Chapter 3 – Affected Environment & Environmental Consequences

The chapter is organized according to the resources of silviculture and forest stand development, wildlife, soils, fisheries, botany, economics, and heritage. The chapter concludes by addressing the specifically required disclosures required by federal statutes and Executive Orders. Information supporting the analysis in this chapter may be found in resource specialist reports, which are incorporated by reference and contained in the analysis file. Many components of the ecosystem that cannot be precisely quantified are described in relative terms or estimated values.

Each section presents the scientific and analytical basis for the comparison of the alternatives displayed in Chapter 2. Following a description of the affected environment for a given resource, probable effects are disclosed for each alternative. The probable effects described include direct effects, indirect effects, and cumulative effects.

Direct and Indirect Effects

"Direct effects" are effects which are caused by the action and occur at the same time and place, and "indirect effects" are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and … related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8)

Cumulative Effects

"Cumulative effects" is defined in the White House Council of Environmental Quality's NEPA regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" 40 CFR 1508.7. The Council on Environmental Quality (CEQ) interprets this regulation as referring only to the cumulative impact of the direct and indirect effects of the proposed action and its alternatives when added to the aggregate effects of past, present, and reasonably foreseeable future actions on all land ownerships across an area that is deemed appropriate for the impacts being analyzed.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details

of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one can not reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EA is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decisionmaking. (40 CFR 1508.7)"

For these reasons, the analysis of past actions in this section is based on current environmental conditions.

This section summarizes activities that were considered in cumulative effects analyses included in Chapter 3. The analysis of cumulative effects for each resource, however, may differ by scale and the activities that are considered relevant to the resource.

Past:

Activities described in the Sol Duc Pilot Watershed Analysis, Deep Creek and East Twin and West Twin Rivers Watershed Analysis, and the Soleduck LSR Assessment make up a large

component of past activities in the area. These activities include past fire history and other natural disturbances, Native American and European settlement, timber harvesting, recreation, and watershed improvement activities. These past activities have contributed to the current condition of the planning area and are discussed further in Chapter 3, as appropriate in discerning the contribution of past activities to the current resource conditions and in cumulative effects analysis. Below lists additional past activities that have occurred in the project area.

- Precommercial Thinning. Some 28 out of the 48 stands in the proposed action seem to have been wholly or partly precommercially thinned at 15-20 years of age, or possibly as late as age 25. This thinning was a non-commercial treatment effected by service contracts that specified thinning, probably to a 10-foot spacing, by selecting the biggest undamaged trees to retain and cutting the rest. This was done by crews of fellers using saws. Trees thus felled were left onsite to decay, and woody residues have now mostly disappeared from the stands entirely. However, stumps are visible in some locations, and precommercially thinned stands have characteristic spacings and understory development that is absent from unthinned stands. Lindh and Muir (2004) found that precommercially thinned stands in the Cascades of western Oregon had higher frequencies of late-seral herbs than did unthinned stands. Many areas of the precommercially thinned stands now also feature a noticeable understory of red huckleberry and hemlock saplings that apparently came in after thinning or were able to persist because of it. The fairly uniform 10-foot spacing that was implemented in this early thinning anticipated a "pulpwood" thinning around age 30 to 40 when the canopies would have closed again, slowing the residual trees' diameter growth rate. With few exceptions this early commercial thinning was not implemented. However, a portion of stand 59 (about 32 acres in the proposed action) was commercially thinned in 1977.
- Prior Commercial Thinning, Stand 059. The area of stand 059 proposed for treatment in this analysis was commercial thinned about 1977, using a ground-based logging system. No consideration (that we know of) was given to snag and coarse woody debris retention at that time. Though unavailable for review, the silvicultural prescriptions of that time generally are thought to have emphasized removing damaged and diseased trees from the stand, and creating a fairly uniform spacing for stands to attain maximum recoverable volume growth. The canopy has since closed and the density has increased again to levels that induce crown recession and reduced diameter growth rates and herb/shrub cover.
- The BPA powerline was put through the project area in 1964-5, requiring deforestation of a corridor approximately 100 feet wide through the length (approximately 11.7 miles) of the project area (equating to about 142 acres). In addition, something in excess of 5 miles of roads were constructed for permanent access to the powerline support poles. The corridor is kept free of arboreal revegetation by periodically cutting young trees invading the clearing. In about 2000-2001 hazard trees and snags were cut from the stand edges bordering the corridor over much of its length through National Forest System land.

More recent past activities considered important for cumulative effects analysis of this project:

Timber:

- Scatter Thin. This project includes about 150 acres of commercial thinning within a planning area of about 710 acres of the lower West Twin River watershed. It was planned and marked as a "New Perspectives in Forestry" thinning project that included the silvicultural objective of diversifying the stand canopy and diameter structure by conducting a kind of "free thinning" that both removed and retained trees from all diameter and crown classes. The thinning was done in the years 1996 to 1998.
- There are several patch clearcuts in the planning area that were harvested from the 1970s to late 1980s, but which were not considered for treatment in any alternative. Most of these regenerated stands have been pre-commercially thinned.
- A search of the Washington State DNR's Forest Practices Application Review System found the following recent activities on State and private ownership within the project's watersheds (covering portions of five Township-Ranges which total over 50,000 acres): 872 acres even age harvest, 195 acres unevenage harvest, 13 acres salvage, 189 acres herbicide spray, 5.4 miles road construction, and 1.7 miles temporary road construction.

Wildlife-related:

- Snag Creation - Previously done in 1990, 1991, and 1994, for a total of 31 trees topped or limbed. These trees were likely a combination of inoculation, topping, and cavity creation.
- Forage Seeding/Fertilizing - Past forage seeding, seeding and fertilizing, or refertilizing contracts used either a preferred forage mix, which sometimes included such things as reed canary grass, and an erosion control mixture. These were done in 1981-2, 1984, 1986, 1988-1990, and 1994. Approximately 150 acres were treated, and includes some overlap of the same area.
- Miscellaneous enhancement projects – A bald eagle nest platform in Bear Creek was installed off of the 3006 road, and various nest boxes were installed in other locations.

Roads:

- Decommissioned about 11 miles of FSR 3040.
- BPA road maintenance work including rocking sections of road restoring a stream crossing.

Present:

- On-going harvest on State and private land in watersheds. A search of the Washington State DNR's Forest Practices Application Review System found proposals for the following activities in the project's watersheds (covering portions of five Township-Ranges which total over 50,000 acres): 870 acres even age harvest, 48 acres unevenage harvest, 16 acres salvage, 234 acres herbicide spray, 4.4 miles road construction, and 0.7 mile temporary road construction.

Foreseeable Future:

- Harvest of timber on Washington Department of Natural Resources (DNR) lands and associated road construction adjacent to the Bear Creek Saddle project area. A search in September 2008 of the Washington State DNR's Forest Practices Application Review System did not find any proposals for activities on these lands. Based on informal communication with DNR personnel the assumption for this analysis is that DNR will clear cut harvest approximately 60-65 million board feet in the vicinity over the next 10-15 years.
- Road construction and timber harvest on private lands in Middle Sol Duc, Deep Creek, and West Twin River watersheds.
- Repair of FSR 30 and replacement of culverts on FSR 30 for fish passage.
- Road decommissioning of 3000490 spur, 3000590 spur, and 3000600 spur.
- Decommission abandoned spur off the 3067 near the 3067050.
- Culvert removal on the Scatter stream crossing road, and associated with that treat 3000845, 3000850, and 3000852.
- Conifer release and understory planting.
- Wildlife plantings.
- Wetland/meadow work to maintain openings for elk and other species is now more important than ever with the continued exclusion of fire as well as the reduction in clearcut harvesting on federal lands.
- Snag creation.
- Other weed treatment, particularly as approved under the Olympic National Forest Invasive Weed EIS.

Silviculture and Forest Stand Development

The planning area has experienced a significant disturbance history of blowdown, fire, and timber harvest primarily in the late 1800s to early 1900s and in the early 1940s through the late 1950s. Stands range in age from about 45 to 60 years old, having been regenerated by clearcutting, broadcast burning, and planting in the 1950s to early 1960s, or by fire, and subsequent salvage and planting in the early 1950s. Many of the conifer-dominated stands were precommercially thinned at age 15-20 to about 10 foot spacing in anticipation of a commercial thin at age 30-40. There are several more recent patch clearcuts in the planning area that were harvested from the 1970s to late 1980s, but which were not considered for treatment in any alternative. Most of these also have been pre-commercially thinned. All of the non-National Forest System lands within the planning area are currently managed by Washington Department of Natural Resources, though some were acquired from Bloedel about five years ago. Their management history is similar to that of National Forest lands in the area.

The stands proposed for treatment are even-aged stands and are overcrowded and structurally uniform (Oliver and Larson 1990). There are few late-successional habitat components such as large crowns and limbs, cavities, and other tree "defects," multiple canopy layers including diverse understory vegetation, or large snags, although coarse woody debris levels are adequate in many areas.

There are few large (>25 inches dbh) trees in these stands at present and numerous small snags, 6-12 inches dbh. Coarse woody debris levels (CWD) are generally in the range of 7-12

percent cover by visual estimates (average may be around 10% cover), compared to the average level for old growth stands in the western hemlock zone of about 11.7% (Henderson et al. 1989).

Plant Associations: Plant associations that best characterize stands in the proposed action are mostly in the western hemlock series (Henderson et al. 1989), though a few fit into the Sitka spruce series, and in one case, the Pacific silver fir series. Major plant associations identified include TSHE/POMU-TITR (western hemlock/swordfern/foamflower) found in 22 stands, TSHE/POMU-OXOR (western hemlock/swordfern /oxalis) found in 14 stands, and TSHE/GASH/POMU (western hemlock /salal/swordfern) found in 10 stands. Minor plant associations identified include TSHE/BENE/POMU (western hemlock/Oregon grape/swordfern) found in two stands, PISI/ POMU-OXOR (Sitka spruce/swordfern-oxalis) found in two stands, TSHE/GASH-BENE (western hemlock /salal/Oregon grape) found in one stand, and ABAM/POMU (Pacific silver fir/swordfern) found in one stand. These plant associations generally indicate moderate to high growth potential for trees, mostly site class 2-3, with only a few in the moderately productive site class 4.

Stands within the project area can generally be divided into two groups, those dominated by alder and those dominated by conifers, though several are patchy combinations of both types. Conifer-dominated stands (37 of the 48 stands proposed for treatment) are composed of a mix of hemlock, Douglas-fir, red alder, Sitka spruce, Pacific silver fir, and a few western redcedar. Minor species such as black cottonwood, bigleaf maple, bitter cherry, willow, and Pacific yew can be found on occasion in some of the stands. Many conifer-dominated stands also exhibit scattered, light understories of hemlock and western redcedar seedlings/saplings/poles, as well as vine maple clumps that provide the beginning of a two-story canopy structure. Ground vegetation in these stands generally is light and consists of a variety of shrubs and herbs depending on the plant association. Seven stands had about 0-5% cover, 21 had 6-10% cover, and nine had 11-25% cover.

Alder-dominated stands are composed of an alder overstory and variable understories of conifers, ranging from none to 100+ stems per acre of sapling/pole-size up to a size codominant with the alder in some instances. These are mostly hemlock, Sitka spruce, and western redcedar, though Douglas-fir and Pacific silver fir can be found in a few cases. Ground vegetation is often heavy, and consists largely of salmonberry, but includes other herbs and shrubs such as vine maple, swordfern, and Oregon oxalis, depending on the site-occupancy of the salmonberry and understory conifers. Six of these stands had about 11-25% cover and five had 26-100% cover.

Alternative A - No Action

Direct and Indirect Effects

Under Alternative A, none of the approximately 2,189 acres of 45 to 60 year old second-growth stands would be commercially thinned.

Alternative A would have no direct effects on stand development. The indirect effect of Alternative A, however, is that stands would continue through the stand development process without intervention, and late-successional habitat for old-growth dependent species would not be accelerated.

Forest stands would remain in the competitive exclusion stage until competition leads to the dominance by some trees and the death of other trees enough to open up the canopy to allow sunlight to the forest floor, a process that can take decades. In the stem exclusion or competitive exclusion stage, there is only one canopy layer, little understory vegetation, and low plant species diversity. Dense overstory canopy shading limits the growth of shrubs and herbs – though they exist in the stands, they are mostly small plants with little biomass – and prevents development of a multi-storied canopy for many decades. Structural and species diversity are therefore relatively low. Competition-related mortality produces numerous small-diameter snags of little wildlife habitat value. Three snags per acre >15 inches dbh are needed to provide adequate snag habitat to support cavity nester populations of red breasted sapsuckers, hairy woodpeckers, and downy woodpeckers, at the 100% level (Brown 1985). There are few large (>25 inches dbh) trees in these stands at present to produce snags of sufficient size for pileated woodpecker nesting habitat.

Alternative A would forego opportunities to use commercial thinning to meet habitat objectives. Since none of the proposed stands would be treated, Alternative A would not fulfill the purpose of and need for increasing the structural and species diversity of forest stands.

Cumulative Effects

The Soleduck LSR Assessment and watershed analyses for the Sol Duc and Deep/Twins watersheds describes the effects on late-successional habitat from past harvest and other disturbances summarized below. The beginning of this chapter also lists additional activities considered for this cumulative effects analysis.

Prior to European-American settlement, single-storied, late-successional conifer stands would have existed in most of the East Twin, West Twin, and Deep Creek watershed, with areas of multi-storied, late-successional conifer stands (USDA et al. 2002). Late single-storied and late multi-storied successional conifer vegetation now cover 11.0 percent of the East Twin, West Twin, and Deep Creek watershed, compared to 27.3 percent of early and early mid conifer/hardwood successional vegetation and 60.8 percent mid-successional stages. Very little late-successional vegetation remains on state and private land because of homesteading and logging activities.

In the Sol Duc watershed, approximately 8,500 acres were harvested between 1941 and 1960, when the stands proposed for treatment originated, and almost 20,000 acres were harvested between 1931 and 1940. Currently, quantities of late-successional forest are well below the natural range of variability for the project area within the Lower Bear Creek subwatershed (4,141 acres in size) within the Sol Duc watershed (USDA et al. 1995, pg. 2.8, 56-57). In fact, the watershed analysis noted that this subwatershed has no late-successional vegetation. Furthermore, the subwatershed has been highly disturbed overall by human-caused wildfires and clearcut harvesting. Upper Bear Creek is 5,424 acres in size with 3 percent in late-successional vegetation. Because large fires have periodically reduced the amount of late-successional forests close to what is currently present, the quantities of late-successional forest may be considered within the natural range of variability. These areas, however, lack the large woody debris and forest floor organics than what would typically be found under natural conditions.

Previous commercial thinning in the area was implemented between 1996 and 1998 through the Scatter Thin project. Scatter Thin included 150 acres of commercial thinning within a planning area of about 710 acres of the lower West Twin River watershed, adjacent to the east end of Bear-Saddle. It was planned and marked as a "New Perspectives in Forestry" thinning project that included the silvicultural objective of diversifying the stand canopy and diameter structure by conducting a kind of "free thinning" that both removed and retained trees from all diameter and crown classes.

Alternative A would not accelerate any forest stands towards late-successional/old-growth conditions. The previously clearcut stands would be left to develop naturally.

Alternative B

Direct Effects

Alternative B would commercially thin about 2,189 acres. Variable density thinning would promote the development of late-successional characteristics identified as priorities in the Soleuck Late Successional Reserve Assessment (USDA 1997, pg. 57) by:

- reducing the density of stands, increasing the growing space available to individual trees, and transferring part of the stands' growth potential from the upper canopy to the forest floor; and
- emphasizing retention of minor species overlooked by past management practices while thinning the dominant tree species, thereby, increasing the relative abundance of those minor species.

Stand diversity can be enhanced through appropriate silvicultural treatments (Washington State Working Subgroup of the Silviculture Committee 1991; Carey and Curtis 1996; Bailey and Tappeiner 1997; Tappeiner et al. 1997; Curtis et al. 1998; Carey et al. 1999; Zaborske et al. 2000; Carey and Wilson 2001; Beggs 2004; Zenner 2005) that have the effect of moving the stand along into the understory reinitiation stage. Structural and compositional diversity can be increased by thinning the overstory to allow the release or introduction and growth of understory vegetation and the development of relatively large diameters, crowns, and limbs. With more sunlight available to remaining trees, trees can be grown to large diameters at a faster rate and provide late-successional stand characteristics earlier in the life of the stands. Snags of target sizes for cavity nesting wildlife can be recruited earlier as well. At the same time care must be taken to preserve existing snags and CWD, which can be reduced by thinning if not protected. Snags and CWD can be actively created during or after thinning treatments. Through repeated thinning treatments, a multi-storied stand condition can be created.

Variable density thinning would also enhance spatial diversity by leaving some areas unthinned while creating gaps in the canopy in others. Design features and mitigation measures detailed in Chapter 2 would adequately minimize risk of any adverse effects on late-successional habitat elements.

Indirect Effects

The indirect effects of Alternative B include:

- accelerating tree growth for the development of large trees, snags, and coarse woody debris;
- providing additional opportunities to create additional snags and ground coverage of coarse woody debris; and
- allowing the increase and diversification of understory vegetation as well as introducing a second (in most stands) canopy layer.

Alternative B would improve habitat conditions for late-successional species on approximately 2,189 acres by moving stands into the understory reinitiation stage of stand development. Large diameter trees would grow more quickly, and shade-tolerant species would begin to occupy the understory. Increased light reaching the forest floor would stimulate the introduction and development of the herb and shrub layer, thus increasing structural and species diversity in the stands. This would move the forest toward the objective of being multi-layered and structurally diverse.

Where light levels are increased sufficiently through thinning and particularly in gaps, hemlock and silver fir seeds in the litter layer would germinate and begin to develop an additional coniferous canopy layer. Under stable environmental conditions, surviving seedlings would continue to compete with all ground vegetation and some would eventually achieve dominance in the understory. Growth rates and tree dominance in the understory could be accelerated through a natural change of stand conditions or by a future treatment such as an understory pre-commercial thinning.

Over time, the shrub and herbaceous biomass would begin to increase compared to the unthinned stand condition, beginning with the first growing season following treatment. Stand basal area (of conifer trees) would approach or exceed pre-treatment basal area within approximately five years, based on observations of similar conditions.

Cumulative Effects

As detailed earlier, past logging activities and settlement of the area has resulted in little late-successional and old-growth habitat remaining in the project area's watersheds. Alternative B would expand the overall acreage within the watershed which has received silvicultural treatment to enhance habitat characteristics and promote development of late-successional structure. This alternative would accelerate the development of approximately 1,300 acres in the Lower Bear Creek subwatershed (in the Middle Sol Duc 6th field watershed), about 423 acres in the Deep Creek Watershed, and about 450 acres in the West Twin River Watershed. Based on informal conversations between Washington Department of Natural Resources personnel and Forest Service staff, large portions of state lands adjacent to the project area are expected to be clearcut harvested over the next 10-15 years. Given current trends, it is anticipated that there will be little development of forest into late-successional and old-growth habitat in the planning area's subwatersheds on non-Forest Service lands. This alternative would help accelerate the development of late-successional forest habitat in watersheds that lack such habitat.

Alternative C

Direct Effects

Alternative C proposes to commercially thinning about 2,136 acres. Alternative C would have the same effects as Alternative B, but on approximately 53 fewer acres.

Indirect Effects

Alternative C would likely improve habitat conditions for late-successional species on about 2,136 acres.

Cumulative Effects

Alternative C responds to the same past effects as Alternative B, except it treats slightly fewer acres.

Wildlife

Wildlife habitat in the Bear Saddle project area encompasses several forest and riparian habitats that provide cover and forage for many species of mammals, birds, amphibians, reptiles, and mollusks. Habitat currently available reflects the various plant associations characteristic of low elevation temperate rainforest and the effects of past human activity, primarily logging and road building, as well as natural disturbances such as fire. Approximately half of the project area lies within the Sol Duc watershed and the other half in the Deep Creek and West Twin Rivers watersheds. Consequently, the Sol Duc Watershed Analysis (USDA et al. 1995) and the Deep Creek and East Twin and West Twin Rivers Watershed Analysis (USDA et al. 2002) both describe wildlife habitat characteristics that encompass portions of Bear Creek Saddle.

The Sol Duc Pilot Watershed Analysis and Deep Creek and East Twin and West Twin Rivers Watershed Analysis cite the following general concerns for wildlife habitat:

- limited late-successional forest habitat,
- habitat fragmentation,
- the amount of remaining core area habitat for forest interior species,
- low levels of snags,
- the quality of dispersal habitat, and
- high road densities and related disturbance (primarily for elk).

The Deep Creek Watershed Analysis more specifically cites concern over:

- the quantity and quality of suitable habitat for northern spotted owl (*Strix occidentalis caurina*),
- the availability of dispersal habitat that connects the remaining suitable owl habitat, and
- the quantity and quality of habitat for marbled murrelet (*Brachyramphus marmoratus*).

The LSR area within the project area is part of the Snider Ridge-Twin Rivers Block of the Soleduck LSR. According to the Programmatic Biological Opinion (PBO) issued by the U.S.

Fish & Wildlife Service on activities proposed for the Olympic National Forest (USDI 2003), approximately half of the entire LSR contains suitable habitat for late-successional species.

This wildlife analysis focuses on special status species including those listed under the 1973 federal Endangered Species Act (ESA), as amended, the Forest Service's Region Six Sensitive Species List, Management Indicator Species (from the Olympic National Forest's Land & Resource Management Plan), other rare or uncommon species, and forest landbirds.

Federally Listed Species

The Endangered Species Act of 1973, as amended, establishes policies and procedures for identifying and protecting species of plants and wildlife that are endangered or threatened with extinction. Under the ESA, all Federal agencies are required to conserve threatened and endangered species and contribute to the ultimate goal of the ESA to return species to the point where they no longer need protection under the statute.

To help identify and guide species recovery efforts, section 4(f) of the ESA directs the Secretary of Interior and the Secretary of Commerce to develop and implement recovery plans for listed species. These plans are to include (1) a description of site-specific management actions necessary for conservation and survival of the species, (2) objective, measurable criteria that, when met, will allow the species to be delisted, and (3) estimates of the time and funding required to achieve the plan's goal and intermediate steps.

Recovery plans are designed to provide the best possible strategy for recovery of a species and a way to evaluate whether recovery has been achieved. Recovery plans are not regulatory documents; rather, they serve as guidance for Forest Service activities including land management planning. Recovery plans provide context and goals for developing Forest Service programs and meeting our section 7 responsibilities under ESA. Forests are directed to continue implementing existing Land and Resource Management Plans (LRMP) unless there is an LRMP revision or amendment which adopts the guidelines outlined in a recovery plan.

In 1997, the USFWS finalized a recovery plan for the marbled murrelet and in 2008 for the northern spotted owl.

The project area provides habitat for two wildlife species listed as threatened under the Endangered Species Act: the marbled murrelet and the northern spotted owl. "Threatened" status means the species is likely to become endangered within the foreseeable future. The table below shows these species' potential occurrence in or adjacent to the analysis area.

Table 7. Federally listed wildlife species.

Common Name	Species Name	Federal Status	Suitable Habitat Present in Project Area	Documented Sightings in Project Area
Marbled Murrelet	*Bachyramphus marmoratus*	Threatened, listed in September	Yes	Yes

		1992		
Northern Spotted Owl	*Strix occidentalis caurina*	Threatened, listed in June 1990	Yes	Yes

Marbled Murrelet (Bachyramphus marmoratus)

The marbled murrelet was federally listed as threatened in 1992, primarily due to excessive harvest of the species' nesting habitat (USDI 1992). Ralph et al. (1995) believed and USDI (1997) reported that possible reasons for the decline included the species' dependence on older forests for nesting that are now scarce and heavily fragmented, its low reproductive rate and adult mortality due to predation, capture in gill nets, and encounters with oil spills. The amount and distribution of the remaining suitable habitat or potential habitat is considered to be the most important determinant of the long-term population trend.

Marbled murrelet nesting habitat includes old growth or mature forests within approximately 89 kilometers (55 miles) of marine environments. Nest stands are characterized by large trees 80 cm (over 32" dbh), moderate to high canopy closure, and a multi-storied canopy (USDI 1997, Hamer and Nelson 1995). Individual nest trees typically contain large branches or deformities for nest platforms, including platforms created by mistletoe infection. The mean nest tree diameter in the Pacific Northwest is 211 cm (83 inches) (Hamer and Nelson 1995). For more detailed information on the status and biology of the marbled murrelet, refer to the federal register notice of the listing (USDI 1992), the recovery plan (USDI 1997), the federal register notice of designation of critical habitat (USDI 1996), and Ralph et al. (1995).

The Recovery Plan for the Marbled Murrelet (USDI 1997) cites the central reason for listing the species as loss of nesting habitat. To fulfill the objective of stabilizing the population, the plan focuses on protecting occupied habitat, minimizing the loss of unoccupied but suitable habitat (i.e. designating critical habitat), and protecting marine habitats. Relative to the Bear Creek Saddle project, specific recovery actions outlined in the plan include using silvicultural techniques to increase speed of development of new habitat, focusing on trees that will provide nesting platforms. Likewise, stands that are not yet suitable for nesting but will be in the next few decades (i.e. stands greater than 80 years old) should not be harvested or thinned.

Surveys for marbled murrelets were conducted in various parts of the Sol Duc and Deep Creek/West and East Twin Rivers watersheds through formal efforts in the 1990s. The only mapped sites for murrelets in the project area are in the east portion and these consist of documented presence during the 1994 and 1997 field seasons.

Suitable habitat for marbled murrelet can be approximated by northern spotted owl habitat. Some stands that have not quite developed into suitable habitat for the spotted owl, however, may contain mistletoe brooms or large diameter limbs (> 5 inches) that are large enough to provide suitable nesting platforms for the marbled murrelet. By contrast, dispersal habitat for northern spotted owl is not suitable nesting habitat for marbled murrelet, and all the units proposed within the Bear Saddle project area are classified as dispersal. Some stands within the project area are mapped as suitable, but project-specific field reconnaissance proved them

to be dispersal habitat. There is a very low likelihood that any trees harvested with the activities proposed would be occupied or contain the necessary components, such as large limbs, moss, and cover, to be potential nest trees. Because specific surveys for either species have not been conducted, any nearby or adjacent mapped suitable habitat is considered occupied.

