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Sawtooth Huckleberry Restoration

Gifford Pinchot National Forest
Mt. Adams Ranger District and Mount St. Helens National Volcanic Monument
Skamania County, Washington

T. 7 N., R. 8 E., Sections 1-3, 9-16, 21-27, Willamette Meridian

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CHAPTER 1. PURPOSE AND NEED FOR ACTION

Background

The Sawtooth Huckleberry Fields were once and probably still are among the most productive berryfields in the Pacific Northwest, but fire exclusion and ecological succession have led to a dramatic loss of productive huckleberry habitat over the past hundred years. Huckleberries are an important treaty resource for the Yakama Indian Nation, and in recognition of this importance the Forest Service granted them exclusive berrypicking rights to a portion of the Sawtooth Huckleberry fields east of Forest Road 2400 in 1932. The historic extent of the Sawtooth Huckleberry Fields includes all or parts of Sections 1, 2, 3, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26 and 27, T7N, R8E, Willamette Meridian This area is situated in headwaters for both the Lewis River and White Salmon River drainages. The intent of considering such a large area is to allow a landscape-level approach to restoration activities.

The objective for this project is to increase huckleberry productivity within the Sawtooth Huckleberry Fields by controlling the encroachment of conifers in areas where huckleberries constitute the predominant shrub species. Removal of conifers would be accomplished through a variety of treatment methods, including hand lopping, girdling, firewood harvest, mechanical mulching, commercial timber harvest and prescribed burning. Slash treatments could also occur.

All of the twelve proposed treatment units are fire-regenerated stands of varying ages that were considered productive huckleberry areas in the early 1900s. Currently the stands contain varying densities of trees that compete with huckleberry shrubs for light, water and nutrients.

Figure 1. Sawtooth Huckleberry Restoration planning area vicinity map.

Purpose of and Need for Action

The Sawtooth Huckleberry Restoration Project proposes to restore conditions that benefit the continued long-term production of native huckleberries (*Vaccinium membranaceum)* on the Mount Adams Ranger District and the Mount St. Helens National Volcanic Monument, in order to benefit local Native Americans, recreational berry pickers and local communities, as well as the natural ecosystems associated with these berry fields (bear, elk, bluebirds). Fruit production is in decline due to increased shade and competition from overstory trees.

The Sawtooth Huckleberry Fields have served as a destination point for Indian people for thousands of years. Today huckleberries continue to be honored by Yakama Indians as a sacred food, with a ceremony that marks the beginning of the summer gathering season. In recognition of its importance to Yakama Indians, a portion of the Sawtooth Huckleberry Fields was set aside for exclusive Indian berrypicking use in 1932. In the Treaty of 1855, the Yakama Nation reserved the right to gather berries on ceded lands.

Fire exclusion and ecological succession have led to a dramatic loss of productive huckleberry habitat over the past hundred years. The Sawtooth Berry Fields were estimated to have covered approximately 6,000-8,000 acres at the turn of the century, and are estimated to cover about 1,500 acres at present.

The Forest Service has a responsibility to the Yakama Nation to manage this treaty resource to ensure its availability over time. The *Gifford Pinchot National Forest Land and Resource Management Plan* (Forest Plan) directs that traditional food and plant material gathering sites used by Native Americans may be managed for continued production of native roots, berries, nuts, herbs, beargrass, and other plant materials typically gathered from the land (Forest Plan, IV-50).

There is a need to reduce the overstory stand to permit more light to reach the existing berry bushes, thus increasing berry production, and remove competing vegetation to allow bushes to expand and occupy more growing space. There is a need to reduce the trend toward loss of berry production and loss of an important treaty and recreational resource over time due to conifer encroachment.

Existing Condition

At present the Sawtooth Huckleberry Fields are estimated to cover approximately 1,500 acres. According to Martinez' classification in 1989, only 182 acres of this 1,500 can be classified as open berry fields. Approximately 313 acres currently contain a high conifer overstory, while 1,005 acres occupy areas with a dense conifer overstory.

Since the major fires of the early 1900s, tree abundance and cover within the Sawtooth Berryfields has steadily increased. The area around West Twin Butte was a highly productive berryfield in the early 1900s. The area is now fully forested, with regenerated trees 20 inches in diameter and 100 feet tall. Similar forest growth has occurred in areas west and east of Sawtooth Mountain. In areas where tree cover and growth has occurred the most, the huckleberry understory is still present, but berry production is extremely low. Fruit production declines when huckleberry bushes become heavily shaded (Minore 1972, 1984, Minore et al. 1979, Barney

1999, Simonin 2000, Stark and Baker 1992)

Desired Future Condition:
The majority of the units proposed for treatment are in the "Roaded Recreation" land allocation in the Gifford Pinchot Forest Plan. Areas in this land allocation, "accommodate dispersed recreation—hiking, fishing, berrypicking, camping, wildlife viewing, rockhounding, winter sports—beside or near roads. They include unique or distinctive portions of the Forest with features like clustered lakes, berryfields, and roaded scenic corridors" (GPFP, IV-95).

To enhance berrypicking in the Sawtooth Berry Fields, a mosaic of conditions ranging from open fields, few trees, and open canopies where sun is getting to shrubs is desired. A landscape where tree canopy is not concentrated, and vigorous shrubs are producing berries, snags are present, and there is enough cover to prevent frost damage to huckleberry shrubs.

