030000 (also referred to as the Coffman Cove Road) through the project area. These State Highway improvements include road widening, realignment, and asphalt paving. Approximately 21.5 miles of highway improvements are taking place in and around the analysis area. This work is scheduled for completion in 2008.

The Inter-Island Ferry Authority has begun seasonal ferry service between Coffman Cove, Wrangell, and Petersburg several times a week. This has the potential for increasing traffic in the project area.

Maintenance of existing NFS road will be ongoing in the project area regardless of the alternative selected. Periodic brushing and road grading projects may occur during the life of the project. Any potential contracts for maintenance and reconditioning would be designed to avoid interference with the proposed timber sale.

The Prince of Wales Island Access and Travel Management Plan (POW ATM) proposes road storage, decommissioning, motorized trail development and other roadwork. Pending a decision document these actions will be implemented in the foreseeable future as funding becomes available (Table 52).

Table 52. Travel Management Plan for Logjam Project Area with Implementation of ATM Plan (miles)

Travel Management of NFS roads	Alt. 1*	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Open & Maintain	75	28	28	28	28
Open & Maintain With OHV	0	39	39	39	39
Motorized Trail	0	11	11	11	11
Storage (no motorized access)	49	51	45	46.3	47
Decommission (no motorized access)	0	2	2	2	2
Convert to Hiking Trail (no motorized access)	0	2	2	2	2
Total Motorized Access	**75**	**77**	**77**	**77**	**77**

*Based on objective maintenance level currently assigned (i.e., the desired future condition).

The POW ATM is currently in progress and expected to be completed in 2009. The Logjam Timber Sale EIS road management objectives are compatible with those in the ATM. All work to be performed will implement Forest Plan standards and guidelines, including BMPs to assure water quality standards are achieved.

3 Environment and Effects

Biological Environment

BOTANY

This section provides a summary of the botany resource in the Logjam project area. Full discussion of the botany resource is in the Biological Assessment and Botany Resource Report located in the project record.

Affected Environment

The only threatened, endangered, or proposed threatened or endangered plant in Alaska is *Polystichum aleuticum*, which is listed as endangered. It is only known from Adak Island and is not expected to occur in the project area.

There are eight sensitive plant species that may occur on the Thorne Bay District, one of these, the Queen Charlotte butterweed has been documented in the Logjam project area. Table 53 shows the sensitive plants that are known or suspected to occur in the Thorne Bay Ranger District.

Table 53. Sensitive plants suspected or known to occur on the Thorne Bay Ranger District.

Scientific Name	Common Name	Presence
Carex lenticularis var. dolia	Goose-grass sedge	Suspected
Glyceria leptostachya	Davy mannagrass	Known
Hymenophyllum wrightii	Wright filmy fern	Suspected
Isoetes truncata	Truncate quillwort	Suspected
Ligusticum calderi	Calder lovage	Suspected
Poa laxiflora	Loose-flowered bluegrass	Suspected
Senecio moresbiensis	Queen Charlotte butterweed	Known
Romanzoffia unalaschcensis	Unalaska mist-maid	Suspected

Recent studies of the nineteen vascular plants are designated as Sensitive in the Alaska Region plants resulted in taxonomic revisions of six of them. Based on the work of taxonomic authorities, these six plants are now included in more broadly distributed or abundant taxa. Because of this they no longer warrant status as being Sensitive Species and will be removed from the list, which is undergoing revision. The six taxa and brief description of their taxonomic status are shown here:

- *Arnica lessingii* ssp. *norbergii* is not recognized by Wolf (2006) in the Flora of North America (he recognizes no subspecies within *Arnica lessingii*);
- *Carex lenticularis* var. *dolia* now includes the somewhat more common *C. enanderi* (Standley et al., 2002);

- *Draba kananaskis* is considered to be a synonym for the more common *D. juvenilis* (Al-Shehbaz et al., in press);
- *Platanthera gracilis* is considered to be a synonym for *P. stricta* (Sheviak, 2002) although they differ somewhat;
- *Puccinellia glabra* and
- *Puccinellia kamtschatica are* both considered to be synonyms for the widespread P. *nutkaensis* (Davis & Consaul, 2007).

Sensitive plant surveys for the Logjam Timber Sale were conducted in 2003 and 2004. A total of 46 units were surveyed (71 percent of the remaining unit pool). Almost 20 miles of road, approximately 69 percent of the planned roads, were surveyed as well. Only one species of listed sensitive plants was discovered within the Logjam Project Area. The Queen Charlotte butterweed (*Senecio moresbiensis*) was documented in several locations within the project area boundary.

All sensitive plant species are discussed in the Biological Assessment/ Biological Evaluation (BA/BE) for this EIS. The effects analysis in the BA/BE is required to address any direct, indirect and cumulative effects of an action on threatened or endangered species or their critical habitat (50 CFR 402.2) and on sensitive species or their habitat (FSM 2672.42). The BA/BE also complies with Section 7 of the Endangered Species act (ESA) which requires all Federal Agencies in consultation with the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to insure that their actions are not likely to jeopardize the continued existence of threatened, endangered or sensitive species or their habitat.

Sensitive plant populations were discovered in or near four planned units. Five other uncommon plant species were discovered in the project area as well.

The Queen Charlotte butterweed (*Senecio moresbiensis*) was the only species listed as sensitive that was found in the project area. Populations of this species were located in four different areas. The Queen Charlotte butterweed populations were found mostly in wetland areas. This species was found in or near units 577-31, 577-34, 577-40 and 577-41. The Queen Charlotte butterweed has a ranking of G3 S2 with the Alaska Natural Heritage Program. The G2 indicates that this species is either rare and local throughout its range, or found locally in a restricted range. The S2 means that it is imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state.

There are about 75 individuals of this species known to exist in five different muskegs in four units, 577-31, 577-34, 577-40, and 577-41, within the project area. This project area has been heavily impacted in the past by both timber harvest and road construction. This past activity occurred before sensitive plants were being inventoried, and as a result, there is no documentation of the effect, if any, of these past activities on the populations of Queen Charlotte butterweed.

Below is a discussion of the units within the Logjam project area that have sensitive plant populations documented in them.

577-31: The butterweed in this unit was discovered in a sedge fen/meadow area. The population size at this location is about 20 plants. The area is dominated by two species of sedge, *Carex sitchenis* and *C. vuride*. Other species include columbine, mountain and western hemlock, yellow cedar, shore pine and Labrador tea. *Malaxis monophyllos* was also discovered in this unit.

577-34 :There were 12 stems of the butterweed found in this location. They are in an undisturbed meadow surrounded by forest. The dominate species were an unknown sedge and *Carex sitchenis*. Other species in the immediate area included skunk cabbage and bracken fern. Tree species included western and mountain hemlock as well as Sitka spruce. All three tree species only amounted to 8 percent cover.

577-40 :This population of *Senecio* is just outside the unit boundary to the north. As the unit and road are planned the population should not be affected. Substantial populations of *Listera convallarioides* and *Malaxis monophyllos* were found in the muskegs and wetlands surrounding the unit.

577-41: This unit contains and is adjacent to areas of unusually high plant diversity. At the western and northern edges of the unit were sedge meadows both of which contained *Senecio.* A total of 40 stems were counted. Within the unit there are some populations of plants of special interest including *Listera convallarioides* and *Malaxis monophyllos*. In the karst area there are a lot of ferns that are only found on karst limestone and are infrequently encountered. The dominate plants found in this unit included shore pine and coastal fleabane, at 15 percent and 10 percent respectively. The highest percentage of cover for any other species was 5 percent.

Special Interest Plants

There were several other areas within the project area in which plants of special interest were discovered. In unit 573-12 populations of *Listera convallarioides* were found and in 573-14 the fern *Botrychium multifidium* was found. Unit 577-29 has *Platanthera gracilis* in it and 577-44 has a high degree of plant diversity. 573-83, 577-84 and 577-90 have Platanthera orbiculata, *Listera convallarioides* and *Botrychium multifidium* and *Botrychium multifidium* in them respectively.

Listera convallarioides, Broad-leaved twayblade, is considered very rare in Southeast Alaska. *Platanthera orbiculata* or round-leaved rein-orchid is much less common than the Alaska rein-orchid although it occurs over a similar range. The fern *Botrychium multifidium*, leathery grape fern, has occasionally been documented during plant surveys on the island.

Environmental Consequences

All action alternatives associated with the Logjam timber sale could result in some degree of direct effects to the sensitive plants documented in the area.

The action alternatives for the Logjam project may affect the known populations of Queen Charlotte butterweed in three of five known locations. There is only one known populations within any current unit boundary (Unit 577-41). Harvest of this unit as planned could negatively impact this population. Two populations are along planned road locations,

accessing Units 577-34 and 577-40. Construction of the two roads as planned for the Logjam project could have an adverse effect on these two populations of Queen Charlotte butterweed. One population is located well outside the planned unit boundary (also Unit 577-41) and another is located in an area of high value wetland that has been deferred from Unit 577-31. These two populations would not be affected by any planned Logjam activities.

The botany cumulative effects area is Prince of Wales Island because of the fact that most of the species listed as occurring on the Thorne Bay district occur on the entire Island. Past, present and reasonably foreseeable future actions considered in the cumulative effects analysis are located in Appendix D.

Queen Charlotte Butterweed and Plants of Special Interest

Alternative 1 Direct and Indirect Effects

No impacts are anticipated under the No Action Alternative to the known populations of these sensitive plant species within the Logjam project area.

Cumulative Effects

No cumulative effects are anticipated under the No Action Alternative.

Alternative 2 Direct and Indirect Effects

Implementation of this alternative would result in impacts to the known populations of the Queen Charlotte butterweed in units 577-31 and 577-41, but not for the populations in units 577-34 or 577-40.

Alternative 3 Direct and Indirect Effects

Implementation of this alternative would result in impacts to the known populations of the Queen Charlotte butterweed in units 577-31 and 577-41 but not for the populations in units 577-34 or 577-40.

Alternative 4 Direct and Indirect Effects

Implementation of this alternative would result in no impacts to the known populations of the Queen Charlotte butterweed in units 577-31, 577-34, 577-40, and 577-41. The populations for units 577-34 and 577-40 are outside the planned unit boundary for this alternative and units 577-31 and 577-41 have been dropped for this alternative.

Alternative 5 Direct and Indirect Effects

Implementation of this alternative would result in impacts to the known populations of the Queen Charlotte butterweed in units 577-31 and 577-41 but not for the populations in units 577-34 or 577-40.

Cumulative Effects (Alternatives 2, 3, 4 and 5)

There may be cumulative effects to the Queen Charlotte butterweed and the plants of special interest as a result of the Logjam Timber Sale. The cumulative effects would be the potential loss of three of the five known locations of this species. There may have been unknown previous negative impacts to this species in the project area. It is unlikely that these combined negative effects to the Queen Charlotte butterweed would tend it toward being listed as a threatened or endangered species.

FISHERIES

Streams and lakes within the Logjam project area provide habitat and contribute to the production of fish that support the local subsistence, sport, guided (both freshwater and saltwater), and commercial fisheries of the area, and are a major food source for many wildlife species. Fish and aquatic resources on the Tongass National Forest provide major subsistence, commercial, and sport fisheries, as well as traditional and cultural values. Abundant rainfall and watersheds with high stream densities provide an unusual number and diversity of freshwater habitats. These abundant freshwater systems on the Tongass National Forest provide spawning and rearing habitat for most of the fish produced in Southeast Alaska.

Watershed descriptions can be found in Issue 1 section above and in the Watershed and Fisheries Resource Reports.

Affected Environment

This section describes the affected environment and existing condition in the watersheds where activities are proposed. Table 4 under Issue 1 lists watershed acres.

Alaska Department of Fish and Game (ADF&G) developed a rating system to rank VCUs on the Tongass National Forest according to their relative resource value. Consequently, ADF&G recommends that those VCUs that have the highest resource value should be managed to reduce risks to fish and wildlife and their habitats. VCU 5770 is primarily the Logjam Watershed. ADF&G lists VCU 5770 as a primary sportfish producer and a secondary salmon producer (Flaunders et al. 1998). Logjam watershed scored low on the salmon producer because ADF&G include pink salmon escapement number into their rating system. Logjam watershed has a low escapement of pink salmon because of a barrier waterfall low in the system. Therefore, the secondary salmon producer rating is based primarily on coho smolt capability.

VCU 5730 is comprised of the following watersheds: all of Sweetwater Lake; all of Trumpeter Creek; majority of Galligan Creek; lower half of Gold Lagoon; and a small percentage of Barnes Lake and Coffman Creek. ADF&G lists VCU 5730 as a primary sportfish producer and a primary salmon producer (Flaunders et al. 1998). Therefore, these watesheds are considered a high priority for protection of fish habitat.

The Logjam project area has over 433 miles of streams and 2,754 acres of lakes and ponds. Streams are differentiated by process group, channel type and by Aquatic Habitat

Management Unit (AHMU) class. Process groups describe the geomorphic properties of stream channels and their general location in the landscape, while channel types further differentiate channels within process groups. AHMU class, channel types and process groups are used to assign appropriate buffers. Methods of determining channel type and process group are in FSH 2090.21 (USDA Forest Service 2001).

Stream Habitat

AHMU Stream Class

The Alaska Region stream value classification is based on subsistence, recreational, and economic fish harvest considerations. The value classes do not imply either ecological importance or prioritization of fish harvest over maintenance of watershed function. Stream classes are as follows:

1. Class I: Streams and lakes with anadromous (migrating from the ocean) or adfluvial (migrating from lakes) fish or fish habitat; or, high quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

2. Class II: Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradients where no anadromous fish occur, and otherwise not meeting class I criteria.

3. Class III: Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability.

4. Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability. Class IV streams are too small to be mapped on aerial photographs, thus they appear only where field mapping has taken place.

Stream classes provide a means to categorize stream channels based on their fish production values. Stream classes I and II receive more protection because they have fish populations. Table 54 shows the total length of stream (in miles) for each stream class in each watershed. The length of Class I and II streams for each watershed will give an indication of which watersheds have more fish habitat.

Table 54. Miles of stream by AHMU class by watershed

Watershed	Class I	Class II	Class III	Total
Barnes Lake	7.2	2.2	2.3	11.7
Coffman Creek	4.8	1.7	5.1	11.6
Galligan Creek	17.6	4.5	7.6	29.7
Gold Lagoon	7.4	2.4	2.0	11.8
Gutchi Creek	11.8	3.7	1.2	16.7
Hatchery Creek	63.9	29.4	61.1	154.4
Lake Bay Coastal	7.5	2.2	1.2	10.9
Logjam Creek	87.8	40.1	42.8	170.7

Watershed	Class I	Class II	Class III	Total
Naukati Creek	26.5	11.6	5.9	44.0
Staney Creek	110.5	32.8	191.3	334.6
Sweetwater Lake	25.1	8.9	21.5	55.5
Trumpeter Creek	12.0	4.8	34.2	51.0
TOTAL	**382.1**	**144.3**	**376.2**	**902.6**

Note: Numbers are rounded to the nearest 0.10. Class IV streams are not included due to incomplete inventory.

Lake Habitat

Lakes play an important role in water storage, and are also important sources of fish habitat, especially for juvenile sockeye salmon and resident Dolly Varden and cutthroat trout. Lakes provide needed over-wintering habitat for coho and sockeye salmon, steelhead trout, and resident Dolly Varden and cutthroat trout. Table 55 shows that amount of lake acres are in the project area and its designated lake class.

Table 55. Acres of Lake by AHMU class in the project area by watershed.

Watershed	Total Watershed Lake Acres	Percent of Lake Acres in Project	Land-locked Lake Acres	Class I	Class II	Class III	Total Lake Acres in the Project Area
Barnes Lake	3.4	0	0	0	0	0	0
Coffman Creek	5.3	0	0	0	0	0	0
Galligan Creek	189.0	80%	0	151.0	0	0	151.0
Gold Lagoon	13.5	68%	1.7	7.5	0	0	9.2
Gutchi Creek	66.2	0	0.3	0	0	0	0.3
Hatchery Creek	880.2	3%	1.5	24.2	0	0	25.7
Lake Bay Coastal	0.3	0%	0	0	0	0	0
Logjam Creek	472.3	99%	39.5	397.3	31.4	2.3	470.5
Naukati Creek	265.3	0	0	0	0	0.5	0.5
Staney Creek	206.9	29%	1.4	58.2	0	0	59.6
Sweetwater Lake	2004.3	100%	1.4	2001.4	1.5	0	2004.3
Trumpeter Creek	32.9	100%	3.5	0	0.7	28.8	33.0
TOTAL	**4139.6**	**66%**	**49.3**	**2639.6**	**33.6**	**31.6**	**2754.1**

Note: Numbers are rounded.

Fish Species in the Project Area

Resident and anadromous fish that utilize habitat within watersheds of the proposed project are included in Table 56. Detailed descriptions of habitat requirements at various life stages and important fish bearing streams are described in the Fisheries Resource Report located in the Project record.

Table 56. Resident and Anadromous Fish Species in the Logjam Project Area

Scientific Name	Common Name	Watersheds with fish species
Oncorhynchus kisutch	Coho (Silver) salmon Coho salmon ■	Barnes Lake, Coffman Creek, Galligan Creek, Gold Lagoon, Gutchi Creek, Hatchery Creek, Lay Bay Coastal, Logjam Creek, Naukati Creek, Staney Creek, Sweetwater Lake, Trumpeter Creek
Oncorhynchus gorbuscha	Pink salmon■	Barnes Lake, Coffman Creek, Galligan Creek, Gutchi Creek, Hatchery Creek, Lake Bay Coastal, Logjam Creek, Naukati Creek, Staney Creek, Sweetwater Lake, Trumpeter Creek
Oncorhynchus keta	Chum salmon	Barnes Lake, Galligan Creek, Gutchi Creek, Logjam Creek, Naukati Creek, Staney Creek, Sweetwater Lake, Trumpeter Creek
Oncorhynchus nerka	Sockeye Salmon	Barnes Lake, Hatchery Creek, Logjam Creek, Sweetwater Lake,
Oncorhynchus mykiss	Steelhead trout	Barnes Lake, Hatchery Creek, Logjam Creek, Naukati Creek, Staney Creek, Sweetwater Lake
Oncorhynchus clarki	Cutthroat trout■	Barnes Lake (a,r), Hatchery Creek (a,r), Lay Bay Coastal (a), Logjam Creek (a,r), Staney Creek (a,r), Sweetwater Lake (a)
Salvelinus malma	Dolly Varden■	Barnes Lake (a,r), Coffman Creek (r), Galligan Creek (r), Gold Lagoon (r), Gutchi Creek (r), Hatchery Creek (a,r), Lay Bay Coastal (a), Logjam Creek (a,r), Naukati Creek (a,r), Staney Creek (a,r), Sweetwater Lake (a), Trumpeter Creek (r)

■ Management Indicator Species
Key: a – anadromous, r – resident

Threatened, Endangered, and Sensitive Fish Species

There are no fish species in the analysis area or within inside waters of the Tongass National Forest that are listed federally (FWS or NMFS) or under the State of Alaska Endangered Species Act.

The Regional Forester has identified three fish species as sensitive in Region 10. Sensitive fish species include the Island King Salmon, Fish Creek chum salmon, and the northern pike. None of the sensitive fish species occur in or near the project area. No further discussion is

needed concerning these fish species. The Biological Assessment/Biological Evaluation provides more details on Threatened, Endangered and Sensitive fish species.

Stream Crossings

In the Logjam project area, surface road erosion and road prism failures are probably the dominant process by which management disturbance results in occasional sedimentation events. These processes are discussed and effects estimated in Issue 1 section.

The Aquatic Habitat Management Handbook (USFS 2001) specifies guidelines for fish passage through culverts. These guidelines will be followed in all proposed road reconstruction and new road construction in the Logjam project area.

The guiding criteria for culvert design, is to allow for natural migration by adult and juvenile fish through the culvert during various flows. The Tongass National Forest developed a juvenile fish passage evaluation criteria matrix with an interagency group of professionals. The evaluation matrix stratifies culverts by type, and establishes thresholds for culvert gradient, stream channel constriction, debris blockages, and vertical barrier (or perch) at culvert outlet. Culvert categories are:

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

Most stream crossing structures on roads in the Logjam Timber Sale have been surveyed at least once to determine function, and have been categorized as green, gray or red. There are 41 red, 5 gray and 48 green crossings in the project area, according to the RCS database (Tongass Road Condition Survey database) as shown in Table 57. Additionally there are 11 crossings that were not identified as fish stream crossings during the road condition surveys, and an analysis of fish passage status has not been completed (they were identified during the design phase of the Federal Highways Coffman Cove Road Project). Out of the 72 red, gray and non-category crossings, 26 crossings have been replaced during the Federal Highways Coffman Cove Road Project. All the stream crossings involved in the realignment will be resurveyed after the roads are paved in 2008 to determine if fish passage has been achieved.

Table 57. Fish passage in the project area by watershed.

Watershed	Green Crossings	Gray Crossings	Red Crossings	Total Fish Crossings
Barnes Lake	0	0	0	0
Coffman Creek	0	0	0	0
Galligan Creek	4	0	3	7
Gold Lagoon	0	0	0	0

Watershed	Green Crossings	Gray Crossings	Red Crossings	Total Fish Crossings
Gutchi Creek	0	0	0	0
Hatchery Creek	0	0	0	0
Lake Bay Coastal	0	0	0	0
Logjam Creek	21	4	22	47
Naukati Creek	0	0	0	0
Staney Creek	0	0	1	1
Sweetwater Lake	19	0	13	32
Trumpeter Creek	4	1	2	7
TOTAL	**48**	**5**	**41**	**94**

Note: Includes only crossings within the Logjam project area.

Methodology

The interdisciplinary team used channel type mapping, anadromous stream RCS data catalog and field surveys to verify channel type and stream class in the vicinity of proposed activities as a basis for effects analysis.

The effects of the alternatives were compared using quantitative variables such as number of existing stream crossings and proposed stream crossings, miles of existing road and proposed road construction, acres of past riparian management area harvested, miles of existing roads in Riparian Management Area (RMA), acres of past and proposed harvest and percent canopy removed.

See Fisheries Resource Report for more information on methods used.

Environmental Consequences

See Issue 1 section for the effects analysis of stream habitat, water quality and water yield.

Effects Common to all Action Alternatives

Large Woody Debris

In all alternatives the standards and guidelines for the riparian management areas were followed and in some alternatives, exceeded. The design of RMA buffers is described in the unit cards. These site-specific designs are expected to effectively protect water quality and

fish habitat. Large Woody Debris recruitment and spacing would remain therefore having no direct or indirect effects and thus no cumulative effects on fish habitat.

Windthrow

The IDT considered windthrow risk and precautionary measures to protect RMAs, this is discussed in detail in the silviculture section of this Chapter.

Fish Passage

The Forest Service is required to provide passage for aquatic species under the Clean Water Act (CWA) in the following manner: CWA Section 404 permitting requirements exempt the Forest Service from 404 permitting only if they are constructed and maintained in accordance with BMPs specified in 33 CFR 323.4(a). Providing aquatic passage is one of those BMPs. If the Agency does not provide passage then a 404 permit must be obtained.

All fish stream crossings in all action alternatives will be designed to pass fish. In addition, all structures will be removed and new roads placed in storage after the timber sale is complete. These actions are expected to result in no direct or indirect effects to fish passage in the project area as all fish crossings will be crossed with bridges. The number of fish streams crossed by alternative is provided in Table 10 Issue 1 section.

Direct, indirect and cumulative effects to aquatic habitat can be found in Environmental Consequences section under Issue 1. No further discussion will be provided in this section.

Essential Fish Habitat Assessment

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act states that all federal agencies must consult the National Marine Fisheries Service (NMFS) for actions and proposed actions that may adversely affect essential fish habitat. The Act promotes the protection of essential fish habitat through review, assessment, and mitigation of activities that may adversely affect these habitats. Consultation procedures have been documented in an attachment to a June 26, 2007 NMFS letter to the Regional Forester.

There are four main steps in the consultation process:

1. The Forest Service determines if the proposed action will have “no adverse effect” or if it “may adversely affect” EFH. Only the “may adversely affect” determination triggers consultation.
2. An EFH Assessment is prepared by the Forest Service as a component of the NEPA document and forwarded to the NMFS to initiate formal consultation.
3. The NMFS will respond in writing as to whether it concurs with the conclusion in the EFH Assessment and may provide conservation recommendations to further minimize effects of the action on EFH.
4. The Forest Service must provide a written response to NMFS within 30 days explaining the evaluation of the conservation recommendations. The response may include reasons for not following the recommendations.