In an effort to understand murrelet productivity and because there is strong evidence that nest predation has a major influence on nest success, a predictive model examining the risk of predation on marbled murrelet nests was developed for the Olympic Peninsula (Cooper et al. 2003). This model examined habitat variables such as landscape patchiness and habitat edges, which engender greater opportunity for corvid presence and predation, then rated areas as having high, moderate, or low risk. The majority of the Bear Creek Saddle project area is classified as having low risk. Two small portions around the mouth of the South Fork of Bear Creek and along the West Twin River are deemed as having moderate risk. The large amount of low risk area is perhaps due to a generally low amount of fragmentation on federal lands in the area.

In March 2004, the 5-Year Status Review (McShane et al. 2004) was published to examine the best available scientific and commercial information on the marbled murrelet. One section of the Status Review, pertinent to this project, addresses potential future habitat gains. In second-growth stands, silvicultural systems, such as small group selection or selective logging with variable retention, are recommended to facilitate habitat development (Manley and Nelson 1999). Development of suitable nesting habitat is dependent on trees attaining a size that will support large, lateral branches. Though thinning activities can produce large trees and develop stand structure and old-growth attributes (Curtis and Marshall 1993, Newton and Cole 1987), the rate at which murrelet habitat characteristics in younger stands can be developed is unknown. Thus, loss of habitat may still be a threat even while implementing habitat specific silvicultural techniques.

Designated Critical Habitat for Marbled Murrelet

The US Fish and Wildlife Service designated critical habitat for the marbled murrelet in 1996 (USDI 1996). Critical habitat is defined as those “lands that are considered essential for the conservation of a listed species” (USDI 2003). The Service identified two habitat features, referred to as primary constituent elements, associated with the terrestrial environment that support the requirements for nesting, roosting, and other normal behaviors. The primary constituent elements include: (1) individual trees with potential nesting platforms and (2) forested areas within 0.5 mile of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height.

Designated marbled murrelet critical habitat in Washington State is primarily on federal lands within Late-Successional Reserves. Critical Habitat Units (CHU) WA-01, WA-02, WA-03 and portions of WA-06 are located within Olympic National Forest. The total acreage of designated critical habitat on Olympic National Forest is 411,900 acres, of which 50% is suitable habitat. Approximately one-half of the project area (852 acres) is within designated marbled murrelet critical habitat unit WA-01-a, of which 45% is considered suitable nesting habitat. These CHUs served as part of a network of marbled murrelet habitat on the Olympic Peninsula, along with habitat available in Olympic National Park and wilderness areas. The

marbled murrelet critical habitat unit that encompasses the Bear Creek Saddle project area is described in the 2003 Programmatic Biological Opinion as the following:

> "This CHU is a combination of federal LSRs and county lands. County lands are to link LSRs together and provide lower-elevation habitat. The adjacent ONP [Olympic National Park] is assumed to be contributing significant amounts of nesting habitat. Conditions are expected to improve in the future throughout much of the CHU on federal lands." The part of the CHU encompassing Bear Creek Saddle falls within Conservation Zone 1 (USDI 1997) and, as stated before, contains approximately 45% suitable habitat (USDI 2003).

Areas designated as critical habitat were done so based on amount of suitable nesting habitat, survey data, proximity to marine foraging habitat, large, contiguous blocks of nesting habitat, range-wide distribution, and the adequacy of existing protection and management (USDI 2003). Specific attributes of each CHU are not indicated in the PBO beyond the description above, however, it is likely that proximity to the marine environment (the Bear Creek Saddle project area is between three and nine miles from the Strait of Juan de Fuca) and the adequacy of existing protection and management (a large amount of land managed by federal agencies) figured more into this area's inclusion than the amount of current suitable habitat or survey data.

Northern Spotted Owl (Strix occidentalis caurina)

The northern spotted owl was listed as threatened under the ESA due to concerns over widespread loss and modification of its preferred habitat (old-growth) and inadequacy of existing regulatory mechanisms. Conservation of the northern spotted owl was one of the primary objectives of the Olympic National Forest Plan as amended (USDA 1995). The Northwest Forest Plan (USDA/USDI 1994a) established the environmental baseline for the Olympic National Forest as consisting of 101,460 hectares (250,714 acres) of suitable spotted owl habitat [40 percent of the Forest's total area (253,768 hectares/627,072 acres)].

The Final Recovery Plan for the Northern Spotted Owl (USFWS 2008) outlines recovery actions to help achieve recovery of the species. Two recovery actions outlined in the recovery plan are applicable to the Bear Creek Saddle planning area. These recovery actions include managing habitat-capable lands within Managed Owl Conservation Areas (MOCAs) to produce the highest amount and highest quality spotted owl habitat the lands are capable of producing (Recovery Action 5). This includes thinning of younger forests to encourage long-term benefits to the species. Recovery Action 32 outlines the approach of maintaining substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs.

While there have not been any spotted owl surveys done specifically related to the Bear Creek Saddle planning area, there are five historic spotted owl activity centers near the project area, four of which are located on National Forest land and one of which is on private land. The first and closest to the project area, #255 (from the Washington Department of Fish & Wildlife database), has a 0.7 mile radius nesting core and 2.7 mile radius home range, both of which overlap into several proposed Bear Creek Saddle units. Portions of three proposed units, and all of one, fall within the 0.7 mile core, and all of 20 proposed units and portions of two units fall within the 2.7 mile area. The last year a pair of owls was confirmed at this site was 2000.

The female bird was found again in 2001 and no birds have been found during the last seven survey seasons (2002-2008). Surveyors with the Pacific Northwest Research Station's (PNW) Olympic demographic study, who have been monitoring activity centers for the last several seasons, stated that they had searched the area out to a mile and a half from the core without any responses (Personal communication with Kurt Laubenheimer 2005). A barred owl (*Strix vaira*), however, was heard at this site during a pre-dawn visit in July 2005 and another barred owl detection was noted during the 2006-2008 surveys.

The nesting core of the second activity center, #402, just barely overlaps into proposed unit #16, with probably an acre or less of overlap. The 2.7 mile home range area encompasses all of 23 proposed units and a portion of one unit. The demography study has not included this site in their survey areas, therefore, the last information from the U.S. Forest Service GIS layer indicates a single bird was found in 1989 with its subsequent status unknown.

The last three activity centers, # 401, 705, and 755 are substantially further from the project area, at 1.6, 2.2, and 2.5 miles respectively from the nearest proposed units. None of the nesting cores of these activity centers overlap with proposed units. Activity center, #401, has a 2.7 mile home range radius that overlaps with portions of six units. A pair was discovered in 1990 (GIS information), however, the demography surveyors have not found any owls at this site as of 2005 (no surveys conducted in 2006 or 2007). Number 705, just a little over two miles from #401, encompasses five proposed units entirely and portions of four units. The PNW surveyors banded and radio-tagged a subadult bird in 1990, but, that bird disappeared soon after and was not found again. PNW has no additional information on this site. And lastly, #755, where a pair has been confirmed every year from 2000-2005 and which nested in 2000 (no chicks fledged) and 2004 (single chick fledged), overlaps with a part of one Bear Creek Saddle unit. However no spotted owls were found during the 2006 surveys, although one barred owl was noted. In 2007 one female spotted owl and one male barred were noted. Interestingly, the 2004 nesting pair from this site did not consist of the same birds that nested in 2000. The historic female from 2000 was replaced in 2002 with a one-year-old female and the 2000 male was replaced with a three-year-old in 2004 (Personal communication with Brian Biswell 2005).

Like with the murrelet, the proposed Bear Creek Saddle stands are not in suitable spotted owl habitat. Such habitat, however, may exist nearby and adjacent to the project area. Without current surveys done to protocol, these unsurveyed stands are considered occupied for the purposes of this analysis.

Several recent reports have looked at what is currently known about spotted owls across their range and what the last decade of federal management (i.e., the Northwest Forest Plan) has or has not accomplished in terms of conserving the species. According to Anthony et al. (2004), northern spotted owl populations are doing the poorest in Washington despite the protection of a substantial amount of habitat on federal lands. Though some decline was expected even with the implementation of the Northwest Forest Plan, the downward trends, even in areas with little timber harvest, suggests that other factors are responsible for the declines (Courtney et al., 2004). While a number of possible reasons exist for the downward trends, nothing definitive can be directly attributed to the decline. Anthony et al. (2004) noted declining populations in areas without timber harvest and populations remaining stable in areas with harvest of mature forest. Likewise, though there is some evidence that barred owls have had a

negative effect on spotted owls, the threat has not been studied to determine whether it is a cause or a symptom of the decline.

Designated Critical Habitat for Northern Spotted Owl

As required by the Endangered Species Act, the US Fish and Wildlife Service has designated critical habitat for the northern spotted owl. Critical habitat for the spotted owl was designated on January 15, 1992 (U.S. Fish and Wildlife Service, 1992a) on National Forest lands outside congressionally designated wilderness. The conservation principles in developing critical habitat are to: develop and maintain large contiguous blocks of habitat to support multiple reproducing pairs of owls; minimize fragmentation and edge effect to improve habitat quality; minimize distance to facilitate dispersal among blocks of breeding habitat; and to maintain range-wide distribution of habitat to facilitate recovery (Thomas et al. 1990). Critical habitat indicates that its designation identify lands that maybe needed for a species eventually recovery and delisting. Critical habitat will not in itself, lead to the recovery of the species, but is one of several measures available to contribute to a species' conservation (CFR, Vol 157, no. 10).

Primary constituent elements for owl critical habitat consist of habitat features that support nesting, roosting, foraging, and dispersal. Dispersal habitat is considered that habitat which functions to assist juvenile dispersal and breeding dispersal of adult spotted owls. It is also habitat which connects suitable habitat patches with one another. Dispersal habitat consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities. Dispersal habitat does not necessarily have old-growth or mature forest characteristics. The general rule for classifying dispersal habitat is to have a stand with an average tree diameter of 11 inches dbh within a canopy cover of 40% (Thomas et al. 1990). On the Olympic National Forest, there are 10 designated Critical Habitat Units (WA-43 through WA-52) totaling over 398,000 acres that are identified that are considered essential for the conservation of the listed species.

The critical habitat unit (CHU) that was designated in 1992 and which encompassed the Bear Creek Saddle project area was named WA-45 (approximately 1,766 acres of the proposed stands fell within this CHU). Approximately 28% of the CHU contained suitable habitat for spotted owls while approximately 54% was designated as dispersal. Given several overall concerns regarding owl habitat in the Olympic Peninsula province, such as generally poor habitat quality and quantity, a high degree of fragmentation, isolation of some owl pairs along the coast, low population levels and low reproductive success, and the risk of genetic and demographic isolation from the Washington Cascades populations, this CHU, along with several others (also designated in 1992), was intended to serve as a single, large interactive unit for the interior of the Olympic Peninsula (USDI 1992). Ideally, the CHU should support clusters of owl pairs by providing large, contiguous blocks of suitable and dispersal habitat (USDI 1992).

On September 12, 2008, the U.S. Fish & Wildlife Service revised designated critical habitat for the northern spotted owl (USDI 2008) based on information in the draft and final recovery plans for the species. The revision reduced the amount of designated habitat from 6,887,000 acres to 5,312,300 acres on Federal lands in California, Oregon, and Washington. On the Olympic National Forest, this translated to a decrease from 398,560 acres in 1992 to 332,332 acres in 2008. For the Bear Creek Saddle project area, this also has resulted in fewer thinning

stands being within critical habitat, and at present, instead of 1,766 acres of treatment being within the CHU, there are approximately 862 acres.

The 2008 critical habitat for the Olympic Peninsula is all lumped into one block, referred to as Critical Habitat #1 (as opposed to the 1992 designation, which was divided up into smaller blocks). Based on the Forest's GIS layer of suitable nesting habitat for northern spotted owls, there are approximately 171,293 (52%) acres of suitable within the revised critical habitat. Treating 862 acres would mean a potential increase of < 1% of suitable habitat within the CHU.

The Programmatic Biological Opinion (PBO) from the U.S. Fish & Wildlife Service outlines specific measures relative to commercial thinning on the Olympic National Forest and the conservation of listed species. The PBO determined that activities associated with commercial thinning during the early nesting season, within critical distances of suitable habitat, may adversely affect listed species due to harassment resulting from noise disturbance. Some acres of harassment are allowed under the programmatic for certain activities, for example, heavy equipment and chainsaws (although the determination remains, "Likely to Adversely Affect" even though it is an approved impact). If those levels of harassment are reached, the remaining units must be harvested outside of the critical nesting periods.

Marbled Murrelet, Northern Spotted Owl, and Designated Critical Habitats

Alternative A - No Action

Direct and Indirect Effects

Under Alternative A, current conditions would be maintained. Approximately 2,189 acres of overly dense, 45-60 year old clearcuts that meet LSR treatment criteria would not be commercially thinned. These stands would remain in early- or mid-seral conditions, generally overstocked with a single canopy layer, fewer than optimal snags and down wood, and a high canopy closure with a corresponding lack of vegetation on the forest floor. These stands would continue to provide dispersal habitat for northern spotted owl but not nesting habitat for marbled murrelet or spotted owl. There would not be any direct effects, through habitat manipulation, which would not occur, nor disturbance, to any individuals of these species that may be using the project area. Likewise, there would be no effect to the mapped critical habitat areas; these stands would continue to provide little in terms of murrelet nesting potential, but would be available as dispersal areas for spotted owls.

Indirect effects would include the delayed development of additional acreage of late-successional/old-growth forests that could provide potential nesting opportunities for murrelets as well as future nesting, roosting, and foraging habitat for spotted owls. Foregoing opportunities to decommission roads would maintain current levels of disturbance and continue to provide edge habitat for potentially more aggressive species.

Endangered Species Act (ESA) Effects Determination: No Effect (no activity proposed)

Cumulative Effects

Activities in the project area that have had the greatest impact from habitat removal or habitat alteration that favors competing species and human disturbance on these two threatened species include previous timber harvest, road building, and, to a lesser degree, catastrophic fire

events. Large-scale, timber extraction that has occurred in the past on federal lands will not be taking place again in the foreseeable future, however, clearcut harvesting still is occurring in many areas on private lands around the project area. It can be assumed that most private lands around Bear Creek Saddle will not be available as either dispersal or suitable habitat in the next several decades. This fact will make the existence of habitat on federal lands even more critical, particularly if they can be utilized as nesting areas.

Alternative B

Direct and Indirect Effects

Thinning prescriptions would create conditions that would foster growth of old-growth structural characteristics necessary for murrelet and owl nesting, such as multi-story canopies, large, lateral branch growth, large trees, and maintenance of existing dead and down wood habitat. Treated stands will continue to function as dispersal habitat by maintaining more than 40 percent canopy cover with trees larger than 11 inches dbh (Thomas et al. 1990). These areas would not automatically become nesting habitat, and the activities, in the short-term, may disturb individuals nesting nearby, owls that are using the proposed stands for dispersal, or murrelets moving through as they return from foraging trips. Seasonal and daily restrictions would minimize these impacts in helicopter units. Sixteen units that are proposed for ground-based and cable logged would be harvested during spotted owl and marbled murrelet breeding seasons and could result in approximately 81 acres of harassment on adjacent suitable habitat. Recent field measurements of noise levels of the K-Max helicopter use on the Olympic National Forest found that its noise disturbance affects a significantly smaller area (300 feet) than the assumed one mile distance. Given the smaller noise disturbance area of such a helicopter, use of a helicopter that produces a noise level of 92 decibels or less may be allowed to operate during the early breeding season. If so, there would be an additional 257 acres of harassment on adjacent suitable habitat, which may still be allowed under the PBO by the US Fish and Wildlife Service. Decommissioning roads would have the effect of increasing the area of future habitat, as well as reducing amount of disturbance and presence by other, more aggressive species (in the long-term) by decreasing the amount of edge habitat.

The effects of this alternative would not remove northern spotted owl suitable habitat (nesting, roosting, or foraging) nor would it remove marbled murrelet nesting habitat. The Purpose and Need for Action of this project (EA Chapter 1) is consistent with the objectives outlined in the recovery plan for the northern spotted owl and the marbled murrelet.

For the marbled murrelet critical habitat block, which is about 30,600 acres in size, the creation of approximately 2,200 acres of suitable habitat (7%) does not represent a large change. Still, these stands are very close to the Strait of Juan De Fuca and would, short-term, provide suitable nesting habitat within just a few miles of foraging areas. Likewise, with the northern spotted owl CHU, the Bear Creek Saddle project would not greatly increase the amount of suitable habitat. However, given that only 52% of the current CHU is currently suitable for nesting, any additional increase would be beneficial, particularly given the specific concerns faced by the owl population on the Peninsula (e.g., fragmentation, isolation, low reproductive success).

Indirect effects would include both positive and negative possibilities. Given the paucity of suitable habitat in the critical habitat block, an improvement in habitat conditions in the long-

term for those species dependent on forests with late-successional characteristics would be beneficial. Conversely, for murrelets, the potential impacts from opening up travel corridors (roads), even though ultimately closed, may include enhancing these areas for corvids, which are predators on nests and chicks. Increased openings may also increase the risk of barred owl presence, although the available data do not conclusively show that this would occur.

Endangered Species Act (ESA) Effects Determination: May Affect, Likely to Adversely Affect (due to harassment from early season harvest operations)

Cumulative Effects

Endangered species restrictions and Northwest Forest Plan requirements have curtailed clearcut logging and road building on Federal lands of late-successional forest stands in the Deep Creek, West Twin Rivers and Middle Sol Duc watersheds since 1993. Prior to this time, however, these were the biggest impacts on the landscape owls and murrelets and their habitats. Since the designation of Late Successional Reserves in 1994, activities in those land designations have sought to protect and enhance late-successional habitat characteristics. Between 1996 and 1998, 150 acres of commercial thinning (Scatter Thin Timber Sale) occurred in the lower West Twin River watershed. In addition, most of the stands within Bear Creek Saddle have been pre-commercially thinned. The activities proposed would accelerate the development of late-successional conditions on about 2,189 additional acres. It is assumed that logging and road building on State and private lands will continue in all three watersheds. There is also a high likelihood that the Washington Department of Natural Resources (WDNR) will initiate substantial timber harvesting in Bear Creek over the next 10-15 years. Therefore, few non-National Forest lands are expected to provide additional late-successional habitat, making the habitat remaining on federal land key to population health.

Activities to further enhance habitat in the planning area, primarily in the form of snag creation, would occur via timber sale receipts (KV dollars) and would contribute to the 31 trees that have been previously topped in the project area. Down wood structures would also be considered; there are no records that these have been done in the past.

Alternative C

Direct and Indirect Effects

The effects of this alternative would be similar to B, with the exception of approximately 43 fewer acres being treated and about 0.4 miles of unclassified, abandoned road being used and decommissioned around a technically vacant spotted owl activity center. This activity center, however, has had no documented spotted owl sightings during the last six survey seasons and has not had a documented owl pair since 2000. One barred owl was found in 2005 and another detected in 2006. Dropping these acres also eliminates the helicopter activity near this site. This part of the alternative was developed in response to the Olympic National Forest Strategic Plan (USDA 2004b), which recognized, based on anecdotal information and speculations from the research community, that the effect of barred owls on spotted owls is largely unknown but may potentially be related to opening up forested stands, even through thinning practices are designed to create late-successional characteristics. The strategic plan outlines the delineation of activity centers into “occupied” (activity within the last five survey seasons) or “vacant” (no activity). There is no scientific evidence, however, to support a theory that thinned stands are more susceptible to barred owl occupation and, in fact, barred

owls are moving into the Elwha drainage in the Olympic National Park, which is some of the most intact old-growth in the area (Personal communication with Brian Biswell 2005). Additionally, many reference documents (USDA 1994a, USDA 1995, USDI 2003, Courtney et al. 2004) recommend habitat manipulation, including the Soleduck Late Successional Reserve Assessment (USDA 1997), which advocates increasing available habitat in those spotted owl activity centers where there is less than 40% suitable habitat in the home range (2.7 mile circle) and less than 500 acres suitable in the nesting core (0.7 mile circle). The activity center (#255) affected by proposed Bear Creek Saddle units falls within this category. Nonetheless, concern, even though it has not been scientifically quantified, is partly the reason behind developing this alternative.

The effects of this alternative would not remove northern spotted owl suitable habitat (nesting, roosting, or foraging) nor would it remove marbled murrelet nesting habitat. The Purpose and Need for Action of this project (EA Chapter 1) is consistent with the objectives outlined in the recovery plan for the northern spotted owl and the marbled murrelet.

Decommissioning roads would have the same benefits as outlined in Alternative B.

This alternative would impact approximately 43 fewer acres around the activity center, but it would also not begin the acceleration process of creating late-successional structural characteristics in an area that has had repeated spotted owl occupancy but now, for some reason, in the last seven seasons has not. Direct and indirect effects to the critical habitat units would be similar to Alternative B, with slightly less acreage overall. There would be 81 acres of harassment to spotted owls and murrelet due to cable and ground-based logging adjacent to suitable habitat. If use of a helicopter that has a noise level of 92 decibels or less is approved, there would be an additional 185 acres of harassment.

Endangered Species Act (ESA) Effects Determination: May Affect, Likely to Adversely Affect (due to harassment from early season harvest operations)

Cumulative Effects

These would be similar to Alternative B, but affecting approximately 53 fewer acres with about 43 of those acres being dropped from the inactive owl activity center.

Regional Forester's Sensitive Species

The following table lists six species on the Regional Forester's Sensitive Species List that have habitat in the project area (USDA 2004c). Designation as "sensitive" means these species are given special management considerations to ensure their continued viability on National Forest lands. Three sensitive species – Olympic Mazama pocket gopher (*Thomomys mazama melanops*), common loon (*Gavia immer*), and American peregrine falcon (*Falco peregrinus anatum*) – do not have habitat present in the project area and would not be affected by any of the alternatives.

Table 8. Regional Forester's Sensitive Wildlife Species with habitat in the project area.

Common Name	Species Name	Suitable Habitat Present in Project Area	Documented Sightings in Project Area
Pacific Bald Eagle	*Haliaeetux leucocephalus*	Yes	Yes
Pacific Fisher	*Martes pennanti*	Yes	No
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	Yes	No
Van Dyke's Salamander	*Plethodon vandykei*	Yes	No
Cope's Giant Salamander	*Dicamptodon copei*	Yes	No
Olympic Torrent Salamander	*Rhyacotriton olympicus*	Yes	No

Bald Eagle

In August 2007, the bald eagle was removed from the federal Endangered Species List (72 FR 37346, July 9, 2007) (USFWS 2007a). The bald eagle continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. On National Forest System lands, it will continue to be protected by the National Forest Management Act (NFMA) and the agency is still required to follow conservation measures outlined in the National Bald Eagle Management Guidelines (USDI 2007b). The bald eagle was designated a "Regional Forester's Sensitive Species" in Region 6 where it previously was a federally listed species. The minimum period the bald eagle will be under the Regional Forester's list is at least 5-years post-delisting during the ESA monitoring period. Because the bald eagle is delisted, the Forest Service will no longer be required to consult with the USFWS on activities that could affect the bald eagle.

There are no known nest sites within the project area, however a nest adjacent to the project boundary was discovered during a flight specifically done for the Bear Creek Saddle analysis during the 2005 season. The Washington Department of Fish & Wildlife (WDFW) surveyors found the empty nest on June 3 and searched the area for alternate nest trees, but did not find any. The only other known nest is along the Sol Duc River over a mile from the project area. There is a concentrated winter foraging area along Bear Creek, which is likely related to salmon carcass placement done by the Pacific Salmon Coalition (Personal communication with Carl Chastain 2006). It is uncertain how long the eagles stay in this area in large numbers, and there may be a night roost nearby though this is not known at the present time. WDFW surveyors, during a flight in December 2005, located ten eagles of different ages roosting in a pocket of old-growth trees near the creek where the carcass placement is done.

A nesting platform for bald eagles was installed along Bear Creek in 1989. The platform at Bear Creek is in a 60-inch dbh Sitka spruce at a height of 110 feet and, as far as can be

ascertained from district records, has not been monitored on a regular basis and is presumed to be unoccupied.

Pacific Fisher (Martex pennanti)

The Pacific fisher, a secretive member of the weasel family, is strongly associated with forested landscape and will actively avoid open areas (Maser 1998). Fisher commonly occur in landscapes dominated by mature forest cover and have been categorized by some researchers as "closely-associated" with late-successional forests (Thomas et al. 1993). Fishers have been found selecting for stands with higher overhead canopy cover due to the increased security and snow-interception that it provides, as well as in those areas with high structural complexity on the forest floor (Wier and Harestad 2003). Seasonally, fishers are known to use both young and mature forest types depending on the shift in prey availability. Additionally, female fishers utilize two distinct sites as dens. Natal dens are comprised of living and dead standing trees with cavities. Maternal dens have been documented as occurring in downed wood, or logs (USDA 1994). Trees used as resting structures are often the largest trees, snags, or down logs available (Weir and Harestad 2003, Zielinski et al. 2004). No known populations of fishers exist in Washington and it is thought that the species is extirpated from the state (Lewis and Hayes 2004). There are no mapped locations for Pacific fisher in the Bear Creek Saddle project area on the forest GIS layer.

