

CHAPTER 3: ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives.

As the environmental consequences of Alternative B (Proposed Action) are so similar to those of Alternative B (modified), unless specifically noted otherwise the effects described for Alternative B in this chapter apply to both versions of Alternative B.

Cumulative Effects

According to the Council of Environmental Quality (CEQ) NEPA regulations, “cumulative impact” is the impact on the environment which results from the increased impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7). This project’s cumulative effects analysis was guided by the June 24, 2005 CEQ Memorandum “Guidance on the Consideration of Past Actions in Cumulative Effects Analysis”, which provides guidance on the extent Federal agencies are required to analyze the environmental effects of past actions.

Past, present, and reasonably foreseeable future actions in or adjacent to the project area are listed below. The area of consideration for cumulative effects analysis varies by resource area, as how the following listed actions relate to a particular resource. Consequently not all past, present, and reasonably foreseeable future actions are discussed for each resource area.

Past activities are described in detail in the Sol Duc Watershed Analysis and include the following:

- Construction of gravel and paved roads in the vicinity.
- Timber harvest activities.
- Human caused wildfires, and
- Construction of powerline corridors and associated access roads.

Of these past activities wildfires have had the dominant role in affecting the area, resulting in almost complete removal of late-successional habitat.

Invasive Plants

Affected Environment

Noxious weeds and other invasive plants may pose a serious threat to the health of National Forests. Executive Order 13112, Invasive Species (Feb. 1999), provides direction that “Federal agencies shall: (1) prevent the introduction of invasive species; (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably; (4) provide for restoration of native species and habitat conditions in

ecosystems that have been invaded.” Prevention of invasive plant spread or new infestations, along with timely treatment and monitoring of infestations are key objectives for the Olympic National Forest (2080 letter from Forest Supervisor, 2/4/2005).

Invasive species surveys were conducted during the July 8, 2004 survey. Six invasive vascular plants were documented.

Table 4 Invasive Plant Species

Scientific name	Common name	Washington State Weed Classification*
<i>Cytisus scoparius</i>	Scotchbroom	B
<i>Geranium robertianum</i>	Herb Robert	B
<i>Hypochaeris radicata</i>	Hairy catsear	B
<i>Lathyrus latifolius</i>	Everlasting peavine	unclassified
<i>Leucanthemum vulgare</i>	Oxeye daisy	B
<i>Senecio jacobaea</i>	Tansy ragwort	B

*B = Non-native species presently limited to portions of the state. Species are designated for control in regions where they are not yet wide-spread. Preventing new infestations in these areas is a high priority. In regions where these species are already abundant, control is decided at the local level with containment as the primary goal.

Cytisus scoparius (Scotchbroom) is an invasive, highly aggressive, flowering shrub that forms dense monotypic stands that displace native vegetation. It thrives in areas of full sun and is often found along roadsides. Seeds and other plant parts are toxic to humans, horses and livestock. It is difficult to eradicate due to substantial and long-lived seed bank. This plant has been documented in the project area along existing forest roads and in an old gravel pit through which the Mt. Muller trail runs.

Geranium robertianum (Herb Robert) is a low growing, herbaceous, winter and spring annual. It is capable of growing under full canopy in very dense populations and thus poses a threat to forest understories and plant biodiversity. It is spreading rapidly in western Washington. This species is found growing beginning where the proposed new construction meets the Mt. Muller trail in the east to where the proposed trail leaves the Mt. Muller trail (Segment 9).

Hypochaeris radicata (hairy catsear) is a perennial plant with yellow flowers resembling a dandelion. It is European in origin and widely established. It is a weed of disturbed sites and waste areas. It is found in the project area along existing forest roads and on the Mt. Muller trail in the gravel pit area (Segment 9).

Lathyrus latifolius (everlasting peavine) is a rhizomatous, deep-rooted legume that climbs through the use of tendrils and can attain heights of 5-7 feet if support is available. When no support is available, the plant forms a viney mat 18-30 inches thick. It grows best in

full sunlight. Once established, the dense mats displace native, desirable vegetation if not properly managed.

Leucanthemum vulgare (Oxeye daisy) is a perennial herb common in waste areas, meadows, railroad rights-of-way and roadsides. It can grow in a wide range of soils especially those low in PH and nutrients. Oxeye daisy can spread both vegetatively and by seed. It aggressively invades fields, where it forms dense populations thus decreasing plant species diversity. In areas of heavy infestation, bare soil is more common, which increases the potential for soil erosion. It is found sporadically through the project area.

Senecio jacobaea (tansy ragwort) is typically a biennial herb but may behave as a perennial if the flowering stalk is injured in any way while flowering. Vegetative regeneration can then occur from crowns, root fragments or intact roots. It also reproduces by seed which can range from 5000 to 20,000 per plant. It is a weed of disturbed sites, waste areas, roadsides and forested areas recently harvested for timber. All parts of the plant are toxic to livestock and humans. It is found sporadically through the project area.

Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects

There would be no direct effect from Alternative A

The No Action alternative would indirectly result in continued spread and new infestations of invasive plant species in the project area where existing roads and trail use occur.

Under the Alternative A, 3.5 miles of unpaved existing trail and railroad grade would continue in their present condition, representing about 3.9 acres of exposed soils suitable for invasive species. On going road maintenance in the form of 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. Invasive plants would therefore continue to spread along the road/trail area.

Cumulative Effects

Under the No Action alternative, existing infestations of invasive plant species would likely continue to spread and would eventually extend beyond the project boundaries into adjacent areas outside the project area.

Alternative B (Proposed Action)

Direct and Indirect Effects

Under Alternative B, about 8.9 acres of total 17.8 acres of trail/road would be paved, resulting in a net of 8.9 acres of unpaved bare mineral soil exposed to invasive species. Alternative B therefore increases the total area of exposed mineral soil subject to invasion. However the paved trail would allow for easier vehicle access to all segments of the trail, potentially increasing the efficiency and effectiveness of invasive species management. The improved road would be maintained without re-grading, instead using routine mowing along the edge of the paved surface and/or manual or mechanical herbicide applications, resulting in lower potential for seed dispersal and less potential for soil containing seed to spill downslope.

Domestic stock animals can contribute to plant invasion through selective grazing of desirable native plants and plant trampling over time resulting in increased disturbance and bare soil, conditions that often favor weedy species. Invasive plants can find their way onto National Forest lands in weed infested feed provided for pack animals and resultant infested manure deposits. Increased equestrian use of trails could offset the benefits of paving and enhanced control of invasives associated with Alternative B.

In order to control noxious weed colonization and spread under the proposed action, weed-spread prevention and weed eradication activities will be implemented before, during and after the proposed action (see Mitigation Measures and refer to compliance with the “Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants” Record of Decision, October 2005). With implementation of these mitigation measures and considering the improved vehicle access on the paved trail, the proposed action would likely enhance control of invasive plant spread and treatment of current infestations.

Alternative B (Modified)

Direct and Indirect Effects

Effects would be similar as described for Alternative B (Proposed Action) but with a more likely enhanced control of invasive plant spread over Alternative B (Proposed Action). This increased control is due to the added years of post-project monitoring and removing the caveat that post implementation survey and monitoring be dependent on funding.

Cumulative Effects for Invasive Plants

This document analyzes only the portion of the Olympic Discovery Trail that is proposed to be constructed on National Forest System land. It is however a part of a larger trail system that enters the project area in the east from the Olympic National Park and exits the project area in the west onto Washington State Department of Natural Resources (WA DNR) and private land ownerships. It is unknown what, if any, invasive plant

species exist on these adjacent land holdings or what prevention and control measures might be in place. It is reasonable to anticipate that if invasive species are present they could be inadvertently transported across ownership boundaries by the trail users. This is more likely if horses use the trail, consuming seeds of invasive plants and depositing them along the trail in manure. To the extent that the Olympic Discovery Trail increases equestrian use Alternative B may result in a cumulative increase in the distribution of invasive species. Improved invasive management may offset this cumulative effect (see Mitigation measures concerning the requirement for certified weed free feed).

Past activities that have likely contributed to the spread of invasive plant species within the Sol Duc watershed 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.

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 and private holdings that could potentially introduce additional unwanted species to National Forest System lands via timber hauling on Forest Service roads.
- Forest Service road decommissioning and culvert replacement projects.
- Proposed KV weed treatment projects.

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 a canopy would generate that would shade out the less shade tolerant weed species. Proposed manual and herbicide treatment of weeds would have positive results in the prevention of invasive plant spread and treatment of current infestations.

Fire

Affected Environment

The risk of fire occurrence in the project area is moderate with large fires historically occurring approximately every 200-250 years. The entire area surrounding the proposed trail was burned over by fires occurring in 1308, 1508 and 1701. Historical data suggest these fires burned with high intensity resulting in total stand replacement throughout the landscape except for some small areas within the riparian areas of the Sol Duc River. Fire occurrence in the Sol Duc Valley increased starting in the mid 1860's when non-native settlement began in this general area, especially the south facing slopes of Snider

Ridge between Fairholm Hill and Bear Creek Road. The average return period for fires occurring in that area since the mid 1860's is approximately 32 years which makes it one of the highest fire return periods on the Olympic Peninsula. Fires that affected the project areas since the 1860's are: Kugel Creek Fire in the early 1890's (Segments 1, 2), the Great Soleduck Fire of 1907 (Segments 7, 8, 9, 10), a fire in 1938 in the Camp Creek area (Segment 3) and the Great Forks Fire of 1951 (Segments 4, 5, 6).

There are several factors influencing the moderate fire risk in the project area. The first is the significant topographic feature of the Sol Duc Valley. The Sol Duc Valley has an east-west orientation that is open on both ends. This orientation allows for east wind events to be funneled through the valley with wind velocity increasing as it passes through Fairholm Pass. A second topographic feature affecting fire risk is the steep south facing slopes of Snider Ridge, which allow vegetation to dry out quickly in summer months. Fuel loading is another factor influencing fire risk. Within the project area, fuel loadings are high with heavy concentrations of large down material, heavy brush and under story vegetation providing ladder fuels, resulting from logging debris and a dying offsite Douglas- fir stand that was planted by the CCC's in the 1930's.

Fire statistics for the Pacific Ranger District for the past 11 years show the greatest risk for fire ignition to be human caused. Escaped campfires are the number one cause, lighting is second and other human fires (smoking, fireworks) are third. The average size for wildfires for the Pacific Ranger District for the past 11 years is 1/10 acre per fire.

Environmental Consequences

Alternative A (No Action):

Direct/Indirect/Cumulative Effects

Fire risk in the project area will remain at its current level. There will be no increase to fire risk.

Alternative B (Proposed Action)

Direct Effect

The proposed action will cause a short term increase to fire risk due to increased slash along the proposed trail. Requiring complete disposal of all construction debris would mitigate this increased risk.

Indirect Effects

Given that fire risk is associated with the level of human activity, the proposed project would increase the risk of fire, in part due to careless smoking, because use of the area would increase. Non-motorized trail use would probably not increase use of the area for camping. Bicyclists and equestrians may travel longer distances each day than hikers,

and thus the incremental increase in trail use by these users would not necessarily increase camping and resulting use of campfires.

To the extent that bicyclists use of the trail increases, trail use by bicyclists may increase the incidental public "monitoring" of fire and may increase the speed with which fire is reported. The paved surface may allow improved emergency vehicle access and result in more rapid and effective fire suppression. Where the existing road/trail is widened, there may be marginal improvements preventing fire from jumping the trail. Increased levels of routine vegetation maintenance may reduce potential for fire in vegetation along the trail.

Fire occurrence will be monitored and addressed in the Operation and Maintenance Plan (O&M Plan). The O&M Plan would include how the trail users will be made aware of the need to practice appropriate fire safe practices.

Cumulative Effects

The proposed trail (Segments 7, 8, 9, 10) traverses an offsite Douglas-fir stand. This timber stand is slowly dying, resulting in increased fuel loads. If a fire were to occur in this area it has the potential to be intense and fast moving. The increased access for emergency vehicles would partly mitigate this risk.

Fisheries

Affected Environment

The majority of the Olympic Discovery Trail project area is located in the Sol Duc River watershed. A segment (FSR 3079-011) of the proposed trail is in the Lake Crescent watershed and is not considered significant in terms of effects due to the size and location of this segment and its limited potential to impact the fisheries resource. This analysis will focus on three Sol Duc River sub-watersheds (6th field) within the project area: Upper Sol Duc River, Middle Sol Duc River and Bockman Creek.

The Sol Duc River watershed provides habitat for a total of 12 distinct stocks of anadromous salmonids. Spring, summer and fall Chinook, summer and fall coho, winter and summer steelhead and sea run cutthroat are the primary salmon species found within the project area sub-watersheds. Major salmon bearing streams within the National Forest, located along the proposed trail are Camp Creek (Segment 3), Kugel Creek (Segments 1, 2), Shuwah Creek (FSR 2902-300, Segment 0-A) and Bockman Creek (FSR 2902, Segment 0-B). Numerous non-fish bearing streams will be crossed by the proposed trail. Many of these non-fish bearing streams are intermittent, seasonally flowing streams, that are dry in the summertime and during other periods of extended dry weather. Some of these intermittent streams flow directly into the Sol Duc River mainstem, particularly along the FSR 2929-070 (Segment 3).

Streams draining off of Snider Ridge in the segment designated for new trail construction are unique, in that when they reach the Sol Duc valley floor they go sub-surface into the

deep, glacially deposited gravels. These streams do not connect with the Sol Duc River, but form forested wet areas.

The proposed trail crosses several bridges and culverts on fish bearing streams, in addition to numerous culverts on non-fish bearing streams. The two bridges located along FSR 2902, cross Bockman Creek and one of its tributaries. The permanent bridges are constructed of concrete and meet the current guidelines and regulations for road crossing structures on fish bearing streams. Further up the FSR 2902 is another stream crossing structure, a culvert that connects a tributary of Bockman Creek with a wet area. Anadromous fish utilize this tributary and wet area.

Drainage along FSR 2902 can be problematic in certain locations but in this instance it is due to the large volumes of surface water generated by the local geology. During storm events surface flow can overwhelm the current road drainage capabilities, causing overland flow onto the road. This is particularly true in the section of the FSR 2902 crossing the Bockman Creek drainage.

The bridge crossing on Camp Creek, along FSR 2929-070 (Segment 3) was constructed to provide for temporary access. The current crossing is believed to have been installed over Camp Creek for timber sale access back in the early 1980's. The bridge does not meet current guidelines for road crossing structures on fish bearing streams. Site surveys indicate that the bridge constricts the channel by at least 35%. When channel migration corridors are included in calculations, the number increases to almost 50%. The Sol Duc Pilot Watershed Analysis (USDA 1995) identified the bridge as a cause for channel constriction and a restoration opportunity.

Drainage along the FSR 2929-070 (Segment 3) is very poor in some locations. The through cut for the road right of way prevents water from draining off of the road surface. Water sits on the roadway until it either evaporates or is absorbed into the ground.

Culverts along the FSR 2929-070 (Segment 3) do not currently meet Northwest Forest Plan standards for stream flow and debris transport. Most of the culverts are reported to be in need of replacement (Appendix 5, Culvert Replacement for Olympic Discovery Trail Proposed Route).