Documentation of the consultation process will be included in the FEIS.

Essential Fish Habitat (EFH) is the water and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. Federally managed species under the jurisdiction of the North Pacific Management Council, managed by NMFS and included in a fishery management plan. Freshwater EFH includes streams, rivers, lakes, ponds, wetlands and other bodies of water currently and historically accessible to salmon. Marine EFH in Alaska includes estuarine and marine areas from tidally submerged habitat to the 200-mile exclusive economic zone.

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

Description of the Proposed Action

The proposed action (Alternative 2) for the Logjam Timber Sale would harvest 3,703 acres of Forest Service land and construct about 29 miles of road on Prince of Wales Island. The other three action alternatives propose harvest ranging from about 1,694 to 3,348 acres and new road construction ranging from approximately 12 to 18 miles. The new road construction includes both temporary and system roads, which all will be decommissioned or placed into storage after timber harvest and associated activities are complete. All fish streams will be crossed with a bridge or log culvert structure. These structures will be removed during road storage after timber harvest and associated activities are complete. Various yarding systems including cable, shovel, and helicopter are proposed. Logs will either be truck to mills on the island or barged from one of the MAFs discussed below. A complete description of the proposed action and all of the alternatives can be found in Chapters 1 and 2 of the DEIS.

Potential Adverse Effects on Freshwater EFH

The Logjam project area has over 1,000 known miles of stream in twelve watersheds. Of this total, 382.1 miles are Class I streams (see Table 4). Logjam Creek, Sweetwater Lake, Hatchery Creek and tributaries are important fish bearing streams in the Logjam Timber Sale project area. Logjam Creek, Sweetwater Lake, and Hatchery Creek have Pink, Chum, Sockeye and Coho Salmon, Dolly Varden, Cutthroat and Steelhead trout (ADNR/ADF&G, 2007). Table 58 shows the salmon species and their life stage that could be affected by the Logjam Timber Sale.

Table 58 Salmon species and their freshwater life stages that could be affected by the Logjam Timber Sale Project

Salmon Species	Freshwater Eggs	Freshwater Larvae and Juveniles	Estuarine Juveniles	Freshwater Adults
Pink	X	X	X	X
Chum	X	X	X	X
Sockeye	X	X	X	X
Coho	X	X	X	X

3 Environment and Effects

The Forest Service has determined that the Logjam Timber Sale may adversely affect freshwater EFH in streams in the Logjam Timber Sale area. These potential impacts include increased stream-flows, increased sediment delivery, altered riparian vegetation, disturbed channel integrity and potential blockage of upstream movement of fish at road crossings.

The Forest Service has determined that all action alternatives would result in minor effects on water quality and aquatic habitat (see discussion under Issue I and Fisheries section in Chapter 3).

By following the standards and guidelines in the Forest Plan, the effects on EFH will be minimized for the following reasons:

- Stream buffers will protect all Class I, II and III streams. Class I and II streams will receive a minimum no-cut buffer of 100 feet and Class III streams will receive a slope break buffer in accordance with the Forest Plan and TTRA.
- Additional precautionary measures will be prescribed to reduce windthrow in RMAs where the risk of windthrow is high. These measures include retaining additional trees adjacent to the RMA.
- Best Management Practices (BMPs) will be implemented to protect water quality and aquatic habitat protection for all freshwater streams within the project area. See unit cards for specific applications of BMPs.
- Bridges or log culverts will be placed over fish streams on road crossings to avoid risks of channel disturbance and culvert blockage. All crossings will be removed after the timber sale.
- No new roads will be built in Class I or II riparian management areas.

Marine EFH

The three Marine Access Facilities that the Logjam Timber Sale may use are the Coffman Cove, Thorne Bay, and Naukati MAFs. A Marine Access Facility (MAF) is an area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, LTF, boat ramp, or a combination of these. A Log Transfer Facility (LTF) is used to transfer logs and timber products from land-based transportation forms to water-based transportation forms (or vice-versa). These facilities are often used for the movement of equipment needed for logging and road building.

Coffman Cove MAF

The MAF in Coffman Cove is a viable option for a timber purchaser to move logs off Prince of Wales Island. The Coffman Cove MAF is a sloped shot-rock fill with a mid-tide riprap-buttressed barge loading ramp. This is a barge loading only facility. The last dive survey was in 2001 with a zone of deposit of 0.18 acres. The Forest Service conducted an over lapping dive survey in 2003 from the LTF to the new site of the IFA ferry dock to identified eel grass beds. Only one eel grass bed was found close to the MAF site which covered approximately one meter squared. The majority of the intertidal plant growth was *Fucus* sp. (rockweed), *Desmarestia viridis*, and *Halosaccion glandiforme* (sea sac).

The Alaska Department of Natural Resources tideland lease number is ADL 27882 expiring in 2021 was transferred to the City of Coffman Cove. The National Pollutant Discharge Elimination Permit (NPDES), AK-G70-0039 was issued on 02/07/2003. This permit has been administratively extended until a new permit can be issued. Use of this facility would require an agreement with the City of Coffman Cove.

Thorne Bay MAF

The MAF in Thorne Bay is viable option for a timber purchaser to move logs off Prince of Wales Island. The sort yard has a trap to reduce sedimentation entering the waters of Thorne Bay. The Thorne Bay MAF is listed as a Tier I, Category 5, Section 303(d) water quality limited water body (ADEC 2003). The Thorne Bay MAF (Alaska ID #1010362) was placed on the 1996 Section 303(d) list for debris (bark and woody material from the MAF and log raft area), and hydrogen sulfide (ADEC 1996, pg 39). Excess debris from the MAF has accumulated on the bottom of Thorne Bay. Review of the data in 1998 showed that the levels of hydrogen sulfide complied with water quality standards outside the mixing zone authorized for dredging. Hence, hydrogen sulfide was removed from the listing by ADEC in 1998 (ADEC 1999, pg 5).

While the MAF is in operation, dive surveys must be conducted annually to monitor bark accumulation (ADEC requirement). Bark debris has been shown to smother natural substances and potentially reduce prey organisms. The last dive to monitor the bark deposit took place during April 2004. The MAF had an area with continuous bark cover of 6.45 acres and an area with discontinuous bark cover of 2.26 acres. Thorne Bay has a zero maximum daily loading for the bark contaminant; therefore this is a barge loading only facility.

Naukati MAF

The MAF in Naukati is a least viable option for a timber purchaser to move logs off Prince of Wales Island. The Naukati LTF was removed and reconstruction of this facility would require multiple permit applications and modifications. The last dive survey was in 2001 with a zone of deposit of zero (0) acres. There are extensive eel grass beds immediately adjacent to the log transfer area and are only 20 to 50 feet away. The eel grass beds currently have sediment blanketing the beds and additional sediment will adversely affect the eel grass habitat for marine and estuarine species. This could lead to sediment covering benthic organisms which may be used as prey, or loss of visibility of prey in the water column. Furthermore, suspended sediment can reduce feeding and growth, cause respiratory impairment, reduced tolerance to disease and toxicants, produce physiological stress, and decrease distribution. Deposited sediment primarily affects the physical habitat – space of adequate quantity and quality to provide for fish needs. Eel grass beds provide rearing habitat for out-migrant salmonids and marine species. The rearing habitat for juveniles is the most critical. It is well known that the greatest mortality of a given year or cohort occurs in young stages, and that the strength of a year-class is most often set in some early critical phase (Elliott 1989).

The Forest Service has determined that the use of these MAFs may adversely affect marine EFH. The potential effects on marine EFH include diminished habitat for managed species and their prey due to placement of shot rock and reduced rearing capability for juvenile salmon due to potentially reduced water. Table 59 and Table 60 show the fish species that are

located in the marine environments and their life stage that could be affected by the use of the LTFs for the Logjam Timber Sale.

Table 59. Marine species and their life stages that could be affected by the Logjam Timber Sale Project.

Species	Eggs	Larvae	Early Juvenile	Late Juvenile	Adults
Arrowtooth Flounder (*Atheresthes stomias*)		X		X	X
Atka Mackerel (*Pleurogrammus monopterygius*)		X			X
Dover Sole (*Microstomus pacificus*)	X	X		X	X
Flathead Sole (*Hippoglossoides elassodon*)	X	X		X	X
Pacific cod (*Gadus macrocephalus*)	X	X		X	X
Pacific Ocean Perch (*Sebastes alutus*)		X		X	X
Rex Sole (*Glyptocephalus zachirus*)	X	X		X	X
Rock Sole		X		X	X
Sablefish (*Anoplopoma fimbria*)	X	X		X	X
Sculpin (*Cottidae* family)				X	X
Shortraker/Rougheye Rockfish (*Sebastes borealis*)		X			X
Skates (*Rajidae family*)					X
Squid				X	X
Walleye Pollock (*Theragra chalcogramma*)	X	X		X	X
Weathervane Scallops				X	X
Yelloweye Rockfish (*Sebastes ruberrimus*)		X		X	X
Yellowfin sole (*Limanda aspera*)	X	X		X	X

Table 60. Salmon species and their marine life stages that could be affected by the Logjam Timber Sale Project

Salmon Species	Estuarine Juveniles	Marine Juveniles	Marine Immature and Maturing Adults
Pink	X	X	X
Chum	X	X	X
Coho	X	X	X

Primary prey items for the following species are based on the Gulf of Alaska Fishery Management Plan (NPFMC 1998):

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

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

- Atka Mackerel are a schooling semi-demersal fish. Juveniles and adults eat mainly copepods and euphausiids, but have been known to eat shrimp, gastropods, annelids, and fish eggs and larvae.
- Rock Sole eggs are adhesive and are laid on the bottom of the ocean. The larvae that hatch consume small zooplankton until they metamorphosis into juveniles. Juveniles are abundant in shallow, near-shore waters and feed on polychaetes and small crustaceans. Adult continue to eat small invertebrates throughout their lives.
- Yellowfin Sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions feeding mainly on benthic infauna and epifauna, euphausiids, and fish.
- Flathead Sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions with their diet composed primarily of organisms

living on the bottom (epibenthic) and pelagic organisms in close association with the bottom (nektobenthic). Flathead sole less than 30 cm total length consumed mainly mysids, gammarid amphipods, and decapod shrimps, whereas flathead sole larger than 30 cm total length consumed mainly ophiuroids, walleye pollock, and decapod shrimps.

- Rex Sole feed almost exclusively on benthic invertebrates. Small rex sole feed mainly on amphipods and other crustaceans. Large rex sole prey chiefly on polychaetes. Rex sole prey primarily on euphausiids, decapod crab larvae, copepods, Oikopleura, and ostracods. Mollusks form only a minor part of rex sole diet. Euphausiids are principal prey only during summer and cumaceans and Oikopleura are more common during the winter.
- Dover sole feed almost exclusively on benthic infaunal and epifaunal invertebrates, mainly polychaetes, ophiuroids, and mollusks. Amphipods are important crustacean prey and Pelecypods make up the most molluskan biomass consumed. Annelids are usually dominated in the diet of juvenile Dover sole.

Conclusion

The Forest Service believes that the Logjam Timber Sale may adversely affect Freshwater EFH and Marine EFH. However, by implementing the minimization measures summarized above, implementing other Forest Plan Standards and Guidelines, and the BMPs, negative effects of the proposed actions on EFH will be avoided or minimized. All the action alternatives would only have minor effects to fish habitat that would last less than a week at the time of the activity. Additional impacts to EFH are likely to occur only from unforeseen events such as landslides, debris blockages of culverts, and road failures. A copy of this Draft EIS will be sent to NMFS, and the Forest Service will continue participating in the EFH consultation process.

INVASIVE SPECIES

An invasive species is one whose introduction does or is likely to cause economic or environmental harm or harm to human health. Specifically, EO 13112 directs all Federal agencies to address the impacts their actions may have on invasive species.

Eighty-eight species of non-natives have been recorded on the Tongass, 46 have an invasiveness ranking according to their invasive characteristics and threat to Alaska, with 29 of those species identified as having a greater potential threat to Alaska. Fifteen of the species found on the Tongass are among the species that pose a greater potential threat.

Although many non-native wildlife species have been introduced or transplanted in Alaska, with the exception of rats in coastal ecosystems and possibly slugs in estuaries, none is considered invasive at the present. Schrader and Hennon (2005) identified 11 aquatic species in their assessment. Six species have already established breeding populations in National Forest lands and other areas in Alaska and include northern pike (*Esox lucius Linnaeus*), yellow perch (*Perca flavescens*), redlegged frog (*Rana aurora*), Pacific chorus frog (*Pseudacris regilla*), rainbow trout (*Oncorhynchus mykiss Walbaum*), and brook trout (*Salvelinus fontinalis*). The other five species are not established in Alaska yet, but cause

widespread problems in the lower 48 states and could become problematic in Alaska. These species of concern are the Atlantic salmon (*Salmo salar*), Chinese mitten crab (*Eriocheir sinesis*), New Zealand mudsnail (*Potamopyrgus antipodarum*), goldfish (*Carassius auratus*), and the signal crayfish (*Pacifacstacus leniusculus*). In Alaska, established populations of northern pike (with the exception of Pike Lakes on the Yakutat Ranger District) pose the greatest immediate concern, while the Atlantic salmon, Chinese mitten crab, and New Zealand mudsnail species are likely to invade Alaska in coming years (Fay 2002). Invasive tree pathogens are not currently damaging Alaskan ecosystems, but there are numerous species that could cause widespread tree mortality if introduced. Four introduced insects are currently established in Alaska: the larch sawfly, alder woolly aphid, spruce aphid, and amber-marked birch leafminer. These insects can cause widespread tree defoliation and mortality.

Within the Forest Service, various approaches are in place to address four action elements (prevention, early detection and rapid response, control, and restoration) in the National Strategy and Implementation Plan for Invasive Species Management (USDA Forest Service 2004f).

In October, 2007, the Tongass National Forest adopted new guidelines for Invasive Species Management in the form of a supplement to the Forest Service Manual: Supplement No.: R10 TNF-2000-2007-1.

The Tongass National Forest High Priority Invasive Plant Species List is a list of plants that initiates control measures across the Forest. Generally speaking, a plant with a ranking higher than 60 is a high priority plant for control; however, there are a few exceptions. *Phalaris arundinacea* (reed canarygrass) is well established, and eradication would be impossible to achieve, so it is not a high priority species for control, despite the fact that it has a very high invasiveness ranking of 83. Likewise, *Taraxucum officinale* (common dandelion) is well established, and therefore would not be a high priority plant, even though it has a relatively high invasiveness ranking of 62. The Forest Service is actively controlling some plants that have not yet been ranked for the state of Alaska.

Affected Environment

Approximately 63 non-native plant species are known to exist on Prince of Wales Island. Many of these species are common throughout southeastern Alaska and are not considered invasive. Of these species, 15 are considered invasive.

Plants listed in Table 61 are considered high priority for treatment Forest-wide (FSM 2080 TNF Supplement 2000-2007-1). The Forest has designated two levels of high priority control schemes: the first is treatment of certain species where feasible; the second is treatment of certain species only in certain locations. Those plants listed are considered high priority plants for potential treatment, and will be managed according to the guidance of the Tongass supplement (when feasible and in certain locations). The species listed in these tables include only those species found in or in close proximity to the Logjam project area boundary.

Table 61. High Priority Invasive Plant Species in or Near the Project Area

Scientific Name	Common Name	Rank 0-100	Comments
actively controlling these plants where feasible			
*Centaurea biebersteinii**	Spotted knapweed	86	1 population near project area
Cirsium arvensis	Canada thistle	76	1 population
Cirsium vulgare	Bull thistle	61	2 populations
Hieracium aurantiacum	Orange hawkweed	79	12 populations
actively controlling these plants only in certain locations			
Leucanthemum vulgare	Oxeye daisy, white daisy	61	Ubiquitous
Phalaris arundicacea	Reed canarygrass	83	Ubiquitous

* Known population eradicated manually

Bull thistle

Two populations are located within the project area for the Logjam timber sale on road 2360000 that is to be open and maintained with OHV use. These populations are located near Unit 577-23.

Canada thistle

The population that is located within the project area for the Logjam timber sale on the 3035190 road which is a road system that is scheduled to be open and maintained.

Orange hawkweed

There are twelve known populations within the project area for the Logjam timber sale (five are located on open and maintained roads (3035100-4 populations and 3035190- 1 population) and five on a road to be stored (3036000) and two on the mainline road). One population is located on the 2057000 and one on the 2056000. Both roads are to be opened and maintained with OHV use.

Oxeye daisy

This species is found in numerous locations across the island, including several populations located within the Logjam project area boundary.

Reed canarygrass

This species is found virtually across the island, including many populations located within the Logjam project area boundary.

Methodology

In 2005, weed surveys were conducted, by contract, on the Prince of Wales road system. Overall, 2,635 non-native plant plots were conducted in high priority areas such as rock quarries, road intersections, and road pullouts. The survey covered approximately 584 miles of road, including roads within the project area.

This survey included plots every ¼ mile along the road system as well as plots located at each intersection and rock pit encountered. Non-native plant plots varied in size depending on the type of disturbed area being surveyed. A road pullout plot size was approximately four tenths of an acre, whereas a rock quarry plot size was equal to the size of the quarry. Access roads and the road front plots were typically 1 or more acres in size. Surveys were done at the appropriate time of year to identify the broadest range possible of non-native plant species.

Weed Risk Assessment

The invasive plant management goals and strategies for this project will follow the guidance contained in the new Forest Service Manual supplement (TNF 2000-2007-1), the Region 10 and Tongass Invasive Plant Management Plans. An Integrated Pest Management approach for invasive plant management, which includes a mixture of manual, mechanical, and chemical control methods, is the best approach for prevention and control of invasive plants. However, any and all of these actions require NEPA analysis which currently has not taken place.

One of the goals for this project is prevention and minimization of spreading certain invasive plants. It will focus on limiting the introduction and spread of existing high priority invasive plants into new areas, especially in the process of road work.

Several factors for management are considered:

1. Focus prevention efforts on the high priority invasive plants listed in Table 61 that are located within the project area.
2. Further focus the efforts on those high priority invasive plants that the Tongass has committed to actively control where feasible.
3. Management considerations for this project will not include those high priority invasive plants known in the project area which the Tongass may have committed to actively control only in certain locations.

   Our logic for not treating some species at this time is due to the widespread distribution of them along the Prince of Wales road system and the low likelihood of success in their ultimate control. However, management efforts would focus on avoiding the introduction of these species into pristine habitats and Land Use Designations that are managed for natural and near natural conditions.

With the above stated management considerations, this would require the following mitigation measures:

1. Require contractors to use identified rock material that is free of any orange hawkweed, bull, or Canada thistle seed or roots from existing quarries prior to constructing new roads.
    a Approved rock sources will be identified in the contract.
    b If any approved rock sources are contaminated with orange hawkweed, Canada, or bull thistle and certification can not be attained without treatment methods, consider the use of contaminated rock for re-constructing existing roads only.
2. Considering controlling any newly introduced high priority invasive plant species/populations not currently in the project area after the project completion, and prior to closing temporary roads.
3. Consider avoiding ditch maintenance or other road maintenance activities that have the potential to spread invasive plants (when invasive plants are flowering or seed stage).
4. Considering monitoring newly constructed roads and active quarries in the project area for at least 3 years after the project competition for new non-native plant introductions.

Environmental Consequences

All alternatives would result in some risk to the spread of invasive plant species in the area. Even under the no action alternative, there is a moderate risk of continued spread due to the amount of traffic in the area. The amount of risk can be related to the amount of road by alternative.

Table 62 and Table 63 show the risks associated with the Logjam project on the specific populations within the timber sale boundary. Many of the locations have a relatively low risk of spread due to the fact that only one population of the species has been documented at that location. The species listed in Table 62 have a relatively high risk of spread, with or without any proposed actions, due to the fact that they are ready very common throughout the project area.

Table 62. High priority invasive plant species in or near the project area (actively controlling these plants where feasible)

Species	Location/population size	Risk without project	Risk with project
Canada Thistle	3035190 rd -1 population	Moderate	Low
Bull Thistle	2360000 rd -2 populations	Moderate	Low
Orange Hawkweed	303600 rd -5 populations	Moderate	Low
	2057000 rd-1 pop	Low	Low
	2056000 rd-1 pop	Low	Low
	3035100- 4 populations	Moderate	Moderate
	3035190-1 population	Low	Low

Table 63. High priority invasive plant species in or near the project area (actively controlling these plants only in certain locations)

Common Name	Location	Risk without project	Risk with Project
Oxeye daisy	Ubiquitous	High	High
Reed canarygrass	Ubiquitous	High	High

The cumulative effects analysis area is Prince of Wales Island because invasive plants have been documented all over the island and due to their ability to spread. Past, present and reasonably foreseeable future projects considered in the cumulative effects analysis are located in Appendix D.

Alternative 1 Direct and Indirect Effects

The Alternative 1 would cause minimal direct and indirect impacts to the known populations of invasive plant species within the project area. Alternative 1 would implement the existing road classifications. Activities to implement that, especially activities related to storing roads would result in minimal direct and/or indirect effects to invasive plant species.

Cumulative Effects

There would be 28 miles of open and maintained road in the project area; 39 miles of open and maintained with OHV use; and 11 miles of motorized trail. There would be 43 miles of road that are stored and 2 miles that would be converted to hiking trails. Except for differences in the miles of road stored all alternatives have similar cumulative effects to invasive plant species. Stored roads may have invasive plants growing in them though the risk of spread to open roads will be minimal. Open roads will not have a change in the risk of spread of invasives from increased motor vehicle traffic.

Alternative 2 Direct and Indirect Effects

Alternative 2 proposes construction of approximately 8 miles of new NFS road. All new construction would be from the existing road system. Approximately 3 miles of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road will be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 21 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. Approximately 3.2 miles of road would be reconstructed. Total road construction for this Alternative is 29 miles. Alternative 2 would result in the greatest risk of the spread of invasive plant species for the Logjam project as it proposes the most road construction/reconstruction.

Cumulative Effects

There would be 28 miles of open and maintained road in the project area; 39 miles of open and maintained with OHV use; and 11 miles of motorized trail. There would be 51.5 miles of road that are stored and 2 miles that would be converted to hiking trails. Except for differences in the miles of road stored all alternatives have similar cumulative effects to invasive plant species. Stored roads may have invasive plants growing in them though the risk

of spread to open roads will be minimal. Open roads will have an increased risk of spread of invasives from increased motor vehicle traffic. Open roads will have an increased risk of new occurrences of invasives from increased motor vehicle traffic.

Alternative 3 Direct and Indirect Effects

Alternative 3 proposes construction of approximately 2 miles of new NFS road. All new construction would be from the existing road system. Approximately 1.5 miles of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of about 13 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. Total road construction for this Alternative is 15 miles.

Alternative 3 would result in a slightly higher for the spread of invasive plant species than Alternative 4.

Cumulative Effects

There would be 28 miles of open and maintained road in the project area; 39 miles of open and maintained with OHV use; and 11 miles of motorized trail. There would be 45 miles of road that are stored and 2 miles that would be converted to hiking trails. Except for differences in the miles of road stored all alternatives have similar cumulative effects to invasive plant species. Stored roads may have invasive plants growing in them though the risk of spread to open roads will be minimal. Open roads will have an increased risk of spread of invasives from increased motor vehicle traffic. Open roads will have an increased risk of new occurrences of invasives from increased motor vehicle traffic.

Alternative 4 Direct and Indirect Effects

Alternative 4 proposes construction of approximately 3 miles of new NFS road. Approximately, 1 mile of decommissioned temporary roadbed would be used as a road base for new construction. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 10 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. Approximately 0.8 miles of road would be reconstructed.

Alternative 4 would result in the least amount of risk of the spread of invasive plants of the proposed action alternatives for the Logjam project.

Cumulative Effects

There would be 28 miles of open and maintained road in the project area; 39 miles of open and maintained with OHV use; and 11 miles of motorized trail. There would be 46.5 miles of road that are stored and 2 miles that would be converted to hiking trails. Except for differences in the miles of road stored all alternatives have similar cumulative effects to invasive plant species. Stored roads may have invasive plants growing in them though the risk of spread to open roads will be minimal. Open roads will have an increased risk of spread of

invasives from increased motor vehicle traffic. Open roads will have an increased risk of new occurrences of invasives from increased motor vehicle traffic.