In September 2007, the Fisher Reintroduction Plan/Environmental Assessment was completed, which outlines a program to contribute to the species' reintroduction to the state by establishing a self-sustaining fisher population in Olympic National Park (USDI 2007b). The preferred alternative involves bringing animals from a source population in Canada and releasing them in three areas of the Olympic National Park, the Hoh-Bogachiel Area, the Queets-Quinault Area, and the Elwha-Sol Duc Area, the last one of which is approximately two miles from the east end of the Bear Creek Saddle planning area. On January 27 and March 2, 2008, a total of 11 animals were released into the Elwha-Sol Duc Area and as of August 26, 2008, one male had left the Park and trekked across the Forest, north of the Sol Duc River and through the western part of the planning area, settling into an area to the northwest off of the National Forest. A second round of releases, with a goal of 40 animals, is planned for winter 2008/2009. The survival and movements of this year's animals will help determine in which release areas the next groups should go.

The proposed Bear Creek Saddle stands individually are not high quality habitat for use by fisher (i.e., forested stands with late-successional characteristics such as numerous snags and downed logs), however, several stands in the eastern part of the planning area, which are mapped as suitable for nesting spotted owls and murrelets are more likely to contain these features, and this habitat would be retained under all alternatives. Resting and denning habitat is more limited in managed forests or those with successive fires, due to the lower expected numbers of snags and logs. Bear Creek Saddle was not surveyed specifically for fisher, however there may be future opportunities to monitor treated areas, particularly if radio telemetry data from the reintroductions show that the animals have moved into and stayed within the planning area.

Townsend's Big-Eared Bat (Corynorhinus townsendii)

Townsend's big-eared bat is a cave-dwelling species that will also utilize human structures, such as buildings, if they provide a "cavern" component. They will night roost in more open settings, including under bridges. There seems to be a preference for I-beam or cast-in-place bridges, as opposed to wooden or cement flat bottom bridges (Perlmeter 1995). Many species of bat also utilize the areas beneath sloughing bark, most often found on old-growth trees and snags.

There are no human structures or caves in the Bear Creek Saddle project area. There are, however, two bridges across Bear Creek and one across the South Fork Bear Creek that were surveyed during the day in June 2005 for big-eared bat. Two of the bridges are concrete and one is constructed of treated timber. No bats of any species were found at this time.

Van Dyke's Salamander (Plethodon vandykei)

This rare salamander, generally considered the most "aquatic" of the woodland salamanders, is usually associated with seepages and streams but can also be observed far from water (Leonard et al. 1993). It can be found in the splash zones of creeks or waterfalls under debris, or under logs, bark and bark on logs near water. Van Dyke's salamander is found only in Washington and only from three areas, the Olympic Mountains, the southern Cascades, and the Willapa Hills. Documented populations have tended to be small and separated from one another (Leonard et al. 1993).

Amphibian surveys on the Olympic National Forest have been sporadically conducted in conjunction with stream or fish surveys or as a specific effort. Surveys were not done specifically for this analysis, but no mapped sightings for Van Dyke's salamander in or near the project area have been recorded from previous efforts. Habitat, however, undoubtedly exists along many of the numerous streams.

Cope's Giant Salamander (Dicamptodon copei)

This species of giant salamander is found in small, steep-gradient, permanent streams with clear, cold water (Corkran and Thomas 1996). Terrestrial Cope's giant salamanders are very rare (Leonard et al. 1993), generally remaining in their aquatic larval and neotenic forms, and spending their days concealed beneath rocks or in other hidden cavities in the stream. The few terrestrial forms found were located beneath surface debris adjacent to the water.

There are no mapped sightings for Cope's Giant salamander in the project area, but potential habitat exists along the steeper, colder portions of streams, particularly in the headwater areas.

Olympic Torrent Salamander (Rhyacotriton olympicus)

This is the only species of torrent salamanders that is found on the Olympic Peninsula. The southernmost boundary of the range is uncertain, but probably does not extend further south than the Chehalis River Valley (Leonard et al. 1993). Olympic torrents are nearly always found around the splash zone of cold, clear streams, seepages, or waterfalls. Seepages running through talus slopes also provide habitat.

There are no mapped sightings for Olympic Torrent salamander in the project area.

Alternative A - No Action

Direct and Indirect Effects

Current forest conditions would remain the same. In the short-term, potential nest trees for eagle would be limited to what currently exists. Acceleration of late-successional characteristics, the most important of which for eagles is the creation of large trees, would not occur and would comprise the indirect effect of no action.

There would not be any direct effects, given the lack of management activities, to any sensitive species for which there is suitable habitat in the project area. Indirect effects would be delayed development of future habitat with late-successional characteristics for species such as the Townsend's big-eared bat. Not decommissioning some roads could potentially impact individual Van Dyke's salamanders if they should be traveling across roads during times when vehicles are also using them. Roads not decommissioned could also fail and destroy suitable habitat.

Cumulative Effects

Bald eagles have been affected by previous timber harvest (habitat loss), road building, disturbance, pesticide use, as well as declining fish populations. Timber harvest on state and private lands surrounding the Bear Creek Saddle project area are expected to continue, and it is assumed, based on past harvest practices that most areas on these ownerships will not provide suitable nesting trees (large trees with large limbs) for eagles in the near future.

Potential to develop certain trees as possible nest trees, through platforms or other means, would be foregone with this alternative.

The effects of previous harvest, road building, and human disturbance have likely had the greatest impact on Pacific fisher and, indeed, their present status as "extirpated" from Washington is likely based on past over-exploitation via commercial trapping as well as loss, degradation, and fragmentation of suitable habitat (Lewis and Hayes 2004). A similar situation exists for Townsend's big-eared bat since its forested habitat includes the sloughing bark of old-growth trees and snags, which has been harvested in great quantities. The "No Action" alternative would not add to the historic impacts. There would also be no additional impacts, beyond what has occurred previously, to the salamanders by maintaining the current condition.

Opportunities to create additional bat habitat would be foregone with this alternative.

Alternative B

Direct and Indirect Effects

A total of about 2,189 acres would be thinned, potentially providing eagle nest trees in the future more quickly than if the stands were left to grow at their present successional rates. Given that these stands do not at present provide eagle nesting habitat, the only possible direct effect would be that of disturbance. An eagle nest found during June 2005 adjacent to the project area boundary was found to be empty/inactive and unrepaired in 2007. If future survey results indicate that this nest is occupied, seasonal restrictions would be required to mitigate for disturbance. The other two nearby eagle nests are 2.3 and 2.5 miles away so, given these

distances, concerns about disturbance during the critical nesting period are minimal for these activity areas. While felling can be accomplished at any time, the foraging area would require that helicopter work for the three units located less than a mile away (Units 8, 10, 56) occur between August 6 and October 30 to accommodate the winter foraging area, as well as early nesting seasons for murrelets and owls.

Indirect effects include the nesting habitat potential that will be fostered for the future. Additionally, any fisheries projects associated with the thinning, particularly road decommissioning and in-stream enhancement work, would indirectly benefit eagles and potentially make the landscape more appealing as nesting territories.

Mitigation measures specific to reduce the effects of project activities to the bald eagle when it was federally listed will continue to be applied under its designation of Sensitive.

Thinning the proposed stands, as well as the construction of temporary roads, may have a short-term, negative effect on Van Dyke's salamander, if individuals are in the forested areas, as opposed to the stream corridor (the other two salamanders are almost exclusively associated with the stream channel). This impact could include some direct mortality but would likely be minimal in terms of effects upon the entire population. Given our lack of baseline data, however, the exact extent of the impact is not known. Decommissioning roads would have benefits for the Van Dyke's salamander by eliminating the potential of those roads to fail and impact salamander habitat. The Townsend's big-eared bat would not be directly affected because the trees that would be harvested do not provide the bat's specific microhabitat. Project design criteria would implement seasonal restrictions and protection buffers if active fisher denning sites are located in the project area. Therefore, project activities would not contribute to trend toward federal listing for any sensitive species.

Cumulative Effects

Continued harvest on state and private lands around the project area will mean continued lack of large nesting trees for eagles in those areas and mature forest in those areas for Townsend's big-eared bat and Pacific fisher. Thinning approximately 2,189 acres on National Forest land would be added to the previous 150 accomplished through the Scatter Thin Timber Sale as future potential habitat. Previous aerial fertilization, on federal and private lands, may have impacted amphibian species, but there would not be any such similar activities with this project. In the short-term, there would be opportunities to add to the habitat base for the bat via placement of nesting structures, as well as by possibly placing coarse woody debris in certain areas of the riparian zones for salamander cover.

Alternative C

Direct, Indirect, and Cumulative Effects

The effects, including effects summary, for this alternative would be very similar, with only a slight decrease (3%) in the amount of habitat enhanced for late-successional conditions. The change in impacts would be negligible for bald eagle and small for the other sensitive species.

Regional Forester's Sensitive and other rare or uncommon species – Mollusks

Species on the Regional Forester's sensitive species list, as well as other rare or uncommon species, that were identified as having potential habitat in the proposed project area are disclosed as follows, as well as in the botany section.

Table 9. Sensitive and other rare or uncommon mollusks with potential habitat in the project area.

Common Name	Species Name	Status
Puget Oregonian snail	*Cryptomastix devia*	Sensitive
Warty Jumping Slug	*Hemphillia glandulosa*	Sensitive
Keeled jumping slug	*Hemphillia burringtoni*	Sensitive

Regarding native mollusks, several species were recategorized as "Sensitive" in December, 2007. The criteria stipulated by a Court order as to whether or not pre-disturbance surveys are required for these recategorized species is still being used by the agency. In this stipulation, surveys are not required in stands proposed for thinning if they are less than 80 years of age. Since the Bear Creek Saddle stands are 45 to 60 years old, surveys then are not required. Three species, *Cryptomastix devia* (Puget Oregonian snail), *Hemphillia burringtoni* (Keeled jumping slug), and *H. glandulosa* (Warty jumping slug) could possibly be found within the project area, however a second stipulation from the court that projects "which affect suitable habitat elements but are dispersed through a project area so that less than 5 percent of those habitat components in the project area are negatively affected" would apply. The two jumping slugs are associated with conifer logs and/or heavy ground cover and the Puget Oregonian snail is associated with hardwoods. Though some alder would be removed for conifer release, it should be less than 5 percent of that habitat type in the project area, and other minor hardwood species would be retained. Coarse wood would not be removed.

Puget Oregonian Snail – This species' occurrence on the Olympic National Forest (ONF) is known from one shell found on south end of Hood Canal Ranger District. Despite extensive surveys across ONF, no other shells or live animals have been found (J. Ziegltrum 2005, pers. comm.). The species is associated with hardwood shrubs and trees, especially big leaf maple and vine maple which would not be removed unless needed for road construction or operational concerns. Less than 5 percent of alder habitat components in project area would be affected. Pre-disturbance surveys are not required.

Warty Jumping Slug and Keeled Jumping Slug – These two species are locally common and abundant on the ONF (J. Ziegltrum 2007, pers. comm.). They occur in moist forest but have wider habitat tolerances than the other mollusks, and therefore could possibly occur within the Bear Creek Saddle stands. Some mortality of individuals could occur. There would be no risk to species viability or a trend toward federal listing. No pre-disturbance surveys required for these species.

Hoko Vertigo Snail – The species is only known to occur in the Hoko River drainage in the northwest portion of the Olympic Peninsula. This project occurs outside of the documented range of this species therefore pre-disturbance surveys are not required.

Malone's jumping slug – Species has not been found on Olympic National Forest (ONF) despite extensive surveys in similar habitats (J. Ziegltrum 2005, pers. comm.). The only documented habitat on ONF is a small piece in the Wynoochee River watershed. It occurs in moist forested habitats, generally over 50 years old with greater than 50 percent canopy cover, especially where dense sword fern, coarse woody debris, exfoliated bark piles and large decaying stumps are found. This jumping slug can also be found in marshy open sites with dense skunk cabbage, fallen logs, and other low vegetative cover (Duncan et al. 2003. Pre-disturbance surveys are not required.

Oregon Megomphix – Species is found in mature or late-seral, moist conifer and hardwood forest, usually in hardwood leaf litter and decaying non-coniferous plant matter under bigleaf maple trees (Duncan et al. 2003). It may also be found at other moist sites where deciduous sites, coarse woody debris, torrent logs or stumps and large sword ferns provide abundant cover. Within the stands at Bear Creek Saddle, some hardwood species would be removed but

it should be less than 5 percent of habitat components that would be impacted. Pre-disturbance surveys are not required.

Evening fieldslug – Species has not been found on Olympic National Forest despite extensive surveys in similar habitats (J. Ziegltrum 2005, pers. comm.). Reported to be associated with wet meadows in forested habitats and moist surface vegetation within close proximity to perennial wetlands, springs, seeps, and riparian areas (Duncan et al. 2003), which will generally be outside areas of thinning operations. Less than 5 percent of habitat components would be affected, if at all. Pre-disturbance surveys are not required.

Blue-gray taildropper - Species has not been found on Olympic National Forest despite extensive surveys in similar habitats (J. Ziegltrum 2005, pers. comm.). It occurs in moist conifer and mixed hardwood-conifer forests, in sites with relatively higher shade and moisture content than those of general forest habitat. It is usually associated with partially decayed logs, leaf and needle litter, mosses and moist plant communities, including big leaf maple and sword fern plant associations (Duncan et al. 2003). Less than 5 percent of habitat components would be affected. Pre-disturbance surveys not required.

Alternative A - No Action

Direct and Indirect Effects

There would not be any direct effects to any of the mollusk species with the No Action alternative. Given that these species seem to be associated with hardwood or mixed conifer-hardwood forests, not developing late-succession habitat would not be an indirect, negative effect because it is not a habitat type that these species are dependent on.

Cumulative Effects

The effects of previous harvest, road building, and human disturbance would have had the greatest impact on management indicator species. A "No Action" alternative would not add to the historic impacts. There would be no additional impacts, beyond what has occurred previously.

Alternative B

Direct and Indirect Effects

There may be some level of mortality on individuals of the Keeled and warty jumping slug species. Given that the jumping slugs have been found to be locally common and abundant on the forest, however, there would be no direct effects and no risk to species viability or a trend toward federal listing.

Cumulative Effects

The effects of historic timber harvest and road building have had the greatest impact on these mollusk species. Harvest of conifer habitat around the project area is expected to continue on other ownerships, limiting the potential of these species to occur on private lands. Removal of conifers in the proposed Bear Creek Saddle thinning units, and the associated short-term disturbance, may impact certain individuals. Given the large amount of habitat in this size and

age category in the subwatersheds affected (outside the project stands) and the project's short-term effects to mollusks, however, the incremental impact of this project would be minimal when taking into account available habitat, as well as other past, present and future activities in the affected watersheds.

Alternative C

Direct, Indirect, and Cumulative Effects

The effects with this alternative would be very similar to Alternative B, with only a slight decrease (3 percent) in the amount of habitat potentially altered for mollusk species. 0.2 fewer miles of new temporary roads would be of benefit to these species by reducing the amount of ground disturbance and vehicle traffic.

Management Indicator Species

Management Indicator Species (MIS) are either selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat, or species whose condition can be used to assess the impacts of management actions on a particular area (Thomas 1979). The following species were identified as MIS for the Olympic National Forest (USDA 1990a):

Table 10. Forest Management Indicator Species.

Common Name	Species Name	Indicator of Habitat Presence	Suitable Habitat Present in Project Area	Documented Sightings in Project Area
Bald Eagle*	*Haliaeetus leucocephalus*	Mature forest stands	Yes	Yes
Northern Spotted Owl*	*Strix occidentalis caurina*	Mature forest stands	Yes	Yes
Pileated Woodpecker	*Dryocopus pileatus*	Mature coniferous forest	Yes	No
Primary Cavity Excavators	*Various*	Dead and dying trees	Yes	No
Roosevelt Elk	*Cervus canadensis roosevelti*	Balance of cover and forage habitats; amount of vehicle disturbance	Yes	Yes
Columbia Black-tailed Deer	*Odocoileus hemionus*	Balance of cover and forage habitats; amount of vehicle disturbance	Yes	Yes
American Marten	*Martes americana*	Mature coniferous forest	Maybe	No

*Bald eagle and northern spotted owl were discussed in previous sections.

Pileated woodpecker (Dryocopus pileatus)

Pileated woodpecker, the largest woodpecker species in the western United States, is a denizen of mature forests, relying on dead and decaying trees for foraging and nesting. Pileated woodpeckers will return to areas after timber harvesting (Ehrlich et al. 1988), but past management in the Pacific Northwest has led to relatively few snags and down logs, especially of large diameters, remaining in many watersheds. Previous timber harvest, as opposed to wildfire events, has had the greatest effect in the Bear Creek Saddle project area. Although there have not been any pileated woodpecker surveys specifically done for this project, it is probable that individuals are using the area for foraging, and likely nesting as well.

Primary Cavity Excavators

"Primary cavity excavators" comprise a broad group of species associated with standing dead trees or snags and down logs that excavate their own cavities. They include hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), brown creeper (*Certhia americana*), and northern flying squirrel (*Glaucomys sabrinus*).

There have not been formal surveys for any of these species, however, based on habitat, many are likely present in the project area.

Roosevelt Elk (Cervus Canadensis roosevelti) and Columbia Blacktail Deer (Odocoileus hemionus)

Roosevelt elk and Columbia blacktail deer are known throughout the Olympic National Forest and Peninsula. There are several established herds of Roosevelt elk that reside on the Forest as year-round residents, as well as many that are migratory, for example, moving into the Olympic National Park during the summer. Deer occur throughout the forest, and both species use a combination of habitats comprised of cover, forage, water, and space. Taber and Raedeke (1980) reported that winter mortality, legal harvest, and poaching were the primary causes of elk morality. Poaching is the second leading cause of mortality to elk in Washington state and is prevalent on the Olympic Peninsula (WDFW 2004). As one might expect, a high density of roads, common throughout much of the Peninsula, can have a negative impact on elk with increased disturbance from legal hunting and poaching (CEMG 1999). Therefore, closing roads no longer needed results in a notable reduction in disturbance to elk (Witmer and deCalesta 1985). The Washington Department of Fish and Wildlife (1996) recommends that road densities be kept below 1.5 mi/mi2 mile in elk summer/fall range and below 1.0 mi/mi2 mile in winter/spring range. None of the five subwatersheds that are included in the Bear Saddle project area meet these recommendations (See Table 13. Existing Road Densities by Sub Watershed in Bear Creek Saddle Planning Area).

Most of the Bear Creek Saddle project area is considered potential elk winter range, which on the Olympic Peninsula is typically defined as land below 1,500 feet in elevation (USDA et al. 1995). Preferred forage areas are in natural openings or managed stands less than 30 years old. Aside from private lands adjacent and near the project area, there are few areas harvested this recently.

The elk herd using the Bear Creek Saddle project area is known as the East/West Twin Herd. The population seems to be stabilizing but cows still experience “breeding pauses” (Personal communication with Frank Geyer 2005). Breeding pauses appear to be consequences of lower quality forage that result in cows being unable to building sufficient reserves, due to high costs of lactation, to breed during subsequent falls (WDFW 2004).

American marten (Martes americana)

The American marten, also known as the “Pine” marten (Martes americana), is most closely associated with heavily forested east and north-facing slopes that contain numerous windfallen trees (Maser 1998). They tend to avoid areas that lack overhead protection and the young are born in nests within hollow trees, stumps, or logs. While no surveys were done specifically for the project area, there have been no documented sightings of marten within the project area. According to a Washington Department of Fish & Wildlife study (Sheets 1993), which combined trapper interviews with remote camera surveys in various locations on the Peninsula, it was concluded that marten may only be found within the Olympic National Park, surrounding wilderness areas, and unfragmented mature timber adjacent to the park. National Forest land, in general, may be too fragmented to support a population. However in August 2008 a dead juvenile marten was found on the east side of the Forest, the first sighting in twenty years (Aubry 2008, pers comm.).

Coarse woody debris levels, although not at the levels of what existed in the natural stands, are reasonably high in some of the proposed thinning stands, probably as a result of early logging

practices when only the most valuable pieces were removed and the rest were left. It is possible that marten exist within the project area.

Alternative A - No Action

Direct and Indirect Effects

There would not be any direct effects to any management indicator species with the No Action alternative. Indirect effects would include delayed development of late-successional forest characteristics for all MIS and lost opportunities to decommission roads and enhance forage opportunities (through thinning) for big game. An opportunity to increase the levels of snags and down wood in the stands would also be lost.

Cumulative Effects

The effects of previous harvest, road building, and human disturbance would have had the greatest impact on the management indicator species. A "No Action" alternative would not add to the historic impacts. There would be no additional impacts, beyond what has occurred previously.

Alternative B

Direct and Indirect Effects

Thinning the proposed stands may have negative impacts from disturbance on foraging pileated woodpeckers and other primary cavity excavators, however, the long-term, more indirect, impacts would be to improve habitat, especially as regards snag and down wood habitat that can be improved through enhancement measures (snag creation, coarse woody debris placement). Snags and down wood would not be removed in the thinning prescriptions except for safety reasons. Benefits to big game would include about 2,189 acres of enhanced forage and this would positively impact the East/West Twin elk herd, which has experienced "breeding pauses" in the past from inadequate forage (Personal communication with Frank Geyer 2005). Decommissioning nearly six miles of unclassified, abandoned roads with the potential decommissioning of another six miles of forest system road would also benefit big game by reducing disturbance from vehicles and human access.

Cumulative Effects

Historic timber harvest and road building would have had the greatest impact on management indicator species. Additionally, aerial fertilization and seeding efforts benefited elk and deer. Increasing the complexity of the Bear Creek Saddle proposed stands would be of benefit to all MIS species in terms of accelerating late-successional habitats, and to big game in terms of forage enhancement and decreased road density. Activities to increase snag and down wood habitat would be of benefit to the avian cavity nesters and marten.

Alternative C

Direct, Indirect, and Cumulative Effects

The effects with this alternative would be very similar to Alternative B, with only a slight decrease (3%) in the amount of habitat enhanced and roads decommissioned. This change would be negligible.

Forest Landbirds

In coniferous forests of Western Oregon and Washington, 27 species of neotropical migratory birds have experienced significant recent declines (1980-1996) or long-term (1966-1996) declining trends based on breeding bird surveys, while 12 species have seen significantly increased population trends (Link and Sauer 1997). The reasons for the decline vary with species. Past intensive forest management practices may have lead to declines due to the loss of older forest habitats. However, more recent forest management may have led to the increase of some species due to the increase in a variety of forest seral stages across the landscape. For many species the reason behind the decline is unknown.

Hardwood stands are of particular importance as a key habitat for some breeding neotropical (and winter resident) songbirds. Hardwood stands and mixed hardwood/conifer stands are abundant throughout the Bear Creek Saddle area and, although there have been no surveys done specifically for forest landbirds in Bear Creek Saddle, several species are likely to occupy the project area, including the golden-crowned kinglet (*Regulus satrapa*), Hutton's vireo (*Vireo huttoni*), and brown creeper (*Certhia americana*).

Alternative A - No Action

Direct and Indirect Effects

There would not be any direct effects to any of the forest landbird species with the No Action alternative. Similar to the mollusks, many forest birds are, particularly during the breeding periods, associated with hardwood and mixed conifer-hardwood forests. Not developing late-succession habitat would not be an indirect, negative effect for these species.

Cumulative Effects

Previous habitat removal, road building, and human disturbance would have had the greatest impact on forest landbirds. A "No Action" alternative would not add to the historic impacts. There would be no additional impacts, beyond what has occurred previously.

Alternative B

Direct and Indirect Effects

Responses of birds to thinning would vary with species of bird and type of treatment. Without having first set up control plots to know what species occupy the proposed stands, it is impossible to know what the effect of the different treatments will be. Previous studies in thinning areas have shown that some species will increase in numbers, some will decrease, and some will have negligible changes in numbers (Personal communication with Nick Palazzotto 2005). Such changes would all be indirect effects from the habitat manipulation. There may be some direct effects in terms of mortality of nests or chicks from harvest operations and possibly adults. It is likely this mortality would be minimal, except perhaps around temporary road construction due to the impacts to ground nesters such as the dark-eyed junco (*Junco*

hyemalis). Additionally, even though numbers of certain species have increased in response to variable-density thinning done on the forest, predators have also increased in these areas, so nesting success of songbirds did not necessarily improve with stand treatment.

Cumulative Effects

Like with mollusks, hardwood habitat is particularly important to nesting songbirds. Additional removal of this component would have some effect on certain species, however most of the impact would be mitigated with the prescription of maintaining clumps of five or more alder to maintain habitat. In other ownerships around the project boundary, it is likely that hardwood habitat will be harvested, depending on market conditions, limiting the potential of these species to occur on private lands.

Alternative C

Direct, Indirect, and Cumulative Effects

The effects with this alternative would be very similar to Alternative B, with only a slight decrease (3%) in the amount of habitat potentially altered for forest landbird species.

DecAID Analysis

DecAID is an advisory tool recently developed to assist land managers in evaluating the effects of forest conditions and proposed management activities on organisms that use snags and down wood. DecAID is a statistical summary of the current knowledge and best available data on dead wood in Pacific Northwest ecosystems. The primary emphasis is on terrestrial vertebrate relationships to dead wood (i.e., it does not address decayed wood elements in aquatic or riparian environments), however, the summary also examines a broader look at key ecological functions and functional groups of wildlife that use snags and down wood.

DecAID is organized around basic "vegetation conditions," a broad descriptor which encompasses wildlife habitat type, vegetation alliance, structural condition (average tree size and canopy closure), and geographic location. It is recommended by the DecAID science team that the information (structural condition) be applied at a fairly large scale, such as on the order of subwatersheds, watersheds, subbasins, etc., or at least of a project size encompassing 20 square miles. The Bear Creek Saddle project area covers seven subwatersheds, Lower Bear Creek, Bear Creek, South Bear Creek, Upper Deep Creek, Middle Deep Creek, Upper West Twin River, and Middle West Twin River, all of which corresponds to the "Westside Lowland Conifer-Hardwood Forest, Washington Coast" vegetation condition. Stands proposed for treatment were classified according to the structural condition and, in the case of Bear Creek Saddle, all but six (out of 66) were determined to be in the "small/medium trees" category. The overall conditions of the subwatersheds can be broadly assumed to fall in this category. The "small/medium trees" structural condition can be characterized as having an average tree size of between 9.8 and 19.7 inches and tree stocking or cover of at least 10%. These stands are usually mid-successional, and generally have not developed a multi-storied layer (Mellen et al. 2003). In looking at the larger picture, it should be noted that within this wildlife habitat type and structural condition, 44% of the area on all ownerships is in the "small/medium" category, 48% is in "open canopy," and 8% is in "large trees" (Mellen et al. 2003). Additionally, 5% on all ownerships has not been previously harvested and, of this 5%, 54% is on federal lands and 46% on nonfederal lands. The conclusion is that a large amount of the

landscape in the western lowland conifer-hardwood habitat type contains smaller, younger forest stands, and this is also true in the Bear Creek Saddle project area.