Environmental Effects

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 affected by road / trail construction, reconstruction, and improvements where stream crossings are involved. Indicators are: sediment / substrate embeddedness, channel width to depth ratio, streambank condition, drainage network increase, 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 assessment of the indicators is more qualitative than quantitative, and is based the reviewers professional judgment.

Alternative A (No Action)

Direct Effects

This alternative would maintain the current watershed conditions and would not directly change any indicators. Fish habitat conditions would remain dynamic relative to the current watershed conditions.

Sediment / substrate embeddedness – maintain - Alternative A would not change the current level of sediment input from road runoff and would maintain the current condition.

Channel Width/Maximum Depth – maintain – streambank armoring at the Camp Creek bridge crossing constricts the natural channel width by 35-50% and results in streambed scour (deepening).

Streambank Condition – maintain – Alternative A would maintain the current condition. Watershed processes affecting streambank scour would remain unchanged.

Drainage network increase – maintain – Alternative A would maintain the current drainage network.

Road density and location – maintain - Alternative A would maintain the current level of miles of road in the project area sub-watersheds.

Function of Riparian Reserve – maintain – Riparian vegetation along the proposed trail is maturing and moving towards becoming fully functioning.

Indirect Effects

Without the Olympic Discovery Trail access needs, there is a reasonable expectation that resource management issues concerning the Camp Creek Bridge could be addressed. Since removal (versus replacement) is relatively inexpensive, funding would be more easily secured, enabling the National Forest to restore that segment of stream channel.

Cumulative Effects

There are no expected cumulative effects associated with the No Action Alternative.

Alternative B (Proposed Action)

Direct Effects

The new construction (Segment 10) would require several stream crossings at the west point where it's proposed to connect to the Mt. Muller Trail. These intermittent streams form a forested wet area where they flow onto the valley floor. The proposed trail crossings are at transition points, where the stream goes from an incised channel to an unconfined, depositional channel. The County is proposing to use a bridge on one stream and an arch pipe on the other. Both types of crossing structures would result in a degree of localized stream bank and channel disturbance (site level), mainly causing sedimentation downstream. Given the locations indicated by the County planner during a field visit, the arch culvert may impinge on the forested wet area. Alternative B (modified) would require a modified culvert and bridge design and/or modified locations which would minimize potential impacts to the stream bank and channel as compared to Alternative B (Proposed Action).

Stream flows at all crossings in the new construction, in addition to one or two along the Spruce Railroad grade, would not be expected to be altered. Effects to the hydrologic functioning of the wet area should not be altered. Riparian vegetation would be removed to accommodate the trail design standards.

Portions of FSR 2929-070 (Segment 3) lack adequate road drainage. Surfacing of the road with asphalt may exacerbate the problem due to the impermeable surface. Four tributaries cross under the FSR 2929-070 (Segment 3), that drain directly into the Sol Duc River. It is not clear if putting an asphalt surface on FSR 2929-070 (Segment 3) may affect the quantity and quality of road runoff delivered to these tributaries. The amount of water available as runoff may increase due to the asphalt surfacing and find new pathways by creating gullies. It is possible that an increase in surface flow may cause scour in the ditches. The direct effects of Alternative B should have minimal impact to water quality and fish habitat. Trail segments along the FSRs 2902 and 2902-300 would not require improvements or reconstruction and would not have any effect on water quality or fish habitat.

Sediment / substrate embeddedness – degrade – the installation and replacement of several culverts and a bridge would cause localized bank and streambed disturbance. Bank and bed disturbance would result in increased sediment production of unknown quantities and should be of limited duration (1 year or less). The impact to fish habitat should be minimal since most of the streams directly affected are non-fish bearing. An increase in runoff into ditches along FSR 2929-070 (Segment 3) may also increase ditch scouring and sediment production that would be transported to the stream channel network.

Channel Width/Maximum Depth – maintain – streambank armoring at the Camp Creek bridge crossing constricts the natural channel width by 35-50% and results in streambed scour (deepening). Indicator would not change in this alternative

Stream bank Condition – degrade – the installation and replacement of several culverts and a bridge would cause localized stream bank disturbance. It is expected to be a short term disturbance as the banks re-vegetate in 1 – 2 years.

Drainage network increase – degrade – Alternative B would increase the current drainage network on the new construction trail segments. Ditch lines along this segment of trail may intercept ground water flow, directing the water towards creeks in this segment and in effect becoming tributaries to those creeks.

Road density and location – degrade – Alternative B would increase the number of trail miles in the Upper Sol Duc sub-watershed by 1.5 miles. While the impacts associated with new trail construction are similar to new road construction, the trail would not have the long term erosional impacts of an active road, since trail use will be limited to non-motorized use only.

Function of Riparian Reserve – degrade – Riparian vegetation along the proposed trail is maturing and moving towards becoming fully functioning. There would be disturbance and loss of riparian vegetation in areas where new trail construction (1.5 miles) and reconstruction (2929-070) are required; from installing and replacing stream crossing structures, meeting clearing limit standards, and removing potential danger trees.

Indirect Effects

The proposed trail plans to utilize the existing bridge over Camp Creek. The bridge decking will require some improvements for use by horses and bicyclists. The problems of stream channel constriction would not be addressed as long as the current bridge on Camp Creek remains.

Cumulative Effects

The Sol Duc River watershed has some of the earliest recorded history of settlement and land use, mainly timber harvesting. Early logging was conducted using railroads as a means of transporting logs. The Sol Duc valley and the Camp Creek drainage have experienced large scale historical fires, resulting in mass wasting and sedimentation, and a loss of riparian trees, all negatively affecting streams and fish habitat. The trail spans several sub-watersheds within the Sol Duc River (5th field) watershed, crossing a number of land ownerships and managements. Within the lands held by private timber companies and the Washington Department of Natural Resources in the Sol Duc River, it is expected that clear cut timber harvesting and new road construction will continue into the future. Improved Washington State forest practices rules requiring riparian leave strips and road management planning will improve and protect fish habitat and water quality.

On National Forest System lands timber harvesting, under the NWFP, is restricted to young second growth stands that are thinned, not clearcut. National Forest System lands

along FSRs 2929, 2929-070, and 2902 have been thinned in the last decade and all temporary roads have been closed and abandoned. No new permanent Forest Service System roads are expected to be constructed in any of the project area sub-watersheds. Within the project area sub-watersheds, restoration activities have been focused mainly in the Shuwah, Bear Creek and Bockman Creek drainages. Restoration has been directed at restoring fish passage, replacing instream large woody debris, and restoring conifers in riparian areas for long term woody debris recruitment. Road decommissioning has been focused mainly in the Upper Sol Duc River sub watershed. Several miles of system road have been decommissioned in the South Fork Sol Duc and Goodman Creek drainages during the last 10 years. Future decommissioning is planned but is dependent on funding. Restoration aimed at restoring terrestrial and aquatic habitat would continue for the remainder of the decade on the National Forest. The impacts associated with the trail construction such as stream bank and stream bed disturbance would have a short term impact on water quality. Loss of riparian vegetation will be localized at specific sites. The long term impact of the trail is not expected to incrementally add to cumulative effects in the watershed. Aquatic habitat would continue to improve.

ACS Consistency

The Olympic National Forest Plan was amended in March 2004 to require the following analysis for projects within Riparian Reserves:

The record for a project within a Riparian Reserve must: (1) describe the existing condition, including the important physical and biological components of the fifth-field watershed(s) in which the project area lies; (2) describe the effect of the project on the existing condition; and (3) demonstrate that in designing and assessing the project the decision-maker considered and used, as appropriate, any relevant information from applicable watershed analysis. (USDA, USDI 2004)

As a general rule, standards and guidelines for Riparian Reserves provide direction that activities in Riparian Reserves “meet,” “not adversely affect,” “not retard or prevent attainment of” the Aquatic Conservation Strategy (ACS) objectives.

The project would be consistent with Riparian Reserve standards and guidelines of the Northwest Forest Plan. The decision maker must determine from the record that the project is designed to contribute to “maintaining or restoring” the ecological health of the watershed.

The existing watershed condition is discussed throughout the Affected Environment sections of this EA, based on information contained in the Sol Duc Pilot Watershed Analysis and other documents. The most important environmental indicators regarding the effects of this project are discussed in the Affected Environment section of this EA and the predicted effects on these indicators are summarized for the alternatives.

Alternative A (No Action) and Alternative B (Proposed Action) both meet the Riparian Reserve standards and guidelines and ACS objectives of “maintaining or restoring” the ecological health of the watershed. Alternative A (No Action) would maintain the current watershed condition, which over time will continue to improve, restoring the watershed’s ecological health. Impacts associated with Alternative B (Proposed Action) would not be significant when measured at the 5th field watershed scale.

Most of the impacts described would be short term and localized at the site scale. While the “foot print” of the trail would be long term and could be considered as an increase in road miles, requiring several new stream crossings and riparian vegetation removal, the impacts are limited to the sub-watershed scale. Alternative B will not prevent attainment of the ACS objectives of “maintaining or restoring” the ecological health of the watershed at the 5th field.

Federally Listed Species - Fisheries

There are no federally listed or proposed fish species in the Upper Sol Duc River, Middle Sol Duc River and Bockman Creek sub-watershed project area.

Direct, Indirect, Cumulative Effects

There will be no direct, indirect, or cumulative effects because there are no federally listed or proposed species in the project area and associated sub-watersheds.

Regional Forester’s Sensitive Species List – Fisheries

The Regional Forester’s sensitive species list of fish that may occur on the Olympic National Forest are Lake Pleasant and Lake Quinault sockeye, coastal cutthroat trout, coastal Chinook salmon, Pacific coast chum salmon, Olympic mud minnow and Salish sucker. Lake Pleasant and Lake Quinault sockeye, the Olympic mud minnow and Salish sucker are not found in the Sol Duc watershed or are found outside of the project area watersheds. Coastal Chinook salmon, fall chum salmon and coastal cutthroat trout are found in the project area watersheds.

Direct, Indirect, Cumulative Effects

No habitat for these species would be directly impacted by the project. Indirect impacts (downstream impacts from sediment) are minimized by incorporating design features and mitigation measures listed in Chapter 2. Therefore, no sensitive fish species are expected to be adversely impacted by action Alternative B.

Essential Fish Habitat

This project would not adversely affect essential fish habitat for Chinook, coho, or pink salmon. Pink salmon are not found in Camp Creek, Kugel Creek or Bockman Creek drainages. Coho and Chinook salmon are found in Camp Creek and Bockman Creek.

Direct, Indirect, Cumulative Effects

Neither alternative would have any impact to the species or its habitat, and any effects to water quality or quantity should be minimal.

Wildlife

Affected Environment

The wildlife analysis is broken up into four sections to make it easier to understand when addressing such issues as spotted owl and marbled murrelet critical habitat, suitable and dispersal habitat, and late-successional reserve and adaptive management area (AMA) designations. The sections are the following:

1. West Section----includes the Forest Service System roads (FSR) 2902-300 and 2902
2. Middle Section----includes the Mary Clark & Cooper Ranch road on National Forest System land and Segments 1 through 5
3. East Section----Segments 7 through 10
4. Far East Section----FSR 3079-011 near Lake Crescent

All of the proposed trail falls within the Sol Duc watershed except for a very small piece, approximately 0.75 miles on the Mary Clark and Cooper Ranch roads, which lies within the Calawah River watershed; and 0.43 miles in Segment 10 and FSR 3079-011 (Far East Section) road which are both within the Lyre River/Twin River watershed. When describing available habitat, this analysis will focus on the Sol Duc watershed.

Wildlife habitat in the project area encompasses several forest successional stages and riparian habitats that provide cover and forage for many species of mammals, birds, amphibians, reptiles, and mollusks. What is currently available is reflective of the various plant associations, representing low elevation temperate rainforest, and the effects of past management practices, primarily logging and road building, as well as natural disturbances such as fire. The Sol Duc Pilot Watershed Analysis and Soleduck Late Successional Reserve Assessment describe wildlife habitat characteristics that encompass portions of the project area. General concerns regarding wildlife habitat in the Sol Duc watershed include an already high degree of fragmentation, remaining core habitat for forest interior species, low levels of snags, quality of dispersal habitat, and high road densities and related disturbance (primarily for elk) (Sol Duc Pilot Watershed Analysis 1995). The Calawah Ridge Block of the Soleduck Late Successional Reserve Assessment (LSR), adjacent the FSR 2902-300, is the only portion of the LSR near the proposed trail (all the other segments are in AMA-adaptive management areas). Additionally, portions of the trail traverse critical habitat units for spotted owl and marbled murrelet.

The proposed action would form a linear recreational route through a combination of National Forest, National Park, state, and private lands. Much of proposed trail is already in place, including FSRs 2902-300, 2902, 2929-070 (Segment 3), Segment 5, FSR 2918, FSR 3079-011, the Mary Clark Road, and the Cooper Ranch Road; and would not significantly add to the impact on wildlife species except in terms of increased human presence. Other segments requiring new trail construction and paving existing Forest Service system roads would be more consequential.

Section 7 Consultation with the U.S. Fish & Wildlife Service (USFWS) will be completed prior to issuing a decision on this project. The U.S. Forest Service will prepare a Biological Assessment (BA) examining the effects on threatened and endangered species from the proposed action on the Olympic National Forest, Pacific Ranger District. Subsequently the USFWS will issue a Biological Opinion addressing acceptable levels of impact.

This wildlife analysis focuses on special status species including those listed under the Federal Endangered Species Act (ESA), the Forest Service Region Six Sensitive Species and Survey and Manage Lists, Management Indicator Species (from the Olympic Land & Resource Management Plan, LRMP), and Forest Landbirds.

Federally Listed Species - Wildlife

The project area provides habitat for three wildlife species listed under the ESA: the threatened northern bald eagle (*Haliaeetus leucocephalus*), the threatened northern spotted owl (*Strix occidentalis caurina*), and the threatened marbled murrelet (*Brachyramphus marmoratus*). Designated Critical Habitat for the northern spotted owl and marbled murrelet are within the boundaries of the analysis area. The table below shows federally listed and Regional Forester's sensitive animal species potential occurrence in or adjacent to the analysis area.