Alternative 5 Direct and Indirect Effects

Alternative 5 proposes construction of approximately 4 miles of new NFS road. Approximately 1.5 miles of decommissioned temporary roadbed would be used as a road base for new construction. All new construction would be from the existing road system. All newly constructed NFS road would be stored after timber haul and associated activities are complete. This alternative proposes construction of approximately 12.5 miles of temporary road. All temporary roads would be decommissioned after timber haul is complete. Approximately 2.8 miles of road would be reconstructed.

Alternative 5 would result in a risk of spread of invasive plant species very similar, but slightly less than Alternative 2.

Cumulative Effects

There would be 28 miles of open and maintained road in the project area; 39 miles of open and maintained with OHV use; and 11 miles of motorized trail. There would be 47.5 miles of road that are stored and 2 miles that would be converted to hiking trails. Except for differences in the miles of road stored all alternatives have similar cumulative effects to invasive plant species. Stored roads may have invasive plants growing in them though the risk of spread to open roads will be minimal. Open roads will have an increased risk of spread of invasives from increased motor vehicle traffic. Open roads will have an increased risk of new occurrences of invasives from increased motor vehicle traffic.

3 Environment and Effects

SILVICULTURE

Methodology

To document the condition of the forest within each proposed harvest unit, formal stand exam sample plots were recorded, along with general observations about the stand. Stand exam plots were located at a frequency of one per ten acres or at least 3 plots per proposed harvest unit for units less than 30 acres in size. Stand exams were conducted using the Common Stand Exam (CSE) protocol. Observations such as stand development stage, stand structure, windthrow potential, insect, disease and decay occurrence were incorporated into the exam procedure. Observations and plot data for each unit are stored in the National Field Sampled Vegetation Database (FSVEG). The General Information, Site Characteristics and Existing Condition sections of the Stand Exam Summary and Diagnosis prepared for each proposed unit document specific stand conditions. Follow-up walkthrough exams were conducted in addition to the formal stand exams. Follow-up visits to stands occurred when data gaps were found or unit modifications had been made that included areas not previously sampled.

Affected Environment

The natural vegetation of the Logjam project area is a mosaic of coniferous forest intermixed with sub-alpine, muskeg, riparian, and shrubland plant communities. The primary species are western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), mountain hemlock (*Tsuga mertensiana*), western red cedar (*Thuja plicata*), and Alaska yellow-cedar (*Chamaecyparis nootkatensis*).

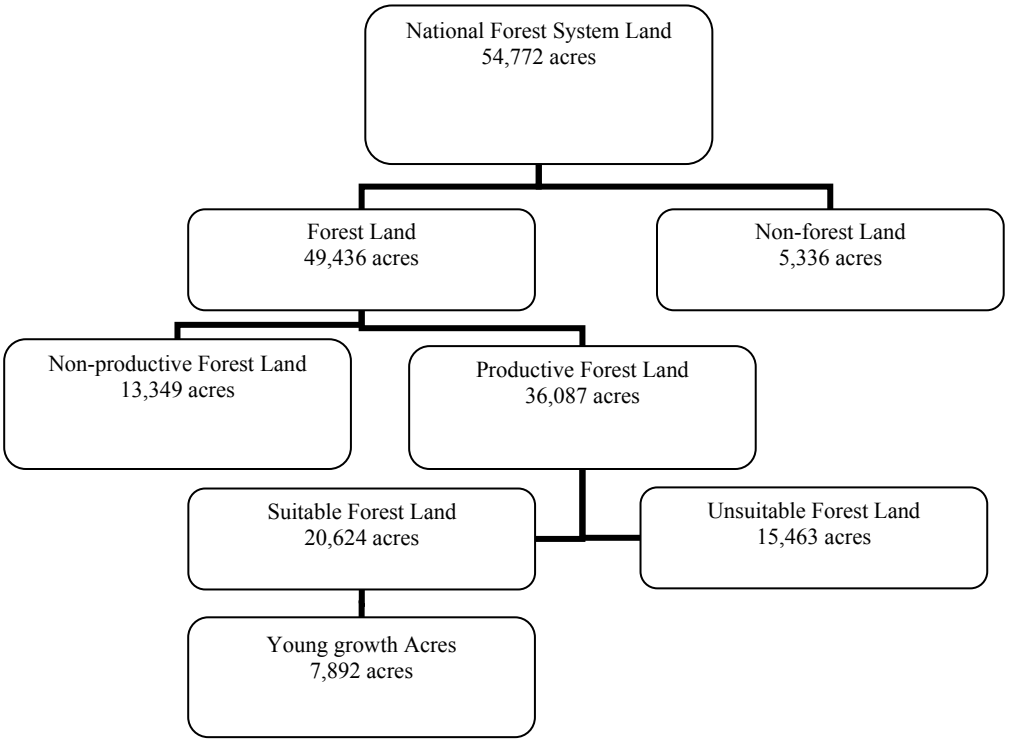
Low productivity forests of mixed conifer and lodgepole pine (*Pinus contorta*) are common on poorly drained sites. Productive forests of hemlock and hemlock-spruce are restricted to steeper slopes where better drained mineral soils occur. The transition zones between well-drained western hemlock/Sitka spruce sites and restricted drainage mixed conifer sites are commonly occupied with a mix of western hemlock and western red cedar as well as Alaska yellow-cedar.

Within the project area there are 12,732 acres of land that are mapped as both suitable and available for harvest. To be considered both suitable and available for harvest, lands must be determined tentatively suitable for timber management and must be within a LUD that allows timber harvest. For this project, these LUDs are Timber Production, Modified Landscape, Scenic Viewshed, Recreational River and Scenic River (see Chapter 1 for LUD descriptions). Although these LUDs allow for timber harvest, some acres within each LUD would not be available for harvest due to protections defined in the Forest Plan Standards and Guidelines for other resources. Some of the protections of significance in the Logjam project area include riparian management zone buffers, high vulnerability karst areas and over-steepened slopes.

National Forest System (NFS) lands are defined by vegetative cover, soil type, and administratively designated land use. This classification scheme is intended to show the amount of land that is covered by forest vegetation, with further divisions to show the amount of land that is capable of commercial timber production. Figure 2 shows the NFS land classifications in the Logjam project area. The acreage numbers are for forested land and do

not include the acres of water. The young growth acres shown in the chart are a subset of Suitable Forest Land. There are other acres of second growth in the Project Area that are not in Suitable Forest Land.

Figure 2. NFS Land Classifications in the Logjam Project Area



Note: There are 10,297 acres of young growth in the project area. Of that total 7,892 acres are on suitable lands.

Non-forest Land

Approximately 10 percent (5,336 acres) of the NFS land in the Logjam project area is classified as non-forest. Non-forest land is land that is biologically unable to support at least a ten percent tree cover. This land classification includes muskegs, rock outcrops, talus slopes, alpine vegetation, and river systems, among others.

Forest Land

Approximately 90 percent (49,436 acres) of the NFS land in the Logjam Timber Sale project area is classified as forest land. Forest land has at least 10 percent tree cover of any size, or formerly had such tree cover and is not currently developed for non-forest use (36 CFR 219.3).

Productive Forest Land

Approximately 66 percent (36,087 acres) of the NFS land in the Logjam Timber Sale project area (73 percent of forest land) is classified as Productive Forest. Productive forest lands are

National Forest System lands that have timber volumes of at least 8,000 board feet per acre, or have the potential to achieve this volume and are capable of maintaining that volume. This land is capable of producing 20 cubic-feet per acre, per year of tree growth. Productive forest land includes young-growth stands that have regenerated with conifer species after natural or human disturbance. Productive forest lands are further classified as either suitable or unsuitable for timber production.

Suitable and Available Forest Land

The Forest Plan assigned Land Use Designations (LUDs) that allow timber harvest in areas that were determined to be suitable for timber production. Some land was removed from the suitable timber base due to Forest Plan standards and guidelines within those areas. Appendix A of the Forest Plan describes the process that was used to identify suitable forest land. Approximately 57 percent (20,624 acres) of the productive forest land in the Logjam project area is classified as Suitable for Timber Production.

National Forest lands within the analysis area for suitability, total 54,772 acres, these acres differ from total project acres because they exclude saltwater and non-Forest Service acres. There are 1,097 acres of non-National Forest System land within the project area; these acres are not included in the above figure. Of the 49,436 acres of forest land, 20,624 are classified as suitable for timber management; 12,732 acres are both Suitable and Available for timber management. The Logjam project proposes to harvest a maximum of 22 percent of the remaining suitable and available timber within the project area.

Unsuitable Forest Land

Unsuitable forest lands are lands that have resource concerns that preclude timber harvest. Areas with slopes greater than 72 percent that have unstable soils, high vulnerability karst lands and areas within riparian, beach and estuary buffers are examples of forest land classified as unsuitable for timber production. Approximately 43 percent (15,463 acres) of the productive forest land in the Logjam project area is classified as unsuitable for timber production.

Initially, the interdisciplinary team (IDT) identified 85 potential harvest units. Of those original units, five (units 6, 7, 8, 19, and 44) were eliminated before analysis because of economic or ecological concerns, or were deferred for later treatment. The remaining 80 units included in the DEIS unit pool are primarily old-growth or mature timber types typical of Southeast Alaska. Various natural phenomena affect the life cycle of forest trees, which experience damage, decay, and eventual death. All stands proposed for harvest are uneven aged stand structure, and old growth stand development stage (Oliver et al. 1996).

Species Composition

The species composition in the project area, as computed from re-aggregated stand exam data, is: western and mountain hemlock, 53 percent; Alaska yellow-cedar, 11 percent; western red cedar, 23 percent; and Sitka spruce, 13 percent. These percentages are based on the percent gross board foot volume of both live and dead trees in the original LSTA proposed harvest units. Shore pine and red alder comprise less than 1 percent of the total volume.

Volume Strata

High Volume Strata: Areas within timber inventory volume classes 5, 6, and 7 on non-hydric soils, and on hydric soils with slopes greater than 55 percent. Hydric soils become waterlogged or saturated with water long enough during the growing season to affect the growth rate of trees.

Medium Volume Strata: Areas within timber inventory volume classes 5, 6, and 7 on hydric soils with slopes less than or equal to 55 percent; areas within timber inventory volume class 4 that are either on non-hydric soils, or are on hydric soils greater than 55 percent.

Low Volume Strata: Areas within timber inventory volume class 4 that are on hydric soils with slopes less than or equal to 55 percent.

The species composition in the project area was computed from re-aggregated stand exam data. Volume strata were determined by using the GIS volume class layer and combining it with GIS soils and elevation information. Gross volume (MBF) per acre by volume strata was determined by the re-aggregation of stand exam plot data by volume strata (Table 64).

Table 64. Gross Volume per Acre by Volume Strata

Strata	Gross Average MBF/Acre◆	Suitable Project Area acres
Low	24.80	4,242
Medium	38.96	4,923
High	45.86	3,546
other◆◆		21
Totals	**36.16◆◆◆**	**12,732**

◆Gross volume for both live and dead trees based on re-aggregated stand exam plot data.
◆◆other includes minor slivers of private lands (17 ac.), non-forested (3 ac.) and previous harvest (.8 ac).
◆◆◆Weighted average based on suitable project area acres.

Forest Health Issues

Dwarf Mistletoe

The occurrence of dwarf mistletoe in late successional western hemlock stands is widespread throughout Southeast Alaska, including the Logjam Analysis Area. The small-scale (canopy gap) disturbance pattern in the old forests of coastal Alaska favors the short-range dispersal mechanism of hemlock dwarf mistletoe and may explain the common occurrence of the disease in this area (Insects and Diseases of Alaska Forests, USDA R10-TP-87, 2001). Dwarf mistletoe presence was recorded in all proposed harvest areas in the Logjam Analysis Area where western hemlock was found. In general, dwarf mistletoe reduces the vigor and growth rate of the host tree so that infected trees require a longer period of time to mature and often produce lower quality timber (Boyce 1961). Dwarf mistletoe often produces cankerous swellings at the point of infection of limbs or main stems. The cankers provide an entrance for wood-destroying fungi, which can lead to significant fiber losses. The majority of units included in the unit pool were rated moderate for the occurrence of dwarf mistletoe. There were 47 units in the current unit pool that were rated moderate, 12 rated high and 21 rated low (Table 65). A moderate rating was given to units when about half of the western hemlock trees observed in the unit had mistletoe infestation ratings of 3 or less, according to the

Hawksworth mistletoe rating system (Hawksworth 1977). A high rating was given when most hemlock appeared to be infected with a rating higher than 3. A low rating was given when mistletoe was absent or only seen occasionally and where present was rated less than 3. Units that rated low were typically units with a heavy cedar component.

Decay Fungi

Decay caused by heart and root-rotting fungi is probably the greatest single cause of disease-related timber volume loss in Alaska (Laurent 1974), and such damage is present within the Logjam Project Area. Approximately one-third of the old-growth timber volume in Southeast Alaska is defective largely due to heart-rotting fungi. Heart rot causes considerable damage in all conifer species in Southeast Alaska but is more common in western hemlock, mountain hemlock, and Sitka spruce (Insects and Diseases of Alaska Forests, USDA R10-TP-87, 2001). Decay centered in the boles of trees can weaken the support structures, thereby leading to breakage. As the broken portion of the tree falls to the forest floor, it may wound adjacent trees and lead to eventual infection of the damaged trees. This is a continual process in old-growth forests in Southeast Alaska and contributes to the diversity of the stand structure.

Decay-causing fungi are present in all stands within the project area. There were 31 units in the current unit pool that were rated high for the occurrence of decay fungi. There were 49 units that rated moderate. No units were rated low. A high rating was given when it appeared that the average defect per tree in the unit would exceed 31 percent, or what is considered the average defect within live old growth trees in Southeast Alaska (Insects and Diseases of Alaska Forests, USDA R10-TP-87, 2001). A moderate rating was given when it appeared that the average defect would be about 31 percent. A low rating would have been given if a unit was determined to be somewhat less than 31 percent. A low rating would usually only be noted where a large amount of the live trees in the stand are young.

Windthrow

The major abiotic damaging agent is windthrow. The loss of trees, singly or in groups, to the effects of wind is the number one factor affecting stand structure and development in Southeast Alaska. High-wind events occur in Southeast Alaska each year, causing considerable damage and loss. Wind disturbance may create some beneficial effects. Mixing of soil associated with uprooted trees is thought to contribute to the prevention of impermeable soil layers and may enhance nutrient cycling (Harris 1999). Other beneficial effects include the exposure of mineral soil, which favors the regeneration of Sitka spruce and cedar and the creation of large woody material for wildlife use.

Windthrow plays an important role in stand development. Wind disturbance occurs over a continuum dependent on topographic features (Nowacki and Kramer 1998). Stand structure can give clues to prevailing wind disturbance patterns. In wind-sheltered areas, stands develop old-growth characteristics through a process called gap replacement, whereby small openings in the forest canopy, created from wind damage, are colonized by brush and eventually conifer species. Wind damage results in uprooted trees and breakage, or “stem snap.” Stem snap from wind disturbances often occurs in conjunction with stem rots, which can create weak points in the boles of trees. Falling trees may wound nearby trees, thereby predisposing them to fungal infections. Over time, a two-layered stand - and eventually a multilayered stand - develops in which small openings are continually created and colonized. Unharvested

stands in areas where wind disturbance promotes gap replacement may reach a certain degree of stability with respect to wind. Selective harvesting in these stands should emulate the gap patterns in natural stands as much as possible.

Traditionally, forest managers have applied large-scale clearcuts in an attempt to minimize losses due to windthrow. Current Forest Service direction calls for the use of alternatives to clearcutting when those alternatives would meet the goals and objectives. As a result, clearcut openings, especially in wind-prone areas, would take advantage of naturally occurring windfirm edges such as muskegs and low-density stands, as well as topographic features that deflect the effects of wind.

Existing windthrow within a stand is an important indicator of windthrow hazard. Certain conditions are indicators of windthrow hazard for individual trees as well as stands. The windthrow history of a stand can be determined from field observations. These conditions, as well as a stand's windthrow history, were used to evaluate the windthrow hazard for each unit.

In the Logjam project area, high windthrow hazard was generally found in areas with exposure due to topography, vortex winds or adjacent logging. There were 19 units rated high for windthrow. These stands were generally located where high wind speeds and turbulence are likely to occur and where the stand structure, composition and tree form make the stand more susceptible to wind damage. Units that were more topographically sheltered from direct storm winds and had less evidence of past wind damage were rated moderate for windthrow. There were 55 units that rated as moderate. Stands rated moderate have either factors that contribute to poor anchorage with low wind force, moderate resistance to overturning and moderate wind force or good resistance to overturning and high wind force. There were 6 units that were well sheltered with little evidence of past wind damage. These units were rated low. Stands rated low are located where topographic sheltering occurs and trees have characteristics that make them more resistant to windthrow (Stathers, Rollerson and Mitchell 1994).

Table 65 shows the occurrence and relative severity of damage for each of the major damaging agents in the unit pool.

Table 65. Major Stand Damaging Agents in the Logjam Unit Pool

Unit Number	Dwarf Mistletoe	Decay Fungi	Windthrow Potential
573-01	Moderate	High	Moderate
573-02	Low	High	High
573-03	Moderate	Moderate	Moderate
573-04	High	High	High
573-05	Moderate	Moderate	Low
573-09	Moderate	High	Low
573-10	Moderate	Moderate	Moderate
573-11	Moderate	Moderate	Moderate
573-12	Moderate	Moderate	Moderate
573-13	Moderate	Moderate	Moderate
577-14	Moderate	High	Moderate
577-15	Low	High	Moderate

Unit Number	Dwarf Mistletoe	Decay Fungi	Windthrow Potential
577-16	Low	High	Moderate
577-17	Low	Moderate	Moderate
577-18	Low	Moderate	Moderate
577-20	Moderate	Moderate	Moderate
577-21	Moderate	Moderate	Moderate
577-22	Low	Moderate	Moderate
577-23	Low	Moderate	High
577-24	Moderate	Moderate	High
577-25	Moderate	Moderate	High
577-26	High	High	Moderate
577-27	Moderate	High	Moderate
577-28	Low	Moderate	Moderate
577-29	Low	Moderate	High
577-30	Moderate	Moderate	Moderate
577-31	Moderate	Moderate	Moderate
577-32	Moderate	High	Moderate
577-33	Moderate	Moderate	Moderate
577-34	Moderate	Moderate	Moderate
577-35	Moderate	Moderate	Low
577-36	High	Moderate	Low
577-37	Low	Moderate	High
577-38	High	High	Low
577-39	Moderate	Moderate	Low
577-40	High	High	Moderate
577-41	Moderate	High	High
577-42	Moderate	High	Moderate
577-43	Low	Moderate	Moderate
577-45	Moderate	Moderate	Moderate
577-46	Moderate	Moderate	Moderate
577-49	Low	High	Moderate
577-50	Low	Moderate	Moderate
577-51	Low	Moderate	Moderate
577-52	Low	Moderate	Moderate
577-53	Low	Moderate	Moderate
577-54	High	Moderate	Moderate
577-55	Low	Moderate	Moderate
577-56	Moderate	High	Moderate
577-57	Moderate	Moderate	Moderate
577-58	Moderate	Moderate	High
577-59	Moderate	Moderate	High
577-60	High	High	Moderate
577-61	Moderate	High	High
573-62	Moderate	High	Moderate
573-63	Moderate	Moderate	Moderate
573-64	Moderate	High	Moderate
573-65	Moderate	Moderate	Moderate
573-66	Moderate	High	Moderate

Unit Number	Dwarf Mistletoe	Decay Fungi	Windthrow Potential
573-67	High	High	High
573-68	High	High	High
573-69	Moderate	High	Moderate
573-70	Moderate	Moderate	Moderate
573-71	Moderate	High	High
573-72	Moderate	Moderate	Moderate
573-73	High	High	High
573-74	Moderate	Moderate	High
573-75	Moderate	Moderate	High
573-76	Moderate	High	Moderate
573-77	Moderate	Moderate	Moderate
573-78	Moderate	High	Moderate
573-79	Low	Moderate	Moderate
573-80	Low	Moderate	Moderate
573-81	Low	Moderate	Moderate
573-82	Low	Moderate	High
573-83	High	High	Moderate
573-84	Moderate	Moderate	Moderate
573-85	Moderate	Moderate	Moderate
577-90	Moderate	High	Moderate
577-92	High	High	High

Source: Individual unit stand exam data and Unit Prescription and Diagnoses
An explanation of how high, moderate and low ratings were determined is within the discussions of dwarf mistletoe, decay fungi and windthrow risk under the Forest Health Issues heading.

Hemlock Fluting

Fluting is a non-infectious disorder common in western hemlock growing in exposed areas along beaches or in second growth stands in exposed locations. The disorder is characterized by deeply incised vertical ridges and grooves along the main stem of the tree. The tree is not injured by the disorder and may actually benefit from it by being more windfirm as a result. Fluting does however reduce the trees economic value for lumber because of bark inclusions, voids and irregular grain (Insects and Diseases of Alaska Forests, USDA R10-TP-87, 2001).

Young Growth Management in the Project Area

Planned intermediate treatments for past harvest units in the project area include various approaches to pre-commercial thinning, pruning, disease control, and other resource specific treatments as appropriate. Past harvests are included in Appendix D.

The Logjam project area has approximately 10,297 acres of past harvest. There is recent state harvest of about 169 acres visible in 2006 photos that are not recorded in FACTS, the USFS database. These acres are included in the total acres of young growth. All young growth in the project area originated from mostly even-aged harvesting. Timber harvest in the project area began in about 1953 and peaked about 25 years ago, around 1983.

Currently about 10 percent of the past harvest in the project area (includes recent State Harvest) are within the 0-15 year old age class. The desired condition of these young stands is full reforestation with desirable tree species suitable for timber production. Intermediate

treatments for young growth currently in the age class of 0-15 will involve activities focused on forest regeneration and health. For the greater part, no treatments are necessary to promote regeneration or increase stand health. The project area has had experimental site preparation burning (about 545 acres) as well as release and weeding (about 460 acres) done in stands that were in this age class. Release and weeding is a treatment where trees that were inadvertently left standing during the regeneration harvest are removed to reduce the chance of mistletoe or disease infection in the young upcoming stand. Site preparation burning was an experimental treatment done to prepare the stand for planting in an attempt to control hemlock regeneration and promote a high spruce component in the new stand. The practice was discontinued due to the high cost and delayed regeneration of these sites. The stands that were burned are currently well stocked and growing with a good understory for deer browse. The potential wildlife benefits currently evident in the burned areas are an outcome that was not anticipated at the time of the burn treatment.

Approximately 81 percent of young growth in the project area is within the 16 to 35 year old age class. The desired condition of stands in this age class is a fully stocked, young, vigorously growing stand in a free to grow condition. Free to grow implies that stand density will be controlled through intermediate treatments, which reduce competition between trees within the stand. The most common intermediate treatment is pre-commercial thinning (PCT) of stands in the 16 to 35 year age class. This type of treatment is an investment in existing growing stock, which is intended to redistribute stand growth to selected stems of good form and healthy character. Precommercial thinning, or PCT, removes excessive stand stocking through the cutting of less desirable trees, while leaving the most desirable trees in a free to grow condition. PCT can be performed to various residual stand densities depending on overall resource objectives. The physical distribution of the thinned trees depends upon several factors not exclusive of resource objectives. About 44 stands in the project area, totaling nearly 2,833 acres (34 percent of the acres in this age class) have been precommercially thinned in the past (FACTS activity data from logjamFactsActivities.xls). A fixed spacing with variance to pick the best leave tree was implemented in these stands. PCT is a treatment which not only redistributes stand growth on selected stems but it also delays canopy closure and extends the time that forage is available for wildlife. All previously harvested acres in the project area that are age 35 or less and have not been thinned, would be considered for PCT in the future. The timing and specifics of the treatment would largely depend on the growth rate of the stand and the goals and objective of the LUD designation that the stand is in. Within timber production LUDs, PCT tree spacing is typically about 14 X 14 feet or about 222 trees per acre. Wider tree spacing is generally applied in non-timber production LUDs where timber harvest occurred prior to the designation of that LUD. Wide spacing of trees in pre-commercially thinned stands promotes understory development and the longer term maintenance of that understory. This condition benefits wildlife. Wide spacing however, promotes the retention and persistence of branches and increased stem taper (McClellan 2004). These characteristics can reduce timber values. Wider spacing in thinning may also increase the risk of windthrow and stem breakage. Within the project area, 634 acres have been thinned to promote riparian and wildlife habitat.