Snag and Down Wood Conditions Across the Landscape

Specific snag and down wood densities were not obtained in relation to this project. The Sol Duc Watershed Analysis (USDA et al. 1995) assessed habitat conditions for cavity dependent species and determined that lower elevation areas with higher proportions of managed forest lands had significant acreages (66% of the watershed) below the minimum snag population levels. These snag levels were determined using a broad rating system that incorporated vegetative series, seral stage, managed/unmanaged status, and Olympic National Forest ecology plot data. Categories included the following snag abundance ratings: None, Very Few, Few (< 40% potential population level), Many (40-59% potential), and Very Many (> 60% potential). The following snag ratings were determined for the three Bear Creek subwatersheds (snag analyses were not done for the Deep Creek/West Twin River Watershed Analysis):

Table 11. Amount of snags across three subwatersheds.

Subwatershed	No Snags	Very Few	Few	Many	Very Many
Upper Bear Creek	2,209 acres (41% of watershed)	--	287 (5%)	2701 (50%)	230 (4%)
South Fork Bear Creek	804 (40%)	--	308 (15%)	177 (9%)	725 (36%)
Lower Bear Creek	2,418 (58%)	--	1098 (26%)	614 (15%)	14 (<1%)

For these three areas, at least half of the subwatersheds are categorized as either having no snags or few. Additionally, small/medium tree stands, which comprise the majority of the landscape's structural conditions, have average trees sizes between 9.8 and 19.7 inches and trees stocking or cover of at least 10% (Mellen et al. 2003). These stands are usually mid-successional and have not developed a multi-storied canopy. Most of these stands have come to this condition as a result of previous harvest activity and though snags of all sizes can be found throughout the project area, in general, their numbers are far below the minimum 40% potential population level outlined in the Olympic LRMP (USDA 1990a).

Affected Species Snags and Down Wood Needs

Several species mentioned in previous sections use snags and down wood and, for some, there are data in the DecAID tables that address their specific tolerance levels. These species include long-eared myotis, pileated woodpecker, brown creeper, and northern flying squirrel (Olympic National Forest Management Indicator Species), and northern spotted owl (federally threatened species). Given the limited information known about existing snag conditions across the subwatersheds and project boundary, making a comparison between what currently exists and species needs' based on tolerance levels from the DecAID data is subjective at best. However, given that 50 percent or more of the three subwatersheds, for which there are snag/dead wood assessments, have few to no snags, it is probable that most of these thresholds would not be met under current conditions. Possibly some of the tolerance levels for smaller snags would be met, particularly in the Upper Bear Creek subwatershed, which has the largest percentage of areas with "many" and "very many" snags. Upper Bear Creek includes Bear

Creek Saddle proposed Units 8-10, 14, 16-24, 26-31. Lower Bear Creek (Bear Creek Saddle Units 55-58 and 60-65) would perhaps be far less likely to meet the snag criteria, however, these are all generalizations.

The Bear Creek Saddle project does not propose to remove any snags or downed wood unless there are safety concerns, therefore, this project would have minimal impact on what currently exists for these habitats. Snag creation, using diverse methods such as topping, inoculation, or girdling, would be done to augment the current condition.

Soils

Potential soil and sedimentation impacts to aquatic resources from project activities were identified as a key issue.

This analysis utilizes geology, soils, landforms, and hydrology information for the Bear Creek Saddle Planning Area, which are described extensively in the Sol Duc Pilot Watershed Analysis (USDA et al. 1995 and Deep/West Twin Watershed Analysis (USDA et al. 2002). Additionally, this analysis utilizes information from the Olympic National Forest Ecological Unit Inventory, or EUI (USDA 2000b). The basic EUI data provides information on the soil resources and evaluates the capabilities of soil for various uses. Field reconnaissance and surveys were also completed to verify conditions such as existing soil disturbance, observations and surveys of historic management effects to the soil, effective ground cover, and soil erosion potential.

Much of the discussion in this report is qualitative, with some quantitative effects. However, the quantitative effects cannot be precisely predicted. In addition, effects of management are influenced by other variables such as weather and details of implementation. Spatial boundaries for soil effects are proposed as past unit boundaries and their immediate surrounding area. Unless otherwise stated, effects are described for the time period immediately after the proposed actions, when effects are at their maximum.

Sediment Modeling - Original studies of sedimentation from logging activities, such as Swanson's study (1987), were generated from clear-cutting activities on private land. The study is old and not representative of current practices on the Olympic National Forest (e.g., commercial thinning, low intensity timber haul, new water quality protections). An accurate quantitative analysis of sediment generated from the project would be difficult to determine because of the variables associated with project activities. Uncertainties include when work would occur, weather conditions (rainfall amount, duration and intensity) during project implementation, and the number of active stream courses when the work would be taking place, condition of the road surfaces, and the intensity of timber haul. Although a quantitative analysis could potentially provide a gross estimate of the amount of sediment generated, it would not relate directly to impacts on fish or water quality because it would not be able to determine how much sediment would be captured through mitigation measures, and the actual quantity of sediment that would actually reach stream channels. The fate and routing of fine sediment through stream channels is also largely unknown.

Slope Stability

The Sol Duc (USDA et al. 1995) and Deep/West Twin (USDA et al. 1997) watershed analyses identifies and describes in detail the slope instability within the planning area. Generally, the majority of the Bear Creek Saddle planning area is a stable landscape with little recent evidence of landslides or other mass failure activity. Approximately 75 percent of the planning area has been rated as low to moderate for landslide potential. The proposed thinning will take place on mostly gentle (less than 30 percent) to moderate (30 to 50 percent) slopes. Observations within the watersheds reveal that slope instability due to shallow rapid landslides occurs on slopes greater than 75 percent.

Numerous historic shallow rapid landslide features were identified within the planning area, mostly less than 0.25 acres in size. These were mapped and described in the watershed analyses, and were associated with both natural and management-related activities. No recent landsliding was identified in the proposed harvest units since the watershed analyses inventories were conducted in the mid to late 1990's, based upon aerial photo interpretation and field reconnaissance.

Deep-seated features are usually large, with movement typically extending into the underlying bedrock. They are often naturally occurring and generally slow moving. No active deep-seated features were identified within or adjacent to the proposed harvest units.

Suitability

All of the proposed harvest units in the Bear Creek Saddle project area are considered suitable for timber management as defined by the Olympic Forest Plan. Areas unsuitable for timber management would include areas with high slope instability, wet areas and soils that are excessively shallow and rocky. All identified areas with unsuitable soils of significant acreage were not considered for harvest. There are some small seeps, wet areas and rock outcrops that are too small to delineate. These areas would be excluded from harvest with mitigation measures and design criteria (see Chapter 2).

Soil Productivity

Overall, the majority of soils that are found within the proposed harvest units have high productivity due to soil development and a climatic regime which provides adequate moisture for plant growth.

Management activities associated with the proposed action can result in direct and indirect effects upon the soil resource. Soil and water quality are maintained when soil compaction, displacement, severe burning, erosion, loss of organic matter, and altered soil moisture regimes are maintained within defined standards. Forest Plan standards and guidelines (USDA 1990a), as well as Forest Service Manual, R-6 Supplement No. 2500.98-1 (USDA 1998a) stipulate that activities should not result in cumulative detrimental soil conditions on more than 20 percent of an activity area (including adjacent roads). For the Bear Creek Saddle planning area, the following primary detrimental soil conditions of soil compaction, soil displacement, and severely burned soils were evaluated to include past management and proposed management activities. Adjacent roads are considered a part of the activity area when they are adjacent to the management unit. All roads were considered in determining the cumulative detrimental soil affects. The detrimental soil conditions for ground-based, skyline

cable, and helicopter are an estimate based on a preliminary logging plan and professional judgment of a logging system specialist, timber sale officer, and soil scientists.

Aulerich et al. (1974) and Power (1974) have shown that skyline cable yarding systems cause little impact to soil. Additionally, skyline yarding systems substantially reduce the need for new roads in units. Helicopter yarding lifts trees, thereby minimizing soil compaction and displacement. Where utilized, a mechanical feller/buncher used to pre-bunch logs in helicopter units would operate on soils considered stable and on a mat of slash generated from the limbing operations. Based on past observation, helicopter yarding (with no pre-bunching) effects on soil productivity are expected to be less than skyline yarding.

The percentage of each unit in a detrimental soil condition was determined through aerial photo interpretation and field reconnaissance. Detrimental condition varies from stand to stand due to the occurrence, manner, and extent of past timber harvest, road construction and fuel treatment activities and the sensitivity of soils. Calculated acres of detrimental soil conditions are shown under each alternative.

Ground-based yarding and road construction/reconstruction would displace the organic and surface soil layers, increasing the potential for overland flow and erosion. Although all new roads would be treated as temporary roads and rehabilitated after the proposed timber sale, surfacing materials (where used) create an inhospitable seedbed with low water holding capacity, and would lengthen the period of revegetation and hydrologic recovery for the road prism. Soils that are compacted take time to recover; tree roots and burrowing animals eventually penetrate hardened soil. However, research conducted in managed timber stands on the Olympic peninsula (Miller et. al. 1996), found that 7-8 years after harvest, tree height and volume did not differ significantly between conifers planted in skid trails and those outside of compacted areas. There is the opportunity to speed the recovery process by using subsoilers and other “decompacting” machinery that scarify deeply into compacted soils. Monitoring conducted on numerous timber sales on the Olympic NF have shown that decompaction treatments on skid trails and temporary roads have been successful in improving soil productivity on these areas, and that damage to lateral tree roots within these corridors does not appear to damage the trees in the residual stands.

Approximately 6 percent of the acreage proposed for thinning in the Bear Creek Saddle project area is in a detrimental soil condition (e.g., existing roads, unclassified roads that have not recovered, and other impacted areas). Roads in the planning area are the primary detrimental soil condition that has occurred from past management activities.

Surface Erosion

Most forest soils have low potential for natural surface erosion. This is because they tend to have generally high permeability, high water storage potential, and they are usually fully occupied with vegetation and surface litter. Across the landscape, there are distinct features with greater surface erosion and mass wasting potential and whose shape and origin are related primarily to erosion processes. These are generally associated with steep slopes and vegetation loss (e.g., from fire, clearcutting, or road construction), runoff, or both. Within the Bear Creek Saddle planning area, these locations are similar to those prone to slope instability: steep inner gorges, dissected mountain headwalls, and other unstable terrains. As discussed previously,

units within these landforms are not considered for harvest, and have an adequate no-cut buffer to protect these slopes and streamcourses.

Existing surface erosion within the planning area is mainly confined to the unpaved road surfaces, road cutbanks, ditches, and some historic unclassified roads and skid trails. However, some areas, such as road cuts and fills, old skid trails, landings, and dispersed recreation sites may have high surface erosion hazard, but due to their limited size and extent, do not appear to be significant in the planning area.

Soil surface erosion has been the subject of modeling developed by the Water Erosion Prediction Project (WEPP) of the Intermountain Research Station, Moscow, Idaho. The WEPP model uses the characteristics of climate, soil texture, local topography, plant community, and surface residue cover to estimate soil erosion potential. This model, like many others, has shortcomings when applied to large areas and when surface roughness of streams and upland slopes are significantly variable. Most erosion models are best used for predicting erosion rates for short segments of land slopes and when surface roughness is not significantly variable. This, along with other validated modeling has shown that adequate no-cut buffer strips eliminate significant delivery of surface erosion sediments to streams. Numerous design criteria and mitigation measures (i.e. seeding, mulching, protective vegetative buffer strips) are planned (see Chapter 2) to minimize soil erosion. Therefore, with the exception of road delivery of sediments, soil erosion is expected to be low.

Sedimentation

"Sediment is the product of erosion, whether it occurred as surface, gully or soil mass erosion" (Brooks et al. 1991). Sediment can be both harmful and helpful to the proper functioning of streams. For instance, landslides are an important natural process that inputs sediment and wood for spawning habitat, yet they can also be a chronic source of fine sediment that can damage young salmonids or foul water systems.

A detailed report of sedimentation can be found in the Sol Duc (USDA et al. 1995) and Deep/Twins Watershed (USDA et al. 2002) Analyses documents. Refer to the Fisheries report for a description of important fish habitats and stocks found within the planning area which are susceptible to effects of sedimentation. To summarize, most of the historic sedimentation was associated with historic wildfires and broadcast burning, mass wasting and road construction in the watershed. Mass wasting and timber harvesting in unstable terrains accelerated the quantity, rate and frequency of sedimentation in these subwatersheds. High sedimentation terrains include dissected mountain headwalls, inner gorges, bedrock hollows and other very steep, concave landforms. In these landforms, sediment delivery is immediate, with direct delivery to streamcourses and downstream aquatic habitats. Water quality and aquatic habitat in the lower systems were certainly impacted historically. In more recent times, roads have contributed a larger proportion of sediment to stream channels, especially those in headwater areas or intersect debris flow paths.

Alternative A – No Action

This alternative would not commercially thin any forest stands or have any road development, reconstruction or decommissioning and closure work associated with the project.

DIRECT AND INDIRECT EFFECTS

Slope Stability

Alternative A would not change existing slope stability in stands proposed for commercial thinning since no activities would occur in them. The potential for indirect effects would remain primarily for existing shallow rapid landsliding associated with abandoned, deteriorating roads that exist within unstable terrains and those that intersect high gradient perennial streamcourses. Decommissioning opportunities of these roads would be foregone. Identified roads located in these landforms include 3000490, 3000590, 3000600, 3000840 and un-named spur off 3067000.

Soil Productivity

Alternative A creates no adverse effects on soil resources in the planning area. No direct effects on soil productivity would occur, since no yarding operations are conducted or road development would occur.

Detrimental soil conditions would remain unchanged at 6 percent. This percentage falls within the Regional and Forest Plan standards of not exceeding 20 percent (USDA 1990a). These impacts from past activities would continue to slowly decline as soils continue to develop and recover through natural physical and biological processes. Compaction and displacement would be ameliorated through root mass expansion, ground cover, organic matter, and litter layer development. Soil fauna and microbe activity would also gradually recover.

Sedimentation

Under Alternative A, there would be no direct effects of sedimentation to aquatic habitats, since no roads would be used or logging activities occur in proposed stands. The indirect effect of no action is that funding opportunities for road repairs and decommissioning targeted for sediment reduction would be foregone. Deteriorating road conditions would continue; road maintenance and repair work would still occur to the extent necessary to protect public safety, and to prevent ongoing resource damage, within existing budgets. Sediment would continue to be generated primarily from poorly maintained open system and unclassified abandoned roads. The amount of sediment that may reach streams would average about recently existing levels. There may be periods where there would be more sediment if the vulnerable roads fail because maintenance is not performed at the level needed because of the lack of funding to do the needed maintenance and upgrading. As some roads brush in and become impassible by standard vehicles, some reduction in sediment rates is anticipated over the long-term.

Under this alternative, decommissioning funding opportunities associated with the Bear Creek Saddle timber sale receipts through KV that would fund removal of these high risk roads would be foregone. Identified roads located in these landforms include 3000490, 3000590, 3000600, 3000840 and un-named spur off 3067000.

CUMULATIVE EFFECTS

The area of consideration for the cumulative effects on the aquatic resources includes the Bear Creek, Deep Creek and West Twin subwatersheds. The positive and negative effects include a combination of the management actions that occur on private, State, and National Forest lands, along with natural occurrences. This cumulative effects analysis considers the amount of detrimental soil conditions and increased soil erosion, runoff, and sedimentation at the subwatershed scale to assess the potential for increased detrimental effects to aquatic habitat conditions.

The Sol Duc and Deep Creek, East Twin, and West Twin River Watershed Analyses identified and described the negative effects of erosion, sedimentation, loss of soil productivity and impacts to aquatic habitat conditions from past timber harvesting and roads (USDA et al. 1995, USDA et al. 2002). Previous clearcut timber harvesting and road construction within these watersheds over the past 20 to 40 years resulted in elevated mass wasting, surface erosion and sedimentation. Sediment yields during this time were generally higher than natural levels. Current condition and trends in these watersheds are mostly unchanged from natural sediment yields, or are in recovery. Since 1999, the Forest Service has focused restoration efforts on protecting the aquatic conditions by reducing road-related sedimentation.

Foreseeable management activities that have adverse impacts to soil productivity and sedimentation would continue within the project area. Ongoing activities include, but are not limited to the following: planned timber harvesting and road construction on state and private lands; dispersed recreation and other off-road vehicle use, road maintenance and road decommissioning and stabilization projects. Regeneration harvest, associated road construction, and log hauling is currently being planned on state lands in the Middle Sol Duc River watershed, adjacent to Bear Creek and some if its lower tributaries. Regeneration harvesting will likely be more common than commercial thinning on these state lands. The extent of acreage harvested, and miles of road constructed on non-Forest Service lands is difficult to estimate, but appears that the state is planning to harvest large areas in the vicinity over the next 10 – 15 yrs. Timber access and haul routes of these lands may rely heavily on the existing National Forest road system, primarily FSR 30 with log haul likely heading primarily west to Highway 101.

Recent activities on National Forest System lands within the watersheds include approximately 11 miles of road decommissioning along the 3040 road system within Deep Creek and West Twin River watersheds. These activities would result in temporary increases in sedimentation associated with culvert removals and re-establishment of stream channels and banks that intersect road prism. Short-term (1-2 years) chronic sedimentation associated with these activities would occur until vegetation is established at these sites, and channels where road intersected the streams are stabilized. Additionally, other road maintenance activities are expected to continue. Overall, sedimentation and risk of road-related mass wasting would decrease by implementation of these road maintenance and road decommissioning projects. The current amounts of bedload and suspended sediment routed down stream channels associated with natural conditions and previous activities (timber harvest, road building) would slowly reduce over time.

Alternative B

Under Alternative B, thinning activities would utilize a combination of ground based, skyline cable and helicopter yarding. Existing roads, skid trails and landings would be reused where

appropriate to minimize additional soil disturbance. All skid trails, landings, new temporary and unclassified roads would be decommissioned by the purchaser as part of the project. This alternative would also improve approximately 21 miles of the existing system roads (e.g., upgrading culverts, improved drainage). If KV funds generated as part of the project are available, there would be an opportunity to decommission additional roads, remove unstable sidecast fills, and increase the coarse wood component in commercially thinned stands to mitigate soil productivity loss associated with past harvest practices.

DIRECT AND INDIRECT EFFECTS

Slope Stability

Potentially unstable terrains are located in the vicinity of some harvest units proposed under Alternative B. These are located in or near units 03, 15, 22, 23, 25, 40, 47, 48, 51, and 53. Concerns with potential tree harvesting and road construction within these units were addressed by one or more of the following: stands were dropped from consideration; unit boundary adjustments made to exclude unstable areas from thinning; logging systems changed to helicopter to provide for better protection and eliminate road construction/reconstruction; no-cut buffers established within portions of the Riparian Reserves; and design features and mitigation measures (see Chapter 2) developed to reduce potential for adverse impacts associated with the proposed treatment.

The risk of shallow rapid landslides associated with existing roads located in unstable terrains would be reduced under this alternative These closed and deteriorated roads would be decommissioned through the timber sale and with available KV funds after the timber sale closes. Identified high risk roads include 3000490, 3000590, 3000600, 3000840 and un-named spur off 3067000. Other road restoration treatments proposed (sidecast pullback, road maintenance, culvert upgrading, drainage improvement) associated with Alternative B would also reduce the potential for shallow rapid landslides and subsequent sedimentation.

Based on observations of past logging practices on the Olympic National Forest, the environmental consequences of typical thinning operations, the riparian reserve protection no-cut buffers, and local data collected on similar soils and landforms there is no evidence to indicate that commercial thinning (40-50% tree removal) of second-growth stands increases failure risk of shallow rapid or deep seated landslides. Slope instability that exists in plantations and natural stands would remain. A thinned overstory should ultimately produce healthier stand conditions that will promote long-term slope stability.

Soil Productivity

Implementation of Alternative B would result in a total area in a detrimental condition of about 11%. Under Alternative B, none of the proposed treatment units would exceed the 20% Regional standard for detrimental soil conditions, both short and long-term. Based on field reconnaissance and aerial photo interpretation, detrimental soil conditions (compaction and displacement) from past timber harvest activities are less than 5% in each plantation. Due to mitigations that would limit soil compaction and displacement (see Chapter 2) and from past observations on similar projects, it is expected that soil displacement and compaction to increase in each plantation by no more than 5% under any action alternative. Treatments that were considered for basing detrimental soil conditions in the activity area include timber harvest, landings, new temporary road construction, reconstruction of unclassified abandoned

roads, and existing system roads. Design criteria and mitigation measures for this project (see Chapter 2) have been developed to minimize the extent of area in a detrimental soil condition, including specifications for skid trails and limiting ground-based yarding equipment to areas with side slopes of less than 30%, unless approved by the district soil scientist. Mechanical pre-bunching activities associated with helicopter yarding would be limited to stable slopes less than 60 percent, single passes by the equipment, and travel over slash generated from the delimbing process. Approval for mechanical pre-bunching activities would be required and occur in coordination with a soil scientist. Compaction of skid trails and temporary roads would be mitigated by decompaction methods. Additionally, decommissioning compacted unclassified, abandoned roadbeds would reduce area in a detrimental soil conditions and, thus, improve soil productivity. Therefore, short-term compaction and mitigating subsoiling would affect few acres in the planning area.

Soil compaction resulting from temporary roads, landings and skid trails associated with Alternative B would result in the short-term loss of the soil's ability to absorb water. These compacted areas would also restrict root growth resulting in an overall reduction in growth of affected trees and make them more susceptible to windthrow. These losses, in turn, decrease microbial populations (including mycorrihazae) and nitrogen fixation by free living organisms resulting in decreases in nutrient cycling. However, these losses are short-term. Research conducted in managed timber stands on the Olympic peninsula (Miller et al. 1996), found that 7-8 years after harvest, tree height and volume did not differ significantly between conifers planted in compacted skid trails and those outside of compacted areas. As stated previously, all temporary roads, reconstructed abandoned roads and landings would be decommissioned as part of the timber sale.

Fuel reduction practices and total acres of slash treatment during and post- harvest would be minimal for Alternative B. Adhering to mitigation measures described in Chapter 2 that are designed to minimize disturbance and retain duff would aid in maintaining duff and woody debris on-site. All unmerchantable material would be dispersed somewhat uniformly throughout the unit. Slash that is delivered to the landings would be hauled back and scattered in the units. Some hand piling and small slash burn piles may be needed, but extent of soil disturbance would be small.

If funds are available, there would be an opportunity to increase the coarse wood component in commercially thinned plantations, which would mitigate soil productivity loss associated with past harvest practices. Forest organic litter input, duff layer development and soil fauna and microbe activity would also gradually recover.

Sedimentation

The planning area contains numerous headwater streams that have gradients that are steep enough to transport sediments downstream to aquatic habitats. Units 20-23, 40, 45-48, and 50-53 are located within or near stream courses that have a high potential for transporting sediment, and have potential for mass wasting and surface erosion. These stream courses are especially susceptible to disturbance associated with roads and clearcut timber harvest. However, all of these stream courses are protected through unit boundary delineation, no-cut riparian reserve area designations, exclusion of road construction, minimal impact logging systems (helicopter) and mitigation measures (see Chapter 2).

Both action alternatives incorporate design features and mitigation measures described in Chapter 2 that minimizes the risk of erosion and potential sedimentation transported to streams. All culverts would be sized to accommodate 100-year flow events. The installation of culverts would result in some short-term sediment input and turbidity during project activities, especially when the culverts are actually installed in the stream channels. Turbidity pulses are expected to last for only a few hours before water clarity returned to background levels. Construction during low summer flows and dewatering the stream channel within the project area would minimize these short-term impacts. Duncan, et.al. (1987) demonstrated that even fine sediments produced from road surfaces settle out rapidly in small mountain stream channels. Less than 50 percent of sediments traveled further than approximately 330 feet. Given the small amount of sediment expected to be generated at these crossings and the tendency for sediment to settle out rapidly in small tributary channels at low flows, the amount of sediment generated by direct construction activities which reach resident and anadromous habitat during summer low flows is expected to be negligible.

Comparing the alternatives, sedimentation associated with Alternative B would be slightly higher than Alternatives C as there would be slightly more reconstruction and new construction, particularly at perennial stream crossings which support aquatic habitat. There would be some direct and indirect effects of erosion and sedimentation associated primarily with road construction, log hauling and decommissioning activities. Sedimentation associated from other timber harvesting activities (i.e. yarding activities, helicopter landings) is expected to be minor and isolated to specific locations. Alternative B incorporates design features and mitigation measures described in Chapter 2 that minimizes the risk of erosion and potential sedimentation transported to streams. Considering the high channel gradients, the transport capability of these stream channels, and the high stream flows; the potential for adverse effects to aquatic habitat is low. The small amounts of sediment anticipated to erode from disturbed ground around the culvert installations would be negligible in relation to the high levels of natural sediment carried by the river during normal frequent high flow events.

Culvert installations at perennial stream crossings have the greatest potential for generating sediment and turbidity that would impact aquatic habitat. Alternative B would reconstruct the 3100010 road and restore two failed streams crossings on fish bearing streams. These culverts, along with all new culvert installations on temporary and reconstruction of abandoned roads would be removed by the purchaser after activities have been completed. Turbidity pulses are expected to last for only a few hours before water clarity returned to background levels. Construction during low summer flows and dewatering the stream channel within the project area would minimize these short-term impacts. Additional sediment may be mobilized from the disturbed fills at culvert installation sites the first winter before they become fully revegetated. Grass seeding, soil stability treatments and sediment traps applied during and immediately after excavation would limit short-term sediment production.