Table 5 Federal and Regional Forest status of wildlife species

Common Name	Species Name	Federal Status or FS Sensitive	Suitable Habitat Present in Analysis Area	Documented Sighting in Analysis Area
Marbled Murrelet	<i>Bachyramphus marmoratus</i>	Threatened	Yes	Yes
Northern Spotted Owl	<i>Strix occidentalis caurina</i>	Threatened	Yes	Yes
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened	Yes	Yes
Puget Oregonian (snail)	<i>Cryptomastix devia</i>	Sensitive/Survey and Manage	Yes	No
Burrington's Jumping Slug	<i>Hemphillia burringtoni</i>	Sensitive/Survey and Manage	Yes	No
Warty Jumping Slug	<i>Hemphillia glandulosa</i>	Sensitive	Yes	Yes
Malone's Jumping Slug	<i>Hemphillia malonei</i>	Sensitive/Survey and Manage	No	No
Blue-gray Taildropper Slug	<i>Prophyaon coeruleum</i>	Sensitive/Survey and Manage	No	No
Hoko Vertigo (snail)	<i>Vertigo n. sp.</i>	Sensitive/Survey and Manage	Yes	No
Evening Field Slug	<i>Deroceras hesperium</i>	Survey and Manage	No	No
Oregon Megomphix	<i>Megomphix hemphilli</i>	Survey and Manage	No	No
Van Dyke's Salamander	<i>Plethdon vandykei</i>	Sensitive	Yes	No
Cope's Giant Salamander	<i>Dicamptodon copei</i>	Sensitive	Yes	No
Olympic Torrent Salamander	<i>Rhyacotriton olympicus</i>	Sensitive	Yes	No
Common Loon	<i>Gavia immer</i>	Sensitive	No	No

American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Sensitive	No	No
Townsend's Big-Eared Bat	<i>Corynorhinus townsendii</i>	Sensitive	Yes	No
Pacific Fisher	<i>Martes pennanti</i>	Sensitive	Yes	Extirpated
Pocket Gopher	<i>Thomomys mazama</i>	Sensitive	Yes	No

Northern Spotted Owl

The Olympic National Forest spotted owl data confirms that three northern spotted owl home ranges (#151, 401, and 705) exist near the proposed trail. Two are on National Forest System land (West and Middle Sections) and one on private ownership (Middle Section). Fragmented forest exists throughout the home range areas, as well as within the analysis area. There is no resident habitat for northern spotted owl in the vicinity of the proposed trail alignment; this analysis therefore examines the amount of dispersal habitat removed, which totals approximately 1.52 miles, or 3.71 acres (Segments 4, 8, 9, 10). This figure only takes into account segments of “new construction.”

Northern spotted owl surveys have been conducted in various parts of the watershed. The most recent surveys on the National Forest sites were completed in 2005 by the Olympic Province demographic study conducted by the U.S. Forest Service, Pacific Northwest Research Station, Olympia. Reproductive status is documented during the survey. In portions of the analysis area that were not covered by surveys from the demographic study, all suitable habitat is considered occupied.

Table 6 Dispersal habitat designations and status of northern spotted owl activity

WDFW Site Number	Status ^a	Activity Center Year ^b	Ownership	.7 mile suitable habitat ^c (acres)	.7 mile dispersal habitat ^c	2.7 mile suitable habitat ^c	2.7 mile suitable habitat ^c
151	R	1996 (2005-No spotted owls, male barred owl found)	Olympic NF (.7 mile nest core-nearly 100% on ONF; 2.7 mile home range-approx. 2/3 on ONF)	532 (54%)	105 (11%)	3,392 (35%)	2,325 (24%)

401	R	1990 (2005-no detections)	Private (.7 mile nest core- 50% on ONF; 2.7 mile home range-approx 2/3 on ONF)	0	550 (95%)	966 (8%)	6,986 (60%)
705	S	1996 (2005-not surveyed)	Olympic NF (approximately 50% on ONF in nest core and home range)	4 (1%)	457 (86%)	445 (5%)	5,777 (63%)

^aStatus from most recent survey, R = Reproductive pair, P = non-reproductive pair, S = Single, H = Historic, U = Unknown.

^bYear in which highest status was determined.

^cNumbers are approximate, calculated from GIS data and include only acres on National Forest lands. Percentages are the relative amounts in each type of habitat on NF lands within the .7 or 2.7 mile areas.

WDFW Site Number	Proposed Trail		Proposed Trail Activities	
	Through .7 mile nest core	Through 2.7 mile home range	Through .7 mile nest core	Through 2.7 mile home range
151	.75 miles of existing road	3.0 miles of existing road	None	None
401	.16 miles of existing road and .2 miles of existing railroad grade	3.2 miles of existing road, 1.9 miles of existing railroad grade, and .39 miles of existing logging road	Reconstruction of existing railroad grade	Reconstruction of existing railroad grade and existing logging road
705	1.5 miles of existing road	5.5 miles of existing road and .45 miles of existing railroad grade	None	Reconstruction of existing railroad grade

Suitable and dispersal habitat available to the northern spotted owl is fragmented, to some degree, in all of the watersheds through which the proposed trail traverses. Of the 145,122 acres within the Sol Duc watershed, approximately 44% is designated as “potentially suitable” habitat (USDA 1995, page 2.10-5) with wide variation between sub-watersheds. Sixty-nine percent of those acres are on National Forest lands. Of the 46,607 acres on the National Forest, a little less than half, or 21,882 acres, have been harvested since 1921. Adjacent to the East and Far East Sections of the proposed trail is the Olympic National Park which contains the most contiguous spotted owl and marbled murrelet habitat on the Olympic Peninsula. The proposed trail on the National Forest is

located primarily through dispersal habitat. Fragmentation, the elimination of late-successional habitat, and quantity of dispersal habitat are referenced in the Sol Duc Pilot Watershed Analysis as concerns (USDA 1995, page 2.10-45).

There is a low likelihood, given that the proposed trail traverses dispersal and foraging habitat, that few, if any, trees adjacent to it would actually be occupied nest trees. Mean diameter for nest trees on the Olympic Peninsula is 54" and the proposed action would be removing only a few trees greater than 21" but all smaller than 40". However, surveys were not conducted for the project area and all suitable spotted owl habitat without current survey information is considered occupied.

Designated Critical Habitat for the Northern Spotted Owl

Portions of the West and Middle Sections of the proposed trail would fall within designated critical habitat units (CHUs) for spotted owl. FSR 2902-300 (West Section) traverses through a portion of Spotted Owl Designated Critical Habitat Unit WA-43. FSR 2929-070 (Middle Section) is adjacent to Spotted Owl Designated Critical Habitat Unit WA-45. CHU WA-43 includes a total of 5,963 Federal acres (USDI 2003), with suitable habitat calculated at 3,244 acres and dispersal, 1,063 acres. Of 22,603 total Federal acres in CHU WA-45, 6,470 acres are suitable and 12,292 acres are dispersal. The proposed trail traverses primarily dispersal habitat though it also bisects some small portions of suitable habitat in the Middle section. The factors to address for CHU's include the alteration of constituent elements: nesting, roosting, foraging; and dispersal habitats.

Marbled Murrelet

Surveys have been conducted in various parts of the Sol Duc watershed. The nearest occupied murrelet detections to the proposed trail, on National Forest System land, are approximately 0.83 miles away in the West Section (Sites 481 and 483). Surveys were not conducted for the project area, and all suitable murrelet habitat without current survey information is considered occupied.

Suitable habitat for marbled murrelet can be approximated by the habitat for the northern spotted owl. Some stands that have not quite developed into suitable habitat for the spotted owl may contain mistletoe brooms or large diameter limbs that are large enough to provide nesting platforms for the marbled murrelet. The manageable limiting factors for the marbled murrelet are quantity and quality of nesting habitat for the species and potential for disturbance.

Given that most of the proposed trail traverses dispersal habitat, which is not nesting habitat for murrelets, there is a low likelihood that few, if any, trees along the proposed trail would actually be large enough and contain the necessary components, such as large limbs, moss, and cover, to be occupied nest trees. However, there are some patches of suitable habitat along the Sol Duc River in the Middle Section that could potentially contain nest trees.

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 then rated areas as having high, moderate, or low risk based on the amount of edge and potential for predation. The West Section of the proposed trail rated out as having a high risk of predation; the Middle Section, a mix of low and moderate; the East Section had a moderate risk; and the Far East Section was a combination of low and moderate, mostly low.

Table 7 Suitable habitat for marbled murrelet detection sites

WDFW Site Number	Status	Year of Detection	Ownership	Suitable Habitat – 0.5 mi. radius
481	Occupied	1995	Olympic NF (100%)	254.4 acres (on ONF)
483	Occupied	1995	Olympic NF (100%)	265.1 acres (on ONF)

Designated Critical Habitat for the Marbled Murrelet

FSR 2902-300 (West Section) lies adjacent to Marbled Murrelet Designated Critical Habitat Unit WA-02A. This CHU is comprised of Federal lands and totals 16,000 acres, of which 73% is designated as suitable habitat (2004 Programmatic). The factors to address for CHU's include the effects to nesting habitat. There are trail construction activities planned for this section.

Most of the proposed trail, as stated previously, traverses through dispersal habitat, defined as those stands with trees greater than 11 inches d.b.h. and 40% canopy cover (USDA et al. 1990), which allows murrelets a modicum of safe travel but is not suitable for nesting by either owls or murrelets, however, FSR 2902-300 (West Section) is adjacent to suitable habitat (which is also the CHU).

Bald Eagle

A portion of the proposed trail would come within 700' of an active bald eagle nest and corresponding bald eagle management area (BEMA). Use of the nest and productivity have been documented off and on since 1991, however, nearby landowners have reported bald eagles using the area since as early as 1977 (Raedeke et al. 1993). Recorded observations have shown adults to be active every year through 2001, there are no data for 2002-2004, and observations beginning in January 2005 indicate two birds are, once again, using the nest. Success appears sporadic with one feathered young documented in 1992 and 1993, no young observed from 1994-1996, and one dead eaglet found at the base of the nest tree in 1995 (WDFW 2002). Data after 1996 contain early season observations but little information recorded later in the season, therefore indications are that the birds are repeatedly active on this nest but productivity is largely unknown. The

Sol Duc Pilot Watershed Analysis recommends closing FSR 2929-070 (Segment 3) to protect this eagle territory from disturbance (USDA 1995, Appendix 2.10 Wildlife, page 5.28).

During the last 14 years, the eagles have been observed perching in a number of mature trees and snags along the Sol Duc River near the nest. Additionally, a platform was constructed in the mid-1980s for potential nesting and placed in a mature conifer approximately 500 feet southeast of the nest tree. To date, this structure has not been used, however, the tree in which it resides is also a potential perch tree (Ament 2005, personal communication).

The Sol Duc River provides a year-round area for feeding. Coho salmon (*Oncorhynchus kisutch*), steelhead (*Salmo gairdneri*), and cutthroat trout (*Salmo clarki*) have been documented in the river near the nest (Raedeke et al. 1993). Additionally, the eagles were observed in 1993 feeding the eaglet a small mammal and landowners have reported seeing the eagles feed on hares and snakes, indicating that nearby clearcuts and other managed stands may also provide important foraging habitat (Raedeke et al. 1993).

Regional Forester's Sensitive Species - Wildlife

The Regional Forester's Sensitive Species (USDA, July 2004) list includes the following wildlife species:

Amphibians

Cope's giant salamander (*Dicamptodon copei*)
Olympic torrent salamander (*Rhyacotriton olympicus*)
Van Dyke's salamander (*Plethodon vandykei*)

Cope's giant salamander inhabit the deeper parts of small, rocky creeks, streams, and seeps, from sea level to 3,200 feet, and therefore, could be found in such riparian areas as Shuwah, Bockman, and Camp creeks, as well as numerous other unnamed streams. Olympic torrent salamander is found more on the edges or seepy portions of very cold water, often near waterfalls, and would likely be present in those areas where flow and cover provide for colder water temperatures, perhaps Camp Creek or along the Sol Duc River. Van Dyke's salamander, a woodland salamander, may be found in the splash zone of creeks or waterfalls, under logs, or in wet meadows, which could possibly include the "boggy area" located in Segment 9.

A review of the WDFW Heritage GIS layer documents survey records for Olympic torrent salamander adjacent the proposed trail in the East Section, however both locations are within Olympic National Park. There are no other documented sightings within the analysis area for these three species, however, surveys for stream-dwelling amphibians have not been conducted in relation to the project area.

Several amphibian species that are not listed in any special category are, or are likely, found in the project area, including the Northwestern salamander (*Ambystoma gracile*),

long-toed salamander (*Ambystoma macrodactylum*), rough-skinned newt (*Taricha granulose*), Western red-backed salamander (*Plethodon vehiculum*), ensatina (*Ensatina eschscholtzii*), tailed frog (*Ascaphus truei*), western toad (*Bufo boreas*), Pacific tree frog (*Pseudacris regill*), and red-legged frog (*Rana aurora*). Reptiles that may be found include the northern alligator lizard (*Elgaria coerulea*), rubber boa (*Charina bottae*), common garter snake (*Thamnophis sirtalis*), and Northwestern garter snake (*Thamnophis ordinoides*). Examining the effects of ground-disturbing activities on herptiles (both amphibians and reptiles) is important given these animals' abilities to be indicators of environmental damage and that amphibian populations are greatly affected, through their sensitive, permeable skin, to air and water pollution. Additionally, given that amphibians and reptiles are cold-blooded animals, they are less able, than mammals for example, to avoid disturbance by fleeing. Some of these species, including the Western red-backed salamander and ensatina, are particularly keyed into coarse woody debris habitat.

Similar to the situation for the listed sensitive amphibian species, there have been no comprehensive amphibian/reptile surveys done for the project area, however a few informal amphibian surveys (March 2005) have documented a large breeding pond containing several dozen egg masses of red-legged frog and Northwestern salamander along FSR 2902-300 (West Section). Also, three Northwestern salamander egg masses were found adjacent to FSR 2929-070 (Middle Section) in a large puddle on an old spur road.

Birds

American peregrine falcon (*Falco peregrinus*)
Common loon (*Gavia immer*)

Peregrine falcon need cliffs or rock outcrops for suitable nesting habitat and there is no such habitat, nor records of falcon, along the proposed trail. Likewise, common loon, which inhabits fresh and salt bodies of water, would not be found along, or adjacent to, the proposed trail.

Mammals

Townsend's big-eared bat (*Corynorhinus townsendii*)
Pacific fisher (*Martes pennanti*)
Olympic pocket gopher (*Thomomys mazama melanops*)

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. Many species of bat also utilize the areas beneath sloughing bark, most often found on old-growth trees and snags. There seems to be a preference for "I-beam" or "cast-in-place" bridges, as opposed to wooden or cement flat bottom bridges (Stuart Perlmeter master's thesis). There are four bridges along the proposed trail, the Camp Creek bridge (FSR 2929-070, Segment 3), the M&R bridge off of FSR 2918 (on private M & R land), and another two bridges on FSR 2902, also on private land, spanning Bockman Creek. The Camp Creek bridge has a 60' steel

girder with wood beams on top. The M & R bridge is steel with a concrete deck, and the two bridges on FSR 2902 are slab bridges with solid concrete bottoms. Technically, these bridges are probably classified as “cast-in-place,” however, given the fact that they are low to the creek and probably fairly wet, their value as bat bridges is uncertain. The M&R bridge may provide warm air for night roosting, however the Camp Creek bridge, with its wooden component, would probably not be utilized. There have been no bat surveys completed in relation to this project.

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 they prefer late-seral forests to other habitats (Thomas et al. 1994). Seasonally, fisher 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, which are comprised of living and dead standing trees with cavities, and maternal dens, which have been documented as occurring in downed wood, or logs (USDA 1994). No known populations of fishers exist in Washington and it is thought that the species is extirpated from the state (WDFW 2004). The analysis area, with its greater proportion of “dispersal habitat,” which reflects younger, even-aged stands of forest, likely does not contain high quality habitat for use by fisher. The adjacent Olympic National Park landscape provides ideal landscape characteristics for this species. If there are fishers on the Olympic National Forest, their use of the project area is not well understood at this time.

Likewise, use of the project area by Olympic pocket gopher is not known, but could potentially occur in natural meadows or meadow-like openings adjacent the proposed trail, in particular, the Spruce Railroad grade.