About 8 percent of young growth within the project area is 36-45 years of age. Stands in this age class have potential for both pre-commercial and commercial treatments, depending upon the average size of the stems. Most stands in this age class are not available for commercial

thinning because the stems normally targeted for removal are still too small to be of commercial value. The difference between pre-commercial thinning and commercial thinning is the production of a commercial product. The same approaches are used to attain similar resource goals. Precommercial thinning is an option for older stands where stand conditions do not allow commercial thinning. Thinning of older stands with larger trees without stem removal may produce unacceptable levels of slash, which can persist for about 10 years and longer. This may inhibit forage maintenance or re-establishment. Various methods of reducing slash depth or amounts have proven to be expensive, often doubling the cost of thinning operations. In general, stands in this age class will not be treated until they grow to a size where commercial thinning is possible.

Only about 1 percent of young growth within the project area is older than age 45. These stands are entirely within non-National Forest lands. Stands in this age class may offer a commercial thinning (CT) opportunity depending on tree size and accessibility.

Environmental Consequences

The effects of timber harvest on forest vegetation vary by silvicultural prescription and the number of acres harvested by prescription. The following provides a discussion of prescriptions, and effects related to the various components of the timber resource including stand structure, forest health and productivity, regeneration and species composition, and windthrow risk. The effects analysis area used is the Logjam project area.

Cumulative effects are analyzed at the end of this section.

Silvicultural Prescriptions

Even-aged and Two-aged silvicultural prescriptions for the Logjam project area were developed by a certified silviculturist to meet the objectives identified by the interdisciplinary planning team. The criteria used to select the appropriate silvicultural system for each unit includes the following:

- Forest Plan LUDs
- Standard and Guide requirements
- Windthrow hazard (the presence of tree and stand attributes determining windthrow potential)
- Stand conditions (diseases and decay fungi)
- Regeneration potential
- Operational feasibility (possible logging systems)
- Economics

Silvicultural prescriptions provide guidance for the entire rotation for treatments that may follow the rotational harvests, including natural regeneration certification, thinning and monitoring.

Riparian Management Areas (RMAs) with concerns for watershed stream channel stability and windthrow potential have been identified and would have trees retained in Reasonable Assurance of Wind firmness (RAW) buffers as needed. The size and configuration of the RAW buffer would be determined during unit layout by an interdisciplinary team as identified in the unit cards. In some cases, creating RAW in buffers has been accomplished through unit design or silvicultural prescription.

Uneven-aged management was not selected for use in any of the proposed harvest units, under any of the alternatives. The two-age clearcutting with reserves treatment planned is very similar to uneven-aged management single tree selection. Two-age management was prescribed instead of uneven-aged management primarily because multiple harvest entries or short cutting cycles are not planned for the stand. The next rotational harvest under two-aged management would be in about 100 years.

Even-aged Management (clearcut)

This silvicultural prescription would result in an even-aged stand by clearcut harvest of cable and shovel portions of the planned alternative unit area. Areas of tree retention are generally external to final cutting unit boundaries or are along stream zones that protrude into the cutting unit. These retention areas generally do not meet distribution requirements for two-age management.

The only instance where dispersed reserve trees, resulting from partial harvesting, might occur inside even-age clearcut harvest areas is where windfirming is prescribed by specialists during unit layout.

Windfirming would typically be applied to unit edges or stream and karst buffers that are determined to be at risk for wind damage after harvest. These would generally be the edges of harvest units or stream buffers that have high exposure to southeast storm winds. Where windfirming is applied would vary depending on the topography and location of the buffer within the unit.

In some cases shovel yarding areas may have sub-merchantable size trees left standing within the unit.

Natural regeneration is expected to be abundant and represent approximately the original species composition of the stand. Additional silvicultural treatments that follow harvest may include tree planting, thinning, girdling and/or pruning. These treatments can be used to influence species composition, increase individual tree growth, promote wood quality and enhance wildlife habitat.

Justification for Clearcutting

Even-aged clearcutting is being prescribed in the Logjam project area to preclude or minimize the occurrence of potentially adverse impacts from hemlock dwarf mistletoe or other insect or disease infestations, logging damage and windthrow. This project implements even-aged management in order to minimize the potential for windthrow in the residual stand while maximizing the use of cable yarding systems needed for maintaining the potential for an economic timber sale offering.

Two-aged Management (clearcut with reserves –individual tree marking)

This prescription would regenerate a two-aged stand by partial harvest in areas proposed for helicopter yarding. Helicopter yarding has been proposed to reduce road construction and associated costs, reduce the impact harvest activities might have on watersheds and/or meet objectives for scenery. The second age class would be achieved by leaving between 75 (HE25) and 50 (HE50) percent of the setting pretreatment basal area, based on standing live trees left uncut.

Trees would be designated for harvest by individual tree marking. In some cases individual trees selected for harvest may occur in groups or strips. Groups would usually be less than 1 acre but may occasionally be up to two acres in size. Trees selected for harvest would generally be well distributed. No large openings would occur as a result of the harvest. Trees to be maintained would represent all species formerly in the stand. Large diameter trees maintained would typically be of low timber value but of high wildlife value. Smaller diameter trees of good form and vigor, particularly spruce and cedar, would also be maintained. These trees would be left to grow into the next timber crop.

The silvicultural prescription would maximize the flexibility of helicopter yarding to allow for the removal of only the trees within the stand that have the highest monetary value to the timber purchaser, while retaining other trees that have higher value for wildlife or would be more economically valuable in the future.

In all helicopter yarding areas, windthrow risk to the residual stand would be determined acceptable based on the level of basal area retained and/or the inherent windthrow potential of the stand. Table 66 summarizes wind risk ratings by silvicultural prescription and alternative.

Table 66. Wind Risk Rating by Silvicultural System and Alternative

Silvicultural System	Wind Risk	Acres				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Even-aged Management Clearcut	High	0	720	395	324	652
	Moderate	0	1,602	1,160	937	1,456
	Low	0	97	0	20	20
Two-aged Management Clearcut with Reserves (ITM*) up to 25% removal HE25	High	0	660	720	107	610
	Moderate	0	0	0	0	0
	Low	0	0	0	0	0
Two-aged Management Clearcut with Reserves (ITM*) up to 50% removal HE50	High	0	0	0	0	0
	Moderate	0	588	334	226	531
	Low	0	36	99	79	79

Source: Individual stand exam diagnosis and windthrow analysis

*ITM=Individual Tree Marking
Note: The 652 acres in Alt 5 accounts for the reduction in unit 43 by 30 acres to meet the Legacy standard and guideline.

Monitoring results from the *Alternatives to Clearcutting Study*, five years post-harvest in wind prone areas reveal approximately 5 percent loss of basal area with 25 percent single tree selection harvest and 6.4 to 8.5 percent basal area loss with 25 percent single tree selection harvest in clumps (McClellan 2004 and 2007). Based on these results, in areas expected to have high windthrow risk to the residual stand, the prescription would require approximately 75 percent basal area retention.

Natural regeneration would occur in the harvested stands in satisfactory amounts. The limited openings in the canopy, combined with the low ground disturbance of helicopter yarding, would promote hemlock regeneration and may somewhat limit the regeneration of the cedars and spruce. Retention of spruce and cedar advanced regeneration would therefore be required. Additionally, smaller diameter, intermediate crowned spruce and cedar trees would also be retained. Trees retained after harvest would remain for the duration of the rotation (approximately 100 years).

In helicopter yarding areas where partial cutting would occur, the primary differences between this two-age prescription and uneven–age management using single tree selection is that the future harvest entries, typically done to create multiple age classes in an uneven-aged management scenario, are not planned. After the initial entry under two-age management, the rotation age for the stand would be finite. After harvest, the stand would undergo intermediate treatments as needed, but otherwise be left to grow until the next regeneration treatment in about 100 years.

Table 67 summarizes silvicultural system and prescription, yarding system and acres by alternative.

Table 67. Silvicultural System and Prescription Acres by Alternative and Yarding System

Silvicultural System	Silvicultural Prescription	Yarding System	Alternative				
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Even-aged Management	**Clearcut**	**Cable/ Shovel**	0	2,419	1,555	1,281	2,128
Two-aged Management	**Clearcut with Reserves ITM* up to 25% removal (HE25)**	**Helicopter**	0	660	720	107	610
	Clearcut with Reserves ITM* up to 50% removal (HE50)	**Helicopter**	0	624	433	305	610
	Total Two-age		**0**	**1,284**	**1,153**	**412**	**1,220**
Total all Prescriptions			**0**	**3,703**	**2,707**	**1,693**	**3,348**

* ITM=Individual Tree Marking
Note: 2,128 acres in Alt 5 accounts for the reduction in unit 43 by 30 acres to meet the Legacy standard and guideline.

Effects to Forest Structure

Alternative 1 Direct and Indirect Effects

No new harvest activity would occur under Alternative 1. Old-growth structured stands would remain in a predominantly old-growth condition. Small-scale, frequent disturbance events would continue in the stand until a large-scale event occurs. At some point in the future it is expected that some stands in the project area would suffer larger-scale damage from a severe storm event, leading to the regeneration of the stand in what would likely be a two-aged or possibly in an extreme case, an even-aged condition.

Alternatives 2, 3, 4 and 5 Direct and Indirect Effects

The structure of the forest would be changed by timber harvest under all of the action alternatives. The change would vary by alternative based on the silvicultural prescription and the number of acres harvested. Where even-aged management is prescribed, harvest would be by cable or shovel systems and result in the creation of homogenous young-growth stands primarily without any older residual trees present within the boundary.

The new stands would naturally grow through a number of structural changes in the future, beginning with a brushy stage where tree regeneration is becoming established and understory plants flourish. This stage would be followed by a period of stem exclusion where inter-tree competition shades out the understory. After that the stand would enter a stage where tree mortality opens growing space and an understory, as well as some old growth characteristics return. The time that any young growth forest spends in any structural stage would be dependant on the natural growing capability of the land and any future treatments that are applied, such as thinning.

Where two-age management is prescribed, numerous residual trees would be left, mainly dispersed across the stands. The number of trees would depend on the amount of retention. Retention of 50 percent of the live basal area is planned for low and moderate wind risk areas. Retention of 75 percent live basal area is planned for high windthrow potential stands. In both cases young growth would occupy the growing space created by harvest between the remaining trees. This would create a situation where a second age class develops within the matrix between older overstory trees. Due to the considerable overstory that would remain, the brushy stage seen after even-age harvesting would generally not occur under either retention amount except where one acre or larger openings are created. The stem exclusion stage would generally not occur to the same magnitude seen in even-age stands either.

In the 50 percent retention areas, the stand structure would be expected to change from old growth to a structure similar to what is naturally seen when stands are transitioning between understory re-initiation and old growth. The understory re-initiation stage is the structural stage just before a naturally developing stand attains true old growth structure (Oliver and Larson 1996). After harvest these stands would continue to develop and should regain old growth characteristics quickly if unaffected by a major natural disturbance event.

Where 75 percent retention is prescribed, it is expected that the structural change post harvest would be only minor and the stand would remain in the old growth structural stage after harvest and through to the next rotation if unaffected by a major natural disturbance event.

3 Environment and Effects

Effects to Forest Health and Timber Volume Production

Alternative 1 Direct and Indirect Effects

Under alternative 1, no timber harvest is planned. Therefore, only natural changes in forest health and timber volume growth would occur. It is expected that forest growth would continue to be offset by decay. Insect and disease processes at work would persist at approximately current levels but due to the general lack of thrift, the forest is at risk and vulnerable to insect and disease attack. Hemlock dwarf mistletoe, where present, would remain in the stand and may infect hemlock stems that regenerate in the gaps adjacent to infected overstory trees.

There would be no noticeable increase or decrease in the productivity of the land for the production of timber products.

Alternatives 2, 3, 4 and 5 Direct and Indirect Effects

Where even-aged management is prescribed, the use of the land to produce timber products would be maximized. The risk of insect, disease and decay within the newly established growing timber crop would be minimized. The new trees that regenerate after even-age treatments would be vigorous and free from decay. The insect and disease processes at work in the stands previous to harvest, including Hemlock dwarf mistletoe, would be mostly eliminated.

Where two-age management is prescribed, forest health concerns can be used as factors to determine which trees to harvest. An attempt would be made to remove the trees that pose the greatest risk to the health of the new stand. Due to the amount of disease and decay found within the old growth stands proposed for harvest and constraints for visuals, economics and wind risk, it is unlikely that all or even a significant proportion of the trees with disease and decay would be removed.

There would, therefore, be a risk of the new stands being infected with the same diseases and decays present in the stands at harvest. This risk would generally be proportional to the amount of basal area retained.

Decay organisms would be transferred between trees when decay ridden trees fall and strike adjacent healthy trees either during harvesting operations or during weather events post harvest.

Hemlock dwarf mistletoe would remain in the stand and likely infect the hemlock regeneration even with selection criteria favoring the removal of infected overstory trees first.

The larger old trees retained for wildlife would be of low vigor. These trees are not expected to grow or change in any way as a result of the growing space created by harvest.

As a result, where two-aged management is prescribed, the utilization of the sites to grow timber would be reduced somewhat in proportion to the amount of old trees that remain and occupy growing space.

Effects to Regeneration and Species Composition

Alternative 1 Direct and Indirect Effects

Under alternative 1, no harvest would occur. Openings in the forest canopy would be created by windthrow and trees falling as a result of decay. Hemlock regeneration would have a competitive advantage over other species when small openings in the canopy occur.

Alternative 2, 3, 4 and 5 Direct and Indirect Effects

Where even-aged management is prescribed the resulting tree regeneration is expected to be vigorous and representative of the approximate species mix of the former stand.

Where two-aged management is prescribed growing space would be limited by the retention of overstory trees. Natural regeneration would occur in the stand in satisfactory amounts, however the limited openings in the canopy combined with the low ground disturbance of helicopter yarding would promote hemlock regeneration and may limit the regeneration of the cedars and spruce. To offset this, the retention of spruce and cedar advanced regeneration would be required. Additionally, smaller diameter intermediate spruce and cedar trees with good vigor would be important to be reserved (Deal and Tappeiner, 2002). Due to the good species mix and the flexibility of individual tree marking in the stands proposed for two-age management, it is unlikely that a species conversion would occur.

Effects to Windthrow Risk

Alternative 1 Direct and Indirect Effects

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

Alternative 2, 3, 4 and 5 Direct and Indirect Effects

Windthrow risk was evaluated for each unit considering prevailing wind direction, topography, evidence of windthrow within proposed units and along edges of previous harvest units, and the proximity to other, wind-generated stands. In units where windthrow risk has been determined to be high, specific measures have been prescribed to reduce or minimize windthrow risk adjacent to unit edges, within stream buffers and to reserve trees. These measures are included on the unit cards and in the draft detailed unit prescriptions located in the project planning record.

Where even-aged management is prescribed windthrow risk would be eliminated within the harvest unit by the removal of all large trees. The future young growth stands created would typically be more windfirm than the old growth stands they replaced.

The regenerated even-aged management stands in current high to moderate wind risk areas are expected to be low risk after conversion to even-aged stands. The lower wind risk in these stands is expected to last through the next rotation.

Exposed stand edges would, however, have increased risk of windthrow in the first few years after harvest due to the adjacent opening. In units where windthrow risk has been determined

to be of concern, specific measures have been prescribed to reduce or minimize windthrow risk adjacent to unit edges or along stream buffers that protrude into the harvest opening.

Where two-age management is prescribed, the basal area retention requirements were increased to offset the potential for blowdown in high windthrow risk areas. As a result, it is expected that wind risk would remain approximately the same as in the stand prior to harvest.

Monitoring results from the *Alternatives to Clearcutting Study*, five years post-harvest in wind prone areas reveal approximately 5 percent loss of basal area with the 75 percent basal area retention prescription (McClellan, 2007). Based on these results, only minor amounts of windthrow are expected to occur following harvest within proposed two-age management units with high windthrow risk.

A mostly unbroken, continuous canopy would remain after harvest in two-age management units. This would reduce the risk of windthrow along unit edges and adjacent to stream buffers that protrude into the harvest area. In most cases, the two-age prescription would eliminate the need for additional windfirming treatments in RAW zones.

In all harvest areas, whether even-aged or two-aged, Riparian Management Areas (RMAs) that have stream channel stability concerns and potential for windthrow have been identified. These RMAs would be reviewed in the field once preliminary unit boundaries are in place. The specific windfirming prescription for that RMA would be determined at that time.

Cumulative Effects

The analysis area for cumulative effects is the entire Logjam timber sale project area. The following are the only activities expected to have cumulative effects to forest vegetation. Appendix D includes past, present and reasonably foreseeable future actions considered in this analysis.

The Logjam project area has approximately 10,297 acres of young growth originating from mostly even-aged harvesting. Timber harvest in the project area began about 1953 and peaked about 25 years ago. The State of Alaska plans to harvest approximately 138 acres using even-aged management within the next 5 years. This harvest would result in the creation of 138 acres of even-aged forests in addition to that proposed in the Logjam project.

Scattered windthrow has occurred along exposed stand boundaries after past harvest and recent road reconstruction activities. No effort to buffer or stabilize these exposed boundaries was made. Older, exposed stand boundaries have stabilized naturally and recently created edges along the new road construction are expected to stabilize also. Where abrupt stand edges are created, either by timber harvest or road construction, there may be a risk for blowdown along that edge.

All previous harvest areas have been certified as regenerated, and contain trees five feet tall or greater. These areas are no longer considered openings for the purposes of scheduling or locating additional created openings (USDA Forest Service 2008b).

Future pre-commercial thinning would provide an opportunity to maintain stand growth and vigor, improve windfirmess, alter species composition and promote or maintain understory vegetation growth. About 4,000 acres of young growth is currently planned for thinning over the next five years in the Logjam project area (William Steele, personal communication).

Prescriptions would be developed to manage for multiple resource values with spacing of leave trees based on site specific objectives. Prescriptions would maintain a minimum 10 foot buffer adjacent to streams and would often maintain unthinned travel corridors for deer. In non-development LUDs, prescriptions would often include creation of gaps and retention of unharvested thickets. These treatments may also be considered in development LUDs on a case by case basis. This future action, when combined with any of the action alternatives, would represent a favorable cumulative effect relative to forest vegetation, windthrow risk, and forest structure and species composition.

WETLANDS

This section provides a summary of the wetland resources in the project area. Forest-wide standards and guidelines for this resource are on page 4-88 of the 2008 Tongass National Forest Land and Resource Management Plan, (Forest Plan). Description and classification of wetlands in the project area follows the Tongass Wetland Classification (DeMeo & Loggy 1989). Detailed discussion of the existing condition of wetlands can be found in the Logjam Soil and Wetland Resources Report, 2008 in the Logjam project record.

Wetlands are defined as "those areas that are inundated or saturated by surface water or groundwater with a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions." (40 CFR 230.41 (a) (1))

There is a concern for wetland loss as a result of the proposed activities. The Forest Service is directed by executive order 11990 to avoid adverse impacts to wetland where practicable.

Affected Environment

Wetlands occupy 63 percent of the land area (approximately 35,538 wetland acres) in the project area. Sixty-nine percent of wetlands in the project area are forested wetland or forested wetland/emergent short sedge complexes with associated wetland types (14,054 acres of forested wetland and 10,482 acres of forested wetland/emergent short sedge). Non-forested wetlands account for nearly 31 percent (11,001 acres) of all wetland types in the project area. These wetlands include estuary, emergent short sedge, tall sedge fens, moss muskeg, and alpine muskeg.

Most wetlands on the project area remain in a pristine condition. Upland timber stands and wetlands are very interspersed over the southern half of the project area. In the northern half of the project area, upland soils are concentrated on steep slopes. Roads across ridgetop wetlands are necessary to access timber on steep slopes. The acres of wetlands on the project area are documented in Table 68 following the description of wetland habitat types in the Project area.

Forested Wetland

Forested wetland and complexes with associated wetland types are abundant covering 25 percent (14,054 acres) of the project area. Forested wetlands include a number of forested plant communities with hemlock, cedar, or mixed conifer overstories, and ground cover consisting largely of skunk cabbage and deer cabbage. Forested wetlands occur on poorly or very poorly drained hydric mineral and organic soils. Forested wetlands are most common on gentle hill slopes or benches, but are found on moderately steep terrain in areas with underlying volcanic geology. Forested wetlands support the transfer of water to downslope resources. These wetlands function as recharge areas for groundwater and streams and for deposition of sediment and nutrients.

Forested Wetland/Emergent Short Sedge Complex

The forested wetland/ emergent sedge complex is less than 50 percent forested. The forested wetland and emergent short sedge wetlands are so intermixed that they cannot be mapped on a small scale. Forested wetland/ emergent short sedge complexes share characteristics of both forested wetland and emergent short sedge types. Sphagnum mosses, sedges, and skunk cabbage dominate these wetlands with low volume class hemlock, cedar, and pine. Soils are very poorly drained hydric organic soils, with occasional hydric mineral soils in small pockets of forested wetland. These complexes are commonly found in riparian areas and occur on gently sloping hill slopes or benches, lower footslopes, and on broad ridgetops. Both complexes contribute to the transfer of water downslope, groundwater and stream recharge, and carbon and nutrient cycling. These complexes provide terrestrial and aquatic habitat for wildlife species, such as black bear, deer, and mink. This complex is abundant throughout the project area covering nearly 19 percent (10,482 acres) of the project area.

Non-Forested Wetlands

Emergent Short Sedge Wetland

Emergent sedge wetlands include areas of low swampy land called fens and rich bogs on moderately deep and very poorly drained organic soils. These wetlands cover approximately about 5 percent (2,632 acres) of the project area. Vegetation consists primarily of short sedges and mosses with scattered shrub communities and shore pine. Emergent short sedge wetland is often found on lower footslopes and on broad ridgetops. These wetlands contribute water to downslope resources and provide carbon and nutrient cycling benefits for watershed function.

Emergent Tall Sedge Fens

Emergent tall sedge fens are characterized by a diverse community of sedges, dominated by tall sedges such as Sitka sedge, with a variety of forbs and occasional stunted trees, usually spruce or hemlock. Soils are typically deep organic muck, often with some thin layers of alluvial mineral soil material. They occur in landscape positions where they receive some run-off from adjacent slopes resulting in somewhat richer nutrient status than bogs. These wetlands function as areas for recharge of groundwater and streams, deposition and storage of sediment and nutrients, and for waterfowl and terrestrial wildlife habitat, including black bear, mink, river otter, and beaver. Many of the sedge fens contain beaver ponds that often provide

high quality waterfowl habitat and salmon rearing habitat. Tall sedge fens account for about 2 percent (1,213 acres).

Alpine Muskeg

Alpine muskegs are similar to emergent sedge and muskeg complexes; however, they occur at higher elevations in the landscape, such as ridge tops and mountain summits. Alpine muskegs are located primarily in the southern half of island where management activities have not occurred and are not planned in the foreseeable future. These wetlands cover about 4 percent (2,307 acres) of the project area. Alpine muskegs are dominated by sphagnum moss with a wide variety of other plants adapted to very wet, acidic, organic soils. Vegetation is a combination of muskeg and sedge meadows on peat deposits, and low growing blueberry and heath on higher rises. Similar to muskeg, shore pine and hemlock trees less than 15 feet high are common. Alpine muskegs are important for snow storage and can be a source for snowmelt water throughout the spring and early summer months. These wetlands also provide summer habitat for terrestrial wildlife species.

Moss Muskeg

Moss muskegs are characterized by nutrient limiting acid peat bogs, dominated by sphagnum moss and peat deposits. Moss muskegs also contain a variety of acid loving vegetation such as cotton grass, ericaceous shrubs, cranberry and blueberry, carnivorous plants, water lilies, Labrador tea, and occasional stunted trees, usually cedar, shore pine, or hemlock. Soils are typically deep in organic peat deposits and accumulate over unconsolidated glacial till or impermeable glacial silts on gentle or nearly level slopes. Moss muskegs often have no significant inflow or outflow of water other than precipitation, thus ponded areas, a result of high surface water, occur within the wetland. These wetlands function as areas of surplus water and peat accumulation creating a stable microclimate and habitat for waterfowl and terrestrial wildlife, including cranes, black bear, amphibians, mink, and deer. Moss muskegs account for about 9 percent of wetlands across the project area, a total of 4,841 acres.