After culvert installations at stream crossings, log hauling, particularly during wet season over gravel roads, would produce the most sediment of the remaining activities. The use of sediment traps along ditchlines at live stream crossings and monitoring the conditions of aggregate roads, are expected to keep sediment increases small, of short duration, and very limited in geographic extent.

Thinning and yarding activities have the potential to increase erosion and sediment delivery, particularly in the short-term (first few years after treatment). However, monitoring of several thinning operations on the Olympic National Forest have found that very little sediment is eroded downstream when project mitigations are followed. Unit boundaries that are set back from stream courses and steep slopes, riparian buffer prescriptions, and limiting ground based equipment near streams all help to minimize this erosion from reaching stream courses.

CUMULATIVE EFFECTS

With proper project implementation (design and mitigation measures), unacceptable cumulative effects on soils resource are not anticipated from Alternative B. While the implementation of Alternative B would result in approximately 11% of the total area to be considered as having detrimental soil conditions, none of the proposed treatment units would exceed the 20% Regional standard for detrimental soil conditions in both the short and long term.

Road restoration activity within the watershed has been extensive in recent years. About 70 miles of road system in all three watersheds have had drainage and stabilization work completed, and 2.5 miles of high risk road have been decommissioned in the Deep Creek drainage. While the road reconstruction and timber harvest activities of Alternative B have the potential to increase sedimentation slightly in the short run, the road reconstruction, maintenance and upgrading treatments would ultimately provide an addition to the benefit derived from previous actions. Additional road decommissioning and stabilization work potentially made possible through KV funding would result in slightly increased benefits added to the restorative effects of the projects undertaken to date.

Foreseeable activities on national forest lands that have adverse impacts to soil productivity and sedimentation would continue within the three subwatersheds that overlap the Bear Creek Saddle planning area. This includes anticipated road decommissioning projects, road maintenance, recreation, and unauthorized off-road vehicle use. These activities would result in temporary increase in sedimentation associated with culvert removals and re-establishment of stream channels and banks that intersect road prism. Short-term (1 to 2 years) chronic sedimentation associated with these activities would occur until vegetation is established at these sites, and channels where road intersected the streams are stabilized. Overall, sedimentation and risk of mass wasting would decrease by implementation of these decommissioning projects.

Sediment above natural levels would continue to be generated primarily from a poorly maintained open road system and remaining unclassified, abandoned roads. The amount of sediment that could reach streams should remain close to current levels in the future. There may periods where there is more sediment if the vulnerable roads fail and maintenance is not performed at the level needed because of the lack of funding to do the needed maintenance and upgrading. As some roads brush in and become impassible by standard vehicles, some reduction in sediment rates is anticipated over the short-term.

Under this alternative, however, more decommissioning funding opportunities are likely to be available through KV to fund removal of these high risk roads. Identified roads likely to be decommissioned include 3000490, 3000590, 3000600, 3000840 and un-named spur off 3067.

Foreseeable management on state and private land include planned regeneration timber harvesting and road construction, road maintenance and road decommissioning, and stabilization projects within the watersheds. In addition, log hauling is currently being planned in the Middle Sol Duc River watershed, adjacent to Bear Creek and some if its lower tributaries. Regeneration harvesting will likely be more common than commercial thinning on these state lands. Thinning by these land managers has so far been limited to gentle terrain near roads that can be completed with ground-based equipment. The extent of acreage treated, and miles of road constructed and reconstructed on state and private lands is difficult to estimate, but harvest could affect the majority of state lands adjacent to the project area over the next 10 years. Access to these state lands for harvest may rely somewhat on the existing National Forest road system, but could potentially require new construction, reconstruction and possibly a bridge across Bear Creek. It is believed that some of the private road reconstruction may include numerous perennial stream crossings in steep, highly dissected terrain, which can deliver sediment efficiently to Bear Creek. The State Department of Natural Resources has routinely closed (through the use of berms or gates) short local spurs when they are not needed for harvest activities. These activities would result in the temporary increase in detrimental soil conditions and loss of soil productivity, most notably where ground based logging operations and new road construction is planned.

Alternative C

DIRECT AND INDIRECT EFFECTS

Direct and indirect effects of Alternative C are similar to Alternative B, except where noted below.

Soil Productivity

Alternative C would have very similar, if not slightly reduced, effects to soils compared to Alternative B (See Alternative B's discussion of impacts to soils). Implementation of Alternative C would result in a total area in a detrimental condition of 10%. As with Alternative B, under Alternative C, none of the proposed treatment units would exceed the 20% regional standard for detrimental soil conditions, both short and short-term.

Sedimentation

Comparing the alternatives, estimated sedimentation associated with Alternative C would be slightly lower than Alternatives B in the short-term. This is primarily due to reduced road reconstruction and new construction, particularly at perennial stream crossings.

Culvert installations at perennial stream crossings have the greatest potential for generating sediment and turbidity that would impact aquatic habitat. Alternative C would not reconstruct the 3100010 road nor repair the failed stream crossings on two fish-bearing streams. These crossings would rely on KV funds to remove old culverts and remaining fill from the stream channels.

CUMULATIVE EFFECTS

The cumulative effects of Alternative C are expected to be similar to Alternative B. With proper project implementation (design and mitigation measures), unacceptable cumulative effects on soils resource are not anticipated from Alternative C. Alternative C would result in a total area in a detrimental condition of 10%, compared to 11% under Alternative B. As with Alternative B, none of the proposed treatment units under Alternative C would exceed the 20% regional standard for detrimental soil conditions in both the short and long term.

Fisheries

Anadromous and resident salmonids such as coho salmon (*Oncorhynchus kisutch*), winter steelhead (*O. mykiss*), and cutthroat trout (*O. clarkii*) are present in the Bear Creek subwatershed, and Deep Creek and West Twin River watersheds. Chinook salmon (*O. tshawythsca*) are found in the Bear Creek drainage but are considered extirpated from Deep Creek (USDA 2002). Fall chum (*O. keta*) are present in Deep Creek and to a lesser degree in the West Twin River, but are not found in Bear Creek. Other aquatic species present in all 3 drainages are sculpins (*Cottid spp*) and Pacific lamprey (*Entosphenus tridentatus*). Salmon, steelhead and cutthroat trout spawn and rear within the mainstem and tributaries of Bear Creek, Deep Creek, and West Twin Rivers. Table 12 shows current stock status of salmonid species inhabiting project area watersheds.

Table 12. Salmonid Stock Status in Analysis Area Watersheds (SASSI 2002)

Stock	Current Status	Watershed		
		Deep Creek	Bear Creek	West Twin River
Fall coho	Healthy	X	X	X
Winter Steelhead	Healthy	X	X	X
Fall chum	Depressed	X		
Cutthroat trout	Unknown	X	X	X
Chinook	Healthy		X	

In the Bear Creek Saddle planning area fish species distribution varies widely within the 3 drainages. Because of its low gradient, Bear Creek has the widest and most varied distribution of salmonids within the planning area, followed by West Twin River and then by Deep Creek. The entire mainstem of Bear Creek (within the planning area) is utilized by anadromous salmonids, as are the lower reaches of several right bank tributaries adjacent to Units 8, 9, 16, and 19. Resident salmonids, mainly cutthroat trout, are more extensively distributed within those tributaries. The upper forks of an unnamed tributary in lower Bear Creek (RM 0.7) flow through units 64 and 65. The extent of anadromous fish use in these tributaries is unknown but resident cutthroat trout are present. On the mainstem of the West Twin River, a falls at RM 4.2 limits anadromous fish distribution as far as the northern most units 52 and 53. Resident salmonids are found along the rest of the mainstem West Twin River up to unit 41. All of the tributaries within the West Twin River portion of the planning area are non-fish bearing. A falls on the Deep Creek mainstem at RM 4.4 limits anadromous fish presence 2 miles downstream of the planning area. Resident trout are found in the mainstem above the falls and

above FSR 30 as far as unit 34. There is no documented fish use in any of the Deep Creek tributaries in the planning area.

Road densities are commonly used as an indicator of sedimentation and surface erosion in a watershed, of which high amounts can be detrimental to fish habitat. Existing road densities in the project area's sub-basins range from approximately 1.7 miles/square mile to 4.1 miles/square miles (see Table 13).

Table 13. Existing Road Densities by Sub Watershed in Bear Saddle Planning Area

Sub-basin	Road density (miles/square mile)
Upper Bear	1.67
Lower Bear	1.91
Deep Creek Upper	4.1
West Twin River Middle	3.0
West Twin River Upper	3.2

The Sol Duc Pilot Watershed Analysis (USDA et al. 1995) used 2.5 miles of road per square mile of watershed area as the threshold to determine when impacts from roads begin to be noticeable on fine sediment in spawning gravels. This threshold was based on research conducted by Cederholm and Lestelle 1972. All the Bear Creek subwatersheds were below threshold values, and intense fires were identified as the major sediment source.

While road density can be a useful indicator of resource damage or condition, there are, however, a number of factors besides road density that also influence sedimentation and surface erosion rates. These factors include the design of the road drainage structures, slope steepness, level of traffic on the roads, soil type, and type of road surface (USDA et al. 1995). In the Deep / Twins Watershed Analysis (USDA 2002) road densities were calculated, but no threshold values were assigned. Instead an aquatic risk rating, which is a compilation of various values, was used. The Deep /Twins WA repeatedly identified the 3040 road system as a major cause of mass wasting. The 3040 road, however, is not in the Bear Creek Saddle planning area and about 11 miles have been decommissioned. Additionally, Forest Service Road 30 has about 9 miles of pavement, which significantly reduces surface erosion potential on that section of road.

For the purpose of this analysis the alternatives were analyzed using selected indicators taken from the "Matrix of Pathway and Indicators" developed by the National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS). Indicators selected from the matrix are representative of habitat features that can be affected by timber harvesting, road construction, and road use. The selected indicators are: temperature, sediment, pool quality, channel width to depth ratio, streambank condition, drainage network, road density and location and riparian condition. Indicators were evaluated against the alternatives and the potential impacts associated with each alternative, and in relation to the current conditions of fish habitat in project area drainages. The indicators are representative of potential impacts in any one stream or several streams at any given time. Where an indicator would not change, the current condition was further described if it is considered degraded or not properly functioning. Short-term describes temporary changes to the indicator lasting 1 year or less.

Table 14. Summary of Potential Impacts to Habitat Indicators by Alternative

INDICATOR	Alt. A (No Action)	Alt. B (Proposed Action)	Alt. C
Temperature	Maintain (all watersheds)	Maintain (all watersheds)	Maintain (all watersheds)
Sediment	Maintain – degraded (DC, BC)	Maintain (WT); Degrade- short-term (BC, DC)	Maintain (WT); Degrade- short-term (BC, DC)
Physical barriers	Maintain – degraded (BC)	Restore (BC); Maintain (WT, DC)	Maintain (all watersheds)
Pool quality	Maintain (all watersheds)	Maintain (all watersheds)	Maintain (all watersheds)
Width to depth ratio	Maintain –degraded (DC, BC)	Maintain (WT); Restore (BC, DC)	Maintain (WT); Restore (BC, DC)
Streambank condition	Maintain –degraded (DC, BC)	Maintain (WT); Degrade- short-term (BC, DC)	Maintain (WT); Degrade- short-term (BC, DC)
Function of riparian reserves	Maintain (all watersheds)	Maintain / Restore (all watersheds)	Maintain / Restore (all watersheds)
Drainage network increase	Maintain – degraded (WT, DC)	Maintain (WT); Degrade- short-term (BC, DC)	Maintain (WT, DC); Degrade- short-term (BC)
Road density and location	Maintain – degraded (WT, DC)	Maintain (WT); Degrade- short-term (BC, DC)	Maintain (WT, DC); Degrade- short-term (BC)

(R)estore = alternative is likely to restore habitat indicator.
(M)aintain = alternative will not have an affect on the indicator; maintain indicator in current condition or return the indicator to current condition.
(D)egrade = alternative will have a negative impact on the habitat indicator / indicator may currently be degraded
WT = West Twin River Watershed, BC = Bear Creek Subwatershed, DC = Deep Creek Watershed

Alternative A - No Action

Alternative A would maintain the current condition in all three watersheds. Roads, both open and closed, system and non-system, would remain in their current state. Drainage and culvert problems on closed system and non-system roads (e.g.; 3000490, 3000010 spurs) and degraded stream crossings (3000010 spur) would remain in their current condition; riparian vegetation growth and development would remain unchanged.

Direct and Indirect Effects

Direct effects are those changes in the physical processes and conditions of the watershed. Indirect effects are the biological changes resulting from the physical changes that can affect aquatic organisms.

The direct and indirect effects of Alternative A are explained in the indicators listed below. The No Action Alternative would result in no changes to the current physical environment, maintaining certain degraded conditions that are mainly associated with roads, stream crossings, and riparian vegetation. Additionally, the No Action Alternative would not have any indirect effects.

Temperature: Maintain – Alternative A would leave all near stream vegetation unchanged and maintain the current shading levels. Stream temperatures would not be affected.

Physical Passage Barriers: Maintain – Stream crossings that are potential fish passage barriers would remain degraded on the FSR 3100010 spur in the Bear Creek drainage. There are no identified barriers in Deep Creek and the West Twin River portions of the planning area.

Sediment: Maintain – Sediment that is transported to the stream channel network from chronic surface erosion associated with failed road drainage in Deep Creek and Bear Creek would remain unchanged.

Pool quality: Maintain – Current condition of pool quality would remain unchanged.

Channel Width/Maximum Depth: Maintain – Channel constrictions at failed stream crossings and undersized culverts would maintain indicator in a degraded condition in Deep Creek and Bear Creek.

Streambank Condition: Maintain – Several failed stream crossings would remain degraded in Bear Creek, Deep Creek.

Function of Riparian Reserves (near stream): Maintain – Current growth rates and vegetation composition would remain unchanged. Suppressed / overstocked conifer stands would remain unchanged.

Drainage network increase: Maintain – The current drainage network would remain unchanged in all three watersheds. Since the road miles are high in the West Twin and Deep Creek sub-watersheds (Table) we are assuming that the current condition is degraded.

Road density and location: Maintain – Road density and location would remain unchanged in all 3 watersheds. Using a threshold value of 2.5 miles of road / square mile of watershed area the current condition is high for road densities in the planning area sub watersheds of Deep Creek and West Twin; and below the threshold values in Bear Creek.

Cumulative Effects

The major impact to the fisheries resource has come from past timber harvesting, roads and fires. Limited residential settlement has occurred in the lower reaches outside the National Forest boundary in Bear Creek, West Twin River and Deep Creek watersheds. Logging began on private land in the area during the 1890s. A large logging camp was set up in the Twin area in 1892. Several others were set up between Twin and Deep Creek. Truck logging began in the 1940s and patch clearcutting commenced in the National Forest portions of the watersheds in the late 1940s to early 1950s. The major road systems were constructed on the National Forest by 1965. Landslides associated with roads and in-unit failures have been most pronounced in Deep Creek and West Twin River. Aerial photo analysis of the 1960, 1980 and 1990 time periods in Deep Creek and the West Twin River showed significant erosion from roads (USDA et al. 2002). A large debris flow in 1990 in Deep Creek traveled over 6 miles downstream and had a major impact on fish habitat and fish populations. The majority of these slides were associated with the Forest Service 3040 road system.

An increased frequency in intensive fires and subsequent salvage logging had a major impact in both the Deep Creek and Bear Creek drainages. The 1939 Deep Creek Fire burned approximately 14,000 acres in the Deep Creek and the Sol Duc River watersheds. Aerial photography taken after the Bear Creek-Deadman's fire of 1952 showed mass wasting and surface erosion as the dominant landscape process (USDA et al. 1995).

Endangered species restrictions and Northwest Forest Plan requirements have curtailed clearcut logging and road building on Federal lands of late-successional forest stands in the Deep Creek, West Twin Rivers and Bear Creek watersheds since 1993. Logging and road building on state and private lands will continue in all 3 watersheds. There is a high likelihood that the Washington Department of Natural Resources (WDNR) will initiate substantial timber harvesting in Bear Creek in the future that would entail new road construction and reconstruction of older roads. The degree of impact to water quality and fish habitat from activities on state and private lands should be significantly reduced from past activities due to more stringent forest practice regulations regarding riparian harvest, road construction and road maintenance.

Since 1999, the Forest Service has focused restoration efforts on protecting water quality by reducing road related sedimentation. The Forest Service decommissioned 2.5 miles of high risk road (FSR 3000250) in Deep Creek and completed drainage and stabilization work on approximately 70 miles of road system in all 3 drainages. The Forest Service also decommissioned approximately 11 miles of road on the FSR 3040 road system in the Deep Creek and West Twin River watersheds. Severe reductions in Forest Service funding for roads, the shifting of regional priorities to road maintenance rather than decommissioning, make it unlikely that any future decommissioning will take place in any of the 3 watersheds with agency funding. Road maintenance will continue, with a priority placed on FSRs 30 and 3067. Current funding will accomplish some upgrades on FSR 30 road in 2006, and it is likely that some level of future funding will be available.

Past restoration efforts in Bear Creek have focused on restoring anadromous fish passage along FSR 30 and near stream riparian conifer planting. Since 1995 the Forest Service has replaced culverts at the Bear Creek and South Fork Bear Creek crossings with bridges; replaced migration barrier culverts on 3 Bear Creek tributaries with 2 open bottom arches and one circular pipe; and removed one migration barrier on the mainstem Bear Creek. Approximately 0.5 miles of abandoned road accessed by the culvert was also decommissioned. An additional high priority migration barrier remains on FSR 30, on an unnamed tributary to Bear Creek. There is a high likelihood that the Forest Service will replace it in the future using Forest Service or other funding sources. The Lower Elwha Klallam tribe has been restoring instream habitat in Deep Creek since 1997. The tribe has done extensive instream wood placement in the lower three miles of Deep Creek. The tribe is expected to continue its instream work in Deep Creek for the next couple of years. The Bonneville Power Administration installed a bridge across the upper West Twin River in 1995. There is no foreseeable instream work planned in West Twin River. Instream habitat conditions within the fish bearing reaches of Deep Creek, Bear Creek and West Twin Rivers range from stable in the Bear Creek and West Twin Rivers to recovering in Deep Creek.

The future status of non-Forest System roads is unknown, but changes in the Washington State forest practice regulations require that private and state land managers develop management plans for their road systems aimed at meeting Clean Water Act requirements.

The cumulative effect of the No Action alternative on the current and future fish habitat conditions of the three project area watersheds would be to maintain certain degraded conditions associated with roads affecting water quality and fish passage.

Alternative B

Much of the road reconstruction, whether on Forest Service or BPA roads, would have no direct affect on water quality. Drainage would be improved and restored on Forest Service roads 3100010 and 3000490. Reconstruction on FSR 3100010 would also restore 2 failed stream crossings on fish bearing streams. Reconstruction of an unclassified road accessing Unit 34 would require crossing 1 small, non-fish bearing stream. New temporary road construction for access to Unit 36 would require crossing a small, intermittent non-fish bearing stream. Alternative B would thin in Riparian Reserves to promote riparian conifer growth, except for areas with no-cut buffers. No entry riparian buffers are designed to protect water quality.

Direct and Indirect Effects

The direct and indirect effects of Alternative B are explained in the indicators listed below.

Temperature: Maintain - West Twin, Deep Creek, Bear Creek – Measurements of stream temperatures in the planning area meet Washington State water quality standards. Alternative B would leave all near stream vegetation unchanged and maintain the current shading levels. Stream temperatures would not be affected.

Physical Passage Barriers: Restore - Bear Creek; Maintain - Deep Creek, West Twin – degraded stream crossings on the 3100010 road on 2 unnamed fish bearing tributaries to Bear Creek would be corrected to access units 64, 65. No changes in the current condition would occur in West Twin River and Deep Creek.

Sediment: Maintain - West Twin; Degrade - Bear Creek, Deep Creek – The use of existing roads and no new temporary road construction or reconstruction involving stream crossings, and limited conveyance potential should maintain the current condition in the West Twin River part of the planning area; in Deep Creek and Bear Creek short-term streambank disturbance associated with road construction/reconstruction and possible surface erosion during wet weather log haul may produce some short sediment pulses. There is a more extensive stream channel network in Units 34, 35 in Deep Creek and along the 3100010 road system in Bear Creek, thereby increasing the potential for conveying surface erosion. Mitigation measures involving weather-related haul restrictions, seasonal timing for road construction, implementation of erosion control measures, and proper road drainage would reduce the potential for measurable levels of fine sediment to reach the stream channel. Many of the streams are intermittent and will be dry for portions of the year.

Pool quality: Maintain - West Twin, Deep Creek, Bear Creek – Current condition of pool quality would remain unchanged. The conveyance of any measurable levels of fine sediment that could affect pool volumes in fish bearing streams is unlikely.

Channel Width/Maximum Depth: Maintain - West Twin; **Restore - Bear Creek and Deep Creek** – It is not expected that this indicator would change in West Twin River given the access road locations and the expected upgrades. Channel constrictions at failed stream crossings on the 3100010 road, and on the 3000490 would be restored when culverts are replaced for road use or when the road access is no longer needed and culverts are pulled.

Streambank Condition: Maintain - West Twin; Degrade - Bear Creek, Deep Creek – It is not expected that this indicator would change in West Twin River given the access road locations and the expected upgrades. Some disturbance would occur on streambanks at several stream crossings where newly constructed temporary and unclassified roads are located in Bear Creek and Deep Creek. Short-term disturbance would occur when culverts are pulled. However in the long-term streambanks would recover as re-vegetation takes place. Closure of the 3100010 road would restrict OHV access and protect and restore the currently disturbed streambanks where OHV use currently takes place.

Function of Riparian Reserves (near stream): Maintain / Restore - West Twin, Bear Creek, Deep Creek – A field review of the current near stream riparian vegetation on all units in the planning area led to recommendations on no-cut, no entry riparian buffers. Buffer widths vary so that some stands with near stream dense, overstocked conifers would be treated to accelerate conifer growth, and provide future large woody debris recruitment. Other units where near stream conifer growth was good would be left untreated. Regardless of the width, all of the no-cut, no entry boundaries are designed to protect water quality.

Up to 17 helicopter landings are proposed within the project area. Most of the proposed landing would be within Riparian Reserves. The actual number and location of landings may change during sale layout and implementation due to operational constraints, type of equipment used, and purchaser needs.

The size and number of new helicopter landings within Riparian Reserves would be minimized by utilizing existing openings and landings as much as possible and by incorporating new helicopter landing sites into designed gaps within timber harvest units where feasible. All landings would be outside of designated riparian no-cut buffers. New helicopter landings along Bear Creek, if any, would be located north of the FSR 30 so that the stream-adjacent areas between Bear Creek and FSR 30 would be protected.

Drainage network increase: Drainage network increase: Maintain -short term / Restore - long term -West Twin; Degrade - short term / Restore - long term - Deep Creek and Bear Creek – In the West Twin River there are no temporary roads being planned for construction. The roads proposed for use in the West Twin River part of the planning area, whether classified or unclassified, or BPA access roads, already have an existing ditch line and would not increase the stream channel network. The current drainage network would remain unchanged in the West Twin River in the short term. After completion of the timber sale, the existing, abandoned unclassified roads would be decommissioned, thereby, reducing the overall drainage network.

In Bear Creek and Deep Creek there would be a short-term increase in the drainage network associated with new temporary road construction. It is unknown whether the new temporary roads would actually result in any interception of sub surface flow and increase the stream channel network. Any increase would be minor given the limited number of miles in temporary road construction, especially in Deep Creek. Any changes may be mitigated by the installation of relief pipes to divert flow before it reaches the stream channel. After completion of the timber sale the existing unclassified, abandoned roads and all new temporary roads would be decommissioned, thereby, reducing the overall drainage network from the existing pre-harvest levels.

Road density and location: Maintain -short term / Restore - long term -West Twin; Degrade - short term / Restore-long term - Deep Creek and Bear Creek – Using a threshold value of 2.5 miles of road / square mile of watershed area, the current condition is high for road densities in the Deep Creek and West Twin planning area. Road densities are below the threshold values in the Bear Creek subwatershed. Road density and location would remain unchanged in West Twin River since no new construction is planned in this subwatershed under Alternative B. After completion of the timber sale, the existing unclassified, abandoned roads and all new temporary roads would be decommissioned, thereby, reducing the overall road densities from the existing pre-harvest levels.

In Deep Creek the planned construction of approximately 0.1 mile of temporary road is minor and would not significantly change the road densities. The indicator is considered as a short-term degradation due to the location of road reconstruction in unit 34. There would be no new temporary road construction in the lower Bear Creek subwatershed, so the road densities would not change. New temporary road construction in the upper Bear Creek subwatershed would be less than 1 mile. After completion of the timber sale, the existing unclassified, abandoned roads and all new temporary roads would be decommissioned, thereby, reducing the overall road densities from the pre-harvest levels.

Alternative B would result in minor changes to the current physical environment, conditions that are mainly associated with roads and stream crossings, and riparian thinning. The direct effects of Alternative B are a potential short-term increase in sedimentation due to surface erosion and stream bank or streambed disturbance, relating to road improvements, temporary road construction and road haul. No changes in the current stream shading would occur.

Indirect effects are the biological changes resulting from the physical changes that can affect aquatic organisms. No negative biological impacts to fish are expected to result from implementation of Alternative B. Levels of sediment produced would not alter pool volumes (quality) or be sufficient to negatively affect spawning gravels. Some positive changes may occur as stream crossings are restored on FSR 3100010, improving upstream fish migration.

Cumulative Effects

The cumulative effects analysis for Alternative B includes the activities described in Alternative A. Alternative B would not add to the downstream cumulative negative effects in the 3 project area watersheds. Some sedimentation associated surface erosion or bank disturbance may be delivered to the stream channel network but would be short-term.