Regional Forester’s Sensitive Species and Survey and Manage-Wildlife

In January 2006, the US Western District Court determined that the March 22, 2004, Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl was to be set aside, and the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidelines was to be reinstated including any amendments or modifications to the 2001 Record of Decision that were in effect as of March 21, 2004. In cases where Survey and Manage species are also on the Regional Forester’s sensitive species list, the more stringent management regulation applies.

The following mollusk species are designated as “survey and manage,” and/or “sensitive”:

Mollusks

Puget Oregonian (snail) (*Cryptomastix devia*)-survey and manage and sensitive
 Burrington's Jumping Slug (*Hemphillia burringtoni*)-survey and manage and sensitive
 Warty Jumping Slug (*Hemphillia glandulosa*)-sensitive
 Malone's Jumping Slug (*Hemphillia malonei*)-survey and manage and sensitive
 Blue-gray Taildropper Slug (*Prophysaon coeruleum*)-survey and manage and sensitive
 Hoko Vertigo (snail) (*Vertigo n. sp.*)-survey and manage and sensitive
 Evening Field Slug (*Deroceras hesperium*)survey and manage
 Oregon Megomphix Snail(*Megomphix hemphilli*)-survey and manage

Surveys were conducted during winter/spring 2004 with two locations for the sensitive warty jumping slug (*Hemphillia glandulosa*) being located in the East Section. No other sensitive or survey and manage mollusks were found. This species, along with the Burrington jumping slug (*H. burringtoni*) are locally common and abundant on the Olympic Forest (Ziegltrum 2001 and 2004). It should be noted that these two species are no longer considered distinct, but rather species complexes (Wilke 2004). Given a similar habitat type throughout this area, Segment 10, we can assume that there are additional warty jumping slugs in the vicinity.

Two of the survey & manage terrestrial mollusks did not meet Forest Service sensitive species criteria for the Olympic National Forest. They include the *Megomphix hemphilli* snail and the evening field slug, *Deroceras hesperium*. Neither of these species were documented during the 2004 mollusk surveys of the proposed trail, and it is likely that the proposed actions would not appreciably affect suitable habitat for them.

Management Indicator Species - Wildlife

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas 1979). Species identified as MIS for the Olympic National Forest (USDA 1990), with the exception of the Roosevelt elk and Columbia black-tailed deer, represent a suite of species that are dependent on mature and old-growth forest habitat. The black-tailed deer and Roosevelt elk represent wildlife associations that require a mix of vegetative age classes.

Table 8 Management Indicator Species

Common Name	Species Name	Suitable Habitat Present in Analysis Area	Documented Sighting in Analysis Area
Northern Spotted Owl	<i>Strix occidentalis caurina</i>	Yes	Yes
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Yes	Yes

Primary Cavity Excavators	Various	Yes	Yes
Roosevelt Elk	<i>Cervus canadensis roosevelti</i>	Yes	Yes
Columbia Black-tailed Deer	<i>Odocoileus hemionus</i>	Yes	Yes
American Marten	<i>Martes americana</i>	Yes	No

Habitats that are potentially suitable exist in the analysis area for MIS species (the northern spotted owl, identified in the Olympic LRMP (1990), was addressed in the section covering federally listed species), including a variety of cover types for big game, and standing live and dead tree habitat for cavity nesters. Effects to the species would include alteration of habitat and potential for disturbance during critical seasons. Habitat along the proposed trail consists primarily of younger stands of conifers that have been mapped as “dispersal.” Even some of the small portions of “suitable habitat,” i.e. older stands with legacy characteristics such as trees with broken tops, cavities, mistletoe and moss, and large limbs, seem to fall more in the “dispersal” category (see Environmental Consequences section under Segment 4). The question regarding removing this habitat will focus on the effect of taking future suitable habitat. Removal of dispersal habitat would be most significant along Segments 4, 8, 9, and 10 where there is either no trail presently (Segments 4, 8, 10) or only a walking corridor such as the Mt. Muller trail (Segment 9). If habitat is also be removed along the entire proposed trail to accommodate the AASHTO standards (20-foot clearing limit), this would also be habitat precluded from becoming future suitable habitat. These “openings” created along Segments 4, 8, 9, and 10 will not provide forage areas for deer or elk and would be removing habitat for species dependent on mature habitat

Pileated Woodpecker, Primary Cavity Excavators, and Pine Marten

Past forest practices, including logging, and wildland fire on National Forest System lands have resulted in relatively few snags and down logs, especially of large diameters. Most of the analysis area traverses young stands, 60-100 years old, with very occasional patches of older forest nearby (for example, along the FSR 2929-070 Segment 3 adjacent the Sol Duc River). Pileated woodpeckers (*Dryocopus pileatus*) use the analysis area at least for foraging, and likely nesting as well, though there have not been any surveys specifically done for this project. Additionally, a broad group of species comprised of birds and mammals associated with standing dead trees or snags and down logs, including the hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), brown creeper (*Certhia americana*), and northern flying squirrel (*Glaucomys sabrinus*), are generally grouped as primary and secondary cavity excavators.

The American marten, or “Pine” marten (*Martes americana*) is most closely associated with heavily forested east and north-facing slopes that contain numerous windfalls (Maser 1998). They tend to avoid areas that lack overhead protection and the young are

born in nests within hollow trees, stumps, or logs. There are no documented sightings of marten within the analysis area, however, there have not been any studies done specifically in relation to this project. 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 System land, in general, has perhaps become too fragmented to support a population. Segments 8, 9, and 10, given their proximity to the park and the fact that they would involve removal of overstory canopy, would likely have the most impact on marten.

Black-tailed Deer and Roosevelt Elk

Black-tailed deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus elaphus*) are known to use the landscape through which the proposed trail traverses. All of the proposed trail can be classified as winter range, which is typically land below 1500 feet in elevation (USDA 1995). Taber and Raedeke (1980) reported that winter mortality, legal harvest, and poaching were the primary causes of elk mortality. Poaching is the second leading cause of mortality to elk in Washington state and is prevalent on the Olympic Peninsula (WDFW 2004).

Open road density has been positively associated with legal and illegal harvest of elk (Leege 1993 and Smith et al. 1993). Road densities vary within the Sol Duc watershed from 0.01 miles/square mile (North Fork Sol Duc sub-watershed, entirely within the Olympic National Park) to 4.2 miles/square mile (Camp Creek). Closing unneeded roads would result in a significant reduction in disturbance to elk (Witmer et al. 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. Fifteen of the 20 sub-watersheds in the Sol Duc watershed have road densities that exceed 1.0 mile per square mile, six of which exceed 3 miles/square mile (USDA 1995, page 2.10-29).

Though the proposed trail would theoretically not be open to vehicular traffic, it is likely it will host some degree of illegal, off-road motorized use. This, coupled with the recreational component of bikers and equestrian use, would have a disturbance effect on big game, though the extent is not known.

Forest Landbirds

Executive Order (EO) 13186 signed by the President on January 10, 2001 defined the responsibility of federal agencies to protect migratory birds and their habitats. The intent of the EO was to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and minimize the take of migratory birds through consideration in land use decisions and collaboration with the U.S. Fish and Wildlife Service (FWS). Pursuant to EO 13186 the Forest Service entered into a Memorandum of Understanding with the FWS in January 2001 with the express purpose of incorporating migratory bird habitat and population management objectives and recommendations into

the agency planning processes. To that end, bird conservation is an issue and shall be discussed in terms of effects as well as incorporation of mitigation.

The Olympic National Forest falls within the Northern Pacific Rainforest delineation of Bird Conservation Regions (BCR) identified by the North American Bird Conservation Initiative (Partners in Flight, 1998). The coastal rainforest conservation region stretches from the western Gulf of Alaska south through British Columbia and the Pacific Northwest to northern California. Heavy precipitation and mild temperatures characterize its maritime climate. Forests of western hemlock and Sitka spruce in the far north dominate the region, with balsam fir, Douglas-fir, and coast redwood becoming more important farther south. Broadleaf forests are found along large mainland river drainage. High priority breeding forest birds include the Northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), Northern goshawk (*Accipiter gentiles*), chestnut-backed chickadee (*Parus rufescens*), red-breasted sapsucker (*Sphyrapicus ruber*), and hermit warbler (*Dendroica occidentalis*). The project area provides habitat for these species.

Many neotropical migratory birds, which migrate long distances between breeding grounds in North America and wintering grounds in Latin America, are experiencing population declines in Pacific northwest forests. While many of these species occur in coniferous forest, some, such as the willow flycatcher (*Empidonax traillii*), Hammond's flycatcher (*Empidonax hammondi*), Swainson's thrush (*Catharus ustulatus*), and warbling vireo (*Vireo gilvus*), are particularly associated with hardwoods or riparian areas. Some species are associated with tall trees, while others occur more in understory shrubs or in early seral habitats. In coniferous forests of Western Oregon and Washington, 27 species have significant recent declines (1980-1996) or long-term (1966-1996) declining trends based on Breeding Bird Surveys while 12 species have significantly increased population trends (Link and Sauer 1997). The reasons for the decline vary with species. Past intensive forest management practices may have led to declines due to the loss of older forest habitats. Conversely, 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 breeding neotropical (and winter resident) songbirds. Species that occupy the project area include golden-crowned kinglet (*Regulus satrapa*), Hutton's vireo (*Vireo huttoni*), and brown creeper (*Certhia americana*). Though the proposed trail traverses primarily coniferous forest, a portion of Segment 9 is near a unique stand of old-growth vine maple which may provide nesting habitat and cover for some avian species. There have not been any bird surveys completed in relation to this project, so it must be assumed that if the habitat is present, that is riparian or hardwood areas, then associated species may be present.

Environmental Effects

Alternative A - No Action

Direct/Indirect/Cumulative Effects

Under the No Action alternative, existing conditions would be maintained as described in the Affected Environment section. Approximately 7.3 miles of forest, railroad grade or gravel road (Segments 1-5, 7-10) would not be paved to create the proposed trail. 3.5 miles of ground that is presently in a vegetated state (Segments 1, 2, 4, 7, 8, 9, 10) would continue to accommodate the growth of mosses, forbs, shrubs, conifers, and hardwoods. The miles associated with the railroad grade (Segment 1, 2, 7), approximately 2.0 miles, would remain accessible only for foot traffic. Mt. Muller trail (Segment 9), 0.30 miles, would also remain only accessible by foot, and 1.2 miles of new trail construction (Segments 4, 8, 10) would likely not be frequented by humans. Thus, the human disturbance through these areas would remain at present levels. The remaining 8.6 miles (FSR 2902-300, 2902, 2929-070 (Segment 3), Segment 5, 2918, and 3079-011) would continue as a gravel road, accommodating vehicle traffic. Approximately 3.71 acres of “dispersal habitat” (Segments 4, 8, 9, 10) would not be removed and would continue to grow toward becoming “suitable habitat.” There would be no direct adverse effects to federally listed species, spotted owls, marbled murrelets, or bald eagles, or the other specially designated species.

Effects Determinations for T&E Species and Critical Habitat

In order to fully inform the Responsible Official and the public as to the effects of this alternative and Alternative B, the preliminary Endangered Species Act (ESA) determinations are disclosed. The range of ESA determinations runs from “No effect”, to “Not likely to adversely affect” (NLAA), to “Likely to adversely affect” (LAA). These determinations are a necessary part of the ESA consultation process which will be finalized prior to signing a Decision Notice on this project.

Implementation of Alternative A would result in a No effect determination for northern spotted owl, marbled murrelet, and the bald eagle. The alternative would have No effect determinations for designated Critical Habitat for northern spotted owl and marbled murrelet.

Alternative B - Proposed Action

Federally Listed Species - Wildlife

Northern Spotted Owl, Marbled Murrelet, and Designated Critical Habitats

Direct Effects

Habitat Removal

Suitable nesting habitat will not be removed as a result of this project. Building the proposed trail would result in an additional 7.3 miles of a paved trail on National Forest land (Segments 1-5, 7-10 and FSR 3079-011). Of those 7.3 miles, 4.3 miles would be located through forest stands currently designated as “dispersal habitat.” Of those 4.3 miles, 1.5 miles (Segments 4, 8, 9, 10) would traverse forested stands that do not at present have a road or railroad grade. This amount of mileage would correspond to removal of 3.71 acres of dispersal habitat. All of this loss would take place in AMA land. The remaining 3.0 miles, of the 7.3 miles of a paved trail, includes surfacing of FSR 2929-070 (Segment 3), which is already functioning as a gravel road. Approximately 4.8 miles of the proposed trail on National Forest System lands would be located on roads already paved, or not planned for pavement (FSR 2902-300 and 2902) and would therefore not present additional effects, in terms of habitat removal, to listed species.

There are no known murrelet sites adjacent to the proposed trail; the most likely possibilities for murrelet presence would be along the Sol Duc River, near FSR 2929-070 (Segment 3), and there is no habitat removal proposed here. Likewise, only one historic spotted owl territory exists adjacent the proposed trail and there is no habitat removal proposed at this location.

The 3.71 acres of proposed dispersal habitat removal, is located in Segments 4, 8, 9, 10. Given that none of these acres of habitat removal are within the murrelet or spotted owl Critical Habitat Units (though there would be some trees removed along the railroad grade in Segment 1 within the spotted owl CHU), and that the number is small and that virtually no dispersal habitat has been removed on the Olympic National Forest in the last decade, the cumulative impact of habitat removal on owls and murrelets is minimal. Additionally, in terms of spotted owls, the Scientific Evaluation of the status of the Northern Spotted Owl (Courtney et al. 2004) report concluded that, based on recent research, a diversity of habitats within an owl’s territory may be beneficial.

Disturbance

Disturbance to wildlife may result from the proposed action, including tree removal and paving, or may occur later, as well as from the increased use of the proposed trail by

bicyclists, hikers, horse people, and possibly illegal all-terrain vehicle (ATV) users after project implementation. The proposed action would have the greatest impact, for murrelets and owls, in areas where 1) there is no travel corridor of any kind at present (Segments 4, 8, and 10); 2) where there is a minimal corridor (Segment 9); and 3) re-vegetated sections of the Spruce Railroad grade (Segments 1, 2, and 7). Seasonal restrictions would not be necessary for spotted owls and marbled murrelets given the lack of nearby suitable habitat.

Trail Construction

Harassment distances for the work involved with the proposed action are 65 yards, from suitable habitat, for spotted owl and 45 yards for marbled murrelet. There are 9.6 acres of suitable habitat within 65 yards of the proposed trail, however these acres are along portions of the route not planned for habitat removal or paving.

Recreational Use

The greatest amount of potential disturbance for wildlife will be the result of long-term recreational use in areas that have not previously been utilized by humans or have been utilized in different ways, such as vehicle traffic but not foot traffic. Unfortunately, there is more information concerning the interactions between roads and wildlife than between recreation trails and wildlife (Gaines et al. 2003). Nonetheless, the most common effects are displacement and avoidance, with some species being more sensitive to motorized trail use and others more sensitive to non-motorized use.