Estuaries

Estuaries are unique brackish environments where fresh water mixes with saltwater. They are the most valuable wetland in the project area, supporting complex and productive ecosystems for critical fish and wildlife habitat. These areas are very rare on the Logjam project area covering less than 0.1 percent (8 acres) in Sweetwater Lake. These areas are valuable for their habitat for both aquatic and terrestrial species. A high diversity of wildlife is typically found in estuaries. The Forest Plan standards and guidelines give estuaries a 1,000-foot buffer.

Table 68. Existing acres of road and timber harvest on wetland by wetland habitat type

Wetland Habitat Type	Project area acres	Percent of project area	Harvested acres	Miles of road	Acres of road	% of wetland type roaded
Estuary	8	less than 0.1%	0	0	0	0
Moss Muskeg	4,841	9%	128*	5.3	26	0.5%
Alpine Muskeg	2,307	4%	130*	1.2	6	0.2%
Tall Sedge Fen	1,213	2%	126*	2.3	11	0.9%

Wetland Habitat Type	Project area acres	Percent of project area	Harvested acres	Miles of road	Acres of road	% of wetland type roaded
Emergent Short Sedge	2,632	5%	55*	1.7	9	0.3%
Forested Wetland/Emergent Short Sedge	10,482	19%	722*	17.6	87	0.8%
Forested Wetland	14,054	25%	2,623	39.5	196	1.4%
Wetland Totals	35,538	63%	3,784	67.6	335	0.9%
Uplands	20,595	37%	6,513	83.4	414	2%
Project Area Totals	**56,133**	**100%**	**10,297**	**151****	**749**	**1.3%**

Calculation of roaded acres based on 40-foot wide disturbed soil road corridor.
Sums may not match due to rounding.
* These wetlands occurred as small inclusions within past harvest units.
** Total road miles are limited to the project area and may not match other sections due to different analysis areas.

The general effects of roads and timber harvest on wetlands is described below.

Roads on Wetlands

Roads across sloping wetlands may affect hydrologic connectivity across the wetland due to road ditches or road fills. A total of 335 acres of wetland have been replaced by roads on the project area. Road building on wetlands has occurred primarily on the forested wetland type (about 196 acres), about 1 percent of forested wetlands in the project area. Forested wetlands are abundant, covering nearly 25 percent of the project area.

Implementation of adequate road drainage minimizes the impacts to hydrologic connectivity of wetlands. Past road construction on non-forested wetlands has been minimal. Approximately 52 acres of non-forested wetlands (emergent short sedge, moss muskeg, alpine muskeg, and tall sedge fen wetlands) have been converted to road, less than one percent of the total acreage for non-forested wetlands. Road segments 2300000 and 3035000 located in the Logjam project area contain the majority of disturbance to moss muskeg wetlands. The 2300000 road is in the process of being upgraded to a state highway. The end of the 3000420 road segment is located on alpine muskeg. This road was constructed to avoid steep slopes. Based on Glaser (1999), effects to wetland hydrology and vegetation adjacent to these roads is expected to be minimal and within the estimates described for Table 68. Table 68 displays the acres of wetlands impacted by roads.

Harvest on Wetlands

Timber harvest on wetlands has temporary effects on wetland hydrology. Rainfall interception studies (Patric 1966; Beuadry and Sagar 1995) indicate that the amount of rainfall hitting the soil surface will increase following clearcutting. Soils within harvested sites tend to gain higher moisture levels resulting in slower growth in the seedling and sapling stage. Soil moisture conditions remain elevated until evapotranspiration surfaces in the canopy of the young stand become equivalent to pre-harvest conditions. Depending on the soil moisture status of the wetland, this effect can range from negligible or last more than 20 years, but in all cases the effect is expected to be temporary. In partially harvested stands, retention of a portion of the canopy cover would further minimize the effect of timber harvest on soil

moisture. Many of the forested wetlands on the Logjam project area support commercial stands of timber. Some of these stands have been harvested in the past and some are proposed for harvest in this EIS. Table 68 displays the acres of wetlands harvested by wetland habitat type.

Wetland Avoidance

Approximately 37 percent of the existing timber harvest is on wetlands, whereas about 63 percent of the project area is wetland (forested wetlands account for about 25 percent of the project area). Approximately 45 percent of the existing roads are on wetlands, whereas about 63 percent of the project area is considered wetland. These numbers suggest that road construction has avoided wetlands to the extent practicable on the project area. On the project area the topography is such that many of the upland forested sites are on hills separated by wetlands. In other parts of the project area, for example the Trumpeter Watershed the upland sites occur on steep slopes. Avoiding steep slopes by building road across wetlands is environmentally preferred when compared to road construction across steep slopes.

The forested wetlands on the Logjam project area often include stands of commercial timber and are managed for their timber resources. Management of the forested wetland timber stands is part of the project goals and objectives. The most economical way to access the forested wetlands timber stands often involves building road. Within the context of overall project objectives, including economics and minimizing harm to the environment, past road construction has avoided wetlands to the extent practicable in the project area.

The four action alternatives would avoid wetlands to the extent practicable. Site-specific wetland avoidance is documented on the road cards for NFS road segments and the unit cards for temporary road segments. At the project scale 60 percent of all proposed roads, both NFS and temporary, are on wetland and 40 percent on uplands in Alternative 2. In Alternative three, 55 percent of the proposed NFS and temporary roads are on wetlands. Under Alternative four, 52 percent of the proposed NFS and temporary roads are on wetlands. In Alternative five, 53 percent of the proposed NFS and temporary roads are on wetlands. At first glance, the data suggests that Alternative 4 would be more efficient in terms of avoiding wetland conversion to roads. However, this information needs to be taken in the context of project objectives and alternative design. Alternatives 2 (60 percent), 3 (55 percent), and 5 (53 percent) have proportions of proposed road miles on wetlands similar to the proportion of wetlands to uplands on the project area (63 percent). With all action alternatives, a high percentage of the proposed harvest is on sites that classify as forested wetlands. Access within and to these stands often requires crossing wetlands. With all of the action alternatives, the same factors discussed in the previous paragraph come into play. Road access to timber on steep upland slopes often requires road construction across gently sloping ridgetop areas that classify as wetlands. All action alternatives and individual road locations avoid wetlands to the extent feasible. The road cards (NFS roads) and the unit cards document wetland avoidance at the site scale (road cards and unit cards are in Appendices B and C).

3 Environment and Effects

Environmental Consequences

The Interdisciplinary Team identified two key indicators to measure the effects of the alternatives on wetland resources:

- Acres of wetland converted to upland due to road construction
- Acres of harvest on forested wetlands

The analysis area for the wetland resource is the Logjam Project Area.

All action alternatives propose some level of timber harvest on forested wetlands. The effect of timber harvest (increased soil moisture levels) on forested wetlands is expected to be temporary. All harvested sites are expected to regenerate naturally.

Due to the preponderance of wetlands and the interspersed nature of wetlands with uplands on the project area, complete avoidance of wetlands from proposed road construction activities is not feasible. Most proposed roads would be constructed on forested wetlands and uplands. All estuaries are avoided by proposed roads in the action alternatives. All proposed roads will be constructed according to State approved BMPs as required by 33 CFR 323. State approved BMPs consist of those BMPs documented in Forest Service Handbook 2509.22 and documented on the road cards in Appendix C. All roads through wetlands will also follow the 15 baseline provisions provided in 33CFR 323 also documented on the road cards. Table 69 provides a summary of proposed timber harvest and road construction on wetlands by wetland habitat type and alternative.

Table 69. Estimated acres of road construction and timber harvest by wetland habitat type and alternative

Key Indicator	Wetland Type	Alt 2	Alt 3	Alt 4	Alt 5
Acres of roads on wetlands	Moss muskeg	7	0.5	3	3
	Alpine muskeg	0.6	0	0	0
	Emergent tall sedge fen	1	0.7	0.7	0.7
	Emergent short sedge	0	0	0	0
	Forested wetland/emergent short sedge	14	5	5	6
	Forested wetland	59	29	25	36
	Total road acres on wetlands	81	36	33	45
Acres of harvest on wetlands	Moss muskeg	71	55	39	68
	Alpine muskeg	48	35	35	40
	Emergent tall sedge fen	23	21	19	21
	Emergent short sedge	4	0	0	<0.01
	Forested wetland/emergent	147	96	72	122

Key Indicator	Wetland Type	Alt 2	Alt 3	Alt 4	Alt 5
	short sedge				
	Forested wetland	1,501	1,026	725	1,256
	Total harvest acres on wetlands	1,794	1,233	890	1,507

Note: Calculation of roaded acres based on 40-foot wide disturbed soil road corridor.
Reconstruction of temporary road through wetlands is not included in the proposed road construction because they are already accounted for in the existing condition.
Numbers may not match due to rounding.

The analysis area for direct and indirect effects for the wetlands resource includes the harvest units and proposed road corridors (both temporary and NFS roads). The analysis area for cumulative effects for the wetlands resource is the project area and includes the foreseeable actions listed in Appendix D.

Alternative 1 Direct and Indirect Effects

No wetland would be impacted under Alternative 1 due to harvest or road construction. Vegetation on forested wetlands harvested in the past would continue to grow toward hydrologic maturity. Wetlands impacted by roads in the past would receive minimal use. Vegetation will occupy ditch lines and in the cases of closed roads, the roadbed may be occupied by red alder. The road prism would remain in an upland condition. Road ditches, if present, will support a variety of upland and wetland vegetation depending on local conditions and seed sources. Hydrologic and vegetation effects would remain limited beyond the road prism (Glaser, 1999).

Cumulative Effects

Approximately 3,784 acres (2,623 acres of forested wetland, 722 acres of forested wetland/emergent short sedge, and 439 acres of non-forested wetlands) of timber have been harvested from wetlands on the project area. This equates to nearly 11 percent of the wetlands on the project area. About 196 acres of forested wetland, 87 acres of forested wetland/emergent short sedge, and 52 acres of non-forested wetland have been converted to road surfaces, ditches and fillslopes (Table 68). When the effects of road and timber harvest are combined, nearly 12 percent of wetlands on the project area have been affected by past management activities. About 1 percent of non-forested wetlands have been affected by past management activities. Approximately 80 percent of the forested wetlands and 92 percent of forested wetlands/emergent short sedge remain in pristine condition. About 88 percent of all project area wetlands remain in pristine condition. On the wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions.

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

3 Environment and Effects

Effects Common to All Action Alternatives

Timber harvest is proposed in wetlands in all action alternatives. Harvest activities are expected to have a minimal and short-term effect on wetland soil moisture. Removal of the timber would lead to a short-term increase in soil saturation until second-growth establishes evapotranspiration surfaces similar to preharvest conditions. Effects on soil moisture would likely be less in areas where partial cutting is utilized. The proposed harvest in all action alternatives would not pose a long-term negative impact to wetlands in the project area.

The effects of road construction on wetland hydrology and vegetation depend largely on the landscape position of the wetland and the substrate (soil) within the wetland. Wetlands located on ridgetops serve to donate water downslope. Soils in these landscape positions are typically peat soils that are shallow (less than 20 inches thick) over bedrock. Because these landscape positions receive more rain than lower slope positions and the soils have a high water holding capacity, the effects of constructing a shot rock road across these wetlands is usually limited to the area of wetland buried by the shot rock, and effects on vegetation are limited to within a few meters of the shot rock (Glaser 1999).

Roads crossing mid slope and lower slope landscape positions have a greater chance of intercepting soil and surface water as the water moves downslope. While application of BMPs provide some assurance that surface water streams will not be diverted by roads, soil water is sometimes captured and diverted to the nearest stream or drainage-relief culvert. Due to the high levels of precipitation and high soil moisture contents, the intercepted soil water does not translate into drier soils downslope. McGee (2000) found that even though an inside road ditch intercepted soil water flowing downslope, the water wells downslope of the road at her Polk Inlet study site did not display a corresponding decrease in soil moisture. In this landscape position, the effects of roads on wetlands extend a bit farther beyond the road prism. The substrate plays an increasingly important role. Thicker peat and mineral soils occur in these landscape positions. Thick peat soils permeate slowly and have an extremely high water-holding capacity. Effects on these soils are limited to within a few meters of the cutbank and toe of fill (Kahklen and Moll 1999, Wrangell Site). Kahklen and Moll also studied the effects of roads on hydrology of mineral soil (upland) sites and found the effects of the road were greater, but still limited to within a few meters of the road. Although soil moisture levels beyond the road cut slopes and fill slopes would change, the wetlands are expected to remain wetlands. The soil moisture levels are not expected to change so much that the wetland (outside the disturbed soil corridor) would develop into an upland site.

Alternative 2 Direct and Indirect Effects

Alternative 2 proposes to harvest timber from approximately 1,501 acres of forested wetland, 147 acres of forested wetland/emergent short sedge, and 146 acres of non-forested wetlands. Trees growing on these wetlands would likely grow slower than trees on upland sites. Soil moisture would temporarily increase as described above. Road construction under this alternative would result in conversion of wetland habitat to road on approximately 59 acres of forested wetlands, 14 acres of forested wetland/emergent short sedge, and about 8 acres of non-forested wetlands. The specific effects are described above. At 81 acres, the effects on wetlands are the greatest of the four action alternatives (Table 69).

Cumulative Effects

Following implementation of Alternative 2, approximately 255 acres of forested wetlands, 101 acres of forested wetland/emergent short sedge, and 61 acres of non-forested wetlands would be converted to roads. About 2 percent of the forested wetlands would have been converted to roads and less than 1 percent of forested wetland/emergent short sedge and non-forested wetlands would be converted to roads. The effects are as described above. Approximately 4,124 acres of forested wetlands, 869 acres forested wetland/emergent short sedge, and 585 acres of non-forested wetlands would have had timber harvest. Cumulatively, around 29 percent of the forested wetlands, 8 percent of forested wetland/emergent short sedge, and 5 percent of non-forested wetlands would have been harvested. The vegetation on the oldest harvest areas would be more than 30 years old and soil moisture conditions should be returning to some facsimile of pre-harvest conditions. The older harvested areas are vigorous second-growth stands. Following implementation of Alternative 2, approximately 69 percent of the forested wetland, 92 percent of forested wetland/emergent short sedge, and 94 percent of non-forested wetlands on the project area would remain in an undisturbed condition.

Alternative 3 Direct and Indirect Effects

Alternative 3 proposes to harvest timber from approximately 1,026 acres of forested wetland, 96 acres of forested wetland/emergent short sedge, and 111 acres of non-forested wetlands. Soil moisture would temporarily increase as described above. Road construction under this alternative would result in conversion of wetland habitat to road on about 29 acres of forested wetlands, 5 acres of forested wetland/emergent short sedge, and over 1 acre of non-forested wetlands. The specific effects are described above. In Alternative 3, 36 acres of wetland would be impacted (Table 69). Alternative 3 is 3 acres more than Alternatives 4, 9 acres less than Alternative 5, and 45 acres less than Alternative 2.

Cumulative Effects

Following implementation of Alternative 3, approximately 225 acres of forested wetlands, 92 acres of forested wetland/emergent short sedge, and 53 acres of non-forested wetlands would be converted to roads. Less than 2 percent of the forested wetlands would have been converted to roads and less than 1 percent of the forested wetland/emergent short sedge and non-forested wetlands would be converted to roads. The effects are as described above. Approximately 3,649 acres of forested wetlands, 818 acres forested wetland/emergent short sedge, and 550 acres of non-forested wetlands would have had timber harvest. Cumulatively, around 26 percent of the forested wetlands, 8 percent of forested wetland/emergent short sedge, and 5 percent of non-forested wetlands would have been harvested. The vegetation on the oldest harvest areas would be more than 30 years old and soil moisture conditions should be returning to some facsimile of pre-harvest conditions. The older harvested areas are vigorous second-growth stands. Following implementation of Alternative 3, approximately 74 percent of the forested wetland, 92 percent of forested wetland/emergent short sedge, and 94 percent of non-forested wetlands on the project area would remain in an undisturbed condition.

Alternative 4 Direct and Indirect Effects

Alternative 4 proposes to harvest timber from approximately 725 acres of forested wetland, 72 acres of forested wetland/emergent short sedge, and 93 acres of non-forested wetlands. Soil moisture would temporarily increase on these sites as described above. Road construction proposed under this alternative would result in the conversion of wetland habitat to road on about 25 acres of forested wetland, 5 acres of forested wetland/emergent short sedge, and about 4 acres of non-forested wetlands. The specific effects are described above in Alternative 2. At 33 acres, the effects to wetlands are lowest of the action alternatives.

Cumulative Effects

Following implementation of Alternative 4, approximately 221 acres of forested wetlands, 92 acres of forested wetland/emergent short sedge, and 56 acres of non-forested wetlands would be converted to roads. Less than 2 percent of the forested wetlands would have been converted to roads and less than 1 percent of the forested wetland/emergent short sedge and non-forested wetlands would be converted to roads. The effects are as described above. Approximately 3,348 acres of forested wetlands, 794 acres forested wetland/emergent short sedge, and 532 acres of non-forested wetlands would have had timber harvest. Cumulatively, around 25 percent of the forested wetlands, 8 percent of forested wetland/emergent short sedge, and 5 percent of non-forested wetlands would have been harvested. The vegetation on the oldest harvest areas would be more than 30 years old and soil moisture conditions should be returning to some facsimile of pre-harvest conditions. The older harvested areas are vigorous second-growth stands. Following implementation of Alternative 5, approximately 75 percent of the forested wetland, 92 percent of forested wetland/emergent short sedge, and 94 percent of non-forested wetlands on the project area would remain in an undisturbed condition.

Alternative 5 Direct and Indirect Effects

Alternative 5 proposes to harvest timber from approximately 1,256 acres of forested wetland, 122 acres of forested wetland/emergent short sedge, and 129 acres of non-forested wetlands. Soil moisture would temporarily increase as described above. Road construction proposed under this alternative would result in the conversion of wetland habitat to road on about 36 acres of forested wetland, 6 acres of forested wetland/emergent short sedge, and about 4 acres of non-forested wetlands. . In Alternative 5, 45 acres of wetland would be impacted (Table 69). Alternative 5 is 9 more acres than Alternative 3, 12 more acres than Alternative 4, but 36 acres less than Alternative 2.

Cumulative Effects

Following implementation of Alternative 5, approximately 232 acres of forested wetlands, 93 acres of forested wetland/emergent short sedge, and 56 acres of non-forested wetlands would be converted to roads. Less than 2 percent of the forested wetlands would have been converted to roads and less than 1 percent of the forested wetland/emergent short sedge and non-forested wetlands would be converted to roads. The effects are as described above. Approximately 3,879 acres of forested wetlands, 844 acres forested wetland/emergent short sedge, and 568 acres of non-forested wetlands would have had timber harvest. Cumulatively,

around 29 percent of the forested wetlands, 8 percent of forested wetland/emergent short sedge, and 5 percent of non-forested wetlands would have been harvested. The vegetation on the oldest harvest areas would be more than 30 years old and soil moisture conditions should be returning to some facsimile of pre-harvest conditions. The older harvested areas are vigorous second-growth stands. Following implementation of Alternative 5, approximately 71 percent of the forested wetland, 91 percent of forested wetland/emergent short sedge, and 93 percent of non-forested wetlands on the project area would remain in an undisturbed condition.

Social-economic[9] Environment

Heritage Resources

Heritage resources include a wide array of historic and prehistoric cultural sites and traditional cultural properties. The Forest Service conducts heritage resource investigations that follow the Section 106 process of the National Historic Preservation Act (NHPA) as amended, procedures of the Advisory Council on Historic Preservation (ACHP) (36CFR800), and Forest Service policy (FSM 2360). Section 106 of NHPA requires federal agencies, prior to any action, to identify heritage resources that may be eligible for inclusion in the National Register of Historic Places (NRHP) and that may be affected by the action. If historic properties are identified the agency must take reasonable action to avoid or mitigate adverse effects.

Consideration of the effects of the Logjam Project consisted of (1) defining the area of potential effects, (2) conducting a review of existing historic and archaeological information about the project area including the results of past heritage surveys, and through consultations with affected tribes and groups, (3) implementation of any additional fieldwork deemed necessary to assess potential effects, (4) development of recommendations based on the results of 1, 2, and 3, and (5) consultation with the State Historic Preservation Officer to seek concurrence with recommendations regarding significance and effect.

Affected Environment

Heritage Resources in the Logjam Project Area

There are five known historic and archaeological sites within the area of potential effects for the Logjam Timber EIS. Three of the sites are prehistoric (CRG-220, CRG-221, and the Sweetwater Lake Site) and two are of the historic period (CRG-154 and CRG-222). Only CRG-154 (the Lake Bay Mine) is considered significant in NRHP terms and is considered to be an historic property. Previous cultural resource work in the vicinity of the Logjam project area has included pedestrian inventories, including limited subsurface testing with soil probes and shovel test units. The cultural sites have been located as part of cultural resource inventories, but have not been intensively recorded.

[9] While there are economic discussions in this section, for a discussion of the social economics of this timber sale a discussion can be found under Issue 3 (see page 121).

Prehistoric sites in the project area include two shell small middens in close proximity to one another and within 100 feet of the coast. The third site is a single groundstone artifact and several bark-stripped cedar trees associated with a modern shoreline of Sweetwater Lake. None of these sites lies within or near a harvest unit or planned road. None will receive increased visitation due to the activities associated with the planned harvest.

Historic sites include the Lake Bay Mine (CRG-154) located northwest of Sweetwater Lake and adjacent to planned harvest unit 573-08. The site contains the remains of an early 20th century mine (shafts, equipment, and structural remains) and is considered eligible for the National Register of Historic Places. Unit 573-08 was dropped from planning; therefore, the site will not be affected. The second historic site, a wooden fish trap poorly described in the earlier literature is reportedly associated with a modern shoreline. The site was not relocated during this survey. However, this site as originally documented is clearly located outside of the area of potential effects for this project.

The most abundant class of cultural resource in the project area is culturally modified trees (CMTs). The archaeological team recorded 352 CMTs during surveys conducted in 2001. The vast majority of the recorded CMTs are located along the shoreline of Sweetwater Lake, and in the cedar-rich fringes of Logjam and Hatchery Creeks. These areas will not be affected by harvest and road construction. One unit, 577-19, contains 19 CMTs in a two acre area. This unit was dropped from consideration for harvest. Appendix A of the Heritage Resource Report to the State Historic Preservation Officer contains a detailed description of CMTs in the project area.

Methodology

Past and Current Archaeological Survey in Logjam Project Area

Cultural resource surveys in and near the current project area (VCUs 5730 and 5770) began in the 1980s with initiation of large scale timber harvest and construction of an inland road system. In 1986, a Washington State University archaeology team under contract to the Tongass National Forest conducted extensive survey on north-central Prince of Wales Island (Ackerman et al. 1987). Ackerman's team surveyed approximately 976 acres within planned timber units and road corridors in the "Logjam Creek", "Sweetwater Lake", and "Hatchery Creek" areas (ibid). The team did not document any historic properties during these surveys. A total of seven culturally modified trees (CMTs) were noted and described.

Hurley notes in an "Archaeological Survey Report and 1990 Work Plan…" that of 1,848 acres identified for harvest within the Sweetwater Lake/North Honker Planning Area, 589 acres (20 proposed harvest units and 4.75 miles of proposed road corridors) were surveyed by Forest Service archaeologists in 1989 (USDA Forest Service 1990a). An additional 100 acres of survey adjacent to the current planning area was conducted in the Luck Lake/Ratz/Coffman planning area (ibid.). No historic properties were identified during these surveys. In a separate report Hurley notes that an 18 acre road corridor (FS 3000403) was surveyed and contained no historic properties (USDA Forest Service 1989).

In 1990, archaeologists with the Tongass National Forest, Ketchikan Area, conducted survey of 243 acres within three planned harvest units and four access road corridors in VCU 5730. No historic properties were noted during these surveys (USDA Forest Service 1990b).

Forest Service archaeologists conducted survey in 1991 in support of 1989-94 Long-Term Sale planning effort in VCU 5770. Four planned harvest units and four access roads totaling 348 acres were surveyed in 1991. No historic properties were recorded (USDA Forest Service 1991a and 1991b).

As part of the environmental impact study for the Central Prince of Wales Timber planning effort, a team of Forest Service archaeologists conducted cultural resource survey in 1992 and 1993 of planned harvest units and access roads scattered across central and northern Prince of Wales Island (USDA Forest Service 1993a and 1993b). These teams surveyed approximately 828 acres in VCUs 5730 and 5770. No new historic properties were recorded during these surveys. Four blazed hemlocks (CMTs) were noted. The historic mining road associated with CRG-154 (Lake Bay Mine) was encountered outside of units and noted (USDA Forest Service 1993a).