With KV generated funds the Forest Service would have additional opportunities to decommission additional roads. Decommissioning would reduce road densities and the drainage network. Priority roads are identified as FSR 3000590, 3000600 spurs in the West Twin River, FSR 3000490 spur in Deep Creek and an abandoned spur on FSR 3067 in the Bear Creek drainage. An additional high priority migration barrier remains on FSR 30, on an unnamed tributary to Bear Creek. The Forest Service would likely replace the culvert in the near future using KV-funds generated from this project or from other funding sources.

Overall Alternative B may result in a future decrease in the cumulative effects of sedimentation by reducing road densities, decommissioning roads rated as a high risk to fish habitat and water quality and improving road drainage on Forest Service roads.

Alternative C

For this alternative some temporary road construction and road reconstruction were eliminated to better address soil and water quality concerns. These units were added to units proposed for helicopter logging in Alternative B. Most of the road reconstruction, whether on Forest Service or BPA roads, would have no direct affect on water quality. Drainage would be improved and restored on FSRs 3100010 and 3000490. Alternative C would not cross 2 fish bearing tributaries or restore the failed stream crossings on FSR 3000010. Reconstruction of an unclassified road accessing Unit 34 would be eliminated and the unit would be entirely helicopter logged. New road construction for access to Unit 36 across a small non-fish bearing stream would be eliminated. Some additional road reconstruction to access portions of units 44 and 45 would also be eliminated due to Northern Spotted owl concerns. Alternative C would thin in Riparian Reserves to promote riparian conifer growth where desirable, and use no-cut, no entry guidelines designed to protect water quality and promote riparian conifer growth where desirable.

Direct and Indirect Effects

The direct and indirect effects of Alternative C are explained in the indicators listed below.

Temperature: Maintain - West Twin, Deep Creek, Bear Creek – The effects of Alternative C for this indicator would be the same as Alternative B.

Physical Passage Barriers: Maintain - Bear Creek, Deep Creek, West Twin – The degraded stream crossings on the 3100010 road on 2 unnamed fish bearing tributaries to Bear Creek would not be corrected to access units 64 and 65. No changes in the current condition would occur in West Twin River and Deep Creek.

Sediment: Maintain - West Twin; Degrade - Bear Creek, Deep Creek – The effects of Alternative C for this indicator would be the same as Alternative B except for the following effects. Reducing the amount of road reconstruction for access to unit 34 and eliminating the stream crossing to access Unit 36 would further reduce any sedimentation potential. However, there is still an extensive stream channel network in Unit 35 in Deep Creek and along the 3100010 road system in Bear Creek, thereby increasing the potential for conveying surface erosion when the road is active.

Pool quality: Maintain - West Twin, Deep Creek, Bear Creek – The effects of Alternative C for this indicator would be the same as Alternative B.

Channel Width/Maximum Depth: Maintain - West Twin; **Restore - Bear Creek and Deep Creek** - The effects of Alternative C for this indicator would be the same as Alternative B.

Streambank Condition: Maintain - West Twin; Degrade - Bear Creek, Deep Creek – The effects of Alternative C for this indicator would be the same as Alternative B.

Function of Riparian Reserves (near stream): Maintain / Restore - West Twin, Bear Creek, Deep Creek – The effects of Alternative C for this indicator would be the same as Alternative B.

Drainage network increase: Maintain -short term / Restore - long term -West Twin; Degrade - short term / Restore - long term - Deep Creek and Bear Creek – This indicator would be the same as in Alternative B except for the following differences. Alternative C eliminates new temporary road construction in Deep Creek, thereby maintaining the current condition. In Bear Creek there would be a short-term increase in the drainage network associated with new temporary road construction. As in Alternative B after completion of the timber sale the existing unclassified, abandoned roads and all new temporary roads would be decommissioned thereby reducing the overall drainage network.

Road density and location: Maintain - Maintain -short term / Restore - long term -West Twin; Degrade - short term / Restore - long term - Deep Creek and Bear Creek – This indicator would be similar to Alternative B except that Alternative C eliminates new temporary road construction in Deep Creek, thereby maintaining the current condition. The indicator is considered as a short-term degradation due to the location of road reconstruction in unit 34. New temporary road construction in the upper Bear Creek subwatershed would be less than 1 mile. After completion of the timber sale the existing unclassified, abandoned roads and all temporary roads would be decommissioned, thereby, reducing the overall road densities from the pre-harvest levels.

Direct effects are those changes in the physical processes and conditions of the watershed. Alternative C would result in a further reduction in minor changes to the current physical environment, due to the further decrease in temporary road construction and road reconstruction when compared to Alternative B. Stream crossings on the 2 fish bearing streams along the 3100010 road would not be restored as part of the timber sale operations. As with Alternative B, the direct effects of Alternative C are a potential short-term increase in sedimentation due to surface erosion and streambank or streambed disturbance relating to road improvements, temporary road construction and road haul. No changes in the current stream shading would occur.

Indirect effects are the biological changes resulting from the physical changes that can affect aquatic organisms. As with Alternative B, no negative biological impacts to fish are expected to result from implementation of Alternative C. Levels of sediment produced would not alter pool volumes (quality) or be sufficient to negatively affect spawning gravels.

Cumulative Effects

The cumulative effects analysis for Alternative C includes the activities described in the cumulative effects section under Alternative A and would be similar to Alternative B. As with Alternative B, Alternative C would not add to the downstream cumulative effects in the 3 project area watersheds. Some sedimentation associated surface erosion or bank disturbance may be delivered to the stream channel network but would be short-term. Overall Alternative C may result in a future decrease in the cumulative effects of sedimentation by reducing road densities, decommissioning roads rated as a risk to fish habitat and water quality, and improving drainage of Forest Service roads.

Regional Forester's Sensitive Species List – Fish

The Regional Forester's sensitive species list of fish that may occur on the Olympic National Forest are Lake Pleasant and Lake Quinault sockeye, Olympic Peninsula coastal cutthroat trout, Washington coast Chinook salmon, Pacific coast chum salmon, Puget Sound coho, Olympic mud minnow and Salish sucker. Lake Pleasant and Lake Quinault sockeye, the Olympic mud minnow and Salish sucker have not been identified as existing in the Deep Creek, West Twin Rivers and Bear Creek watersheds. Puget Sound coho are not found in any of the project area watersheds. Pacific coast chum salmon are not found in Bear Creek. Pacific coast chum salmon are found in Deep Creek and West Twin River, but utilize habitat outside the project area. Washington Coast Chinook salmon are thought to be extirpated from Deep Creek and are not found in the West Twin River. Washington Coast Chinook salmon are found in the mainstem Bear Creek, in portions of the project area up to Unit 9. Coastal cutthroat trout are found throughout the three project area watersheds.

Alternative A

Direct and Indirect Effects

Alternative A would maintain the current condition of indicators affecting both the physical and biological processes for the Chinook, chum and cutthroat trout in all 3 watersheds. Roads, both open and closed, system and non-system, would remain in their current state. Drainage and culvert problems on closed system and non-system roads (e.g.; 3000490, 3000010 spurs) and degraded stream crossings (3000010 spur) would remain in their current condition; riparian vegetation growth and development would remain unchanged.

Cumulative Effects.

The cumulative effects of Alternative A (No Action) would be to maintain current degraded conditions associated with roads, affecting water quality and fish passage.

Alternative B

Direct and Indirect Effects

In Bear Creek no direct effects are expected to impact Chinook salmon and any potential indirect effects (minor downstream inputs of sediment) are minimized by incorporating design features and mitigation measures listed in Chapter 2. There would be no direct and indirect affects for Chinook in Deep Creek and West Twin River.

There would be no direct affects for cutthroat trout in Deep Creek and West Twin River and Bear Creek. Indirect impacts may occur in reconstructing 2 failed stream crossings on the FS 3100010 road, which would access Units 64 and 65. Impacts would be short-term and when the project is completed the stream bed and stream banks would be restored and fish passage would be improved. OHVs would be barred from using these stream crossings as fording sites. Indirect effects in all 3 watersheds (downstream impacts from sediment) would be minimized by incorporating design features and mitigation measures listed in Chapter 2.

Pacific coast chum salmon are found in Deep Creek and West Twin River, but utilize habitat well outside of the project area, and would not be directly or indirectly affected by the project.

Cumulative Effects

Alternative B would not add to the downstream cumulative effects in the 3 project area watersheds. Some sedimentation associated surface erosion or bank disturbance may be delivered to the stream channel network but would be short-term. Overall Alternative B may result in a future decrease in the cumulative effects of sedimentation by reducing road densities, decommissioning roads rated as a high risk to fish habitat and water quality and improving road drainage on Forest Service roads. Replacing the culvert at MP 4.6 on the FS 30 road would restore fish migration into an unnamed tributary of Bear Creek.

Alternative C

Direct and Indirect Effects

The direct and indirect effects for Alternative C are the same as Alternative B, except that the failed stream crossings on the FS 3100010 road would not be reconstructed. Therefore, there would be no potential indirect effects from reconstructing the failed stream crossings.

Cumulative Effects

The cumulative effects for Alternative C are the same as Alternative B.

Botanical Resources

A pre-field review was performed in order to determine whether the activities proposed in this project pose a potential threat to federally listed Threatened or Endangered species, or Regional Forester's Sensitive species. Aerial photographs, the 2004 Regional Sensitive Plant list, the Olympic National Forest Rare Plant Occurrence GIS cover, Interagency Species Management System (ISMS), Bureau of Land Management's Geographic Biotic Observations (GeoBOB) database, Washington State Natural Heritage program, district files, and the Olympic National Forest Plants of Concern Identification Guide (May 1994) were consulted.

Findings from the pre-field review and associated surveys are documented below.

Federally Listed Species

There are no Endangered or Federally listed vascular plants, bryophytes, fungi or lichens documented or suspected on the Pacific Ranger District.

There is one Federally listed Endangered vascular plant, *Arenaria paludicola* (Marsh sandwort), that could occur on the Olympic National Forest (USDA 2004a). It is, however, considered extirpated from the state of Washington. There are no known current or historical sites of this species within the proposed project area and due to lack of suitable habitat, it is not likely to occur. Thus, there would be no direct, indirect or cumulative effects to this Federally Endangered plant.

Regional Forester's Sensitive and other rare or uncommon Species

Vascular Plants

Sensitive and other rare or uncommon vascular plant species were assessed for the Bear Saddle Timber Sale planning area in May of 2005 and reviewed in March of 2006 due to changes in management direction. Of the 35 documented or suspected sensitive vascular plant species and two other rare or uncommon vascular plant species for the Olympic National Forest, five sensitive species were identified as having potential habitat in the proposed project area (see Table).

Table 15. Regional Forester's Sensitive and other rare or uncommon plants with potential habitat in the project area.

Scientific name	Common name
Cimicifuga elata	Tall bugbane
Carex pluriflora	Several-flowered sedge
Montia diffusa	Branching montia
Poa laxiflora	Loose-flowered bluegrass
Polemonium carneum	Great polemonium

Field surveys were conducted for these five vascular plants during the period between June 2 and August 8, 2005 and no sensitive or other rare or uncommon vascular plants were found.

Common to all Alternatives

Direct, Indirect and Cumulative Effects

As no sensitive or other rare or uncommon vascular plant species were found in the project area, there would be no direct, indirect or cumulative effects to these species. Implementation of the proposed action would have no risk to species viability or a trend toward listing.

Bryophytes (mosses and liverworts)

Sensitive and other rare or uncommon bryophyte species were assessed for the Bear Saddle Timber Sale planning area in May of 2005 and again in March of 2006 due to changes in management direction. Two species, *Tetraphis geniculata* and *Schistostega pennata*, were identified as having potential habitat in the proposed project area. These two species have sensitive status.

Field surveys were conducted for these two mosses between June 2, and August 8, 2005 and one site of the moss, *Tetraphis geniculata,* was found.

This small population occurs in Unit 62 and covers approximately one square inch on the cut face of a decaying log. More intensive surveys were conducted in the surrounding area in an attempt to locate additional sites, however, none were found.

Tetraphis geniculata is a moss that often occurs mixed in with or adjacent to *Tetraphis pellucida* (a common and widespread species in our area) and can only be distinguished from this species by its twisted and geniculate seta (sporophyte stalk). The habitat for this species is most often described as the cut or broken ends or lower sides of large decaying logs, stumps or snags from sea level to subalpine elevations. This moss is usually found in areas with a cool moist micro-climate and a high canopy closure.

Tetraphis geniculata was originally identified as a Protection Buffer species under the Northwest Forest Plan Record of Decision (USDA and USDI 1994). In 2001 this species was assigned to Survey and Manage Category A after a determination that it was rare and pre-disturbance surveys were practical (USDA and USDI 2001). The stated direction was to manage all known sites. In April of 2004 the Regional Forester's Sensitive Species List was updated to include *Tetraphis geniculata.*

Alternative A (No Action)

Direct and Indirect Effects

Under Alternative A, the No Action Alternative, no active management activities would occur that might damage the structural integrity of the substrate being occupied by the population. Natural processes would continue to dominate, canopy cover would remain high and the microclimate would remain essentially the same. Therefore, Alternative A, No Action, would have no risk to species viability or a trend toward listing.

Cumulative Effects

No effects –Alternative A, No Action, would have no risk to species viability or a trend toward listing.

Alternative B and Alternative C

Direct Effects

The potential for this small population of *Tetraphis geniculata* to be damaged or obliterated during tree felling and yarding activities would be reduced or eliminated by protecting the structural integrity of the occupied log. By implementing the specified mitigations measures for this site under both action alternatives, there would be no direct effect and no risk to species viability or a trend toward listing.

Indirect Effects

Tetraphis geniculata appears to need bare wood in order to colonize and is vulnerable to competition from other bryophytes. Like most bryophytes, it is sensitive to desiccation that might occur from a changed moisture regime. Under either of the action alternatives thinning would result in a decrease of canopy cover which might cause a decrease in humidity and an increase in sunlight at the site. These changes may favor the growth of competing species which over time may out-compete *Tetraphis geniculata.* These negative indirect effects may affect the viability of this species at this site but may be minimized with the implementation of the specified mitigation measures.

Thinning proposed under either of these alternatives has the potential to provide larger diameter trees faster thus providing larger diameter down woody debris that may be preferable for colonization for this species and thus may in this manner be of benefit.

Cumulative Effects

There are three proposed wildlife KV projects that could possibly affect this site and they are the proposals for snag creation, nest tree enhancement and down wood creation. All three of these projects would involve either topping or felling of additional trees after the thinning treatment has occurred. These activities have the potential to damage the substrate (log) being occupied by the *Tetraphis geniculata* or the population itself. By implementing the specified mitigation measures that would protect the structural integrity of the occupied log, however, there would be no cumulative effects and no risk to species viability or a trend toward listing.

Fungi

There are 17 fungi species documented or suspected to occur on the Olympic National Forest that are designated as a Sensitive species. Only one, *Bridgeoporus nobilissimus*, has characteristics that make it feasible to conduct pre-disturbance surveys. Sixteen of the sensitive fungi are seasonal in nature, with fruiting bodies in the fall or spring, but not predictable from one year to the next.

Table 16. Fungi on Regional Forester's Sensitive Species and other rare or uncommon lists documented or suspected to occur on the Olympic National Forest.

Fungi Species	Status	Ecological Function
Albatrellus avellaneus	Sensitive	Mycorrhizal
Albatrellus ellisii	Sensitive	Mycorrhizal
Bridgeoporus nobilissimus	Sensitive	Wood saprobe
Clavariadelphus occidentalis	Sensitive	Mycorrhizal
Cordyceps capitata	Sensitive	Parasite
Gomphus kauffmanii	Sensitive	Mycorrhizal
Gyromitra californica	Sensitive	Wood/Litter Saprobe

Leucogaster citrinus	Sensitive	Mycorrhizal
Phaeocollybia attenuata	Sensitive	Mycorrhizal
Phaeocollybia fallax	Sensitive	Mycorrhizal
Phaeocollybia oregonensis	Sensitive	Mycorrhizal
Phaeocollybia piceae	Sensitive	Mycorrhizal
Ramaria cyaneigranosa	Sensitive	Mycorrhizal
Ramaria gelatiniaurantia	Sensitive	Mycorrhizal
Ramaria stuntzii	Sensitive	Mycorrhizal
Sarcodon fuscoindicum	Sensitive	Mycorrhizal
Spathularia flavida	Sensitive	Litter Saprobe

The assumption was made that species that were not considered "survey practical" under the Survey and Manage Standards and Guidelines (most category B & D species, including most fungi), would not require survey under the Sensitive Species Program. Rather, other components of pre-project clearances such as habitat evaluation; review of existing records, inventories and spatial data; or utilization of professional research, or literature would be utilized to analyze potential risks to the species resulting from project activities.

Bridgeoporus nobilissimus was not found during surveys conducted between June 2, and August 8, 2005. None of the 17 sensitive fungi species are documented as occurring in the project area**.** A review of the 2006 database (GeoBOB) indicated that there were no known sites of any rare or uncommon fungi species in the proposed project area.

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Under Alternative A, no ground disturbing management activities would occur. Natural processes would continue to dominate, canopy cover would remain high and microclimate would remain essentially the same. Trees and down woody debris acting as hosts for these fungi species would be retained. For these reasons, Alternative A, No Action, would have no known risk to fungi species viability or a trend toward listing.

Alternative B (Proposed Action) and Alternative C

Direct and Indirect Effects

Under either of the two Action Alternatives, the primary impacts to fungi species would come from the disturbance generated from felling, yarding and from road construction. Thinning operations would directly affect ectomycorrhizal fungi abundance and species composition

due to their dependence upon their tree hosts and indirectly due to the decrease in canopy cover, change in microclimate and increase in soil compaction. Partial cutting that favors retention of a diverse mix of tree species and harvesting prescriptions that retain enough stand basal area with good tree vigor could allow some timber harvest without necessarily reducing ectomycorrhizal communities (Kranabetter and Kroeger 2001). New road construction proposed under either of these alternatives is one mile or less so the extent of the direct impact from this activity would be localized. While the proposed project may provide suitable habitat for the above fungi species that were not targeted during surveys, it is unknown whether they occur within the project area. Pre-field screening determined that the there are no known sites within the project area and no local concentrations of any of these species are apparent. For these reasons, the implementation of Alternatives B or C could impact fungi species or habitat, but there is a low likelihood of occurrence, a low risk to species viability, and a low likelihood of trend toward listing caused by this project.

Since no *Bridgeoporous nobilissimus* was found in the project area, there would be no direct or indirect effect to this specific sensitive species. Implementation of the proposed action would have no risk to species viability or a trend toward listing.

Cumulative Effects

There are three proposed wildlife KV projects that have the potential to cumulatively affect this site and they are the proposals for snag creation, nest tree enhancement and log pyramid creation. All three of these projects would involve either topping or felling of additional trees post harvest. Falling additional trees might have a negative impact on fungi by creating larger above ground gaps which can create below ground gaps in the hyphal network (Durall et al. 1999). Larger gaps would further reduce the canopy cover and decrease soil moisture However, these types of projects tend to be small in scale, and in all cases the top of the tree or entire tree would remain on site and might then be of benefit by contributing to soil nutrition over time and providing habitat in the form of decaying wood. For this reason, the effects of proposed enhancement projects in combination with the effects of Alternatives B and C could impact fungi species or habitat but there is a low likelihood of occurrence, a low risk to species viability, and a low likelihood of trend toward listing caused by this project.

As no *Bridgeoporous nobilissimus* was found in the project area, there would be no cumulative effect to this sensitive species. Implementation of the proposed action would have no risk to species viability or a trend toward listing.

Lichens

Sensitive and other rare or uncommon lichen species were assessed for the Bear Creek Saddle planning area in May of 2005. Ten sensitive lichen species, documented or suspected to occur on the Olympic National Forest, were identified as having potential habitat within the proposed project area.

Field surveys for sensitive and other rare or uncommon lichens were conducted between June 2, and August 8, 2005. No lichens considered to be sensitive or having pre-disturbance survey

requirements were found. A review of the 2006 database (GeoBOB) indicated no documented known sites for other rare or uncommon lichen species in the project area.

Table 17. Sensitive and other rare or uncommon lichen species documented or suspected to occur on the Olympic National Forest.

Scientific name	Status
Cetrelia cetrarioides	Sensitive
Collema nigrescens	Sensitive
Dermatocarpon luridum	Sensitive
Dendriscocaulon intricatulum	Sensitive
Erioderma sorediatum	Sensitive
Leptogium burnetiae var. hirsutum	Sensitive
Nephroma bellum	Sensitive
Peltigera neckeri	Sensitive
Platismatia lacunosa	Sensitive
Usnea longissima	Sensitive
Hypogymnia duplicata	other rare or uncommon
Leptogium cyanescens	other rare or uncommon
Nephroma occultum	other rare or uncommon

Common to All Alternatives (A, B, and C)

Direct, Indirect and Cumulative Effects

As no sensitive or other rare or uncommon lichen species were found in the project area, there would be no direct, indirect or cumulative effects to sensitive or other rare or uncommon lichens. Implementation of the proposed action would have no risk to species viability or a trend toward listing.

Invasive Plants

Invasive species surveys were conducted during the period between June 2, and August 8, 2005. The following ten invasive vascular plants were documented in the project area.

- Canada thistle (Cirsium arvense)
- Bull thistle (Cirsium vulgare)
- Scotchbroom (Cytisus scoparius)
- Herb Robert (Geranium robertianum)
- St. John's Wort (Hypericum perforatum)
- Hairy catsear (Hypochaeris radicata)
- Everlasting peavine (Lathyrus latifolius)

- Oxeye daisy (Leucanthemum vulgare)
- Reed canary grass (Phalaris arundinacea)
- Tansy ragwort (Senecio jacobaea)

Alternative A (No Action)

Direct and Indirect Effects

The No Action Alternative would result in continued spread and new infestations of invasive plant species in the project area primarily where existing road use occurs.

Cumulative Effects

Under the No Action Alternative, existing infestations of invasive plant species would likely continue to spread via future road management activities and other forest use and would eventually extend beyond the project boundaries into adjacent areas outside the project area. Anticipated road building and timber harvest on adjacent Washington State Department of Natural Resources land have the potential to introduce additional invasive species if Forest Service roads are used for access.

Alternatives B and C

Direct and Indirect Effects

Under Alternative B or C, areas of new construction would produce newly exposed ground. These areas would be susceptible to noxious weed and invasive plant colonization, particularly since there are already invasive species documented in the immediate adjacent area that could provide a ready seed source. In addition, there are a number of roads with existing weed infestations that are proposed for reconstruction and use to access stands proposed for thinning. If no pretreatment of these invasions occurs prior to their use, vehicle traffic following reconstruction would have the potential to transport the existing invasive seeds located in these areas to other locations not presently occupied by these species. Without mitigation, invasive species would continue to spread along existing road corridors.

In order to control noxious weed colonization and spread under the proposed action, weed-spread prevention and weed eradication activities would be implemented before, during and after project activities (see Mitigations Measures). Implementation of the proposed project with mitigations would provide positive results in the prevention of invasive plant spread and treatment of current infestations.

Cumulative Effects

Past activities that have likely contributed to the spread of invasive plant species include but are not limited to the following:

- Construction of gravel and paved roads providing ease of access to the watershed.
- Timber harvest activities using machinery imported from other geographic areas containing different invasive species propagules.
- Construction of the Bonneville Power Association powerline corridor and associated access roads.

- Erosion control measures and forage seeding projects introducing non-native invasive plant species in seed mixes and straw sediment barriers.

On going road maintenance in the form of road blading, ditch pulling and hauling away of associated debris to waste sites is currently spreading some of these species as is the use of material for resurfacing from infested rock sources.

Future activities that may impact the spread of invasive plant species either positively or negatively include:

- Timber harvest on adjacent Washington State Department of Natural Resource land that could potentially introduce additional unwanted species to National Forest lands via timber hauling on Forest Service roads.
- Forest Service road decommissioning and culvert replacement projects.
- Proposed forage enhancement projects.
- Proposed KV weed treatment projects.

Many of the activities that occurred in the past took place during a time when there was little or no awareness of the detrimental impacts of invasive plant species and probably no consideration was given to this issue during that period resulting in their marked spread upon the landscape. In some cases non-desirable species were introduced with good intent such as increasing animal forage or for erosion control. The emphasis on prevention and control of invasive plant species is relatively recent. Forest practices and direction have evolved as have our knowledge and awareness regarding these species.

A number of these future projects would provide opportunities for a reduction in the abundance of invasive species. Road decommissioning would allow these disturbed areas to return to a more natural state, revegetating where possible with native species or non-persistent non-natives, and over time the regeneration of canopy cover would shade out the less shade tolerant weed species. Forage enhancement seeding and planting of timber sale helicopter landings and temporary roads with native species would prevent colonization of those areas by invasive species. These projects combined with proposed manual and herbicide treatment of weeds would have positive results in the prevention of invasive plant spread and treatment of current infestations.

Economic Viability

Given that the Purpose and Need of this project is ecological in nature, the generation of maximum revenue is not a priority. Cost-effectiveness, however, is still an important aspect of any project plan. Because the only certain funding source to accomplish the Purpose and Need is through the sale of wood products that would be removed as part of the treatment, this method of accomplishing the project objectives would not be possible if it is not commercially viable. Trade-offs also need to be considered between project components included that would increase the cost of implementation (e.g., helicopter logging) and the net revenue available for projects that could only be implemented as part of the project through the use of KV funds (e.g., the decommissioning of system roads or abandoned roads that are in the sale planning area but are not used as part of the timber sale).