Indirect Effects

Increased Garbage

Areas heavily used by humans for recreational activities often result in increased garbage left on site and this can attract corvids and may increase the chance of predation on nearby marbled murrelet nests (Nelson and Hamer 1995). While the chance of there being murrelet nests near the proposed trail is small due to the habitat being classified as dispersal, there are pockets of suitable along FSR 2929-070 that may provide suitable nest trees. The effect of a potential increase in trail garbage may be small but would still exist.

Fragmentation

A total of 1.5 miles (Segments 4, 8, 9, 10) of “new” edge (3.71 acres) would be created with this project. Given the fact that this edge will, at most, be 20 feet wide for Alternative B (Proposed Action) and 22 feet wide for Alternative B (modified), this would not have a significant impact, particularly since this habitat modification would take place outside of Critical Habitat.

Cumulative Effects

The greatest impacts to the spotted owl and marbled murrelet have come from large-scale habitat conversion of late-successional forest to stands that are now single-species

(predominantly) plantations and second-growth, depending on when they were harvested. Road building, which has facilitated this process, has contributed by fragmenting and isolating remaining stands of old-growth and also by allowing human access that can result in disturbance and, in some instances, direct mortality. Given that most of the project area is not adjacent to any late-successional stands, except for the very west end, and that the project does not remove this habitat, the cumulative effects of removing less than four acres of dispersal habitat would be minimal. In terms of recreational disturbance, previous impacts to the landscape include the construction of the Mt. Muller hiking trail (approximately 20 miles), the Klahowya campground, and various dispersed camp sites. The potential for the proposed trail to draw greater numbers of users would possibly have some impact to dispersing owls, though this can't be quantified and would likely be minimal compared to past management activities.

Effects Determinations for T&E Species and Critical Habitat

This alternative would result in a determination of Not likely to adversely affect northern spotted owl because there would be no removal of suitable habitat and proposed activities are not within harassment distances of suitable habitat. There would be a determination of Not likely to adversely affect northern spotted owl Critical Habitat as there would only be habitat removal within segment 1 (the only segment that goes through Critical Habitat) and activities would not significantly alter the constituent elements of Critical Habitat.

There would be a Not likely to adversely affect determination for marbled murrelet as there would be no removal of suitable habitat and activities are not within harassment distances of suitable habitat. There would be No effect to marbled murrelet Critical Habitat.

Bald Eagle

Direct Effects

Habitat Removal

The proposed trail would remove 3.71 acres of currently designated spotted owl "dispersal habitat," (Segments 4, 8, 9, and 10) which are not presently suitable nesting habitat for late-successional species. Only Segment 4 (0.23 miles and approximately 0.06 acres) would remove this potential future eagle habitat near a large body of water (the Sol Duc River), which is also important for eagle foraging. This loss of potential future habitat would not be significant. Additionally, there would be no effects to prey species.

Disturbance

Trail Construction

Due to proximity to a portion of the proposed trail, a current bald eagle nest could be adversely impacted by the proposed trail construction activity, if the work is done during

the critical nesting and fledgling period. Seasonal restrictions in Segments 4, and parts of 3 and 7, will be implemented to minimize disturbance to the nearby bald eagle nest, if it is determined that nesting is occurring. Eliminating or minimizing trail construction during this critical period would reduce the impacts to bald eagles.

Recreational

Eagle pairs vary widely in their response to disturbance depending on previous nesting history, the birds' previous experience with humans, the availability of alternative nest sites, and the amount of development in the area (Therres et al. 1993). It is clear that the pair using the nest near the proposed trail tolerates a variety of noise disturbance already, including vehicle traffic from Highway 101, residential activity from nearby homes, and current ATV, motorcycle, and hiking use along FSR 2929-070. Since future pairs of birds may not be as tolerant of disturbance (USDA 1995), activities near a bald eagle nest on federal lands need to be analyzed in terms of impacts to the nest territory, not the present pair utilizing the site.

Based on current human activity occurring in proximity to the nearby eagle nest tree, additional hikers and bikers, and perhaps even illegal ATV users, would not adversely impact this nest (S. Ament and K. Livezey, per. comm.). However, a monitoring plan is planned to be implemented to determine nesting success before, during, and after the proposed action to document future pairs' responses at this site.

Indirect Effects

Future nesting success or failure may be an indirect consequence of the trail project, however, it may be difficult to differentiate between failure due to the trail or other reasons.

Cumulative Effects

Similar to the spotted owl and marbled murrelet, bald eagles have been affected by previous timber harvest (habitat loss), road building, disturbance, as well as declining fish populations. They have also been affected by pesticides and direct persecution, both of which are outside the scope of this document. State and private lands surrounding the Olympic Discovery Trail project area will continue to be harvested. The removal of habitat for this project, while not presently suitable eagle habitat, reflects acres that will not in the future become habitat either. However, compared to past management activities, the effect is minimal.

Effects Determinations for T&E Species

This alternative would have a determination of Not likely to adversely affect bald eagles, due to the implementation of seasonal restrictions for construction activities.

Regional Forester's Sensitive Species and Survey and Manage-Wildlife

Direct Effects

Habitat Removal

Some individuals in the two locations of the sensitive warty jumping slug may experience direct mortality from the proposed action. However this species is locally common and abundant on the Forest and suitable habitat adjacent to the trail construction area would provide habitat for the species. The proposed action would not affect the viability or a trend toward listing any sensitive or survey and manage mollusk species.

Of the three listed amphibians, only the Van Dyke's salamander would likely be affected by habitat removal as the other two (Cope's giant and Olympic torrent) are almost exclusively found in stream zones. Van Dyke's is also closely tied with riparian zones, however may also be found far from water, typically north-facing slopes with a thick cover of mosses (Leonard et al. 1993). Most of the proposed trail is on fairly flat ground and none of the segments with new construction could be considered north-facing. The effects of habitat removal would be negligible for these species.

In terms of amphibians in general, the removal of the dispersal habitat and conifers less than 21 inches, would not directly impact amphibians since these species do not use standing trees for refugia. Downed logs, within the proposed trail, or dying trees sloughing chunks of bark may provide habitat for such species as ensatina (*Ensatina eschscholtzii*) and Western red-backed salamander (*Plethodon vehiculum*). Where possible, these trees will be maintained and large pieces of wood moved carefully away from the trail corridor.

The only bridge that may provide some Townsend's big-eared bat habitat might be the M & R bridge over the Sol Duc River. Given that this use would likely take place in the evening or night and the fact that the bridge is already widely used by a variety of vehicles, additional bikers or horses would not contribute appreciably to disturbance for bats. Given that Pacific fisher are considered extirpated from Washington, at this time, there would be no effect on them with this habitat removal. The effects to pocket gopher cannot be quantified but this species may experience direct mortality and/or be displaced due to the paving and/or ensuing use. It is not likely that this impact, given the small area of new disturbance (3.71 acres within Segments 4, 8, 9, 10) would significantly reduce the population.

Disturbance

Trail Construction

It is not anticipated that there would be significant harassment from the proposed action to any of the listed sensitive species. For these species, direct mortality would be the main concern.

Recreational

There is potential for some direct mortality of the mollusk species, Van Dyke's salamander, and the pocket gopher if any of these animals should be found on the trail surface during periods of human use. It is difficult to quantify what the impact might be since we do not have good baseline knowledge of population numbers for these species. Whether or not this incidental mortality would be significant enough to cause a loss of viability of these species cannot be stated definitively, though it would seem unlikely.

Other amphibians, besides listed species, and particularly those species that may use portions of any of these segments during their migrations to breeding ponds, may be affected to varying degrees by recreational traffic on the proposed trail. For example, the western toad (*Bufo boreas*) would have the greatest potential for mortality and disturbance because it is diurnal, has a high survivorship to metamorphosis, aggregates in more open areas, and moves upland to well-insulated sites (Hayes 2005, personal communication). Travel distances vary greatly for amphibians and are typically shorter for salamanders, 200-300 meters, compared with 1-5 kilometers for frogs, specifically the red-legged frog. Ranids (true frogs) would move between breeding sites and upland sites during wet conditions and in the evening when recreational use would be low. We do not have any detailed information on which species may be located along the proposed trail; however there is a substantial breeding pond for red-legged frog and northwest salamander along FSR 2902-300 in the West Section. Since there is no paving planned for this area, the effects should be minimal. The "boggy area" near the Mt. Muller trail is also a potential area for amphibians, but an informal egg survey in March 2005 did not document any egg masses. Direct effects for amphibians would include mortality from ground disturbance and construction as well as mortality from human use. Reptiles will also be susceptible since they are often attracted to paved areas as heat sources.

Indirect Effects

Increased garbage

One effect of refuse in wildlife habitats is that amphibians, reptiles, and small mammals are often trapped inside discarded bottles where they are unable to escape due to the smooth interior, narrow opening, remaining liquid, and bottle orientation (Jochimsen et al. 2004). Efforts at public education, i.e. informational signs, may alleviate the problem, however, in most cases, areas opened up to recreational use generally suffer increased litter. In terms of listed sensitive species, this could possibly impact Van Dyke's salamander if it is moving from one habitat to another.

Fragmentation

The amount of habitat that would become further fragmented with the proposed action is a relatively small amount. On a large, population-level scale, these species would likely not be adversely affected. For individual animals living near, or on, the proposed trail, the impacts would be consequential, particularly during construction.

Cumulative Effects

Previous habitat removal and road building have had the greatest impacts on these sensitive species. Vehicle traffic, having increased over the years due to increased access, has impacted some species more than others, including possibly the mollusks and the salamanders. Cumulatively, the proposed trail would not add a significant amount of impact, in terms of habitat removal or vehicle traffic. While no baseline population data on these species exist and creates some uncertainty, it is expected that the project may impact some individuals but would not contribute to overall population declines.

Long-term impacts of this project would result from increased human recreational use of different wildlife habitats. This could include vegetation damage off the proposed trail, increased garbage on site, and possibly effects on movement patterns of these species. The project may impact individuals of these species but it is not likely that the populations overall would be severely affected,.

Management Indicator Species - Wildlife

Direct Effects

Habitat Removal

A total of 1.5 miles (Segments 4, 8, 9, 10) will be added to the landscape as nonforested habitat. Removal of dispersal habitat, in this case generally conifer trees under 21 inches d.b.h., would not have a great impact on the MIS species; pileated woodpecker, the primary cavity excavators, Roosevelt elk, black-tailed deer, and American marten. However, the on-going removal of danger trees, green and dead, along the proposed trail would have an impact on cavity nesting birds and others, including some mammals, which use such trees for perches and foraging. There are some sections, specifically a piece in Segment 10 (East Section), just west of the Olympic National Park boundary, which has substantial numbers of snags along the proposed trail. Without having baseline information on species which require such habitat for the proposed trail, it is difficult to quantify the level of effect.

The effects to these cavity-using species would include removal of standing dead (identified as danger trees) and coarse woody debris that serves as foraging or nesting/denning habitat. Given this, it is important to note a recently developed analysis tool, known as DecAID, which evaluates the effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. DecAID also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. DecAID is best used on a large scale, i.e. that of sub-watersheds, watersheds, sub-basins, or physiographic provinces, and because of the sheer volume of work involved (the proposed trail traverses eight sub-watersheds), coupled with the low volume of habitat removal, less than 4 acres, the analysis has not been done.

Disturbance

Based on conclusions described in the General Technical Report (Gaines et al. 2003) on assessing the cumulative effects of linear recreation routes on wildlife habitats, trail construction and the ensuing recreational use would negatively impact deer and elk. Avoidance and displacement are the most common results when these species are confronted with people walking, skiing, snowmobiling, or driving on trails. We can assume that there will be similar impacts with biking and equestrian use to varying degrees based on amount of use. Disturbance from trail construction has the potential to have the greatest impact during the winter because the proposed trail goes through winter range, generally defined as those areas below 1,500 feet in elevation. Disturbance from recreational activity should inherently be minimal during this time of year.

Disturbance to primary cavity excavators and the marten would likely be minimal.

Indirect Effects

Effects from increased garbage and/or fragmentation would likely not have significant impacts on MIS species. The small amount of habitat removal, coupled with these species' agility, would not contribute to a decline in population numbers though again, there is limited information on specific numbers for these species, particularly marten.

Cumulative Effects

The effects of previous harvest, road building, and human disturbance would have had the greatest impact on management indicator species. The proposed trail, while minimally intrusive for numerous species, especially compared to previous management activities, may have a larger effect to MIS species given the long-term nature of opening up a corridor through the forested landscape for human use. And this disturbance would most likely have the greatest impact on big game species. It may cause certain animals to avoid areas of the proposed trail but this would not likely have a significant impact on the population.

Forest Landbirds - Wildlife

Direct Effects

Habitat Removal

Most of the 3.71 acres removed by the proposed action (Segments 4, 8, 9, 10) would impact mid-seral coniferous habitat, in which dwell a variety of species including the black-throated gray warbler (*Dendroica nigrescens*) and Hutton's vireo (*Vireo huttoni*). The loss of 3.71 acres of this habitat would likely impact some individuals but probably not adversely the entire populations of any species. Danger tree removal would also affect forest landbirds, in particular secondary cavity nesters such as the western bluebird (*Sialia mexicana*).

Disturbance

The proposed action trail construction and future recreational use would likely not have a significant impact on forest landbirds; the primary effect would be habitat removal.

Indirect Effects

Similar to MIS species, any indirect effects from increased garbage and/or fragmentation would likely be minimal for bird species. With only 1.5 miles of new construction through forested stands (Segments 4, 8, 9, 10), and given that the clearing limit for the proposed trail is 20 feet for Alternative B (Proposed Action) and 22 feet for Alternative B (modified), a relatively large distance for amphibians, for example, but not significant for species that fly, fragmentation issues should be minimal.

Cumulative Effects

Previous timber harvest and road building have had the greatest impacts on forest bird populations. This alteration of habitat has also resulted in the increase of some species which are more aggressive and have contributed to some species' declines. In terms of the cumulative effect of the proposed trail, some individuals may be displaced by construction of the proposed trail, perhaps even experiencing mortality, but it is not likely that the proposed trail itself would negatively adverse any populations.

Botanical

Introduction

The Sol Duc watershed encompasses approximately 148,895 acres of land, most of it forested. Much of this watershed lies within the *Tsuga heterophylla* (western hemlock) zone. This vegetation zone is characterized as warm temperate to maritime. Winter and summer temperatures are moderate. Dominant tree species are Douglas-fir and western hemlock (Forested Plant Associations of the Olympic National Forest, 1989). Several stand replacing fires have occurred since the early 1900's and most stands in the project area are 50 to 90 years old.

Little direct impact to vegetation or soil is anticipated to occur in the utilization of the 8.6 miles of existing Forest Service system roads (FSR 2902-300, FSR 2902, Segment 3-FSR 2929-070, Segment 5, and FSR 3079-011), although invasive species would need to be considered as there are documented sites of *Cytisus scoparius* (Scotch broom) and *Senecio jacobaea* (tansy ragwort).

The 2.0-mile Spruce Railroad grade (Segments 1, 2, 7) was originally constructed in 1918, used until 1959 and then dismantled. The railroad grade is for the most part easily discernable and in various states of regeneration, ranging from almost drivable conditions to containing pole sized timber. Vegetation on the grade would be impacted but it is not

likely the adjacent strip of vegetation containing 40 to 65 year old trees would be impacted.