In support of the current Logjam planning effort, Forest Service archaeologists conducted survey in 2001. Six harvest units totaling 541 acres were intensively surveyed. An additional 680 acres were survey in areas of indirect effects within the project area. These areas included the corridors of Logjam and Hatchery Creeks as well as a substantial portion (approximately seven miles) of Sweetwater Lake shoreline. No historic properties were documented during these surveys. However, archaeologists did record 352 CMTs.

In 2004 and 2006, Forest Service archaeologists monitored and recorded information at CRG-154, the Lake Bay Mine. The harvest unit closest to this site has been dropped from consideration.

Monitoring

Monitoring following road construction is defined in the Programmatic Agreement between the Alaska region of the Forest Service, the State Historic Preservation Officer and the Advisory Council on Historic Preservation. The sample based nature of survey coverage results in only a small amount of survey coverage in areas of low sensitivity for heritage resources. Following road construction and harvest, disturbed areas would be monitored to test the predictive model on which the sampling design is based.

Environmental Consequences

The “area of potential effects” for all alternatives is considered to be the Project Area as defined in this document. Under all of the alternatives, the preferred management of heritage resource sites eligible for, nominated to, or listed in the National Register (historic properties) is avoidance and protection. Several factors contribute to low potential for the Logjam Project to effect historic properties within the area of potential effects for the project. Most known historic and archaeological sites in the project area are located on or very near the coast. The factors described in the Region 10 (FS) Programmatic Agreement with SHPO and the Advisory Council on Historic Preservation which contribute to sensitivity for cultural resources are absent from the directly affected portions of the project area (USDA Forest Service 2002). The imposition of a 1,000 foot coastal buffer effectively removes all harvest and road construction activities from this area of highest potential for the occurrence of

heritage sites. Planned harvest units are, for the most part, on steep slopes at higher elevations; again in low sensitivity areas for heritage resources.

Direct effects include damage due to harvest and road construction activities. Therefore areas of direct effect are defined as planned harvest units and road corridors.

Indirect effects result from activities peripheral to the harvest itself. These would include the risk of increased damage of historic properties due to increased visitation of the project area. Increased visitation might result from higher numbers of workers in the area during harvest or from increased accessibility to the area due to road improvements.

Cumulative effects to heritage resources result from the collective impacts of natural decay, erosion, and forest processes as well as modern cultural processes, which may include recreational artifact collection and vandalism of historic properties and developments such as timber harvest and road construction.

The Logjam Project Area is roaded and receives considerable recreation use at present. The planned timber harvest will not significantly increase the use of the project area by the public, nor will it contribute to increased potential impacts to heritage resources.

Alternative 1 Direct and Indirect Effects

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

Alternatives 2, 3, 4 and 5 Direct and Indirect Effects

Alternatives 2 through 5 contain no proposed harvest units or roads that would have a direct and significant effect on historic properties. There would be no direct effects.

Harvest and road construction would not significantly increase access and visitation to areas of high sensitivity for heritage resources. All proposed roads would be decommissioned or put into storage after harvest activities are complete. No indirect effects are anticipated from these alternatives.

Cumulative Effects (all alternatives)

Cumulative effects of the Logjam Project are considered minimal in all alternatives. Harvest and road construction are not in areas of high potential for heritage resources or near known historic properties. Project activities would not contribute significantly to the degradation of historic properties in the project area.

NHPA Section 106 Compliance

Therefore a finding of “no historic properties affected” is recommended for all alternatives. Under the terms of the existing Programmatic Agreement with the Alaska State Historic Preservation Officer and the Advisory Council on Historic Preservation (USDA FS 2002, as amended 2007) “the Forest may proceed with the undertaking in lieu of a consensus determination of eligibility pursuant to 36 CFR 800.4”. The complete report of the Heritage

Resources analysis for the project will be submitted for programmatic review at the conclusion of the fiscal year.

RECREATION

Interest in recreation opportunities in Southeast Alaska are growing with increased tourism to the area. Tourism is becoming more important to the communities on Prince of Wales Island, but current recreation use on the island is predominantly from island residents. Recreational pursuits in the project area include freshwater fishing, big game and waterfowl hunting, off-highway vehicle use, kayaking/canoeing, hiking and wildlife viewing, local subsistence recreation, picnicking, and camping.

Affected Environment

In 2004, Southeast Alaska had an estimated population of 70,622 people, with about ¾ of these people residing in Juneau, Ketchikan, and Sitka (Colt et al. 2007). The remaining population can be found in over 45 small communities scattered throughout the region. Most of these small communities have populations of less than 1,000 residents. Wrangell, Petersburg, and Ketchikan are the closest population centers to the project area. Smaller communities in the vicinity include Coffman Cove, Naukati, Craig, Klawock, Hollis, Hydaburg, Kasaan, Thorne Bay, Point Baker, Port Protection, and Whale Pass. Coffman Cove (population 162 in 2007) is the closest community to the project area.

Tourism

Southeast Alaska

Nearly 1 million tourists visited Southeast Alaska in 2004 (Cerveny 2005), with seventy-five percent arriving by cruise ship. Non-cruise tourists tend to either utilize package deals designed to provide transportation, lodging, meals and activities or visit as independent travelers. These independent travelers design their own travel itineraries and tend to utilize public transportation systems and stay in the local communities. For the majority of Alaska visitors, it is important to experience the natural resources, cultural history and wildness of the region. Many have expectations of seeing glaciers, wildlife or being able to bring home wild game and fish. According to Cerveny 2005, “tourism providers often rely on public lands to bring guests closer to glaciers, bears, and whales.” In 2001, it was estimated that 188,000 visitors participated in guided commercial tours on Tongass National Forest lands (Cerveny 2005). The direct and indirect economic value of tourism to Alaska is estimated to be $1.5 billion, and provides approximately 26,000 jobs (Global Insight 2004). Recreation opportunities on the Tongass National Forest are an important part of Alaska’s tourism and economic sustainability.

Prince of Wales Island

Prince of Wales Island tourism is limited by the lack of regularly scheduled public transportation. Cruise ships do not travel to Prince of Wales and until 2002, the ferry system only traveled to Prince of Wales once a week. Also, the island road system is not paved

between most of the island communities. Federal Highway grants have expanded the paved road system from Craig to Hollis and then to Thorne Bay. Currently the road to Coffman Cove is being paved.

Tourists in Craig, the largest population center on Prince of Wales Island, participate in three basic activities; fishing, hunting or pleasure boating (Cerveny 2005). Some nonconsumptive opportunities, like kayak and hiking tours, are beginning to develop. An estimated 4,000 to 6,000 visitors came to Craig and Klawock during 2001 (Cerveny 2005). The majority of these visitors come to Craig with a travel package, which includes charter fishing or guided hunting and accommodations. Much of the direct revenue from these tourists goes to with the lodges and charter operators, but some indirect effects occur through the purchase of gas, supplies, and groceries.

Now, the privately owned Inter-island ferry system transports people to Prince of Wales on a daily basis. An additional ferry terminal opened in 2006 in Coffman Cove, transporting people several days a week during the summer months between Wrangell, Petersburg, and Coffman Cove. This new service and continued road development are predicted to increase tourism to the island.

During the period of mid-May to mid-September in 2006, the ferry provided 1,955 passengers and 483 vehicles service on the southbound route to Coffman Cove. In 2007 during this same period, numbers increased to 2,054 passengers (5 percent increase) and 588 vehicles (18 percent increase) (Chapman 2007).

Some tourism businesses have seen a large increase in business from the ferry service (Hull 2007), and others have stayed about the same or decreased due to the Coffman Cove Road construction project (Hedges 2007). Coffman Cove visitors come to the area primarily to fish, and the Sweetwater Lake, Hatchery Creek, and Logjam Creek waters are the prime fishing areas. However, this access has been closed due to construction.

Recreation Opportunity Spectrum

The ROS inventory is based on the evaluation of three criteria: setting, activity, and experience (USDA Forest Service 1982). The ROS inventory system is not a management system, so it does not dictate what type of activities are permitted in a given area, rather it generally describes and provides guidelines about the types of recreation opportunities that are compatible with the management activities in an area. The Recreation Resource Report, which is located in the Project record, contains detailed information on ROS.

The majority of the area has been inventoried as Roaded Modified, providing access for such activities as subsistence recreation, sportfishing, big game hunting, and waterfowl hunting. Opportunities for more remote recreation can be found in the upper reaches of Logjam Creek, the area around and to the west of Gold and Galligan Lagoon, the slopes to the southeast of Sweetwater Lake, and the flats area along the southeastern project boundary.

Table 70. ROS Designations within the Logjam Project Area

ROS Class	Acres
Roaded Modified (RM)	38,621
Semi-Primitive Motorized (SPM)	117
Semi-Primitive Non-Motorized (SPNM)	16,847
Primitive (P)	285
(Saltwater)	263
Total	**56,133**

Saltwater is included in the ROS GIS layer.

Recreation Places

Within the project area, inventoried recreation places include the following (USDA Forest Service 1997b) and the associated recreation activities that occur within these places are noted. These recreation places are shown in Map 11 along with the recreation sites listed below.

A. Slopes near headwaters of Logjam Creek in the southern part of project area – popular for hunting and hiking

B. Gravel pit along State Highway 925 - popular for fossil digging

C. Logjam Creek access at Forest Road 23 and 30 junction - fishing, hiking, and wildlife viewing

D. Sweetwater Lake and Gold and Galligan Lagoon – fishing, boating, wildlife viewing, hiking, sightseeing

An additional recreation place may need to be added to the inventory:

E. This recreation place encompasses the 2360000 road system and is popular for OHV riding (Off-Road Club 2007). The future management of the roads within this recreation place will be determined with the Access Travel Management planning process.

Recreation Sites

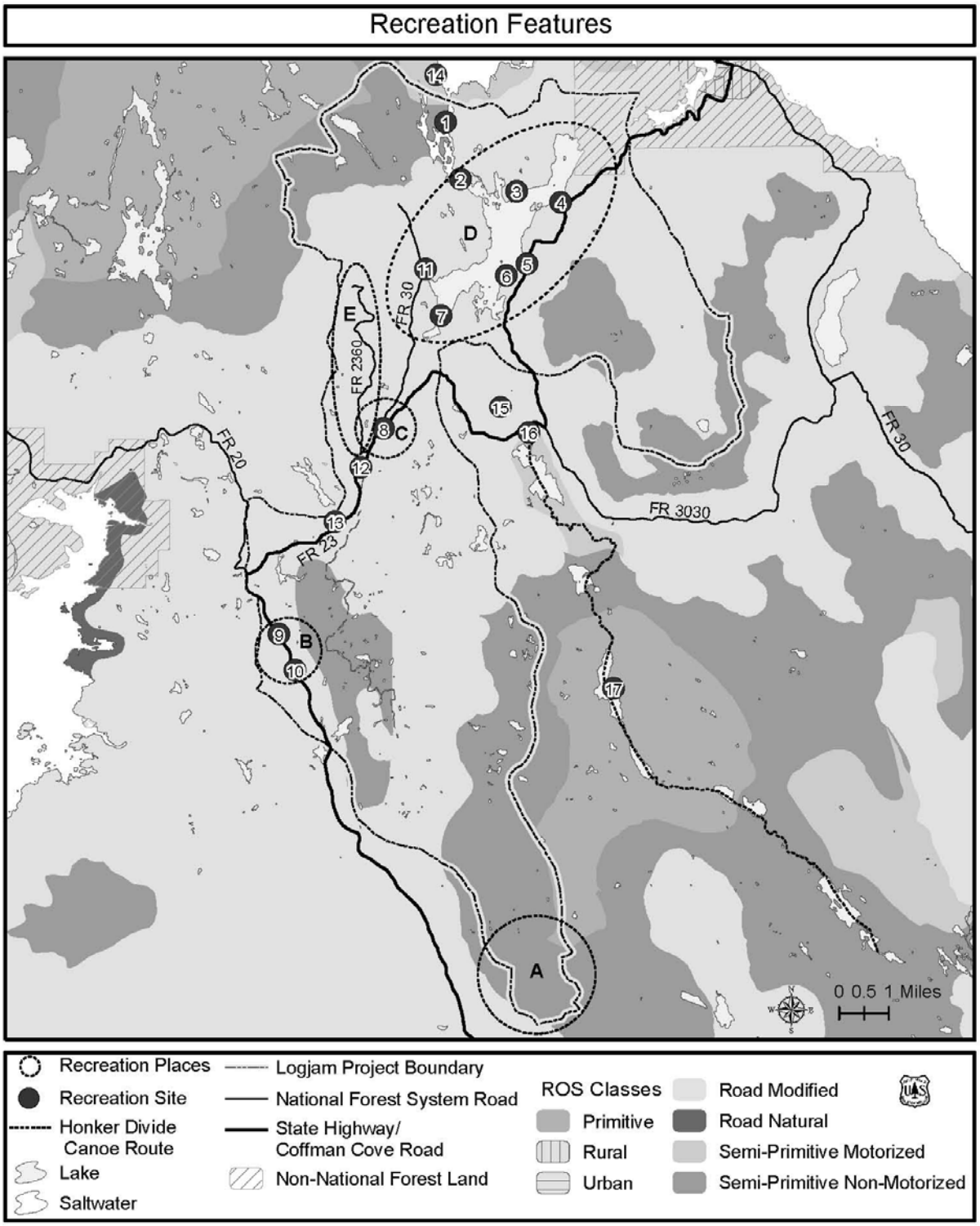
The Recreation Sites GIS layer identified thirteen sites within the project area, many associated with recreation on Sweetwater Lake. Most of these sites also fall within several Recreation Places described in the previous section, further delineating those areas of more concentrated use. Map 11 illustrates the location of these sites and Table 71 provides site details:

Table 71. Recreation Sites within the Logjam Project Area

Map #	Site Type*	Description
1	Dispersed	Canoe/kayak route, Barnes Lake
2	Dispersed	Canoe/kayak route, Gold and Galligan Lagoon
3	Dispersed	Sweetwater Lake access
4	Dispersed	Sweetwater Lake access
5	Developed	Sweetwater Lake Cabin access trail
6	Developed	Sweetwater Lake Cabin
7	Dispersed	Hatchery Creek/Sweetwater Lake access
8	Dispersed	Logjam Creek access
9	Dispersed	Gravel pit popular for fossil digging
10	Dispersed	Non-existent – should be removed from inventory
11	Dispersed	Sweetwater Lake campsite
12	Developed	Logjam Creek fishing access site
13	Dispersed	Rabbit Ears Picnic Pavilion

*Developed = a managed Forest Service recreation site with some level of development provided for the comfort of the recreational user. Dispersed = a site generally without any development or improvements maintained by the Forest Service that offers one or more recreational activities (e.g., fishing access, wildlife viewing)

Map 11. ROS inventory, Recreation Places and Recreation Sites



Sweetwater Lake Cabin is one of the more popular cabins on the island because of its proximity to Coffman Cove and easy access from the road system. According to the National Recreation Reservation Service, the cabin has been reserved on average 87 nights a year and housed on average 102 visitors a year (2003-2005). Access from the road includes a parking area and short access trail with a skiff for traveling the ½-mile distance to the cabin.

The lake itself is a popular fishing spot for rainbow trout, cutthroat trout, and Dolly Varden, as well as coho, sockeye, and pink salmon. Many animals, including Sitka black-tailed deer, black bear, marten, mink, otter, and beaver are commonly seen. Seals are often observed in the lake. The abundance of fish and wildlife in this lake setting presents ample opportunities for forest visitors to view wildlife, fish, hunt, boat, hike, and sightsee. In addition, the lake is often a start or end point for canoe/kayak trips through Gold and Galligan Lagoon, Barnes Lake, and Lake Bay near Coffman Cove.

Two productive stream systems that flow into Sweetwater Lake (i.e., Logjam Creek and Hatchery Creek) are also popular areas for fishing, hiking and wildlife viewing. Several road pullouts along Forest Road 30 and the Coffman Cove Road provide access to Logjam Creek and Hatchery Creek. Recent road improvements to the Coffman Cove Road (Forest Road 30) have included paving, signing of parking areas and fishing access points. A network of access trails to Logjam Creek has developed over time from this road and offer visitors access to fishing areas. Hatchery Creek Trail, which is located outside of the project area, is used for hiking, viewing wildlife, and fishing access.

The gravel pit on State Highway 925 provides a site for fossil digging. This site was identified in the current Recreation Facility Analysis process as an important recreation site for island residents.

Three additional sites were identified in the Logjam EIS field inventory (2007) that needs to be added to the GIS inventory. These are also listed in Table 71 above.

- A dispersed campsite located on the 3000398 road approximately 0.15 miles from the junction with Forest Road 20 was identified. This site consists of several small camp structures that indicate repeated use from year to year. There is a small, crude smoker, a large fire pit, some makeshift tables, and rocks that outline where tents may have been.
- A signed fishing access site with a well-developed gravel road pullout is on Forest Road 23. There is an undeveloped path from the pullout to the creek and along the bank of Logjam Creek.
- The City of Coffman Cove has a special use permit to operate and maintain a picnic pavilion near Rabbit Ears Lake. The site has been improved for OHV riding to accommodate a variety of skill levels and vehicle types. This site is open to the public year round. In addition, the City of Coffman Cove will periodically apply for recreation event permits to hold OHV events at this location.

Due to this proximity to the project area, five developed recreation sites (Table 72) were considered for the effects on scenery from proposed activities.

Table 72. Recreation Sites and Recreation Places outside Logjam Project Area

Map Number	Site
14	Barnes Lake Cabin
15	Hatchery Creek Trail
16	Honker Divide Canoe Route trailhead
17	Honker Lake Cabin
(No Number)	Honker Divide Canoe Route

Off-Highway Vehicle Use

During public meetings, the Prince of Wales Off-Road Club indicated two of their primary use areas within the project area: Rabbit Ears Picnic Pavilion and the nearby 2360000 road system. Other road systems were also identified for potential OHV opportunities. Future management of OHV use on island roads will be determined through the Access Travel Management planning process and decision.

Special Use Permits and Outfitter/Guide Use

At this time, freshwater fishing is the only activity authorized to outfitter guides by special use permit in the Logjam project area. All reported activity occurs in one of three places; Sweetwater Lake, Hatchery Creek, and Logjam Creek. All use reported at Sweetwater Lake and Logjam Creek likely occurs within the boundary of the project area, while the Hatchery Creek use likely occurs both within and outside the project area.

During 2002 to 2006, there have been nine outfitter/guides permitted within the project area, all operating within the Recreational River LUD (Slayton 2007b). From 2002 to 2006, the maximum number of clients served in one day is 12, occurring on Hatchery Creek in June 2005. The average number of clients served per day is 3.5 (Hatchery Creek), 3.3 (Logjam Creek), and 6.8 (Sweetwater Lake), with an average of one party per day on trails and at dispersed sites. This level of use is well within the maximum allowed of 20 parties per day for the Roaded Modified ROS class.

Outfitter/guides pay the Forest Service “service day fees” for each client for each day they use National Forest system lands to conduct their activities. Current fees for freshwater fishing, the only permitted outfitter guide use in the area, are $3.03 per service day. Using today's fee for freshwater fishing ($3.03), the total fees collected by the Forest Service over this five year period (2002 to 2006) would have been $1,060.50 (350 clients x $3.03).

A carrying capacity analysis for all of Prince of Wales Island (including the project area) has been initiated for Outfitter/Guide use. The carrying capacity concept for recreation is part of the management of wilderness areas, national parks and other recreation areas that receive high levels of use, have evidence of recreation related impacts and/or conflicts between users or user groups (Manning 2001). The effort underway may result in site-specific management if conflict or impacts are found to exist.

3 Environment and Effects

Methodology

The Recreation Places and Recreation Sites GIS data were used to identify these places and sites, and was supplemented with more recent accounts of important places for recreation. The location of these areas was evaluated based on their proximity to proposed activities.

Environmental Consequences

This section examines the potential effects to recreation resources resulting from the implementation of the proposed activities in the Logjam project area.

Recreation Opportunity Spectrum

The existing ROS classes found in the Logjam project area would change with the action alternatives proposed (Table 73). With a project area approximately 56,133 acres in size, the resulting changes would be minimal in scope. The addition of roads and harvest units proposed in each alternative would result in some of the project area (less than 3 percent of the total acreage of the project area) currently inventoried as Semi-Primitive Non-Motorized being converted to Roaded Modified. The Semi-Primitive Motorized and Primitive ROS classes would not be impacted.

Table 73. ROS class acres resulting from implementation of the proposed alternatives

ROS Class	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Roaded Modified (RM)	38,621	40,295	39,464	39,290	39,517
Semi-Primitive Motorized (SPM)	117	117	117	117	117
Semi-Primitive Non-Motorized (SPNM)	16,847	15,173	16,004	16,178	15,951
Primitive (P)	285	285	285	285	285
(Saltwater)	263	263	263	263	263
Total	**56,133**	**56,133**	**56,133**	**56,133**	**56,133**
Acres changed from "Semi-Primitive Non Motorized" to "Roaded Modified"	**0**	**1,674**	**896**	**843**	**669**

Based on observations of the recreation uses of north Prince of Wales Island, along with lack of documentation of user concerns regarding recreation in the scoping phase of this project, a change in the ROS classification for a portion of the project area is not likely to greatly impact Prince of Wales Island's recreation users. Some changes to existing ROS character, resulting from timber harvest in development LUDs, were anticipated as part of the management objectives and direction incorporated into the Forest Plan.

All of the action alternatives would result in a conversion of some acres from SPNM to RM within the Logjam project area. Alternative 2 would result in the most change from the existing conditions, with nearly twice as many acres converted compared to the other action alternatives. Alternative 5 and Alternative 3 result in almost the same amount of acres converted, with Alternative 4 resulting in the least amount of acres converted (see Table 73). Alternative 1 would not change the existing ROS classification for the Logjam project area.

Recreation Places and Recreation Sites

The following groups are identified, with a discussion on direct and indirect impacts anticipated with the implementation of the proposed alternatives:

Recreation Sites and Places along the existing Road System (see Map 11)

This group includes three recreation places:

B) Gravel pit along state highway 925 that is popular for fossil digging

C) Logjam Creek access at the junction of Forest Road 23 and 30

E) Proposed new recreation place (road 2360 for OHV riding)

And seven recreation sites (from south to north in the project area) include (see Map 11):

9) Gravel Pit popular for fossil digging

13) Rabbit Ears Pavilion Site

12) Logjam Creek Fishing Access Site

8) Logjam Creek Access

11) Campsite at Sweetwater Lake

5) Sweetwater Lake Cabin Access Trail

4) Sweetwater Lake Access

Alternative 1 would result in no change to these recreation sites and places, as no timber harvest or road building is proposed.

None of the action alternatives (Alternatives 2, 3, 4, and 5) would result in lasting impacts to any of the recreation places or recreation sites, with the exception of scenery, which is discussed in the scenery resource report. Dispersed recreation use is expected to continue in the project area. With the proposed timber harvest and road building, recreation opportunities are expected to remain much the same as that occurring now, once the Logjam Timber Sale is complete. Those recreation sites and places associated with access to Logjam Creek and OHV use on Forest road 2360 would be the most impacted, as that part of the project area includes concentrated harvest along road 2360 and Forest Road 30 in all action alternatives.

One of the more noticeable impacts to recreation sites and places in this group would be the potential for a temporary increase in traffic associated with an ongoing timber sale, including possible road closures or delays necessary for safe timber harvesting operations.

Recreation Sites and Places Associated with Sweetwater Lake, but not on the Road System (See Map 11).

This group includes one recreation place:

D) Sweetwater Lake and Gold and Galligan Lagoon

And five recreation sites:

1) Canoe/kayak route, Barnes Lake

2) Canoe/kayak route, Gold and Galligan Lagoon

3) Sweetwater Lake Access

6) Sweetwater Lake Public Recreation Cabin

7) Hatchery Creek/Sweetwater Lake Access

Alternative 1 would result in no change to the current condition experienced near Sweetwater Lake, as no timber harvest or road building would occur.