The Forest Service's regional TEA.ECON economic analysis tool was used to evaluate the alternatives. This tool was developed to evaluate timber sale economics at the planning or sale layout level and takes into account factors such as estimated timber volume, selling value of wood products, and implementation costs. The estimated value of wood products is based on regional selling values and the value that local ranger districts are receiving from actual timber sale offerings. These values take into account tree species, tree size, and wood quality. The estimated implementation cost is also based on regional logging cost values, as well as local district timber sale logging costs. These sales have included ground-based, cable, and helicopter costs. The estimated revenue can increase and decrease over time and by sale offering because of fluctuations in local and regional lumber prices. If a timber sale offering is bid higher than the appraised value, then there would be more revenue return to the US Treasury or available for KV funded projects. Also the estimated treatment acres and volume of wood products may be reduced by as much as 25 percent from initial estimates due to factors such as additional riparian buffers on intermittent streams that were not shown on project maps but would be located during sale layout and portions of proposed treatment units that ultimately cannot be efficiently or economically yarded.

The socio-economic environment affected by activities within the Olympic National Forest is discussed in the Olympic National Forest Plan Final EIS (USDA 1990a), the Forest Ecosystem Management Analysis Team (FEMAT) Report (1993), and the Northwest Forest Plan FEIS (USDA and USDI 1994b). The role of the wood products and forestry service contract industries in the economies of the northwest are discussed in these documents.

This analysis only takes into consideration identifiable and quantifiable economic benefits and costs and does not include nonquantifiable economic benefits. This may create an inherent bias since cost and budget information is typically more readily available than economic benefit information. Nonquantifiable benefits, such as improved wildlife habitat, however, are reflected in other areas of this chapter for the public's and responsible official's consideration.

Alternative A - No Action

Alternative A would have no direct costs or benefits.

Alternative B

Direct Effects

Alternative B would cost approximately 1.02 million dollars over three years to implement. The wood products value is estimated at about 1.45 million dollars. Thus, the present net value, or the net amount that would be available for KV and other projects, of Alternative B is approximately $436,000. Its benefit-to-cost ratio is 1.43.

Indirect and Cumulative Effects

Alternative B could provide funding and other indirect economic benefits by helping maintain the wood products and forestry service contract industries.

Alternative C

Direct, Indirect and Cumulative Effects

Alternative C is relatively less cost-effective than Alternative B. It would cost about 0.99 million dollars over three years to implement. The wood products value is estimated at 1.20 million dollars. The present net value of Alternative B, which may be available for KV and other projects, is estimated at about $210,000. Its benefit-to-cost ratio is 1.21.

The indirect and cumulative effects of Alternative C are similar to Alternative B.

Table 18. Financial Analysis Results

Alternative	Product Value in Millions	Project Cost in Millions	Present Net Value	Benefit to Cost Ratio
A	0	0	0	0
B	$1.45	$1.02	$436,000	1.43
C	$1.20	$0.99	$210,000	1.21

Heritage Resources

Quileute Tribal Use

The Quileute people have from earliest times considered the Sol Duc to be their hereditary property. They have used the Sol Duc and its drainage area as homesites and ceremonial places, as fishing and hunting grounds, for root-digging and berrying, for gathering raw materials for medicines and for manufacturing what they needed, and for recreation (USDA et al. 1995).). The Quileute consider the following resources, among others, to be key cultural resources: anadromous fish stocks, elk, deer, bear, raven, eagle, large cedar trees and cedar bark, beargrass, swampgrass, and camas (USDA 1996).

Salmon were a mainstay in the diet of the Quileute people, but they also hunted whales and other sea mammals, land mammals, and birds. Large clearings were maintained so as to enhance bracken fern growth. Steelhead were of particular importance because they could be caught in the winter months. Elk hunting was a very important economic pursuit and was sometimes done on an organized, cooperative basis.

Most travel was by foot or dugout canoe. Canoes were usually made from Western redcedar logs which were split in two lengthwise, hollowed out by burning or adzing, and floated to a habitation site for finishing. Many woods, including cedar, spruce, alder, and maple, were split and carved into an array of structures, utensils, tools, weapons, boxes, religious and ceremonial items, and artwork. Tree bark and roots were processed into fabric, cordage, or basketry materials. Many species of berries were gathered in season, and sprouts, bracken fern roots, and camas provided critical nutritional components. Bear grass, fireweed, and cattails were harvested and used in the manufacture of basketry and matting

The Sol Duc Pilot Watershed Analysis documented locations of sites known to have cultural significance to the Quileute Tribe (USDA 1996). Two sites were identified in the general vicinity of the proposed project area.

Klallam Tribal Use

The following information on settlements and territory of the Klallam Tribe was taken from the Cultural Assessment Module of the Deep Creek and East and West Twin Watershed Analysis (USDA et al. 2002).

The Deep Creek and West Twin River watersheds were part of the traditional territory of the Klallam Tribes. At the time of the Treaty of Point No Point in 1855, Klallam territory included the north-sloping watersheds of the Olympic Peninsula and the south shore of the Strait of Juan de Fuca from the Hoko River to Port Townsend. The members of the Elwha Klallam Tribe are for the most part descendants of Klallam who were resident in villages west of the Dungeness River at treaty times. These villages included two near Port Angeles, and others at the Elwha River, Indian Creek, Pysht River, Clallam Bay, and the Hoko River.

Klallam villages were located on salmon streams or in the sheltered bays along the strait in order to take advantage of the marine, river, and upland resources. Klallam hunters also followed river drainages to access the foothills and high country of the Olympic Mountains for hunting and to travel to the territories of other peoples for trade and other purposes. Trails documented in the mid-1800s in the Pysht and Elwha drainages were used for trade between the Klallam and Quileute. There were undoubtedly trails in the Deep/Twins watersheds as well that were followed by the Klallam into the Olympics and Lake Crescent area.

The Cultural Assessment Module of the Deep Creek and East and West Twin Watershed Analysis noted that there is potential for archeological remains to be found in the Deep/Twins watersheds; however, the most likely sites identified were located near the mouths of rivers and creeks where settlements were more permanent. It was noted that there may have been hunting or fishing camps in other parts of the watershed, but specific locations are not known.

Settlement History

Deep Creek and the Twin Rivers have been identified by Elwha Klallam elders as former village locations that existed before European contact and the 1855 treaties. In 1892, five Klallam men filed for applications for homestead claims on locations on the Twin Rivers, Deep Creek, and just east of Pysht under the provisions of the 1884 Indian homestead legislation.

European settlement of the watersheds began in the mid to late 1800s in response to the 1855 treaties and the 1878 Timber and Stone Act. The town of Forks was established in 1877, with cattle, oil, timber, fish, wildlife, and plants extracted and utilized for subsistence and profit. The more accessible lowlands and foothills along the Sol Duc River were railroad logged in the early 1920s, utilizing the Spruce Railroad link between Lake Crescent and Port Angeles, which was completed in 1918. Railroad logging in the valley reached its peak in the 1930s and was essentially over by the 1940s. During this time, the three major logging companies in the valley were harvesting over 500 million board feet a year.

A large logging camp was set up in the Twin area in 1892. Logging was done with horses or oxen and wagon haul and rafting in the 1890s, changing to steam donkeys and railroad haul early in the 1900s. In 1914, the Twin logging camp was the largest in Clallam County. Near the end of World War I, 200 soldiers of the Army's Spruce Division were stationed at Twin to help provide spruce lumber for the war effort. The area was extensively logged, including low elevation portions of the West Twin River and East Twin River subwatersheds, in the late 1920s and 1930s.

The Olympic Peninsula Loop Highway, completed in 1931, improved access to Forks and the Sol Duc River area. Road development within the watersheds increased dramatically with the advent of modern trucks in the 1950s. Segments of Forest Service Road 30 may have been developed as early as 1899, when a county road existed alongside Bear Creek in Township 30 North, Range 11 West,

The Olympic National Forest Cultural Resources Overview, prepared for the Forest Service by Jack McCormick and Associates in 1978, inventoried a number of cultural resources sites on the former Soleduck Ranger District. The feature identified as H-4 is in closest proximity to the project area and is described as a settler trail depicted on O. P. Anderson & Co. Township Plats of Clallam County, 1899. It extended along Bear Creek toward Sappho, in the SW ¼ Section 23, T30N R12W. It was noted in 1978 that the location of the former trail was of historical interest, and should be mapped for Forest Service files. It's not known whether this was ever done.

Human Developments in the Planning Area

In addition to roads constructed and maintained by the Forest Service, several past and current physical structures exist or are known to have existed within the planning area. They include the following:

Bonneville Power Administration Powerline. An aerial electrical transmission line, operated by the Bonneville Power Administration as the Port Angeles – Sappho #1 115 kV line, traverses much of the planning area. The powerline corridor and many of its supporting access roads were constructed by the BPA in 1964 and 1965. Approximately 5.4 miles of these access roads would be reconstructed and used for log haul under the timber sale.

Qwest Buried Fiber Optic Cable. In 2002, Qwest Communications was authorized to install a buried fiber optic cable within the road prism of FSR 30 between Highways 101 and 112. The cable was buried an average of 42 inches deep in the ditchline of the road, with several aerial segments in areas where culvert replacement or road reconstruction was planned. Orange location markers placed at intervals along the roadside are the primary visual evidence of the cable installation.

Calvin White Domestic Waterline. A buried domestic water transmission pipeline is located on National Forest land in Section 24 of T. 30 N, R. 12 W., within planned commercial thinning unit 061. The intake for the water system is located just north of the Bonneville Power Administration powerline, in a small stream. The line runs south for about 500 feet to a settling box, and then continues on for about 1,000 feet to the Calvin White residence on private land. The portion of the waterline on National Forest land has

been under permit for several decades. During commercial thinning operations, the waterline and settling box would be protected from damage.

Site of Deep Creek Guard Station. A guard station seasonally operated and staffed by the Forest Service was located near the divide between West Twin River and Deep Creek. Its existence is noted in the 1964 Impact Report prepared by the Forest Service for the installation of the BPA's Port Angeles – Sappho Power Transmission Line, and that it was manned during the fire season. Although its location is only generally indicated on maps from the time, it appears that the Guard Station was located on or near FSR 3000490. An overgrown rock pit is currently located in the approximate vicinity of the guard station, and no physical remnants of the guard station remain.

Bear Creek Mine. A old manganese mine site exists in Section 24 of T. 30 N, R. 12 W., within planned commercial thinning unit 061, just north of the BPA powerline corridor. Clallam County Minerals Search records from the 1970s list mining claims by Sherman Douglas, known as Sher Mack I – IV, as recorded to be in Sections 13 and 24. The mine site was reportedly tested by the Bureau of Mines in the 1940s to assess the potential for further development for wartime needs, but apparently was not found to be a site worth further excavation. The only remaining visual evidence of the mine site is an exposed rock face where excavation took place.

National Register of Historic Places

The nearest property eligible for listing on the National Register of Historic Places is the Snider Work Center, located in Section 28 of Township 30 North, Range 11 West. Four structures built by the CCC are eligible for inclusion on the National Register, although a formal nomination for listing has not been submitted by the Forest Service.

Snider Work Center is located approximately three miles from the project area as the crow flies, and about five miles by road. The proposal would not impact the National Register-eligible buildings or the Snider compound in any way.

Survey Methodology and Results

Ground surveys consisting of meandering transects were conducted in 45 of the 47 proposed project units in the fall of 2005. Transects generally began at an existing road near each unit, and contoured through the stands, meandering to examine ridgelines, terraces, rock outcrops, riparian areas, and other unique topographic features. The area examined along each transect was approximately 30 feet in width. The Cultural Resource Reconnaissance Report (found in the analysis file) lists the approximate length and area covered by each transect, and provides a large-scale map of each stand illustrating the route of each transect. A total of 12 days were spent surveying for cultural resources in the field.

Potential for mineral soil visibility was low due to duff depths, although other opportunities such as upturned root wads, mountain beaver dens, ditches, road edges, stream channels, powerline access roads, and other disturbed areas were examined. Findings were limited to evidence of past logging such as springboard notches on large stumps, pieces of wire logging cable, skid roads and corridors, and a few items placed or left in the stands during past human use, including a washtub, metal auger, abandoned vehicles, and concrete water tanks installed

by the Forest Service. Photographs and descriptions of these items are found in Exhibit 10 of the Cultural Resources Reconnaissance Report in the analysis file.

In Unit 53, a patch of about six red cedar trees that had been stripped of bark were observed. The trees were second-growth, about 16 inches in diameter, and their bark had been chopped horizontally for 8 to 12 inches at the base of the trees, then pulled off for up to about 20 feet in long narrow strips. The cambium had grown in around the edges of the stripped areas, so the stripping is more than a year old, but likely less than 10 years old. The bark was likely removed for use in making cedar bark basketry or other weaving products.

Ground surfaces were also surveyed along a sampling of proposed road reconstruction sites along Forest Service Roads 3100010, 3006011, 3067050, 3067055, 3000401, 3000490, 3000579, 3000580, and a decommissioned road at milepost 5.5 of Forest Service Road 30. Each side of the roads has been previously cleared of vegetation, logged, covered with fill in areas, and compacted. Plants noted in the project area included sword fern, trailing blackberry, salmonberry, grass, salal, vine maple, red alder, Douglas-fir, and western hemlock. The primary evidence of human activity noted was the roads, their drainage structures, and the surrounding plantations. Two of the 47 stands proposed for thinning, Units 10 and 29, were not examined because of difficult access.

Site-specific field surveys conducted for this project, previous cultural resource surveys for other projects in the nearby area, other professional archeological surveys, and a literature search revealed no evidence of cultural resources within the immediate proposed project area. It was concluded that no known cultural resources will be affected by the proposed project.

No traditional cultural properties were identified during the literature search or through tribal coordination for this project. As planned, the project will not interfere with American Indian treaty rights or the federal trust responsibilities of the Forest Service. If information about such resources becomes available during the project, every effort will be made to provide access to sacred sites and to usual and accustomed places protected by treaty rights.

Alternative A (No Action)

Direct and Indirect Effects

There would be no direct or indirect effects under Alternative A, given that no road construction or vegetation management actions would take place on National Forest lands. The currently existing human developments within the planning area (Forest Service and BPA roads, BPA powerline corridor, Qwest fiber optic cable, and the domestic waterline) would continue to be maintained by the responsible parties under the terms and conditions of agreements and permits authorizing the use.

Sites at which human activities are known or suspected to have taken place in the past but are no longer occurring, such as the Deep Creek Guard Station site and the Bear Creek manganese mine, would continue to become less evident as vegetation and weathering obscure any remaining features of their existence.

Cumulative Effects

Past activities that have impacted the watershed include but are not limited to the following:

- Human travel through the watersheds, first over trails in the Deep Creek, West Twin River, and Bear Creek drainages, led to the construction of gravel-surfaced and eventually paved roads near these watercourses.
- Timber harvest on federal, state, and private lands in the watersheds initially resulted in conversion of late-successional stage forest through clearcut harvest. Beginning in the mid-1990s, timber harvest on National Forest lands has been focused on commercial thinning of mid-coniferous successional forest stages.
- The construction of the Port Angeles – Sappho #1 115 kV line by the Bonneville Power Association in 1964 and 1965 resulted in the removal of trees from a corridor about 20 miles in length and averaging 200 feet in width. The powerline corridor is maintained to prevent the growth of trees within the cleared area. Numerous short road segments were constructed to provide vehicle access to the powerline, and many of these road segments have been inadequately maintained over the years, causing erosion, sedimentation, and uncontrolled use.

While there are no sites of significant cultural or historical importance within the planning area, there are numerous areas where human actions have taken place over the years, and where evidence of human use may be found. While other activities occurring in the vicinity may have minor impacts to cultural resources, there would be no cumulative impact from the implementation of Alternative A on these human use areas since no ground disturbance would occur.

Alternatives B and C

Direct and Indirect Effects

Under Alternatives B and C, varying levels of road construction, reconstruction, and decommissioning and commercial thinning would take place on National Forest lands. The currently existing human developments within the planning area (Forest Service and BPA roads, BPA powerline corridor, Qwest fiber optic cable, and the domestic waterline) would continue to be maintained by the Forest Service and by the responsible parties under the terms and conditions of agreements and permits authorizing the uses. Fifteen roads (about 5.4 miles) constructed by the BPA for powerline access would be improved by the Forest Service to accommodate log and rock haul. These roads would be left in their improved condition after commercial thinning activities is complete. These roads are not considered to be culturally significant, so there would be no impact on heritage resources.

Sites at which human activities are known to have taken place in the past but are no longer occurring, such as the Deep Creek Guard Station site and the Bear Creek manganese mine, would continue to become less evident as vegetation and weathering obscure any remaining features of their existence. Alternatives B and C would have no impact on the condition of these known sites, as the sites are not within areas proposed for timber harvest or roading.

Sites at which human activities are suspected to have taken place in the past but no specific evidence exists, such as riparian areas or ridgelines where trails may have existed or fishing or hunting may have occurred, may be disturbed by road reconstruction and logging activities. In the event that subsurface archeological evidence is located during implementation of this project, ground-disturbing activities would cease pending an evaluation for cultural

significance by a qualified archeologist. Impacts from either action alternative, however, are not expected.

Cumulative Effects

While there are no identified sites of significant cultural or historical importance within the planning area, there are numerous areas where human actions have taken place over the years, and where evidence of human use may be found. The impacts of the implementation of Alternatives B and C on these human use areas are anticipated to be limited to the areas where ground disturbance would occur. The requirement of cessation of ground-disturbing work activities in the event that subsurface archeological evidence or previously unidentified cultural resources are located and a subsequent evaluation for cultural significance by a qualified archeologist would mitigate the potential effects of ground disturbance in these areas. Therefore, there would be no significant cumulative effects for either Alternative B or C.

Other Effects

ACS Consistency

Both Alternatives B and C are consistent with Riparian Reserve standards and guidelines. Both action alternatives are designed to meet and/or not prevent attainment of the Aquatic Conservation Strategy Objectives at both project and watershed scales.

Objective 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

The project contributes to a restorative effect on Objective 1 by promoting the development of late-successional forest characteristics in second growth stands in portions of three watersheds and helping to meet the desired future condition for Late Successional Reserves, Adaptive Management Areas, and Riparian Reserves described in the Olympic National Forest Land and Resource Management Plan.

The Bear Creek Saddle project would accelerate development of late successional habitat features and promote increased vegetative diversity, both within and outside of Riparian Reserves in three watersheds. Information from the project area watershed analyses - Deep Creek, East Twin, West Twin Rivers Watershed Analysis (USDA Forest Service, Elwha Klallam Tribe and Wa. Dept. of Ecology, 2002), and the Sol Duc Pilot Watershed Analysis (USDA et al, 1995) was used to describe the vegetative natural range of variability (Bear Creek Saddle EA pages 53-56) and the aquatic systems existing condition (Bear Creek Saddle EA pages 100-102). The project meets Northwest Forest Plan Record of Decision (ROD) standards and guidelines for management of Riparian Reserves as outlined in the ROD C-32 with the application of silvicultural practices to control stocking, reestablish and manage stands, and to acquire vegetation characteristics needed to attain the aquatic Conservation Strategy Objectives.

Thinning treatments would increase structural and compositional diversity by releasing understory vegetation, and promoting development of residual trees with relatively large

diameters, crowns and limbs. Skips within the treatment areas would insure that not all young stands are treated in the project area, providing forest complexity at project and landscape scales.

Where vegetative complexity is high, no-cut riparian buffers along all streamcourses would maintain the high level of vegetative complexity associated with these areas. Riparian buffer widths would be variable depending on fish presence, stream size, slope stability, shade cover, sediment delivery potential and water quality considerations.

Management requirements and mitigations were developed to retain desirable habitat components in the treated stands. The measures are described in pages 30-37 of this Environmental Assessment.

Objective 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

The project contributes to a restorative effect on Objective 2 through restoring connectivity by removing or reconstructing some of the failed stream crossings on existing roads. No-cut buffers along all streamcourses would protect riparian areas from disturbance and maintain a high level of connectivity along these corridors.

The vegetation treatments and associated activities proposed in the Bear Creek Saddle project are spread across 3 watersheds. The project would help restore lateral, longitudinal and drainage network connections both within each watershed and between the 3 watersheds. At the landscape scale the Bear Creek Saddle project would help reconnect inland, freshwater river systems with the coastal watersheds. Treatments within the Bear Creek Saddle planning area and previous treatments in adjacent watersheds are designed to develop a landscape scale pattern of more complex and diverse stands.

No-cut riparian buffers along all streamcourses would maintain a high level of connectivity along streamcourses. Site specific road treatments proposed as part of the project would help restore stream and riparian connectivity by removing obstructions at failed stream crossings, permitting the unobstructed movement of water, sediment, woody debris, and aquatic organisms.

Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The project would contribute to a restorative effect on Objective 3 by restoring the physical integrity of stream channels by removing or reconstructing failed stream crossings on existing roads, decommissioning existing roads, and blocking road access to illegal ATV use. No-cut buffers along all streamcourses would protect riparian areas from disturbance and maintain the physical integrity of stream channels and streambanks.

The physical integrity of the aquatic system would be protected by designating no-cut buffers along all stream channels and by designing stand treatments and road construction, reconstruction, and decommissioning activities to minimize impacts at the project sites.

Maintenance of streambank conditions is described in the Bear Creek Saddle EA at pages 103 and 106.

New temporary road construction would be limited and would occur in only two of the watersheds within the planning area. Only one new temporary road stream crossing would be constructed. This crossing would involve a small, intermittent, non-fish bearing stream. The crossing would be removed after use. Impacts would be negligible.

On the existing road system being used in the planning area, removal of failed culverts in fish bearing streams, removal/replacement of failed culverts in non fish bearing streams, road decommissioning, and blocking road access to illegal ATV use, would start the process of streambank and streambed restoration to more natural conditions.

Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

The project would contribute to maintaining the current high water quality conditions addressed in Objective 4 in the project area by designating no-cut buffers along all streamcourses and by implementing best management practices, management requirements, and required mitigation measures.

The current water quality conditions on National Forest lands within the Bear Creek Saddle project area are considered high quality for aquatic communities as described in the Deep Creek, East Twin, West Twin Rivers Watershed Analysis (USDA Forest Service, Elwha Klallam Tribe and Wa. Dept. of Ecology, 2002), and the Sol Duc Pilot Watershed Analysis (USDA et al, 1995).

Designated riparian no-cut buffers would maintain current streamside shading to protect stream temperatures. Riparian no-cut buffers would also prevent sediment generated from timber harvesting operations from reaching stream channels. Designated stream buffers consider slope stability, shade cover, sediment delivery potential and water quality considerations. The Bear Creek Saddle EA at pages 102-107 describes how water quality parameters are maintained or restored in the long-term by the action alternatives.

New temporary road construction would be limited. Only one new temporary road stream crossing would be constructed. This crossing would involve a small, intermittent, non-fish bearing stream. The crossing would be removed after use. Impacts would be negligible.

Best management practices, management requirements and mitigations were developed to address potential impacts at the project scale and to retain desirable habitat components in the treated stands. The measures are described in pages 30 to 37 of this Environmental Assessment. Measures on pages 33 to 35 of the EA specifically outline requirements for roads, landings and skid trails so as to minimize and mitigate potential impacts to soil and water. These measures will be employed to limit and restrict sediment from reaching flowing waters during project implementation, especially during log haul in wet weather.

At the project scale, the project would have a minor impact on water quality from newly exposed stream banks and streambeds when failed culverts are replaced or removed. Based on past observations from large culvert removals and replacements on tributaries in the Sol Duc and North Fork Calawah drainages, culvert work is likely to create turbidity pulses that last for only a few hours, at most, before water clarity returns to background levels, Construction sites may continue to produce small amounts of sediment and turbidity throughout the first winter until the sites are fully revegetated and stable. Any short-term increases in sediment production or turbidity are expected to be well within the range of what would typically occur during high winter flows or as a result of natural streambank erosion. (EA pages 93-94) At the watershed scale, changes in the overall sediment rates would not be detectable. After the completion of the proposed project, numerous existing unclassified, abandoned roads and all new temporary roads would be decommissioned, reducing the overall road network within the drainage from current conditions. These actions would contribute to the health of the riparian, aquatic, and upland ecosystems.

Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

The project contributes to maintaining Objective 5 at the project scale, and promoting restoration at the watershed scale by helping to restore the natural sediment regime by removing or reconstructing failed stream crossings on existing roads, improving road drainage, and decommissioning existing roads to decrease sedimentation and reduce the risk of mass wasting.

The Bear Creek Saddle project would help restore the natural sediment regime through road improvements such as replacing failed culverts and restoring natural drainage patterns (routing water off of road surfaces). These activities would reduce the rate and volume of sediment from chronic surface erosion, as described in the Bear Creek Saddle EA at pages 102-103. Proposed road decommissioning would also help restore the natural sediment regime by reducing the risk for mass wasting that has a significant effect on water quality and downstream fish habitat. While sediment would continue to be generated by open roads and unclassified roads within the 3 watersheds, the proposed road decommissioning would be a benefit to the restoration of the sediment regimes in those watersheds (Bear Creek Saddle EA pages 104-105 and 107).

At the project scale, based on observations of past Olympic National Forest thinning sales with similar prescriptions, riparian buffers, soils and landforms, there is no evidence that the project will increase failure risk or cause additional shallow or deep seated landslides. Over the long term, the thinned stands are expected to produce healthier stand conditions that will promote slope stability.

At the project scale, all stream courses are protected with a no-cut riparian buffer, minimal impact logging systems, and mitigation measures. New temporary road construction would be limited. Only one new temporary road stream crossing would be constructed. This crossing would involve a small, intermittent, non-fish bearing stream. The impacts of constructing and removing the crossing would be negligible.

The mitigation measures are described in pages 30 to 37 of this Environmental Assessment. The project includes activities at individual sites that will result in short term increases in sediment production, but have long-term benefits. For example, culvert installations or upgrades, and road decommissioning work all have the potential to create short term sediment movement. Sediment inputs to streams from culvert work would be likely to create turbidity pulses that last for only a few hours, at most, before water clarity returns to background levels, based on past observations from implementation of large culvert removals and replacements on tributaries in the Sol Duc and North Fork Calawah drainages. Construction sites may continue to produce small amounts of sediment throughout the first winter until the sites are fully revegetated and stable. Any short-term increases in sediment production or turbidity are expected to be well within the range of what would typically occur during high winter flows or as a result of natural streambank erosion.