The greatest potential for impact to botanical resources would occur in the 1.2 miles of new construction (Segments 4, 8, 9, 10) and 0.3 miles of reconstruction of the existing Mt. Muller trail (Segment 9). The forest in the project area is approximately 40 to 65 years old. It is a mixed coniferous stand and contains a legacy component of remnant large woody debris and snags. Scattered along the slope are a number of small seeps/streams. The proposed trail, Segment 10 at the west point where it's proposed to connect to the Mt. Muller Trail, crosses a stream that flattens out and supports wet area vegetation just before connecting with the Mt. Muller trail. The Mt. Muller trail (Segment 9) runs roughly parallel to the stream through a large patch of old *Acer circinatum* (vine maple) that provides habitat for large moss mats and a variety of cyanolichens before re-entering a more predominantly coniferous stand. An invasive species, *Geranium robertianum* (herb-robert), begins to be evident at this point and continues to be seen along the trail route until the proposed trail (Segment 9) joins the established Mt. Muller trail. This trail segment (Segment 9) also goes through an old gravel pit that is infested with *Cytisus scoparius* (Scotch broom).

In order to determine whether the proposed action poses a potential threat to Regional Forester's Threatened, Endangered, Proposed or Sensitive (TEPS) species a pre-field review was performed. Due to new management direction in January of 2006, Survey and Manage flora species were also reviewed. Aerial photographs, the 2004 Regional Sensitive Plant list, the Olympic National Forest Rare Plant Occurrence GIS cover, Interagency Species Management System (ISMS), BLM 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.

Affected Environment

Federally Listed Species

There are no Endangered or Federally listed Candidate or Proposed 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 is suspected to occur on the Olympic National Forest (USDA Forest Service, Pacific Northwest Region, Federally Listed, Proposed and Candidate Species, and Proposed or Designated Critical Habitat, April 2004).

Marsh sandwort was historically known from Pierce County, Washington, and from San Francisco, Santa Cruz, San Luis Obispo and San Bernadino Counties in California. It grows mainly in wet areas and freshwater marshes, from sea level to 1476 feet in elevation, and can grow in saturated acidic bog soils and sandy substrates with high organic content. Eight of the nine California occurrences are considered extinct

(Washington State Natural Heritage program 2005). It is considered extirpated from the state of Washington.

There are no known current or historical sites of this species within the project area and due to lack of suitable habitat it is not likely to occur.

Regional Forester's Sensitive and Survey and Manage Species

Vascular Plants

Vascular plant species designated as Sensitive and/or Survey and Manage were assessed for the project area in February of 2004 and reviewed in February of 2006 due to changes in management direction. Of the 36 documented or suspected sensitive plants for the Olympic National Forest, four species were identified as having potential habitat in the project area.

Table 9 Vascular Plant Species

Scientific name	Status	Common name	Habitat
<i>Cimicifuga elata</i>	Sensitive	Tall bugbane	Moist, shady woods, low elevation.
<i>Coptis asplenifolia</i>	Sensitive Survey & Manage Category A	Spleenwort-leaved goldthread	Moist coniferous forest & bogs
<i>Montia diffusa</i>	Sensitive	Branching montia	Low elevation forest
<i>Poa laxiflora</i>	Sensitive	Loose-flowered bluegrass	Moist woods of mixed conifer & deciduous stands; riparian areas

*Survey & Manage Category A – Rare. Manage all known sites. Survey prior to habitat disturbing activities.

Field surveys were conducted for these four vascular plants on July 8, 2004 and no sensitive or Survey and Manage vascular plants were found.

Bryophytes (mosses and liverworts)

Sensitive bryophyte species were assessed for the project area in February of 2004 and again in the winter of 2004 and February of 2006 due to changes in the Regional Forester's list and management direction. One species, *Tetraphis geniculata*, was identified as having potential habitat in the project area.

Field surveys were conducted July 8, 2004 and January 21, 2005 and no sensitive or Survey and Manage bryophytes were found.

Fungi

There are 17 fungi species documented or suspected to occur on the Olympic National Forest that are designated as Forest Service Sensitive, 16 of which, are also categorized as Survey and Manage 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 10 Fungi Species

Sensitive Fungi Species	Status*	Ecological Function	Habitat
<i>Albatrellus avellaneus</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Fruits on soil in assoc. w/roots of conifers, probably <i>Picea</i> spp., Oct. - Jan.
<i>Albatrellus ellisii</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Solitary, scattered, gregarious, or in fused clusters on ground in forests. Under conifers or mixed forests associated w/ <i>Abies</i> , <i>Picea</i> , <i>Pinus</i> , <i>Pseudotsuga</i> , <i>Tsuga</i> or <i>Castanopsis</i> . Observable late summer and autumn.
<i>Bridgeoporus nobilissimus</i>	Sensitive Survey & Manage Category A	Wood saprobe	Sporocarps occur in mesic to wet microsites in forests of all seral stages in the ABAM zone. Uses large diameter <i>Abies procera</i> & <i>Abies amabilis</i> material as host. Observable all year.
<i>Clavariadelphus occidentalis</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Solitary to gregarious or in caespitose clusters of 2 or 3 sporocarps; on soil or duff under mixed deciduous-coniferous or deciduous forests. Associated with <i>Abies</i> , <i>Calocedrus</i> , <i>Picea</i> , <i>Pinus</i> , <i>Pseudotsuga</i> , <i>Thuja</i> , <i>Tsuga</i> , <i>Quercus</i> and <i>Arbutus</i> . Sept. - Mar. sometimes May.
<i>Cordyceps capitata</i>	Sensitive	Parasite	Parasitic on various <i>Elaphomyces</i> (Deer truffle) species in hardwood or coniferous forests. Season: autumn
<i>Gomphus kauffmanii</i>	Sensitive Survey & Manage Category E	Mycorrhizal	Closely gregarious to caespitose, partially hidden in deep humus under <i>Pinus</i> and <i>Abies</i> spp. In autumn.
<i>Gyromitra californica</i>	Sensitive Survey & Manage Category B	Wood/Litter Saprobe	Found fruiting on or adjacent to well-rotted stumps or logs of coniferous trees or on soil rich in brown rotted wood. Season: June.
<i>Leucogaster citrinus</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Found in assoc. with the roots of <i>Abies concolor</i> , <i>A. lasiocarpa</i> , <i>Pinus contorta</i> , <i>P. monticola</i> , <i>PSME</i> , & <i>TSHE</i> from 280 - 2000 m. in elevation. Season: Aug. - Nov.
<i>Phaeocollybia attenuata</i>	Sensitive Survey & Manage Category D	Mycorrhizal	Scattered in humus soil and with mosses under mixed coniferous forests or forests associated with <i>Pseudotsuga</i> , <i>Tsuga</i> , <i>Picea</i> , <i>Abies</i> , <i>Pinus</i> and <i>Sequoia</i> . Mid to late autumn.
<i>Phaeocollybia fallax</i>	Sensitive Survey & Manage Category D	Mycorrhizal	Scattered to gregarious in highly humus soil in mixed coniferous forests assoc. with <i>Abies</i> , <i>Picea</i> , <i>Pseudotsuga</i> , <i>Thuja</i> , <i>Sequoia</i> & <i>Tsuga</i> . Season: Sept-Dec.

Sensitive Fungi Species	Status*	Ecological Function	Habitat
<i>Phaeocollybia oregonensis</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Associated with the roots of ABAM, PSME, and TSHE. Fruits Oct. - Nov.
<i>Phaeocollybia piceae</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Associated with the roots of ABAM, PSME, and TSHE. Fruits Oct. - Nov.
<i>Ramaria cyaneigranosa</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Fruits in Oct. in humus or soil and matures above the surface of the ground. Assoc. w/ <i>Abies</i> spp., PSME and TSHE.
<i>Ramaria gelatiniaurantia</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Fruits in Oct. in humus or soil and matures above the surface of the ground. Assoc. w/ <i>Abies</i> spp., PSME and TSHE.
<i>Ramaria stuntzii</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Fruits in humus or soil and matures above the ground in Oct. or Nov. Assoc. w/ <i>Pinaceae</i> spp.
<i>Sarcodon fuscoindicum</i>	Sensitive Survey & Manage Category B	Mycorrhizal	Scattered to gregarious on soil in fall and winter.
<i>Spathularia flavida</i>	Sensitive Survey & Manage Category B	Litter Saprobe	In clusters or fairy rings on litter or woody debris of conifer and hardwood forests in summer and fall

*Survey & Manage Category A – Rare. Manage all known sites. Survey prior to habitat disturbing activities.

*Survey & Manage Category B – Rare. Manage all known sites. Pre-disturbance surveys not practical.

*Survey & Manage Category D – Uncommon. Manage high priority sites. Pre-disturbance surveys not practical.

*Survey & Manage Category E – Rare. Manage all known sites. Status undetermined

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 because they are considered to be not “survey practical.” Rather, other components of pre-project clearances such as habitat evaluation would be utilized to analyze potential risks to the species resulting from project activities.

There are a total of 184 fungi species, including the 16 noted above, that are Survey and Manage species requiring either pre-disturbance surveys or management of known sites. None of the 17 sensitive fungi species listed on Table 10 are documented to occur in the project area and a review of the 2006 Survey and Manage database (GeoBOB) indicated that there were no known sites of any Survey and Manage fungi in the proposed trail location. The project area may provide suitable habitat for the above fungi species that were not targeted during surveys, however, the distance to the nearest known occurrence is substantial (>10 miles) except for *Spathularia flavida* which has a documented site approximately seven miles distant in the Olympic National Park.

Only one of the 17 species, *Bridgeoporus nobilissimus* (Category A), has a survey protocol for pre-disturbance surveys under the Survey and Manage program. *Bridgeoporus nobilissimus* was not found during surveys conducted on July 8, 2004. It is thus unlikely that the proposed action would have a risk to *Bridgeoporus nobilissimus* species viability or a trend toward listing.

Lichens

Sensitive lichen species were assessed for the Olympic Discovery Trail project area in February of 2004 and again in the winter of 2004 and February of 2006 due to changes in management direction. Of the twelve sensitive lichen species documented or suspected to occur on the Olympic National Forest, nine species were identified as having potential habitat within the proposed project area. Eight of these lichen species also have Survey and Manage status as noted below.

Table 11 Lichen Species

Scientific name	Status*	Habitat
Cetrelia cetrarioides	Sensitive Survey & Manage Category E	On bark, mainly <i>Alnus rubra</i> and hardwoods in moist riparian and valley bottom forests.
Collema nigrescens	Sensitive Survey & Manage Category F	On bark of broad-leaved trees and shrubs in low elevation forest, often riparian.
Dermatocarpon luridum	Sensitive Survey & Manage Category E	Grows on rocks, boulders and bedrock in streams, rivers or seeps between 1000-6500' in elevation. Usually submerged or inundated for most of the year.
Erioderma solediatum	Sensitive Dropped from Survey & Manage list	Found growing on riparian <i>Alnus rubra</i> in coastal fog zone.
Leptogium burnetiae var. hirsutum	Sensitive Survey & Manage Category E	Typically epiphytic but also on decaying logs, mosses and rock.
Nephroma bellum	Sensitive Survey & Manage Category E	In moist forests often on riparian hardwoods.
Peltigera neckeri	Sensitive Dropped from Survey & Manage list	On mossy logs, soil and tree bases, especially in wet habitats such as lowland forests.
Platismatia lacunosa	Sensitive Survey & Manage Category E	On boles and branches of hardwoods and conifers in moist, cool, upland sites as well as moist riparian forest.
Usnea longissima	Sensitive Survey & Manage Category F	Epiphytic, fruticose species found in coniferous or hardwood stands and riparian areas.

*Survey & Manage Category E – Rare. Manage all known sites. Status undetermined.

*Survey & Manage Category F – Uncommon or concern for persistence unknown. Status undetermined. Management of known sites not required.

There are a total of 35 Survey and Manage lichens, including those noted above, requiring either pre-disturbance surveys or management of known sites. Ten lichens (Categories A & C), have a survey protocol for pre-disturbance surveys under the Survey and Manage program. Three of these species were identified as having potential habitat in the project area.

Scientific name	Survey & Manage Category*	Habitat
Hypogymnia duplicata	C	On bark and wood of conifers in cool moist forests, low elevations to mountaintops.
Leptogium cyanescens	A	On bark, rotten logs and rocks in mixed conifer stands and in maple and willow thickets in riparian and upland habitats.
Nephroma occultum	C	In late-successional and old-growth, occasionally in younger stands with remnant older live trees. Epiphytic on conifers and sometimes hardwoods in cool, humid microclimate conditions, both riparian and upland.

*Survey & Manage Category A – Rare. Manage all known sites. Survey prior to habitat disturbing activities.

*Survey & Manage Category C – Uncommon. Manage priority sites. Survey prior to habitat disturbing activities.

Field surveys for sensitive and Survey and Manage lichens were conducted July 8, 2004 and January 21, 2005. Two sensitive lichen species, *Nephroma bellum* and *Usnea longissima*, were located. The *Nephroma bellum* is also a survey and manage species. No lichens with pre-disturbance survey requirements were found. A review of the 2006 Survey and Manage database (GeoBOB) indicated no documented known sites for other Survey and Manage lichens on the proposed trail location.

Usnea longissima (Sensitive)

The current known and suspected range of *U. longissima* in the Northwest Forest Plan area is all of Washington and Oregon except Eastern Cascades, and the California Klamath and Cascades Physiographic Provinces. According to Keon & Muir its distribution within its range is limited and patchy. Prior to 2004 this species was not on the sensitive list for the Olympic National Forest and, thus, not inventoried. Numerous sites, however, are known to exist on the forest.

Although this lichen was originally thought to be a riparian species, it is now thought to have a broader ecological niche. In the Northwest Forest Plan area, *U. longissima* generally occurs in old-growth and late successional conifer stands, and in hardwood stands and riparian areas. It is typically infrequent but can be locally abundant in all

habitat types. It may also grow in clear-cut and other young stands where there is suitable substrate for colonization. Studies and experiments done by Keon & Muir (Keon & Muir 2002; Keon 2002; Keon 1999) in the Oregon Coast Range suggest that the presence of a nearby propagule source may be more important to dispersal and survival at both the local and landscape level than habitat characteristics. Remnant or retention trees function as sources of inoculum from which lichen propagules may disperse (Peck & McCune 1997).

This lichen was found in the form of litterfall on several places along the eastern portion of the proposed railroad grade reconstruction where it exits the Olympic National Park.

Nephroma bellum (Survey and Manage, and Sensitive)

Nephroma bellum is an epiphytic, foliose cyanolichen that generally occurs in moist or humid forest on branches and twigs of conifers and riparian hardwoods. It is known to occur in the Northwest Forest Plan in the following Physiographic Provinces: WA Western Cascades, WA Eastern Cascades, WA Olympic Peninsula, OR Western Cascades, OR Eastern Cascades, OR Klamath, OR Coast, CA Coast. Current information indicates that it may be common in the Northwest Forest Plan area, although rare in parts of its range including the Olympic Peninsula. The BLM and U.S. Forest Service Interagency Special-Status and Sensitive Species program website (www.or.blm.gov/ISSSP) documents a total of 158 sites of which 46.2% occur in late successional reserve or congressionally withdrawn land allocations. The ISSSP website documents four sites of *Nephroma bellum* on the Olympic National Forest. An additional 22 sites are known to exist in the Olympic National Forest and Olympic National Park (M. Hutten pers. comm.) that are not contained in the ISSSP site.