All of the action alternatives (Alternatives 2, 3, 4 and 5) propose timber harvest surrounding the lake in three main areas: on the slopes west/southwest of the lake off Forest Road 30, off the 3030 road system north of Sweetwater Lake, and off various forest roads intersecting with the main Coffman Cove road east of the lake. The most lasting impact resulting from any action alternative would be the change in scenery resulting from the various alternatives, which is discussed in the Scenery Resource Report. Other impacts to the recreation experience include noise and activity associated with active timber harvest sales, which would be apparent to users of Sweetwater Cabin. Depending on a person's location on the lake, harvest activities may be noticeable in all action alternatives. Some people might be disturbed by this activity going on, while others may find it interesting to observe.

Both Alternatives 2 and 5 propose nearly the same harvest strategies in the three areas mentioned above. Both Alternatives 3 and 4 propose less harvest that would be visible and observed from Sweetwater Lake, with Alternative 4 having the least impact of the alternatives. Once the timber sale is complete, recreation opportunities in the Sweetwater Lake vicinity would remain much as they are currently, regardless of the alternative implemented.

Logjam Creek Headwaters

This discussion includes only the Logjam Creek Headwaters that is popular for hunting and hiking (Recreation Place A, Map 11). There is no timber harvest proposed in or near this recreation place in any of the alternatives, so there would be no effect to this recreation place resulting from the Logjam Timber Sale.

Off-Highway Vehicle Use

Alternative 1 would not result in any change to OHV use in the Logjam Project area. None of the action alternatives propose the construction of new roads or areas that would be open to OHV use, nor do they propose the closing of such areas. The Rabbit Ears Picnic Pavilion site is located on the border of the project area with timber harvest proposed nearby in all action alternatives, but the harvest is not proposed to be yarded to the access road for the pavilion site and should not affect access to, nor use of, the area. Nearby harvest would result in a change in the scenery nearby (see the Scenery Resource Report), but it is my understanding that the OHV group seeking a special use permit for this site would not be adversely impacted by this change (personal communication, Houser). The Recreation Place that encompasses the 2360 road system would be affected during the life of the timber sale, due to traffic associated with active timber harvest, but none of the alternatives propose the opening or closing of any existing roads. OHV management for the project area, as well as the entire road system on

Prince of Wales Island, will be addressed in the ongoing Access Travel Management Plan process, and decision will be rendered regarding OHV use on Prince of Wales Island.

Special Use Permits and Outfitter Guide Use

It is difficult to determine the economic impact this activity has on nearby communities, as the amount of outfitter/guide clients' spending in these communities varies widely, and local vs. non-local purchasing by the outfitter/guides themselves is also hard to determine. A more useful approach to determining the effects to outfitter guides is to examine the potential the timber sale activities has on the outfitting/guiding sector to continue to conduct their established activities.

None of the alternatives would result in long-term impacts to the ability of outfitter guides to use these areas. Alternative 1 would result in no change to current conditions, while Alternatives 2, 3, 4, and 5 all propose timber harvest that would use the same roads for hauling. Increased traffic, and temporary road closures to address safety concerns during active timber harvest, may have an impact on the locations that outfitter guides choose as their point of access to fishing areas. These impacts would be temporary, ceasing after the timber harvest operations are complete.

Cumulative Effects

The cumulative effects analysis area for the recreation resource is the portion of Prince of Wales Island accessible from the existing road system between Control Lake and Coffman Cove, including the Logjam Project Area. Past, present and reasonably foreseeable future actions considered in this analysis can be found in Appendix D. The surrounding roads and harvested areas have already heavily influenced the type of recreation use in this area. After the Coffman Cove Road is paved, increased recreation and outfitter guide use to this area may increase.

SCENERY

This section describes the visual resources within and adjacent to the Logjam project area. The objective is to determine whether the proposed management activities meet identified Scenic Integrity Objectives (SIOs). The process of planning harvest units, road construction, and developing a range of alternatives is documented in other sections of the planning record, of which, scenic resource considerations are an integral part.

Affected Environment

The Existing Scenic Integrity of a landscape characterizes how and to what degree the natural inherent scenic characteristics of a certain landscape have been altered by managed or natural activity. Logjam project area is comprised of landscapes with varying degrees of scenic conditions from natural to altered.

Major topographic features within and adjacent to the project area include Sweetwater, Galligan Creek, Logjam, Hatchery Creek, and Trumpeter Creek watersheds. The community

of Coffman Cove is within five miles to the Northeast of the project area. Forest Highway 30 (Coffman Cove Road) bisects the project area running east to west from Coffman to Forest Highway 925 (North Prince of Wales Road) junction.

Previous timber harvest activity has occurred on approximately 10,147 of the 56,133 acres in the project area. Approximately 7,500 acres were harvested between 1978 and 2008. Approximately 159 acres of this harvest occurred since 2000 on land within the Project Area that is owned and managed by the State of Alaska, Department of Natural Resources. The first timber harvest occurred in the early 1950s near the community of Coffman Cove in the northeastern corner of the project area. Large scale harvesting operations began within the project area in the early 1960s and continued until a few years before the Ketchikan Pulp Company's operations ceased in 1999.

No other Forest Service timber sales have been scheduled within the Project Area, however the area is likely to continue to provide limited small roadside and salvage timber sales for small Prince of Wales Island mills into the foreseeable future.

Criteria for Evaluating Scenic Resources

Visual Priority Travel Routes and Use Areas (VPR)

The Forest Plan provides Standards and Guidelines that include the designation of Visual Priority Routes and Use Areas. These areas were defined with regards to public input. These areas were identified as locations where scenic quality is an integral part of the landscape experience. They include land areas viewed while traveling on roads, trails, or marine routes (Visual Priority Travel Routes) and areas viewed from campgrounds, visitor centers, or permanent communities (Use Areas) These areas are key to the analysis process and are included in this scenery report. A complete index of Visual Priority Travel Routes and Use Areas is listed in the Forest Plan Appendix F-19. There are 8 inventoried Visual Priority Routes and Use Areas in the vicinity of the project area as shown in Figure 3.

Figure 3. Visual priority routes and use areas

Visual Priority Routes and Use Areas	*Locations*
Recommended Wild, Scenic and Recreational Rivers	• Thorne River / Hatchery Creek/Barnes Lake
Forest Service Cabins	• Sweetwater Lake • Barnes Lake • Honker Lake
Public Use Roads	• Control Lake to Coffman Cove (3030 road)
Dispersed Recreation Areas	• Honker Canoe Route – Gold & Galligan Lagoon to Throne Bay • Gold and Galligan Lagoon • Hatchery Creek Area

Distance Zones

Visibility, mapped in terms of distance zones, is a measure of how visual changes are perceived in the landscape. Changes in form, line, color, and texture become less perceptible with increasing distance. The Forest Service describes visibility in terms of three distance zones: foreground, middleground, and background (USDA Forest Service 2007). Areas not visible from Visual Priority Travel Routes and Use Areas are termed “not seen”. Each distance zone describes the level of detail or change that can typically be perceived when viewing the landscape. The Seen Area or what is visible of the Logjam project landscape from Visual Priority Travel Route and Use Areas is classified into the following categories:

- Foreground: (0 - ½ mile) – The portion of the seen area in which detail in the landscape becomes noticeable. Foliage and fine textural details of vegetation are normally perceptible within this zone. The units visible within the Foreground distance zone are those along the Coffman road as seen from Viewing Points (VP) 9, 10, 11, 12, 13, 14.
- Middleground : (½ - 3 to 5 miles) - The portion of the seen area in which details of foliage and fine textures cease to be perceptible and objects in the landscape are perceived mainly by their form. Vegetation appears as outlines or patterns. Units within middleground distance zone are those seen from Sweetwater Lake as described in the Key Viewing Points section below.
- Background: (3-5 miles and greater) - The portion of the seen area where texture and color are weak, and landforms become the most dominant element. Background views of the mountain ranges frame the horizon in this landscape. The visual elements of line and form are dominant. Strong color contrasts of sufficient size may still be noticeable. There are no units visible from Background distance zone within or adjacent to the project area.

- Not Seen: Those landscapes within the project area not visible as a result of topographic relief or other physical attributes from Visual Priority Travel Routes and Use Areas are classified as Seldom Seen.

Table 74. Project area acres by distance zone

Distance Zone	Acres
Foreground	3,834
Middleground	42,659
Background	9,377
Saltwater	263
Logjam Project Area	**56,133**

Data Source: c:\tmp\notesE1EF34\logjam_scenery_for_paul_xls

Key Viewing Points

Map 12 illustrates key viewing points used to assess the Existing Scenic Integrity of the project area and to develop project designs that will be consistent with the adopted visual objectives for each land use designation. The View Points designated 1 through 14 were identified in the Forest Plan and were confirmed during seen area field reconnaissance.

The project area is most commonly seen by travelers using the Coffman Cove Road or by boaters on Sweetwater Lake. Viewpoints used for this analysis are within Sweetwater Lake and Coffman Cove Road, (Viewpoint 1- 14). All are included and identified as Visual Priority Routes and Use Area in the Forest Plan, from which views of the project area were analyzed.

Viewpoint 1, 3 and 6 are of units 573-10, 11, 12 and 13. This area received the most scrutiny as a result of these proposed units being located in Scenic Viewshed LUD. Viewpoint 2 and 7 are of unit 537-01. Viewpoint 4 is toward units 573-67 and 68. Viewpoint 5 is toward 573-74 and 75. Viewpoints 8 – 14 are positioned along Coffman Cove Road in order gain the best vantage of their corresponding proposed units.

The Scenery Resource Report, located in the Project record includes a table that lists all units not seen from a Visual Priority Route (VPR) and identifies those units seen from the corresponding view point, Land Use Designation (LUD), Distance Zone, Scenic Integrity Objectives (SIO), Visual Absorption Capacity (VAC) and approximate acreage.

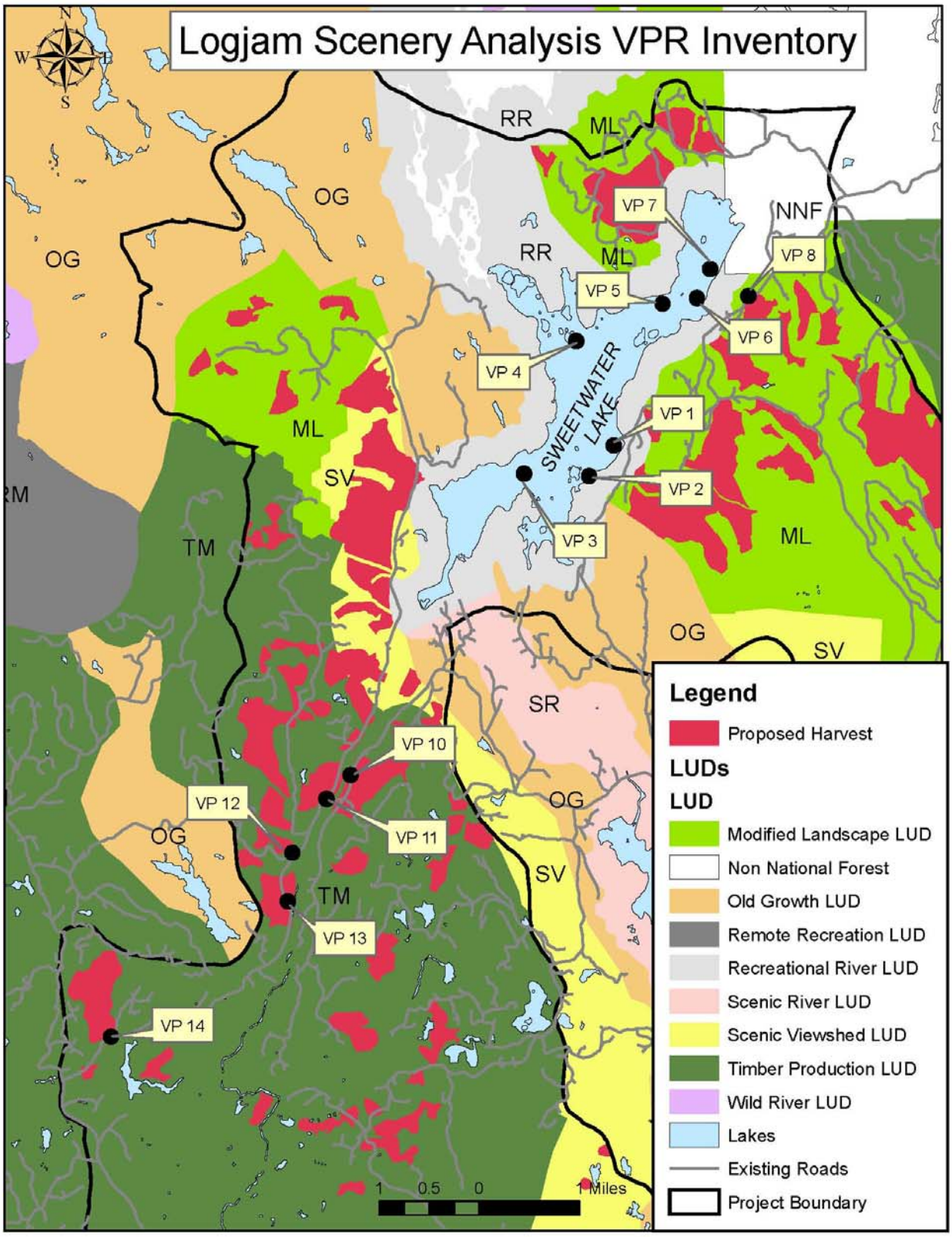
Approximately 80 percent of the project area is categorized as “Not Seen” from Visual Priority Travel Routes or Use Areas as shown in Table 75.

Table 75. Project Area Visibility from Visual Priority Travel Routes or Use Areas

Visibility	Acres
Seen	6,203
Not Seen	49,667
Saltwater	263
Logjam Project Area	**56,133**

Data Source: c:\tmp\notesE1EF34\logjam_scenery_for_paul_xls

Map 12. Logjam Scenery Analysis Viewpoint Inventory



Existing Scenic Integrity (ESI)

ESI describes the visual appearance of the landscape at the time the project area scenery assessment in conducted. It excludes the context of whether the landscape is seen or seldom seen from Visual Priority Travel Routes and Use Areas and indicates the amount of change that has occurred in the past, and what level of change may be acceptable in the future. The relevance of ESI for this analysis is to use the present visual condition of the project area as a baseline to evaluate the acceptable desired future condition and cumulative effects outlined in the Forest Plan management prescription criteria. Six levels are used to describe the landscapes Existing Scenic Integrity ranging from unaltered to heavily altered. ESI is measured by the following condition types, as described in the Forest Plan:

- Type I : Landscapes where only ecological change has occurred, except for trails needed for access. Landscapes appear to be untouched by human activities.
- Type II: Landscapes where change is not noticed by the average forest visitor unless pointed out. These landscapes have been altered but changes are not perceptible.
- Type III: Landscapes where changes are noticeable by the average forest visitor, but they do not attract attention. Changes appear to be minor disturbances.
- Type IV: Landscapes where changes are easily noticed by the average forest visitor and may attract attention. Changes appear as disturbances but resemble natural patterns in the landscape.
- Type V: Landscapes where changes are very noticeable and would be obvious to the average forest visitor. Changes tend to stand out, dominating the view of the landscape, but are shaped to resemble natural patterns.
- Type VI: Landscapes where changes are in glaring contrast to the landscape's natural appearance. Changes appear as dramatic, large scale disturbances that strongly affect the average forest visitor.

The ESI of the project area is primarily in a Type I condition, as evidenced by the relatively small amount of disturbance within the project area (Table 76). Approximately 8,100 acres or 14 percent of the project area was managed for timber harvest within the last 30 years. This condition however is not consistent throughout with 3,759 acres or 7 percent in a Type V condition as seen from key viewing points within the project area. ESI Type V rating is more a result of the extent of harvest than the direct visual appearance of the trees when viewed from visual priority viewing locations.

Table 76. Project Area Acres by Existing Scenic Integrity

Existing Scenic Integrity	Acres
Type I	45,574
Type III	375
Type IV	6,162
Type V	3,759
Saltwater	263
Logjam Project Area	**56,133**

Data Source: c:\tmp\notesE1EF34\logjam_scenery_for_paul_xls

Visual Absorption Capacity - VAC Analysis

Visual Absorption Capacity (VAC) is an estimate of the relative ability of a landscape to absorb change resulting from alterations such as timber harvest. VAC incorporates elements of slope, distance zone, visibility, and landscape complexity in measuring this capacity for change. The Forest Plan management prescriptions provide direction in determining the maximum harvest treatment and allowable visual disturbance within development areas utilizing Visual Absorption Capacity classes. The classes are Low, Intermediate, and High, and as identified express a low, intermediate, or high capacity of the landscape to absorb change

The project area topography has slopes ranging from 0 to slopes greater then 60 percent. The landscape complexity can be classified as intermediate because of its diversity in vegetative patterns such as varied topography, muskeg, shoreline, and drainage patterns. The proposed harvest units are situated so that if visible, they are seen in the background from local use areas and in the background or middleground from the water. Likewise, much of the project area cannot be seen at all from Visual Priority Travel Routes or Use Areas. As a result, the project area can be classified as having an intermediate visual Absorption Capacity (Table 77). No development is proposed in foreground viewing areas.

Table 77. Project Area Acres by Visual Absorption Capacity Class

Visual Absorption Capacity Class	Acres
Low	19,151
Intermediate	30,130
High	6,589
Saltwater	263
Logjam Project Area	**56,133**

Data Source: c:\tmp\notesE1EF34\logjam_scenery_for_paul_xls

Allowable Visual Disturbance

Allowable Visual Disturbance expresses how much allowable visual disturbance is acceptable for a given area during any given time period. The proposed management activities for the Logjam Project Area may occur adjacent to or near previously harvested locations. Even though individual harvest units may meet a particular Visual Quality Objective, cumulatively a greater impact may result.

Maximum disturbance thresholds modeled during the cumulative effects analyses of the Forest Plan using SPECTRUM and are described in Appendix B of the Forest Plan, Final EIS. Using this model, it was determined that within the Timber Production LUD for areas adopting the Very Low SIO, up to 50 percent of suitable lands may be under development at one time. In Modified Landscape LUD for areas adopting Moderate SIO, up to 20 percent of suitable lands may be under development at one time. In Scenic Viewshed LUD for areas adopting High SIO, up to 10 percent of suitable lands may be under development at one time.

Previously harvested units measured within Scenic Viewshed LUDs comprise less than 1 percent total existing disturbance. For Modified Landscape and Timber Production LUDs, the level of existing disturbance is 2 percent & 6 percent, respectively. These levels of disturbance are well within the maximum disturbance threshold for all LUD designations as illustrated in Table B-6 of Appendix B of the Forest Plan, Final EIS.

Methodology

The scenic resource objectives are based on the visibility of landscapes from identified Visual Priority Routes & Use Areas listed in Appendix F of the Forest Plan, incorporating management objectives of the Forest Plan land use designations. The scenic resource evaluation of the project area initially reviewed the GIS mapping data of inventoried visual resource attributes for content and accuracy. Visual Nature Studio II terrain modeling software was used to inventory and simulate effects of management prescriptions. Field reconnaissance of the project area was conducted to verify the scenic inventory mapping information. This included examination of the visual experience from within and outside the study area. The Adopted Scenic Integrity Objectives for the project were formulated in GIS incorporating the Forest Plan Land Use Designations and the Distance Zone visual resource attribute. No further modifications were made to the database and all relevant GIS information for the scenery resource was determined accurate.

Methodology used to evaluate visual quality for this project is described in the Forest Service Scenic Management System (SMS). SMS provides the framework for the inventory of visual resources and provides measurable standards for its management. SMS includes the following criteria for evaluating scenic resources and each criterion has been discussed above.

- Visual Priority Travel Routes and Use Area (VPRs)
- Key Viewing Points
- Existing Scenic Integrity (ESI)
- Visual Absorption Capacity (VAC)
- Scenic Integrity Objectives (SIO)
- Land Use Designation (LUDs)
- Allowable Visual Disturbance

Scenic Integrity Objectives (SIO)

Forest-wide Scenery Standards and Guidelines include Scenic Integrity Objectives (SIO). SIOs are measurable goals used for the management of visual resources. Scenic Integrity

Objectives vary by land use designation and apply to any activity that could affect the visual character of the landscape. Scenic Integrity Objectives are determined based on a variety of physical and sociological parameters including Distance Zone, which is used to determine the distance between the potential viewer and the managed activity. Table 78 summarizes the SIO acreage in the Logjam project area.

SIOs are characterized as follows:

- High SIO: "Design activities to not be visually evident to the casual observer" (Forest Plan, pg 4-84). This SIO applies to the Scenic Viewshed Land Use Designation. Activities may only repeat form, line, color and texture that are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc. should not be evident.
- Moderate SIO: Management and design activities will be subordinate to the landscape character of the area. Changes in the landscape may be evident to the casual observer but appear as natural occurrences when contrasted with the appearance of the surrounding landscape.
  Low SIO: Management activities may visually dominate the characteristic landscape. Activities of vegetative and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that visual characteristics are those of natural occurrences within the surrounding area or character type.
- Very Low SIO: Land Management activities may dominate the characteristic landscape. Yet when viewed as background, should appear to be a natural occurrence.

Table 78. Summary of Scenic Integrity Objectives (SIO) within the project area

Scenic Integrity Objective	Acres
High	11,625
Moderate	8,784
Low	16,340
Very Low	19,121
Saltwater	263
Logjam Project Area	**56,133**

Data Source: c:\tmp\notesE1EF34\logjam_scenery_for_paul_xls

Environmental Consequences

The future visual condition of the affected landscape within Logjam Project Area is represented by the Scenic Viewshed, Modified Landscape and Timber Production land use designations of the Forest Plan. The visual effects of timber management will be evident after harvest has occurred. The landscape would reflect a higher degree of visual change associated with timber harvest than that characteristic of natural appearing forest environments. Several factors would contribute to the magnitude of visual impact associated with these activities and include: the location from where development is visible, the distance at which it is observed,

the vegetative composition of the surrounding landscape, and the design outcome of the activity.

Each of the action alternatives would result in varying degrees of change to the visual appearance of the landscape. The majority of proposed harvest units would be screened from view by topography and foreground vegetation. Green tree retention within each of the harvest units and corresponding shape would further reduce the overall visual effects of timber management. All action alternatives would meet or exceed a higher level of visual integrity than the Adopted Scenic Integrity Objective of the corresponding LUD designations.

Maps showing the scenery analysis viewpoint inventory by alternative can be found in the Scenery Resource Report located in the Project record.

Cumulative effects for all action alternatives are discussed at the end of this section.

Alternative 1 Direct and Indirect Effects

Under Alternative 1 no timber harvest or road building would take place and no visual disturbances would be caused by management activities. This alternative would maintain the existing visual character of the landscape.

Cumulative Effects

Cumulative effects were analyzed at the project level (for all alternatives). Cumulative effects are within Forest Plan Standard and Guidelines for scenery as anticipated under Alternative 1. Past, present and reasonably foreseeable future activities considered in the cumulative effects analysis can be found in Appendix D.

Alternative 2 Direct and Indirect Effects

The direct effect of implementing Alternative 2 would result in approximately 373 acres of managed units visible throughout the project area after harvest activities are completed. The most pronounced visual effects would occur in units 573-67 & 68 as seen within Modified Landscape LUD where Scenic Integrity Objectives are Low. This alternative would result in approximately 68 acres of visible clear-cut. The size and configuration of these units is within Forest Standard and Guidelines and will meet corresponding SIO Low for Modified LUD as seen from VP-4 in Sweetwater Lake.

Effects to units in Scenic Viewshed LUD visible from Sweetwater Lake will be indiscernible to the untrained eye. Only the portions of units 573-10, 11, & 12 that are screened by existing vegetation from Sweetwater Lake will be clear-cut. The remaining portions of these units are visible from the lake and will be managed using single tree selection with helicopter removal. This harvest method will meet SIO High for those units in Scenic Viewshed LUD.

The overall effects from management activities within the project area would be obvious to the casual forest observer if Alternative 2 is implemented. Visual disturbance would be dispersed throughout with no single area impacted beyond maximum disturbance thresholds at any one time. All units would meet their corresponding SIO or a higher degree of scenic integrity. No unit or units would exceed their corresponding Scenic Integrity Objectives as designated in the Forest Plan.

Alternative 3 Direct and Indirect Effects

Alternative 3 is similar in effect to Alternative 2 with approximately 254.5 acres of managed units visible throughout the project area after harvest activities are completed. If selected, there would be little discernable difference between Alternatives 2 and 3 to the forest visitor. The only noticeable difference would occur in unit 577-43 within Timber LUD with corresponding Low Scenic Integrity Objective. The overall effects from management activities within the project area would be obvious to the casual forest observer. Visual disturbance would be dispersed throughout with no single area impacted beyond maximum disturbance thresholds. All units would meet their corresponding SIO or a higher degree of scenic integrity. No unit or units would exceed their corresponding Scenic Integrity Objectives as designated in the Forest Plan.