At the watershed scale changes in the overall sediment rates would not be detectable given the high variability in natural rates of sediment input. Road treatment and road decommissioning with the proposed project would overall, decrease sedimentation and risk of mass wasting following project implementation.

Objective 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The project would maintain the current instream flow conditions described in Objective 6 at both the project and the watershed scales due to the age of the vegetation, the low elevation of the project area, and the small portions of the watersheds that would be affected.

A high percentage of each of the watersheds in the planning area is within hydrologically mature vegetation. Almost the entire planning area is below the rain on snow zone. (Deep Creek, East Twin, West Twin Rivers Watershed Analysis – USDA Forest Service, Elwha Klallam Tribe and Wa. Dept. of Ecology, 2002, and Sol Duc Pilot Watershed Analysis (USDA et al, 1995).

This project would not substantially affect instream flows. While tree removal may result in reduced evapo-transpiration rates, allowing more water in the soils for runoff, this would be a temporary effect lasting 3-5 years until crown expansion and ground vegetation response offsets the short-term reduction. The initial reduction in vegetation represents only a small overall change that would not be measurable at the project scale. Small increases in stream flow could occur within some of the individual tributaries adjacent to harvest units, but given the very small drainage areas affected, these changes would not be detectable at the project or watershed scale. There is high natural variability in discharge that is related directly to annual or seasonal precipitation. Over time, the accelerated growth response of the residual trees as well as the development of under story vegetation would increase evapo-transpiration rates.

Objective 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The project would maintain the current floodplain inundation and water table conditions (as relate to Objective 7) at both the project and the watershed scales due to the protection

measures that will be implemented along all stream channels and waterbodies and the small portions of the watersheds that would be affected by thinning activities.

The project would not affect the timing, variability, or duration of floodplain inundation or water table elevation in meadows and wetlands (Bear Creek Saddle EA pages 135-136) in any of the 3 watersheds within the Bear Saddle planning area. At the project scale, floodplains are protected with no-cut riparian buffers, exclusion of road construction, minimal impact logging systems and mitigation measures. The proposed removal of vegetation with the stand treatments will not affect the floodplain or water table elevations in any of the 3 project area watersheds.

Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

The Bear Creek Saddle project would contribute to the restoration of Objective 8 at the project and watershed scale by restoring the composition and structural diversity of riparian vegetation by promoting the development of late-successional forest characteristics in second growth stands both outside and within Riparian Reserves and by decommissioning some existing roads in riparian areas. The lower Bear Creek subwatershed in particular is well below the natural range of variability for quantities of late-successional forest (EA page 54). No-cut buffers along all streamcourses and avoiding new stream crossings for temporary roads, except for a single crossing of a small, intermittent, non-fish bearing stream, will protect riparian areas from disturbance and maintain the existing riparian vegetation.

The Bear Creek Saddle project requires no cut buffers along all riparian corridors and wetlands. These buffers encompass diverse plant communities, protect current shading levels for thermal regulation, protect stream banks from operational disturbances and ensure that soil disturbance does not get routed to streams or wetlands. Designated no cut buffers along units in the planning area, will also protect channel migration processes. Only one of the temporary roads would cross a stream channel. The channel is a small, intermittent, non-fish bearing tributary and impacts are expected to be negligible. The proposed road decommissioning would initiate restoration along riparian corridors at current road crossings. How the action alternatives would maintain or restore aquatic habitat indicators is described in the Bear Creek Saddle EA at pages 102-107.

The size and number of new helicopter landings within Riparian Reserves would be minimized by utilizing existing openings and landings as much as possible and by incorporating new helicopter landing sites into designed gaps within timber harvest units where feasible. All landings would be outside of designated riparian no-cut buffers. New helicopter landings along Bear Creek, if any, would be located north of FSR 30 so that the stream-adjacent riparian areas between Bear Creek and FSR 30 would be protected.

The proposed thinning treatments are designed to accelerate the development of late-successional characteristics in second-growth stands, and to provide heterogeneity in the landscape by the retention of cedars and minor hardwoods, and through retention areas or “skips” that allows for untreated stand conditions to provide different stocking levels and

species composition. Skips also protect snags and coarse woody debris. Coarse woody material of all sizes would remain on site in treated areas. Any large pieces of wood that are moved during temporary road construction would be replaced on scarified roads after the stand treatment and road decommissioning is completed. The measures are described in pages 30 to 37 of this Environmental Assessment.

The prescription provides retention of larger diameter trees, favoring Sitka spruce, Pacific silver fir and Douglas-fir since those species tend to be larger than their hemlock neighbors. An alder component would also be retained, but in alder –dominated or mixed alder/conifer stands, some alder would be removed to release the conifer component. Variety of the forest stands would be promoted with the retention of the hardwood components.

Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

This project contributes to restoration of this ACS objective through restoring habitat for riparian-dependent species by promoting the development of late-successional forest characteristics in second growth stands within Riparian Reserves, by replacing failed culverts on existing roads, and by decommissioning some existing roads in riparian areas. No-cut buffers along all streamcourses and avoiding new stream crossings for temporary roads, except for a single crossing of a small, intermittent, non-fish bearing stream, would protect riparian areas from disturbance and maintain the existing riparian conditions.

The Sol Duc Pilot Watershed Analysis and Deep Creek, East Twin, and West Twin Rivers Watershed Analysis, as well as the Sol Duc Late Successional Reserve Assessment (LSRA) characterized the project area as landscape fragmented by competitive exclusion ecosystems (plantations) with concerns for the quality and availability of dispersal habitat for spotted owl (as further described in the Bear Creek Saddle EA page 57). A specific Riparian Reserve issue for owls is to provide dispersal habitat (ROD B-13). While the upland treatment for the Bear Creek Saddle project is designed to encourage development of forest stand characteristics suitable for nesting murrelets and spotted owls, the riparian areas contribute to the connectivity of the treated stands with suitable habitat within the three watersheds.

At the site specific scale, the Bear Creek Saddle project requires no-cut buffers along riparian areas. This would help maintain the existing microclimates which are especially important for species that are extremely sensitive to changes in temperature and humidity, such as amphibians and certain types of vegetation, as well as for those animals that use the riparian areas as travel corridors. These riparian areas contribute to the landscape heterogeneity of both untreated and treated stands. The retention of cedars, minor hardwoods and untreated areas or “skips” provides for different stocking levels and species composition. This variety of stand conditions would create a diverse range of habitats that would support a variety of species within the riparian areas and across the landscape.

There are a number of roads with existing weed infestations that are proposed for reconstruction or decommissioning. If there is no treatment of the invasives, these species would continue to spread and new infestations would be likely, including into riparian areas. The project proposes weed spread prevention and eradication activities to be implemented before, during, and after project activities. Native plant species are supported through the proposed noxious weed treatments with the project and the mitigation measures to minimize

invasive weed species. See mitigation measures described in pages 30 to 37 of this Environmental Assessment.

The action alternatives provides for the development of habitat conditions within the riparian areas and across the landscape to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species at the project and watershed scales.

SUMMARY

Overall, the Bear Creek Saddle project would help restore riparian vegetation and aquatic conditions within the three fifth field watersheds by promoting the development of late-successional forest characteristics in second growth stands both within and outside of Riparian Reserves and by reconstructing some failed crossings, improving road drainage, and decommissioning existing roads. The thinning treatments are designed to help meet the desired future condition for Late-Successional Reserves, Adaptive Management Areas, and Riparian Reserves described in the Olympic Land and Resource Management Plan. Because terrestrial vegetation and aquatic components and processes are so tightly inter-connected, meeting the Desired Future Condition for these land allocations will also contribute to abundant, well dispersed, high quality habitat for riparian-dependant species.

The Bear Creek Saddle project would also help restore the natural sediment regime through road improvements such as replacing failed culverts and restoring natural drainage patterns (routing water off of road surfaces). These activities would reduce the rate and volume of sediment from chronic surface erosion. Proposed road decommissioning would also reduce the risk of large mass wasting events that would have significant effects on water quality and downstream fish habitat.

Designated no-cut buffers along all streamcourses; avoiding new stream crossings when constructing temporary roads except for a single crossing of a small, intermittent, non-fish bearing stream; and implementing Best Management Practices, management requirements, and required mitigation measures as part of the project would protect riparian areas and maintain the existing vegetation, connectivity, water flow, water quality, and habitat within all three watersheds.

The Bear Creek Saddle project would include some activities that would result in short term increases in sediment production at individual sites. For example, culvert installations or upgrades, and road decommissioning work all have the potential to create short term sediment movement. Any stream channel disturbances or adverse water quality impacts are anticipated to be small, short-term, and localized. Sediment inputs to streams from culvert work would be likely to create turbidity pulses that last for only a few hours, at most, before water clarity returns to background levels. Construction sites may continue to produce small amounts of sediment throughout the first winter until the sites are fully revegetated and stable. Any short-term increases in sediment production or turbidity would be expected to be well within the range of what would typically occur during high winter flows or as a result of natural streambank erosion. At the watershed scale, changes in water quality, turbidity or sediment production would not be detectable.

Essential Fish Habitat

This project would not adversely affect essential fish habitat for Chinook, coho, or pink salmon as designated under the Magnuson-Stevens Fishery and Conservation Act. Pink salmon are not found in any of the three watersheds within the planning area. Chinook salmon are not found in Deep Creek and West Twin Rivers. Chinook salmon are found in Bear Creek. Coho salmon are found in Deep Creek, West Twin River and Bear Creek. Activities in Deep Creek and West Twin River are well away from coho habitat. In Bear Creek activities are more closely associated with coho and Chinook habitat. While road construction, reconstruction and log haul may generate some short-term inputs of fine and coarse sediment, measurable impacts to fish habitat are not expected to occur. The project would generate funds for restoration projects that would result in long-term benefits for coho and Chinook salmon habitat by decommissioning high risk roads and restoring fish passage.

Fuels/Fire

The risk of wildfire occurrence in the planning area is low with no fire activity having occurred in the past 20 years. While the risk of wildfire is low, the area has had large fire activity in the past. The entire planning area was burned over by high intensity fires in 1308, 1508 and much of the northeastern portion of the planning area was burned in 1701. Additional fires occurred in smaller portions of the planning from 1867 up to 1952. There has been no large fire occurrence in the planning area since 1952 (USDA et al. 1995).

While the risk of fire occurrence in the planning area is low, the consequences of a fire occurring could be high. The natural fire return interval for the planning area is 200 to 300 years with high intensity fires resulting in total stand replacement. Historical data suggest that these high intensity fires were fanned by east wind events occurring after very dry summers with total rainfall of less than two inches for the summer months. Any fires occurring in the planning area in late summer or early fall could result in severe fire intensities due to east winds events being funneled down the Sol Duc, Bear Creek and West Twin Drainages.

Fire statistics for the entire Pacific Ranger District for the past 20 years show the greatest risk for ignition to be human caused with escaped prescribed fires from timber management activities being the number one cause and campfires the second cause for ignition. Lighting is the third ignition source. With reduced timber management activities on the Pacific Ranger District, as a result of the implementation of the Northwest Forest Plan, there have been no escaped prescribed fires in the past 13 years. During this 13-year period escaped campfires has been the number one fire cause, lighting is second and other human fires (smoking, fireworks) is third. Potential ignition sources in the planning area from human activities are: industrial logging operations on National Forest, State and private lands; recreational uses such as horseback riding, hunter camps, OHV riding; forest product gathering and power line operations and maintenance.

The expected fire behavior with pre-treatment conditions under Alternative A (using the National Fire Danger Rating System and the 90th percentile for fire weather data from Tom Creek weather station) was modeled to have rate of spread of approximately 2 chains (approx. 132 feet) per hour with flame lengths of 1 foot, according to the BEHAVE 3.0.1 fire behavior prediction and fuel modeling system. In the event of a fire or if a fire were to occur, the expected containment size of a wildfire would be 1 acre or less. After the stands in the project

area are treated (commercially thinned) under either Alternative B or C, there would be an increase in dead-down fuels in tons per acre and fuel depths.

The expected fire in treated areas would increase to rate of spread of approximately 6.1 chains (approx. 400 feet) per hour with flame lengths of 3.4 feet. Expected containment size of a wildfire would be approximately 11 acres. The increase in fire behavior in treated stands would last approximately 15 years but will begin to decrease after 2 years as small fine fuels decay and fuel depths are reduced.

The risk of wildfire occurrence would increase slightly from planned activity, but would remain low for the planning area. The increase in wildfire risk would mainly be due to the increased human activity (mainly commercial thinning activities) in the project area and the resulting addition of fire-receptive fuels in treated areas. To reduce the possibility of wildfire ignition and to reduce wildfire rates of spread, fuel reduction measures would be required as noted in Chapter 2. Any planned burning of activity slash would be done following all State and Federal laws including the Clean Air Act.

Parklands, Prime Farmlands, Wetlands, Wild and Scenic Rivers, or Ecologically Critical Areas

The project planning area does not contain parklands, prime farmlands, or wild and scenic rivers, nor does the project area contain any 404 listed wetlands. Areas that may be considered ecologically critical, such as critical habitat for the northern spotted owl, are discussed in previous sections of this chapter.

Wilderness and Inventoried Roadless Areas

The project does not contain and would not impact any Wilderness or inventoried roadless areas. There are no Wilderness areas in the northern portion of the Pacific Ranger District, where this project is located. There are no Inventoried Roadless Areas (IRA) near the planning area. The closest IRA is located about 10 air miles to the south of the planning area.

Clean Water Act

Deep Creek and West Twin River are independent tributaries that flow into the Straits of Juan De Fuca. Bear Creek is a tributary to the Sol Duc River. The Washington Department of Ecology included water body segment DB51HV, in Deep Creek, on the 303(d) list of impaired water bodies due to sedimentation and temperature. This segment of Deep Creek is outside of the National Forest boundary and the Bear Creek Saddle planning area. Observing relevant Best Management Practices can serve to prevent or minimize both types of pollution, as can effective restoration and enhancement of watershed and riparian areas. Observing Best Management Practices would serve, at a minimum, to maintain current water quality in analysis area streams.

Both of the action alternatives would have no effect on existing stream temperatures because the existing stream side shading would be maintained. The project poses some potential for soil erosion and off-site movement of sediment, but these would be kept to a minimum through protection of riparian areas, implementation of best management practices, and mitigation measures. Sedimentation is not expected to be enough to measurably alter stream

functionality. By observing the Best Management Practices and mitigation measures described in this Environmental Assessment, Alternative B and C would protect beneficial water uses in this area and maintain water quality in the associated streams in compliance with the Clean Water Act.

Clean Air Act

This project is not expected to adversely impact air quality. Due to the project's design, there will be very limited pile burning of harvest-generated fuels. Timber felling will be directed away from roads, and landing slash will be yarded back into the units. Any planned burning of activity slash (e.g., within 100 feet of boundary with a private residence) would be done following all State and Federal laws including the Clean Air Act. Scenic Quality

Scenic Quality

The Olympic National Forest Plan did not specifically develop visual quality objectives for the project area. Under the 1990 Forest Plan the project area was assigned to Management Prescription C1 – Spotted Owl Habitat Areas and E1 – Timber Management. Neither of these two prescriptions have specific requirements related to scenery management. Broad Forest Plan direction for scenery management which applies to this area is found in the management objective for scenery which states that "Management of landscapes outside of scenic viewsheds will be aimed at meeting Visual Quality Objectives" (Forest Plan pg. IV-24). Areas outside designated viewsheds, Wildernesses, and research natural areas are classified under the visual quality objectives of Modification or Maximum Modification. All activities proposed under the action alternatives meet these objectives, and in this respect are consistent with the Forest Plan.

Climate Change

While there is ongoing research on the potential impacts of global climate change in the region and while no specific forest management recommendations have been published regarding global climate change, a brief review of climate change research in the region was conducted to assess predicted changes in climate, and relate the changes to impacts climate change may have on the desired outcomes of, and the potential impacts from, this project.

Although El Niño/Southern Oscillation and the Pacific Decadal Oscillation comprise the primary factors for climate variability in the Pacific Northwest (Climate Impacts Group 2006b), the influence from global climate change is a growing concern. According to the Climate Impacts Group, based out of the University of Washington, climate modeling for the Pacific Northwest predict a future rate of warming of approximately 0.5 degrees Fahrenheit per decade for the Pacific Northwest through at least 2050, relative to the 1970-1999 average temperature (2006b). Temperatures are projected to increase across all seasons, although most models project the largest temperature increases in summer (June-August), and the average temperatures could increase beyond the year-to-year variability observed in the Pacific Northwest during the 20th century as early as the 2020s. Nakawatase and Peterson (2006) studied the effects of climate variability on forest growth across the western and northeastern Olympic Mountains. Their results suggest that warmer temperatures predicted for the Olympic Mountains would result in decreased productivity at high elevations (i.e. subalpine forest types) in the northeastern region of the Olympic Mountains as a result of decreased

summer soil moisture. Growth in low- to mid-elevation Douglas-fir and western hemlock forests, however, would depend on the combined effect of potential decreases in precipitation and increased temperature in the summer.

Whether and how increasing temperatures resulting from global climate change would alter predicted forest response to the proposed commercial thinning under any of the action alternatives would depend on specific site conditions in relation to temperature and soil moisture availability on tree growth. If temperature were to increase while precipitation changes minimally, as predicted by the Climate Impacts Group, tree evapotransportation would increase nonlinearly, leading to more frequent drought stress (Littell 2007, *pers comm*). Douglas-fir, in particular, is sensitive to low soil moisture (Climate Impacts Group 2004b). A moderate density commercial thinning could decrease competition for water during the summer while limiting additional evaporation from the soil and transpiration from the understory in the summer (Littell 2007, *pers comm*). Such thinning could also maximize the duration of snowpack in spring by having an open enough canopy that more snow accumulates in the ground rather than on the forest canopy, yet, is still shaded from melting by the sun in the spring.

The resulting increased available moisture, in turn, could reduce the risk of dead or drought-stressed trees created by increasing temperatures and changes in precipitation caused by climate change and that would be susceptible to fire and disease in the near-term. Given that late-successional and old-growth forests are generally thought to be more resilient to climate change, the aim of this project to promote late-successional and old-growth forest conditions should also serve to better protect the forest from climate change impacts. Increasing forest habitat connectivity would also allow species to reach new locations as climate change alters existing habitat (Climate Action Group 2004a). As noted in this Environmental Assessment (EA), watershed analysis documents and project-specific analysis describe the general current conditions in and around the project area as being fragmented habitat with limited quality, quantity, and distribution of mature and old-growth forest.

Diversifying forest structure and promoting the development of late successional habitat characteristics in simplified, second-growth stands as proposed would: 1) accelerate the development, 2) increase the amount and 3) increase the connectivity of old-growth habitats. Under the No Action Alternative, simplified, second-growth forests would be left to continue through the stand development without intervention, and opportunities to accelerate development of late-successional and old growth forest characteristics would be foregone.

Climate change may affect an increase in peak flows with a correlating risk to roads, potential landslides and downstream flooding. According to the Climate Impacts Group (2006a, 2007), however, while changes in precipitation are less certain than changes in temperature, most models predict modest changes in regional precipitation through the mid-century. Models suggest that there would be slight decreases in summer precipitation and slight increases in winter changes, but little change in the annual mean by mid-century. Winter precipitation changes are predicted to be largest in December – February, but still within the range of year-to-year variability observed during the 20th century. A larger percent of the precipitation, however, would fall as rain rather than snow with the warmer temperatures, but natural year-to-year and decade-to-decade fluctuations in precipitation are likely to be more noticeable than longer term trends associated with climate change. While an increased likelihood of extreme

precipitation events may also be a result of climate change, there is little information to confirm the increased risk for the Pacific Northwest region. The environmental effects to soils analyzed and documented in the EA details slope stability conditions being low risk. Given the fact, however, that no new permanent roads would be constructed as part of this project, that temporary roads built are expected to be decommissioned within five years of their construction, and that road management requirements listed in the Project Design Criteria would minimize impacts to water quality and fish habitat (e.g., culverts that remain for more than 1 year must be able to accommodate 100-year peak flows, as required by Appendix A of the MOU between the Washington Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region, Regarding Hydraulic Projects Conducted by the USDA Forest Service, Pacific Northwest Region), global climate change is not expected to discernibly increase the risk of the roads used in this project causing landslides and downstream flooding.

Forests can play an important role in mitigating climate change by naturally taking carbon out of the atmosphere (Perschel et al 2007). The forest vegetation in the project area is sequestering carbon, which is the uptake and storage of carbon. There may be some effect on carbon sequestration by the removal of tree biomass associated with the action alternatives, however this is a complex issue and tools are not available to estimate the impacts at the fine project scale and put those impacts into context of the overall carbon budget at regional or global scales (Gravenmier per com 2008).

Uncertainty limits our ability to know what effects the alternatives might have on carbon sequestration. The state of our understanding of this issue is not developed enough for us to make conclusions at the project scale. But considering the relatively small potential impact of this project (partial tree removal on about 2,200 acres out of the over 600,000 acres on the Olympic National Forest) it is reasonable to assume that any project impacts would be so small at the regional carbon budget scale that it is acceptable to act even in the face of uncertainty.

Effects of Climate Change on Invasive Species

Global climate change is predicted to alter precipitation and seasonal temperature patterns, as a result of increased levels of atmospheric carbon dioxide (CO_2) and other factors (Mote 2004). Most recent studies on the interaction between climate change and invasive plants conclude that climate change is likely to favor invasive plant species to the detriment of native plant species for individual ecosystems (Chornesky et al. 2005, Climate Change Science Program 2008, Dukes and Mooney 1999, Hellmann et al. 2008, Pyke et al. 2008). In some studies, invasive plant species have demonstrated increased growth rates, size, seed production, and carbon content in the presence of elevated CO_2 levels (Rogers et al. 2008, Rogers et al. 2005, Smith et al. 2000, Ziska 2003). Warming climates may remove elevational barriers to invasive plant distribution that currently exist (Tausch 2008).

Many invasive plants are species that can thrive in the presence of disturbance and other environmental stressors, have broad climatic tolerances, large geographic ranges, and possess other characteristics that facilitate rapid range shifts. The predicted changes in climate are thought to contribute additional stressors on ecosystems, including those on National Forests, making them more susceptible to invasion and establishment of invasive plant species (Joyce

et al. 2008).

Predicted conditions may also make management of invasive species more difficult. Some current treatments used on invasive plants may be less effective under conditions of climate change scenarios and/or elevated CO_2 (Hellmann et al. 2008, Pike et al. 2008, Ziska, Faulkner, and Lydon 2004).

Predicting how climate change will affect invasive plants, and invasive plant management, at the local or even regional scale is more difficult to deduce than are these general indications. Anticipated changes in the climate for the Pacific Northwest (e.g. more rain, less snow, warmer temperatures (Mote 2004, Mote et al. 1999, National Assessment Synthesis Team 2000) or elevated $C0_2$ may not be realized at a local area, particularly within the time frame of this analysis. Growth of invasive plants under elevated CO_2 conditions will also be influenced by environmental conditions such as soil moisture, nutrient availability, and the plant community in which the invasive species occurs (Cipollini, Drake and Whigham 1993; Curtis, Drake, and Whigham 1989; Dukes and Mooney 1999; Johnson et al. 1993; Taylor and Potvin 1997). The complex interaction of multiple and uncertain variables make site-specific predictions speculative.

Current science is insufficient to precisely determine a cause and effect relationship between climate change and the Proposed Action for the project area. A general conclusion, based on the preponderance of current literature, suggests that "most of the important elements of global change are likely to increase the prevalence of biological invaders" (Dukes and Mooney 1999). The National Forest landscape will become more vulnerable to the establishment of invasive plants infestations, actual acreage affected by invasive plants could increase, and control strategies may become more difficult. Recommended management responses to these predictions are early detection (resulting from regularly scheduled monitoring) followed by a rapid response to eradicate initial infestations (Hellmann et al. 2008, Joyce et al. 2008, Tausch 2008).

Given that all alternatives include control of invasive plants with an early detection/rapid response component, and the large uncertainties regarding effects of climate change at any specific location over the time frame of this project, there is insufficient information to discern any meaningful differences between alternatives. All actions are consistent with recommendations for management response in the face of potential influences of climate change on invasive plants.

Irreversible and Irretrievable Commitment of Resources, Unknown Risks and Precedents

No irreversible or irretrievable commitments of resources are associated with any alternative. While roads are often considered irreversible, all roads constructed in this project are temporary and would be decommissioned and returned to productivity, along with all existing unclassified, abandoned roads used for this project. This project is consistent with current scientific and ecosystem management concepts and does not involve unknown risks or precedents.

Public Health and Safety

Public health and safety would be protected by adherence to Occupational Safety and Health Administration (OSHA) and other laws.

Socio-economic Effects

Employment and personal income would be generated by the value of the wood products that may be produced by the action alternatives (Alternatives B and C). While small in the context of the Olympic Peninsula economy overall, these benefits would contribute to social and economic well-being of the local economy.

Environmental Justice

The effects of the proposed action and the alternatives thereto are discussed throughout Chapter 3 of this document. These effects are expected to be similar for all human populations regardless of nationality, gender, race, or income level. None of the alternatives entails any known inequitable distribution of social or environmental consequences to a particular group or segment of society.

Impacts to the gathering of special forest products such as salal were identified as having the potential to disproportionately affect minority populations. Given that only one of the proposed stands had evidence of salal harvesting, however, it is expected that there would be little negative impacts to salal harvesting opportunities. On the contrary, this project would promote the growth of vegetation on the forest floor including salal in treated forest stands.

Therefore, there are no known negative effects of any of the alternatives on civil rights, women, or minorities.

Analysis File

The analysis file is considered an integral part of the environmental assessment. The analysis file includes:

- Olympic National Forest Programmatic Biological Assessment Project Consistency Evaluation Form
- Public Comment Files
- Cultural Resources Report
- Specialist Reports