In the project area, this lichen was found in a moist vine maple flat just after the proposed new construction joins the existing Mt. Muller trail.

To mitigate the effects on *Nephroma bellum*, the known site would be managed under Survey and Manage direction, and vine maple trunks and limbs cut during trail construction in this area will be relocated adjacent to the trail corridor and left to serve as a propagule source.

Environmental Consequences

Federally Listed Species

Alternatives A and B

Direct, Indirect, Cumulative Effects

There would be no direct, indirect or cumulative effects to this Federally Endangered plant. Therefore, implementation of the proposed action would not affect the viability of this species.

Regional Forester's Sensitive and Survey and Manage Species

Vascular Plants

Alternatives A and B

Direct, Indirect, Cumulative Effects

There would be no direct, indirect or cumulative effects to sensitive or Survey and Manage vascular plants. Implementation of the proposed action would have no risk to species viability or a trend toward listing.

Bryophytes (mosses and liverworts)

Alternatives A and B

Direct, Indirect, Cumulative Effects

There would be no direct, indirect or cumulative effects on sensitive bryophytes. The proposed action would have no risk to the viability of sensitive or Survey and Manage bryophytes or a trend toward listing.

Fungi

Alternative A (No Action)

Direct and Indirect Effects

No effects – 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 (Proposed Action)

Direct and Indirect Effects

It is possible that the large woody debris and soil disturbance required for construction of the proposed trail would impact scattered individuals. Construction of the proposed trail would also lead to a potential increase in access to adjacent areas and thus the possibility of increased disturbance by trail users who wander off the paved trail. It would be reasonable to assume that over time a small number of trees that might provide fungi habitat, located adjacent to the trail, would need to be removed as they decline in health due to insect infestation or disease processes and become hazardous to the trail users. Due to the linear nature of the project, it is likely that the extent of impact would be localized to the trail corridor. Assuming a 2-foot zone of impact along each side of the 12.1 mile trail, total project impact to suitable habitat for fungi species would total about 5.9 acres. Suitable habitat, however, is located adjacent to the project area and would presumably continue to provide habitat for these species. For this reason, Alternative B May 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. For *Spathularia flavida* there is a reasonable likelihood of occurrence but it would maintain a low risk to species viability and a low likelihood of trend toward listing caused by this project for the same reasons.

Cumulative Effects

In general, the fungi comprise a cryptic and challenging taxa group. Sporocarps may be seasonal, ephemeral and annually variable making detection difficult. In many cases the ecology and habitat requirements are poorly known. As these species are assumed to be associated with late successional habitats, alteration of these habitats has the potential to impact these fungi species. The degree of this impact, however, is difficult to quantify given the lack of information on the distribution and habitat requirements of many of these fungi species.

Past activities or events have most affected fungi habitats by converting the late successional habitat conditions across the watershed to early successional stages. These activities are described in more detail in the Sol Duc Pilot Watershed Analysis (USDA Forest Service 1995), but include large-scale activities on both federal and non-federal lands such as:

- Construction of gravel and paved roads in the vicinity.
- Timber harvest activities.
- Human caused wildfires, and
- Construction of powerline corridors and associated access roads.

In a 1-mile corridor along the alignment of the proposed trail, large-scale activities have affected almost all of late successional habitat, or almost all of the total late successional habitat in the 12.1 square mile corridor. Because the proposed project will be confined to existing roads and trails, except for 3.5 miles of new construction and re-construction in

areas with vegetation less than 60 years old, the proposed project will not have direct effects on late successional habitat. Other current activities occurring in the project area include general road maintenance and fern and salal harvest. These activities are occurring in areas previously impacted by the past activities listed above and, thus, would not likely add a significant impact to the habitat. To a lesser degree than in the past, activities such as timber harvesting and human development continue in the watershed across all land ownerships. These activities are likely to continue in the future. Given that the proposed project will not result in conversion of late successional habitats, it will not substantially contribute to cumulative loss of suitable habitat for the suite of fungi species in the Sol Duc watershed.

Lichens

Alternative A (No Action)

Direct and Indirect Effects

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

Cumulative Effects

No effects -- Because Alternative A has no direct or indirect effects to lichen species, this alternative would have no cumulative effects to species viability or a trend toward listing.

Alternative B (Proposed Action)

Direct and Indirect Effects

It is possible that vegetation removal required for construction of the proposed trail would impact scattered individuals of the two lichen species evaluated. It is also reasonable to assume that over time a small number of trees adjacent to the trail would need to be removed as they decline in health due to insect infestation or disease processes and become hazardous to the trail users. Again, a few scattered individuals could be impacted; however, because suitable habitat would be retained in the watershed, undisturbed areas inhabited by these lichen species could be dispersed to other portions of the watershed and impacts to the two species are likely to be minor. In addition, suitable habitat located adjacent to the project area will presumably continue to provide habitat for these species. For this reason, Alternative B May Impact sensitive *Usnea longissima* lichen individuals or habitat, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the species. The project would not effect the persistence of the Survey and Manage *Nephroma bellum* lichen, as this site would be managed under Survey and Manage direction.

Cumulative Effects

As with the fungi taxa group, past activities and events have likely had the greatest impact on lichen species and habitat conditions across the watershed. These activities are described in more detail in the Sol Duc Pilot Watershed Analysis (USDA Forest Service, 1995), but include large-scale activities on both federal and non-federal lands such as:

- Construction of gravel and paved roads in the vicinity.
- Timber harvest activities.
- Human caused wildfires, and
- Construction of powerline corridors and associated access roads.

In a 1-mile corridor along the alignment of the proposed trail, large-scale activities have affected almost all of late successional habitat, or almost all of the total late successional habitat in the 12.1 square mile corridor. Because the proposed project will be confined to existing roads and trails, except for 3.5 miles of new construction and re-construction in areas with vegetation less than 60 years old, the proposed project will not have direct effects on late successional habitat. Other current activities occurring in the project area include general road maintenance and fern and salal harvest. These activities are occurring in areas previously impacted by the past activities listed above and, thus, would not likely add a significant impact to the habitat. To a lesser degree than in the past, activities such as timber harvesting and human development continue in the watershed across all land ownerships. These activities are likely to continue in the future. Given that the proposed project will result in loss of less than 0.11 percent of potential habitat for these lichen species, it will not substantially contribute to cumulative loss of suitable habitat for the two lichen species evaluated.

For this reason, Alternative B May Impact the sensitive lichens *Usnea longissima* and *Nephroma bellum* individuals or habitat, but would not likely contribute to a cumulative trend towards federal listing or cause a loss of viability to the species

Heritage

Affected Environment

Prehistoric

The proposed project is within the historic ancestral territory of S'Klallam tribes. At the time of contact with Europeans, a maritime settlement and subsistence focus was common among the S'Klallam tribes, the other tribes on the Olympic Peninsula, and the larger Pacific Northwest region (Eells 1985; Elmandorf 1960). Large, semi-permanent villages were abundant along the coast, especially at the mouths of rivers. During the fall, however, small groups moved inland to hunt and gather terrestrial resources, focusing on deer, elk, and other mammals, riverine fish, and plants and berries. The ethnographic data indicates that Native Americans utilized the interior of the Olympic Peninsula not only to procure resources during the fall season, but also for travel (Eells 1985; Elmandorf 1960). Interior trails were utilized by individuals and groups trading, warring and visiting across the mountains. In general, the peoples of the interior Olympic Peninsula can be described as highly mobile, with seasonal patterns of migration.

Archaeology extends our understanding of Native American culture in the Pacific Northwest back approximately 12,000 years (Ames and Maschner 1999; Matson and Coupland 1995). Within the Olympic Peninsula interior, the vast majority of prehistoric sites are classified as part of the Olcott cultural tradition (e.g. Dancy 1968; Grabert and Gaston and Jermann 1975; Grabert and Pint 1978; Munsell 1971; Stilson and Chatters 1981; Schalk and Taylor 1988). Olcott sites date between 10,000 Before Present (BP) and 4,500 BP and are characterized by sparse lithic scatters composed of dacite leaf-shaped bifaces, flakes and debitage (Bulter 1961; Kidd 1964). Olcott site location, artifact assemblage compositions, and environment reconstruction have resulted in an interpretation of Olcott as part of an interior-focused, highly mobile culture (Shaulk 1988; Matson and Coupland 1995).

The environments affected by the proposed action are largely restricted to areas disturbed by railroad and road construction and use (shoulders, cuts and fills). Archaeological sites are sometimes bisected by roads and could be within the areas of potential affect. Other geographic areas proposed for treatment include previously undisturbed forested areas. Archaeological resources could occur in forested locations and would less likely to be previous disturbance. Both of these locations may have archaeological sites that could be affected by the proposed actions resulting from direct, indirect or cumulative effects.

European Settlement

The Olympic Peninsula was first sighted from ship deck by 18th century Spanish and English explorers looking for the Northwest Passage and fur traders (Evans 1983). However, settlement of the peninsula did not begin in earnest for another century. Initial homesteaders settled in the lowland prairies and river valleys, but were moving inland by the 1890s. Many of the first homesteaders were farmers and fishermen. However, the vast majority of settlers were involved in the timber industry, which began in the early 19th century and grew rapidly as the California Gold Rush increased the demand for lumber (Evans 1983). Ore deposits also drew prospective, but largely unsuccessful, miners to the area (Righter 1978). Finally, beginning in the 1930s the Conservation Corps (CCC) constructed numerous campgrounds, ranger stations, lookouts, bridges and miles of roads and trails across the peninsula (Righter 1978). In general, historic sites on the Olympic National Forest include logging camps and activity areas, CCC Forest Service buildings, homesteads and recreation residences.

The environments affected by the proposed action are most commonly restricted to areas disturbed by railroad and road construction and use (shoulders, cuts and fills). Historic sites, especially railroad grades, are sometimes bisected by or modified into, roads and could be within the areas of potential affect. Two historic sites are known within the area of potential effect. The historic Spruce Railroad is within the area of potential effect and segments of it will be adapted and incorporated into the Olympic Discovery trail. The Crescent Mine is outside the immediate project area, but remains within the area of potential effect. Both of these sites, as well as any previously undiscovered historic sites could be affected by the proposed actions resulting from direct, indirect or cumulative effects.

Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects

No effects- Alternative A, No Action, will have no effect on any known or as yet undiscovered cultural properties. If no action is taken then there will be no ground disturbance to impact known or as yet undiscovered cultural properties.

Cumulative Effects

No effects- Alternative A, No Action, will have no effect on any known or as yet undiscovered cultural resources. If no action is taken then there will be no ground disturbance to impact known or as yet undiscovered properties.

Alternative B (Proposed Action)

Direct and Indirect Effects

Alternative B proposes to complete the multi-user, non-motorized Olympic Discovery Trail through National Forest, National Park, and private lands. Ground disturbing activities associated with trail construction have the potential to effect cultural resources. Trail construction will include adapting 2 miles of the Spruce Railroad grade, constructing 1.2 miles of new trail, reconstructing 0.3 miles of Mt. Muller trail, and modifying 8.6 miles of existing Forest Service Road. Where the trail will be constructed from existing Forest Service road, all activities will take place within the previously disturbed road prism and have no potential to effect cultural resources. Project design criteria (mitigations) are stipulated for ground disturbing actions in areas that are outside previously disturbed areas.

Two known historic sites lie within the Olympic Discovery Trail area of potential effect: Spruce Railroad and Crescent Mine. On contract with the Olympic National Forest, Ward Tonsfeldt Consulting evaluated the Spruce Railroad for eligibility to the National Register of Historic Places. A nomination is now pending covering the 16 resources within the Spruce Railroad found to be eligible. Alternative B will avoid impact to potentially significant resources through an MOU between the Olympic National Park and the Office of Archaeology and Historic Preservation. The MOU will insure that no portions of the railroad eligible for the National Register will be adversely effected by trail construction. The Crescent Mine is potentially eligible for the National Register of Historic Places, but more information is necessary before a determination can be made. To protect the site against disturbance a temporary fence will be placed around the Crescent Mine during construction.

Project areas outside of existing railroad grade and Forest Service roads and trails are considered previously undisturbed. Potential effects for these areas of trail construction

were mitigated against by background research, pedestrian survey and subsurface testing (Kwarski, *in prep*). No new cultural properties were identified within these areas through background research or fieldwork. In previously undisturbed areas, potential effects will be further mitigated against by archaeological survey following initial ground clearing and prior to laying down road gravel. Following mitigations associated with this project will insure the proposed actions have no potential to effect cultural properties.

Cumulative Effects

Alternative B cumulative effects could include increased disturbance to the Crescent Mine and Spruce railroad site resource, resulting from increased use of the nearby area. Site monitoring will determine if there are potential indirect effects to nearby cultural resources and changes to management will then be implemented to further protect the railroad and mine. Since there are no other cultural properties within the project area, there will be no cumulative effects for cultural properties in the project area unless post-ground clearing survey identified as yet unidentified cultural properties.

Compliance with Other Laws, Regulations, and Policies

Historic or Cultural Resources, Parklands, Prime Farmlands, Flood Plains, Wetlands, Wild and Scenic Rivers, or Ecologically Critical Areas

The Heritage section of this EA disclosed two known historic sites with the project's area of potential effect, Spruce Railroad and Crescent Mine. Mitigation measures will be implemented such that there will be no effect to cultural properties by the activities associated with Alternative B.

A forested wet area formed by intermittent streams at the west end of segment 10 was identified, but this area does not meet the definition of a federally designated wetland. Additionally there are no parklands, prime farmlands, flood plains, Wild and Scenic Rivers, or Ecologically Critical Areas within the project area.

Wilderness and Inventoried Roadless Areas

There are none within the project area.

Clean Water Act and Clean Air Act

The Washington Department of Ecology has included 10 segments of the Sol Duc River, identified as EC91QM, on the 303(d) list of impaired water bodies due to dissolved oxygen and temperature. One segment located in T30N, R11W, Section 27 Sol Duc River, is inside of the National Forest boundary and the Olympic Discovery Trail planning area. Observing relevant Best Management Practices can serve to prevent or minimize both types of impairments, 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 alternatives would have no effect on existing stream temperatures and dissolved oxygen levels 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 Best Management Practices and mitigation measures described in this Environmental Assessment, Alternatives A and B would protect beneficial water uses in this area and maintain water quality in the associated streams in compliance with the Clean Water Act.

This project would not negatively affect air quality. Burning of slash is not anticipated but if it does occur would be on a very small scale, and would follow all Federal and State requirements of the Clean Air Act. Trail construction could create a limited amount of dust, but this would be minimal and localized to the project area.

Scenic Quality

Although trail segments which cross existing roads would be visible at the point of intersection, there would be no affect to the scenic value of the landscape of the Sol Duc Valley and surrounding rugged terrain. Vegetation removal is limited and would not detract from the scenic quality of the area. In reality the proposed action will provide trail users access to views previously only seen by more able bodied individuals.