Alternative 4 Direct and Indirect Effects

Implementing Alternative 4 would result in the least visual disturbance of any proposed alternative. The direct effect of implementation would result in approximately 206 visible acres of managed landscape throughout the project area. In comparison Alternative 4 would visually disturb approximately 60 percent fewer acres then Alternative 5.

The most noticeable difference between Alternative 4 and any other alternative would occur in units 573-67 & 68, as seen from Sweetwater Lake. Less visual impact would occur to this area due to smaller harvest units and less forest canopy disturbance.

The overall direct effects from management activities within the project area would be obvious to the casual forest observer if Alternative 4 is implemented. However visual disturbance would be dispersed throughout the project area with no single area impacted beyond maximum disturbance thresholds at any one time. All units in alternative 4 would meet their corresponding SIO or a higher degree of scenic integrity. No unit or units would exceed their corresponding Scenic Integrity Objectives as designated in the Forest Plan.

Alternative 5 Direct and Indirect Effects

Alternative 5 proposes the largest percent of visual change to the project area. Approximately 442 acres would be visually evident after management activity is complete. The visual disturbance associated with this alternative would only be slightly greater than Alternative 2. In essence the effects of implementing Alternative 5 would be similar to Alternative 2 where the overall effects of management activities will be obvious from Sweetwater Lake and the Coffman Road. Visual disturbance will be dispersed throughout with no single area impacted beyond maximum disturbance thresholds at any one time. All units would meet their corresponding SIO or a higher degree of scenic integrity. No unit or units would exceed their corresponding Scenic Integrity Objectives as designated in the Forest Plan.

Cumulative Effects for Alternatives 2, 3, 4 and 5

Cumulative effects consider the overall scenic effects expected as a result of past, present, and reasonably foreseeable future impacts in the project area. Past, present and reasonably foreseeable future actions considered in this analysis are included in Appendix D. These effects include timber harvest, roads, associated construction activities, and existing effects of

adjacent non-National Forest lands. Past, present and reasonably foreseeable future activities considered in the cumulative effects analysis can be found in Appendix D.

For the Timber Production LUD, effects would lead to a visual condition where management activities appear highly evident and become a dominant feature in the landscape. In the Modified Landscape LUD, management activities would visually dominate most of the seen area, but would borrow from naturally established form, line, color and scale. Activities such as road building, slash, and landings would remain visually subordinate. In the Scenic Viewshed LUD, timber management activities would be visible from visual priority travel routes or use areas, but evidence of harvest would not be visually evident or would be subordinate depending on the unit SIO.

The visual effects of timber harvest are greatest immediately following completion of the project. Within 5 years, vegetation would begin to grow, transitioning a change in color from brown to light green. Trees retained in the harvested areas would reduce the overall contrast of new growth with the surrounding forest. From 5 to 20 years after removal, young trees would become established, reaching a height of approximately 15 feet, further reducing the color contrast with adjacent forested areas. After 50 years, the emerging forest would achieve a height of approximately 50 feet. Color contrast at this point is near that of a mature forest and only textural differences would be apparent. Edge lines forming the boundary of harvested areas would become less apparent. At 80 years after harvest, stand vegetation would achieve 75 percent of their mature height. At 100 years, the stand would reach approximately 100 feet in height and appearance of the past harvest would not be evident.

Assuming a continuation of the present harvest levels through successive Forest Plans, removal of all suitable timber within the Logjam project area is expected to occur within the next 100 years. During this period, the forest would be in a continuous state of transition towards meeting the desired condition of the Timber Production and Modified Landscape management prescription objectives. The landscape would be characterized by regenerating harvested areas of mixed age classes from young stands to trees of maturing height, typically in 40 to 100 acre groups. The appearance of the activities associated with timber harvest will present landscape highly modified by this change. Approximately ten years after harvest, all proposed units and effects from past harvest will have greened-up. Based on past monitoring studies, it is determined this amount of time would reduce the visual contrast to a point that would bring most of the disturbed project area to a Type IV Existing Scenic Integrity. The project area should appear in a moderately altered condition where changes in the landscape are easily noticed. These changes should appear as disturbances, but resemble natural patterns in the landscape.

In 30 to 40 years, all the recently harvested areas would have regained enough forested texture so that much of the project area would regenerate to a slightly altered condition or a Type III ESI. At this time the landscape should regain mature forest characteristics where effects from past harvest are noticeable by the average forest visitor, but they do not attract attention. These changes in the landscape should appear to be minor disturbances.

Within another 20 to 30 years, the area would move from a slightly altered condition to a near-natural visual condition or Type II ESI. Changes in the landscape would not appear to be noticeable by the average forest visitor unless pointed out. Effects from past harvest and the visual impact caused by these harvests would not be perceptible.

In addition to the present visual condition created by past timber harvest, there could be additional effects created by any future harvest. Future harvest activities could have slight to moderate effects to the general landscape. These effects should be analyzed in order to determine those effects at that time.

WILD AND SCENIC RIVERS

There are no designated Wild and Scenic rivers on Prince of Wales Island and associated islands. However, during the 1997 Forest Plan revision five river/lake systems were determined eligible and suitable for designation, and have been recommended for inclusion in the Wild and Scenic River System: Essowah Lakes and streams, Kegan Lake and streams, Salmon Bay Lake and stream, Sarkar Lakes, and Thorne River/Hatchery Creek/Barnes Lake.

Affected Environment

Within the project area is a portion of the Thorne River/Hatchery Creek/Barnes Lake recommended Wild and Scenic River which, in its entirety, flows from Lake Bay near Coffman Cove through Sweetwater Lake to Thorne Bay. The segments that fall within the project area are classified as scenic and recreational. A portion of Hatchery Creek that flows into Sweetwater Lake is classified scenic. The recreational segment consists of Sweetwater Lake, and part of Gold and Galligan Lagoon. This river is recommended for the following outstandingly remarkable values:

- Scenery – The river corridor offers a diverse landscape for scenery with contrasting elements of rock, old-growth forest, muskegs, alpine, meadows, and rounded mountains. The chain of lakes along the Honker Divide Canoe Route are interconnected by streams and portages and allow visitors to view unique wetlands, and diverse shorelines and stream channels.
- Recreation – Sport fishing use is extensive due to the diverse sport species available. Convenient road access and three public reservation cabins along the corridor bring visitors to the area. Extensive canoe opportunities exist with the Honker Divide Canoe Route, which starts at Hatchery Creek Bridge on the Coffman Cove Road and traverses 30 miles of streams and lakes ending at the city dock in Thorne Bay. Opportunities for wildlife viewing are also a draw and subsistence hunting is a common activity in the area.
- Fish – Fishing opportunities exist throughout most of the year. Sport species include: coho, sockeye, chum, and pink salmon, as well as cutthroat, rainbow, and steelhead trout and Dolly Varden char. Thorne River produces the largest run of steelhead on Prince of Wales Island, and the watershed is listed among the 19 “high quality” watersheds identified by ADF&G in Southeast Alaska for fisheries values.
- Wildlife – Extensive wetlands areas provide habitat for waterfowl, loons, great blue heron, and trumpeter swans. Sweetwater Lake is important wintering area for trumpeter swans. Other wildlife species that occur in the corridor are bald eagles, black bear, wolves, river otter, seals, marten, mink, weasels, beaver, and Sitka black-

tailed deer. The only known inland-nesting bald eagles in Southeast Alaska occur in the Thorne-Hatchery area.

Environmental Consequences

Scenic River LUD

Only a small portion of the Scenic River LUD lies inside the Logjam project area boundary (Map 3, Chapter 1). None of the alternatives propose timber harvest or road construction within the Scenic River LUD, resulting in no direct, indirect, or cumulative impacts.

Recreational River LUD

The Recreation River LUD includes Sweetwater Lake and Gold and Galligan Lagoon, including shore lands within ¼ mile. Two proposed timber harvest units for the Logjam project are partially within the Recreation River LUD. A portion of harvest unit 573-01 is within the Recreation River LUD along the northwest shore of Sweetwater Lake., The southeastern portion of harvest unit 573-11 is within the Recreation River LUD in the vicinity of the southwestern shore of Sweetwater Lake. Table 79 shows harvest acres proposed by alternative in Recreational River LUD.

Table 79. Harvest Acres Proposed within the Recreation River LUD

Unit	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
573-01	0	8	0	9	9
573-11	0	0	40	15	42
Total harvest acres proposed in Recreation River LUD	0	8	40	24	51

Alternative 1 does not propose harvest or road construction and would not affect the Recreation River LUD.

All of the action alternatives propose a small amount of harvest within this LUD. Timber harvest is compatible with the Recreational River LUD, as long as the adjacent LUD allows it. The alternatives proposed in the Logjam Timber Sale project will not significantly affect the outstandingly remarkable conditions for which the Thorne River-Hatchery Creek segments were recommended, and will not affect the eligibility of this river for inclusion in the Wild and Scenic River System.

Cumulative Effects

Past, present and reasonably foreseeable future actions considered in this analysis are included in Appendix D. None of the alternatives would result in cumulative impacts to the Scenic River LUD, with none of them proposing harvest inside this LUD. Alternative 1 would not result in cumulative effects to the Recreation River LUD. Past harvest units around Sweetwater Lake are within the Recreation River LUD, and implementation of Alternatives 2, 3, 4, or 5 would not change the free flowing condition of the river itself, as well as the characteristics of the river's immediate environment.

Adverse Environmental Effects

Implementation of any action alternative would result in some adverse environmental effects that cannot be effectively mitigated or avoided if the proposed action or alternatives are to take place. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or reduce significant adverse consequences. In addition, the application of Forest Plan Standards and Guidelines, Best Management Practices (BMP), mitigation measures, and a monitoring plan are intended to further limit the extent, severity, and duration of these effects. The specific environmental effects of the alternatives were discussed earlier in the chapter, and mitigation measures are described in Chapter 2. Formulation of alternatives includes the avoidance of potentially adverse environmental effects; however, some adverse impacts to the environment which cannot be completely mitigated may occur.

Standards and guidelines, BMPs, and mitigation measures are designed to prevent significant adverse effects to soil and water; however, the potential for adverse impacts does exist. Sediment production would occur while roads are being built and timber is harvested. Some sediment would be produced by surface erosion, channel erosion, and mass movement.

Disturbance, displacement, or loss of fish and wildlife may occur as a consequence of habitat loss and increased human activity in the project area. All alternatives would result in a decrease in deer habitat capability. The resulting deer densities in all alternatives will remain as the threshold guideline of 18 deer/mi^2 both in WAA 1421 by itself and in the combined area of WAAs 1420, 1421, and 1422. All action alternatives would result in a decrease in high value marten habitat, snag dependent species habitat and Prince of Wales flying squirrel habitat. However, habitat adequate to maintain viable populations of these species is maintained by the Conservation Strategy that is a part of the Forest Plan.

The Logjam project may have an effect on the goshawk and its habitat within the project area; however habitat adequate to maintain viable populations of these species is maintained by the Conservation Strategy of the Forest Plan.

New road construction and the human activities associated with new access to areas previously unroaded would result in impacts to fish and wildlife. Improved access into areas that previously had limited roads could have similar effects. The proposed activities could temporarily increase competition for subsistence resources.

Naturally occurring windthrow often exposes mineral soil and may contribute to erosion. Logging methods have been found to increase the rate of windthrow near the borders of partial harvest areas. Partial harvest also has the potential to increase the susceptibility of the timber remaining in the units to windthrow, based on landscape position and wind patterns. Windthrow effects could increase the potential for surface erosion, specifically along stream corridors.

Unavoidable adverse effects to scenery resources are the immediate visual changes that occur to the existing landscape. Noticeable differences are expected to take place between naturally occurring landscapes and those managed for timber. Over time these changes will become more subtle as managed stands reach a point of maturity. At that time the effects of

management blend into more natural occurring forests characteristics. Additional effects will include future harvest in addition to the present visual condition created by past harvest activity. Future harvest activities could have effects to the visual characteristics of the existing landscape and will need to be analyzed in order to determine those effects at that time.

Relationship between Short-term Uses and Long-term Productivity

The intensity and duration of these effects depends on the alternative and the mitigation measures applied to protect the resources. Most unavoidable effects are expected to be short-term. Short-term effects usually last less than two to five years. Effects would be managed to comply with established legal limits in all cases, such as maximum time for regeneration. Monitoring procedures and mitigation measures have been planned for those areas which may be affected to reduce these effects. Specific mitigation measures are documented in the unit and road cards (Appendix B and C, and if a decision is made to harvest, mitigation measures for harvest units and roads will be listed in the Record of Decision).

Some localized adverse effects may occur on a recurring, though temporary basis. Effects such as road construction; timber harvest; timber hauling; recreation traffic on untreated roads; and the operation of internal combustion engines may cause temporary adverse effects to air quality.

All alternatives would come under the mandate of the Multiple Use and Sustained Yield Act of 1960. This act requires the USDA Forest Service to manage Forest System lands for multiple uses including timber; recreation; fish and wildlife; range; and watershed. All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. Trees can be reestablished and grown again as a renewable resource if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term productivity of the project area through the use of specific standards and guidelines, mitigation measures, and BMPs. Long-term productivity could change as a result of various management activities proposed in the alternatives. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the project area may fluctuate as a result of short-term uses, but no long-term effects to the water resource are expected to occur as a result of timber management activities.

Timber harvest is a short-term use of wetland resources. Harvest activities are expected to slightly alter the hydrology of harvested wetlands for several years after harvest. Soil moisture levels are expected to rise slightly following harvest due to the loss of canopy interception. Soil moisture levels are anticipated to return to near pre-harvest levels as second-growth

establishes and provides canopy cover across the site. Effects on wetland hydrology may be negligible in areas where partial cutting is utilized.

Harvest activities are expected to disturb soils. These small scale disturbances do not pose adverse effects to long-term soil productivity. Due to the thick organic mat covering most mineral soils, surface erosion would be limited to detrimentally displaced areas, roads, windthrow, stream banks and recent landslide tracks. Detrimentally displaced areas within timber harvest units are routinely slashed and seeded shortly after they occur (Best Management Practices 13.14). Slashing the disturbed site provides soil cover, reducing the force of raindrop impact and the length of exposed slope. Grass seeding and fertilizing the area further provides soil cover and organic matter for soil rehabilitation. Full suspension yarding techniques proposed for units with steep slopes would effectively limit soil disturbances.

Timber rotations are normally over a 100-year or longer rotation, depending upon site quality. Harvest has been scheduled to allow the earliest cut stands to mature into merchantable timber before the planned harvest of original stands is complete to ensure adequate production of timber. Mature timber stands would be harvested again on a new rotation after the first rotation is complete. Management of the timber resource on these rotations could affect long-term productivity, depending on the intensity of silvicultural practices. Projected timber rotation lengths are not anticipated to affect long-term productivity. Mitigation measures are planned under all the alternatives to ensure future availability of other renewable resources as well.

All alternatives would provide the habitat necessary to contribute to the maintenance of viable, well-distributed populations of existing native and desired non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat; whether used for breeding, feeding or resting. Management Indicator Species (MIS) are used to represent the habitat requirements of all fish and wildlife species found in the project area. All alternatives provide standards, guidelines, and mitigation measures for maintaining long-term habitat and species productivity. The alternatives vary in the amount of risk presented to both wildlife habitat and habitat capability.

Opportunities for dispersed recreation use including hunting, hiking, camping, off road vehicle use, and fishing would be maintained. In all action alternatives, these opportunities may be increased for future generations. The setting in which these additional opportunities occur varies by alternative. The long-term potential for the project area, to provide a spectrum of recreation opportunities would be maintained in all alternatives.

Irreversible Commitments of Resources

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time; at a great expense; or because the resource has been destroyed or removed.

The construction of arterial and collector roads, to provide access to the forest, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Irreversible actions also include the associated rock quarries which are developed in conjunction with these roads. Alternative 1 would have no new road construction. Alternatives 2, 3, 4 and 5 would construct roads to harvest units as described in the transportation section of this chapter.

Loss of soil due to erosion and mass failures is an irreversible commitment of resources. The loss of soil resources has been minimized to the extent feasible in all action alternatives by following Region 10 Soil Quality Standards, incorporating BMPs and applying mitigation measures specified in this document.

Borrow pits and quarries would be needed for road construction under Alternatives 2-5. The amount of acreage affected is estimated by alternative in the Soils section of this document (see Environmental Consequences page, Soils 156 and Transportation 167). The amounts of shot rock and crushed rock will vary with each development. As previously mentioned, every two miles of road construction requires about a 2 acre rock pit. This rock would be utilized in construction as well as reconstruction of new roads. There are 64 existing rock pits within the analysis area. Where feasible these pits will be used; however, most new road construction would require the development of new rock pits. Location and sites could be designed and their use timed to minimize the impacts upon other resource values and existing facilities. The locations of these sites could have potential for dispersed recreation opportunities, such as camping or shooting ranges. The excavation sites would be evident and would likely alter the landscape, even with screening. The rock and gravel resources are not replaceable; therefore these actions would be irreversible.

Loss of cultural resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. Standards and guidelines; survey methodology prior to activities; and mitigation measures specified in this document provide reasonable assurance that no irreversible loss of cultural resources would occur.

Old-growth forest structure converted to even-aged forest structure by harvest could be considered an irreversible commitment of resources. It is not expected that old-growth characteristics would naturally reoccur within harvest areas for approximately 100 to 150 years, if there is a second rotation of timber harvest (80 years), which is converted again to even-aged forest structure, this effect would be irreversible. Alternative 1 would not harvest any old-growth. Alternatives 2, 3, 4, and 5 would harvest old-growth timber as described in the old-growth; wildlife; and timber and vegetation sections of this chapter.

Inventoried Roadless Areas (IRAs) are set aside to determine their eligibility for inclusion into the National Wilderness Preservation System. Once an area is roaded it is generally no

longer available for wilderness consideration. Proposed harvest in Inventoried Roadless Areas in Alternative 2 of this project would affect IRAs 511 and 514 which are considered lower value roadless areas in the 2008 Forest Plan (see Chapter 1, page 10). Loss of acres due to timber harvesting or road building will have irreversible effects to the character of the affected acres in these roadless areas, thus further reducing the roadless area total acreage.

Road construction is considered an irreversible commitment of soil resources in the project area due to the long term loss of soil productivity. In the case of road construction, soils are either scrapped away or are buried beneath road fill, greatly limiting their pre-disturbance productivity. Such commitments are considered irreversible because the soil resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the soil resource has been destroyed or removed. Acres of soil disturbance from roads is discussed in the Soils section of this chapter (see Soils section, Environmental Consequences, page 156).

Wetlands displaced by road construction activities are irreversible commitments of the project resources. Such commitments are considered irreversible because the wetland soils have deteriorated to the point that renewal can occur only over a long period of time, or at a great expense, or because the wetland soils have been destroyed or removed. In the case of road construction, wetland soils are either scrapped away or are buried beneath road fill, greatly limiting their pre-disturbance productivity. Acres of wetland displacement are discussed in the Wetlands Environmental Consequences section of this Chapter page, 218.

Irretrievable Commitments of Resources

Irretrievable commitment of natural resources means loss of production or use of resources due to management decisions made in the alternative. This represents loss of opportunities for the period of time the resource cannot be used.

Selection of action alternatives for timber harvest could be considered an irretrievable commitment of resources. After timber harvest, the units harvested could not produce economic resources until another rotation of harvestable trees are ready for harvest (about 100 years). Log quality would be less in all managed stands after proposed harvest of old growth timber stands. There would be an irretrievable economic commitment to resources as it pertains to old growth timber, because of the high quality of wood from slower growing, older trees. However, selection of Alternative 1 and foregoing timber harvest opportunities at this time in certain areas, due to resource concerns or economics may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible because future entries could harvest those areas if they are still classified as part of the suitable timber base.

Loss of sediment into streams from road construction, including implementing or removing culverts may be an irretrievable commitment to fisheries and watershed resources. Although erosion from stream banks occurs naturally, sediment entering streams from the construction of road and installing or removing culverts would be above that of natural background levels. It would take a long period of time for rock and leaf litter to breakdown to reform soil that was disturbed and lost into streams as sediment. Even though sediment production is a

consequence of this project, following Forest Plan Standards and Guidelines, and BMP's help minimize the effects to fish and aquatic resources.

The reduction in the visual quality of an area due to timber harvesting would be an irretrievable commitment of resources. The commitment is irretrievable because viewsheds will typically heal from a visual quality standpoint after about 40 years. Second-growth trees will have the color and height needed so as not to be evident to the casual observer after this time. Alternative 1 would have no irretrievable commitment of visual quality. Alternatives 2, 3, 4, and 5 would irretrievably commit visual resources due to timber harvesting.

Old-growth forest structure converted to even-aged forest structure by harvest can be considered an irretrievable effect. It is not expected that old-growth characteristics would naturally reoccur within harvest areas for approximately 100 to 150 years, if there is no second rotation, this effect would be irretrievable, however, old growth forest structure would eventually return to the landscape. Alternative 1 would not harvest any old-growth. Alternatives 2, 3, 4, and 5 would harvest old-growth timber as described in the old-growth; wildlife; and timber and vegetation sections of this chapter.

The following irretrievable effects would occur to wildlife: All alternatives would result in a decrease in deer habitat capability. All action alternatives would result in a decrease in high value marten habitat. All action alternatives would result in a decrease in snag dependent species habitat. All action alternatives would result in a decrease in Prince of Wales flying squirrel habitat; however habitat adequate to maintain viable populations of flying squirrel is maintained within old growth reserves. All action alternatives would result in a decrease in productive old growth habitat. Habitat adequate to maintain viable populations of old growth associated species such as the spruce grouse, migratory birds and others would be maintained within the old growth reserves.

Possible Conflicts with Plans and Policies of Other Jurisdictions

The regulations for implementing NEPA require a determination of possible conflicts between the proposed action and the objectives of Federal, State, and local land-use plans, policies and controls for the area. The major land-use regulation of concern is Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA).

Incomplete or Unavailable Information

Much of the Tongass National Forest resource data resides in an electronic database formatted for a geographic information system (GIS). The Forest uses GIS software to assist in the analyses of these data. GIS data is available in tabular (numerical) format, and as plots displaying data in map format. For this EIS, all the maps, and most of the numerical analyses, are based on GIS resource data. All numeric values in this document are approximate.

There is incomplete knowledge about many of the relationships and conditions of wildlife, fish, forests, jobs and communities. The ecology, inventory and management of a large forest area are complex and science is continuously developing. The biology of wildlife species

prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well established in the respective sciences for the Deciding Official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences.

Our ability to actually measure changes in streamflow, sediment, habitat features, or other aquatic parameters in response to the Logjam Timber Sale is extremely limited due to the lack of baseline data and the natural range of variability of these parameters in response to climate and other factors. Nonetheless, there is sufficient information for these watersheds to proceed with a credible comparison of the magnitude and extent of likely effects across alternatives. See Watershed (Thompson, 2008) and Fisheries (Brigham, 2008) Resource Reports for more detail on incomplete and unavailable information.

The Conservation Strategy as described in Appendix D of the 2008 FEIS itself is a step toward addressing landscape connectivity by maintaining an extensive network of reserves and landscape connectivity on the Tongass; however, the effectiveness of the reserves and buffers in relation to their size, landscape pattern, and geographic distribution has yet to be scientifically tested (Powell et al. 1997).

Edge effects change as forest grows; however, there is little information on how that may reduce overall effects over time.

Unit 577-37

In this unit a small cave, as well as an insurgence stream was discovered recently in the north eastern portion of the unit. Alternatives 2, 3, 4, and 5 propose construction of 0.24-0.29 miles of road on high vulnerability karst. The location of these road segments will be changed between the draft and final EIS to avoid high vulnerability karst wherever possible. See Karst section for information about this unit.

Climate Change

While there is general agreement among scientists that the climate is warming, there is considerable uncertainty concerning the exact effects of climate change on the forests of Southeast Alaska and how best to deal with possible changes to the many resources on the Tongass National Forest. Global warming is not a reasonably foreseeable consequence of the proposed action, or alternatives, however, climate change analysis for this project can be found in the Biodiversity Resource Report this project's administrative record, and is incorporated herein by reference.

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