Irreversible and Irretrievable Commitment of Resources, Unknown Risks and Precedents

Irreversible commitment of resources refers to a loss of future options with nonrenewable resources or resources that are only renewable over a long period of time. There would be an irreversible reduction in soil productivity associated with the trail construction proposed in Alternative B. However the reduction is only about nine acres and is very small in comparison to available acres in the Sol Duc Watershed. There would also be an irreversible commitment of mineral resources due to the rock and asphalt used to surface roads under Alternative B. The amount involved would not significantly deplete the overall supply of rock and mineral resources suitable for these purposes.

Irretrievable commitment of resources refers to a loss of production of renewable resources. Resources that would be irretrievably lost as a result of the trail construction in Alternative B are loss of tree growth and wildlife habitat where vegetation is removed. Again this reduction is a very small percentage of the available acres in the Sol Duc Watershed.

Trail construction and maintenance is a common practice on the Olympic National Forest, and this project would not create any unknown risks or precedents.

Public Health and Safety

Safety is what initiated the Olympic National Park and the Washington State Department of Transportation to look at alternatives to remove non-motorized use from State Route 101 in 1997.

Shared roadways are defined by AASHTO as a roadway which is open to both bicycle and motor vehicle travel. This may be an existing roadway, street with wide curb lanes, or road with paved shoulders. The proposed action does include shared routes on Segments 3 (FSR 2929-070), 5, and 6 (FSR 2918) in addition to FSR 3079-011, 2902, and 2902-300. Signing a shared roadway should indicate to bicyclists that particular advantages exist to using these routes compared with alternative routes. This means that responsible agencies have taken actions to assure that these routes are suitable as shared routes and will be maintained in a manner consistent with the needs of bicyclists. In order for bicycles and motor vehicles to share the use of a roadway without compromising the level of service and safety for either, the facility should provide sufficient paved width to accommodate both modes. 12' curb lane width can accommodate both bicycle and motor vehicles in the same lane. Pavement surfaces should be smooth and the pavement should be uniform in width. (Mitigation #9).

Based on current use and conditions, it may be necessary to prohibit FSRs 2918, 2902, 2902-300 as a shared roadway and allow FSRs 2929-070 and 3079-011 with restricted use during periods of active use by heavy equipment. A summary assessment can be reviewed in Appendix 6, Engineering Hazard Analysis for Proposed Shared Roadway. These recommendations were made without regard to implementing any type of mitigation measures. The assessment is based on the probability of an accident and the severity of an accident if one should occur. Speed plays a significant role in each of the elements analyzed in the assessment. Slower speed will allow both the motorized and non-motorized users more time to react appropriately to changes in traffic volume, site distance, climatic and surface conditions. The line officer can choose to implement mitigation measures to reduce maximum travel speed and authorize shared roadways on the above Forest Service system roads.

Safety is further addressed in Alternative B (modified) for shared routes with the increased shoulder width, installation of bike/equestrian rails on bridges where the bridge height warrants a railing, signing narrow sections, and installing a gate on FSR 2929-070. These requirements would increase user safety on shared routes over that in Alternative B (Proposed Action) address safety concerns identified in the Engineering Hazard Analysis for Proposed Shared Roadway.

Socio-economic Effects

Those portions of the Olympic Discovery Trail that are complete have already proven to attract event organizers to host large scale competitive events. The events held to date have shown to be a great economic boost to the local community. Leaders in community tourism development believe that the trail will contribute to the “draw” of the Olympic Peninsula as a destination point for travelers.

Environmental Justice

On February 11, 1994 President Clinton signed Executive Order 12898 directing Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of activities on minority or low-income populations. Where Forest Service proposals have the potential to disproportionately affect minority or low-income

populations, effects must be disclosed (and mitigated to the extent possible) through NEPA analysis and documentation.

In consultation with the Quileute Indian Tribe a concern that surfaced was the impact the proposed project may have in the future on natural resources that are culturally important to the tribe if the trail should experience intense use. A high volume of traffic on this trail could disturb foraging elk and deer within sight or smell of humans in the project area. It might also impact culturally important plants within close proximity to the trail. Since the use and impact of that use is difficult to predict at this time it is recommended that the County monitor the use and potential adverse impacts on culturally important natural resources and address adverse impacts in the O&M Plan after consultation with both the Quileute Indian Tribe and the Olympic National Forest.

Other than the concern mentioned above, the effects of the proposed action and the No Action alternative are discussed throughout the Environmental Consequences sections of this document. The 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.

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

National Forest Management Act Compliance

Compliance with the National Forest Management Act (NFMA) can be demonstrated by finding that a project is consistent with the following applicable requirements of 16 USC 1604(g)(3).

(g)(3)(A) insure consideration of the economic and environmental aspects of various systems of renewable resource management, including the related systems of renewable resource management, including the related systems of silviculture and protection of forest resources, to provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish

This EA considered the effects of implementing the alternatives on the economic and environmental aspects of the project area. This consideration, as documented in this chapter, included the forest resources of botany, watershed, wildlife, and fish.

(g)(3)(B) provide for diversity of plant and animal communities based on the sustainability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan

Actions proposed under the alternatives provide for diversity of plant and animal communities within the project area as described within the multiple-use objectives of the Forest Plan. The effects to plant and animal communities are described in the resource sections of this chapter.

(g)(3)(C) insure research on and (based on continuous monitoring and assessment in the field) evaluation of the effects of each management system to the end that it will not produce substantial and permanent impairment of the productivity of the land

Monitoring proposed in chapter 2 of this document would provide an evaluation of the effects of implementing an alternative.

Forest Plan Consistency

The analysis performed by the interdisciplinary team found that the actions proposed under Alternative B are consistent with the Forest Plan. The project's purpose and need is consistent with Forest Plan goals and objectives. The Plan identified goals and objectives of providing a variety of dispersed non-motorized recreation and providing a trail system that meets demand while providing for a variety of recreation user groups, and included as a potential project the reconstruction of the Spruce Division/Port Angeles Western Railroad grade as a recreational trail. The impacts to resources as evaluated in this EA have been found to be consistent with Forest Plan direction and standards and guidelines. Descriptions of the effects of implementing the various alternatives and Forest Plan consistency rationale can be found in the individual resource sections in this chapter.

Tiering

As stated in Chapter 1, this Environmental Assessment is tiered to the Final Environmental Impact Statement for the 1990 Olympic National Forest Land and Resource Management Plan (LMRP) (USDA 1990a). The LMRP was amended by the 1994 Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA and USDI 1994), commonly known as the Northwest Forest Plan, and its amendments. This document also tiers to the 2005 Final Environmental Impact Statement (FEIS) and Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (USDA 2005). This analysis incorporates by reference the Olympic National Forest's LMRP (USDA 1990b), its Road Management Strategy (USDA 2000), the Sol Duc Watershed Analysis (USDA 1995), Solduck LSR Assessment (USDA 1997), and the Olympic National Forest Access Travel Management (ATM) Plan (USDA 2003b).

The proposed action's project area is on National Forest System land and complies with all federal, state, and local laws and regulations.

Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

ID Team Members:

Diane Rubiaco, Team Leader/writer/editor

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Phil DeCillis, Fisheries Biologist

Molly Erickson, Recreation

Reed Callis, Fire

Rick Driggs, Engineering

Deborah McConnell, Botanist

Ray Hershey, Vegetative Management Specialist

Federal, State, Local Agencies:

Washington Department of Natural Resources

U.S. Fish and Wildlife Service

Washington Department of Fish and Wildlife

Olympic National Park

Tribes:

Quileute Tribe

REFERENCES

- Ament, S., Washington Department of Fish & Wildlife. 2005. Conversation with Betsy Howell; Pacific Ranger District, Olympic National Forest.
- Castellano, M. A., E. Cazares, B. Fondrick, and T. Dreisbach, 2003. Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan. USDA General Technical Report PNW-GTR-572. January 2003.
- Castellano, M. A., J. Smith, T. O'Dell, E. Cazares, S. Nugent, 1999. Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan. USDA General Technical Report PNW-GTR-476. October 1999.
- Cooper, B.A., M.G. Raphael, and D.Evans Mack. 2003. Refining a landscape-scale habitat model and inland monitoring program for marbled murrelets in the Olympic Peninsula. Final Report prepared for USFS Pacific Northwest Research Station and Olympic Natural Resources Center. ABR, Inc., Environmental Research & Services, P.O. Box 249, Forest Grove, OR 97116.
- Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutierrez, J. M. Marzluff, and L. Sztukowski. 2004. Scientific evaluation of the status of the Northern Spotted Owl. Sustainable Ecosystems Institute, Portland, OR.
- Gaines, W.L., P.H. Singleton, and R.C. Ross. 2003. Assessing the Cumulative Effects of Linear Recreation Routes on Wildlife Habitats on the Okanogan and Wenatchee National Forests. USDA Forest Service, PNW-GTR-586.

- Hayes, M., Washington Department of Fish & Wildlife. 2005. Email and phone communication with Betsy Howell; Pacific Ranger District, Olympic National Forest.
- Hitchcock, C.L., Cronquist, A., Ownbey, M., and Thompson, J.W. 1969. Vascular Plants of the Pacific Northwest. (5 Vols). University of Washington Press. Seattle, WA.
- Hutten, M. 2005. Personal communication.
- Jochimsen, D.M., C.R. Peterson, K.M. Andrews, and J.W. Gibbons. 2004. A Literature Review of the Effects of Roads on Amphibians and Reptiles and the Measures Used to Minimize Those Effects. Idaho Fish and Game Dept and USDA Forest Service.
- Keon, D.B. & P.S. Muir. 2002. Growth of *Usnea longissima* across a variety of habitats in the Oregon Coast Range. *Bryologist* 105:233-242.
- Keon, D.B. 1999. Predicting presence of the sensitive lichen *Usnea longissima* in managed landscapes: a comparative multivariate analysis. Oregon State University, Corvallis.
- Keon, D.B. 2002. Fertile *Usnea longissima* in the Oregon Coast Range. *Lichenologist* 34:13-17.
- Lawton, Elva. 1971. Moss Flora of the Pacific Northwest. The Hattori Botanical Laboratory, May 1971.
- Leonard, W.P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, WA. 168 pp.
- Link, W. A., and J. R. Sauer. 1997. Estimation of population trajectories from count data. *Biometrics* 53:63-72.
- Maser, C. 1998. *Mammals of the Pacific Northwest, From the Coast to the High Cascades*. Oregon State University Press, Corvallis, OR. 406 pp.
- McCune, B. & L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press, Corvallis, OR
- Nelson, S.K. and T.E. Hamer. 1995. Nest Success and the Effects of Predation on Marbled Murrelets. General Technical Report PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Peck, J.E. & B. McCune. 1997. Remnant trees and canopy lichen communities in western Oregon: a retrospective approach. *Ecological Applications* 7:1181-1187.
- Pojar, J. and MacKinnon, A. 1994. Plants of the Pacific Northwest Coast, Washington, Oregon, British Columbia, and Alaska. B.C. Ministry of Forests and Lone Pine Publishing.
- Raedeke Associates, Inc. 1993. Camp Creek Bald Eagle Management Plan, Soleduck Ranger District, Olympic National Forest. 5711 Northeast 63rd Street, Seattle, WA 98115.
- Sheets, T.J. 1993. Washington State Pine Marten Distribution. Washington Conservation Corps, Washington Department of Fish & Wildlife.
- State of Washington, Natural Heritage Program, 2004.

- Survey Protocols for Survey & Manage Category A & C Lichens in the Northwest Forest Plan Area, Version 2.1 (2003). C. Derr, R. Helliwell, A. Ruchty, L. Hoover, L. Geiser, D. Lebo & J. Davis.
- Taber, RD, and KJ Raedeke. 1980. Status report, Roosevelt elk of the Olympic National Forest. University of Washington, College of Forest Resources. Seattle, WA.
- Therres, G.D., M.A. Byrd and D.S. Bradshaw. 1993. Effects of development on nesting bald eagles: case studies for Chesapeake Bay. Trans. North American Wildlife & Natural Resources Conf. 58:62-69.
- Thomas, J.W., ed. 1979. Wildlife habitats in managed forests – the Blue Mountains of Oregon and Washington. Handbook No. 533. Washington, D.C.:U.S.Dep. Agric. 512 pp.
- USDA 1990a. Final Environmental Impact Statement on land and resource management plan. USDA Forest Service. Olympic National Forest. Olympia, Washington.
- USDA Forest Service. 1990b. Olympic National Forest Land and Resource Management Plan. Olympia, WA
- USDA Forest Service and USDI Bureau of Land Management. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl. Portland, Oregon.
- USDA Forest Service and USDI, Bureau of Land Management. 1994. Record of Decision; Attachment A, Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.
- . 2004. Record of Decision Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl; Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy.
- . 2004. Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.
- USDA Forest Service, Natural Resource Information System (NRIS), Invasive Plant Inventory Database.
- USDA Forest Service, Olympic National Forest, 2005. Olympic National Forest Rare Plant Occurrence GIS cover.
- USDA Forest Service, Pacific Northwest Region, 1989. Forested Plant Associations of the Olympic National Forest. R6-ECOL-TP 001-88 1989. J. Henderson, D. Peter, R. Leshner, D. Shaw.
- USDA Forest Service, Pacific Northwest Region, 2005. Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants, Final Environmental Impact Statement and Record of Decision.
- USDA Forest Service, Region 6 & USDI BLM ISMS database and associated GIS covers, 2004.
- USDA Forest Service, USDI Bureau of Land Management, USDI Fish & Wildlife Service, USDI National Park Service. 1990. A Conservation Strategy for the

- Northern Spotted Owl: Report of the Interagency Scientific Committee To Address the Conservation of the Northern Spotted Owl (ISC Report). Portland, Oregon.
- USDA Forest Service. 1994. The Scientific Basis for Conserving Forest Carnivores, American Marten, Fisher, Lynx, and Wolverine in the Western United States. GTR RM-254, Fort Collins, CO.
- USDA Forest Service. 1995. Sol Duc Pilot Watershed Analysis. Olympic National Forest, Olympia, WA.
- USDA Forest Service. 1997. Soleduck Late Successional Reserve Assessment. Olympic National Forest, Olympia, WA.
- USDA Forest Service. 2004. Regional Forester's Sensitive Species List. Portland, Oregon.
- USDA Natural Resources Conservation Service, PLANTS Database.
<http://plants.usda.gov>.
- USDI Fish & Wildlife Service. 2003. Biological Opinion for Selected Forest-Management Activities, Olympic National Forest, 2003-2008.
- Washington Department of Fish & Wildlife. 2002. Camp Creek Bald Eagle Territory Occupancy/Productivity Survey. From Shelly Ament, WDFW, Sequim, WA. -
- . 2004. Washington State elk herd plan, Olympic elk herd. Olympia, WA.
- Washington State Noxious Weed Control Board, www.nwcb.wa.gov.
- Wilke, Thomas. 2004. Genetic and Anatomical Analyses of the Jumping Slugs, Final Report, Contract #43-05G2-1-10086.
- Witmer, GW, and DS deCalesta. 1985. Effects of forest roads on habitat use by Roosevelt elk. Northwest Science. 59:122-125.
- Ziegltrum, J. 2001. Olympic National Forest Monitoring Report. Olympia, WA.
- Ziegltrum, J. 2004. Draft Management Recommendations for Two Species of the Genus Hemphillia. Olympic National Forest, Olympia, WA.