The Sawtooth Berryfields and adjoining areas that were historically characterized as berryfields would have increased berry production and benefit Native Americans, recreational berry pickers, and local communities. In addition, wildlife (bear, elk, bluebirds) associated with early successional forest that has a preponderance of huckleberry would be benefiting from increased berry production.

Figure 2. Photo of productive huckleberry habitat in the Sawtooth Berryfields in 1936. USFS photo by Ray Filloon.

Figure 3. Photo showing productive huckleberry habitat within the Sawtooth Berrfields in 1936. Note evidence of past wildfire in the form of standing snags. USFS photo by Ray Filloon.

Management Direction

This action responds to the goals and objectives outlined in the *Gifford Pinchot National Forest Land and Resource Management Plan* (Forest Plan, 1990), as amended by the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (Northwest Forest Plan, 1994). This EA is tiered to the 1990 Environmental Impact Statement that was the basis for analysis for the Forest Plan. The Forest Plan and the Northwest Forest Plan were combined into a convenient reference, referred to in this document as Amendment 11. This action is consistent with and helps move the project area towards desired conditions described in the Forest Plan.

The project area is located primarily within a Roaded Recreation and Matrix management allocation as described in the Forest Plan and Northwest Forest Plan. Other management areas described in the Forest Plan that occur to a lesser degree in the project area include Visual Emphasis and General Forest. The project is expected to meet Forest-wide standards and guidelines and Management Area direction for these allocations. Units are situated within either the matrix or administratively withdrawn land allocations under the Northwest Forest Plan.

Gifford Pinchot Forest Plan Land Allocations:

Roaded Recreation: Six of the proposed treatment units are located within a Roaded Recreation management allocation as described in the Forest Plan. These lands are meant to accommodate dispersed recreation, including hiking, berry picking, camping and wildlife viewing beside or near roads. They include unique or distinctive portions of the Forest with features like clustered

lakes and berryfields. The Roaded Recreation allocation applies to the Sawtooth Huckleberry Fields and Surprise Lakes. The desired future condition for this allocation is management activities are evident, but not conspicuous. Vegetation will remain largely natural in appearance along the major travel ways and may vary from natural openings through stands of mature and old-growth timber. Trees may be felled and removed to enhance recreation. Huckleberry collection by Native Americans and the general public is the primary recreational activity that drove the establishment and delineation of this management area. Tree felling and removal to enhance huckleberries would directly enhance the recreational value of this allocation.

Visual Emphasis: Four of the proposed treatment units are located in a Visual Emphasis management allocation along Forest Road 2400 and Forest Road 3000. The goal of this allocation is to provide a natural or near-natural landscape as viewed from the designated travel route. The desired future condition for this allocation is to accommodate a variety of activities, which to the casual observer, are either not evident or are visually subordinate to the natural landscape. Timber harvest activities may be permitted in compliance with assigned Visual Quality Objectives. The Visual Quality Objective for this land allocation is partial retention which requires that the activities remain visually subordinate to the natural landscape. Treatments that promote huckleberry production and timber resources, provided they meet a partial retention Visual Quality Objective, are consistent with allocation objectives.

General Forest: Two proposed treatment units are located within a General Forest management allocation. The objective for these lands is to restore and accelerate the timber growth and yield of even-aged stagnated stands and to manage for the continued production and utilization of forest resources, principally timber, water, fish, dispersed recreation, and wildlife. The desired future condition is for all tree sizes and mixture of native species from seedlings to mature saw timber well distributed on the landscape. The full range of recreation opportunities is available in this land allocation (Forest Plan Amendment 11 p. 6-25). Treatments that promote huckleberry production and timber resource would be consistent with allocation objectives.

Northwest Forest Plan Land Allocations:

Matrix: Approximately half of the proposed treatment stands are located within lands allocated as matrix. This land allocation overlaps with Visual Emphasis and General Forest land allocations from the Forest Plan. Matrix lands are those outside designated reserves (such as late-successional reserves) where most vegetation management will occur (Forest Plan, Amendment 11, p. 6-1).

Administratively Withdrawn: The remaining treatment stands are located within lands allocated as administratively withdrawn. This land allocation overlaps with the Roaded Recreation land allocations from the Forest Plan.

Riparian Reserves: Some of the units have portions dedicated to riparian reserve management. Riparian reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. No action is proposed within any riparian reserves other than the use of existing roads.

Key Watersheds: Sawtooth Berryfields straddle a plateau between the Middle Lewis River Watershed and the Trout Lake Creek Watershed. The Middle Lewis River Watershed has been designated as a Tier 1 Key Watershed under the Northwest Forest Plan. Tier 1 Key Watersheds

directly contribute to anadromous salmonid and bull trout conservation. The Trout Lake Creek Watershed is a non-key watershed. Watershed analyses were completed for both watersheds in 1995 and 1996, respectively. In this area streams are few, but there are several lakes and ponds (Surprise Lakes, Frog Lake). No action is proposed within any riparian reserves other than the use of existing roads.

Other Management Direction:

Inventoried Roadless Area: In addition to the management allocations described in the Forest Plan, two of the proposed treatment units (within the Roaded Recreation management allocation) are within the Red Lake Inventoried Roadless Area (IRA), at the northern end of Indian Heaven Wilderness. These roadless areas are generally managed to preserve their roadless characteristics. Both action alternatives are consistent with the 2001 Roadless Area Rule. While the Rule generally prohibits cutting, selling or removal of timber, exemptions are included if the project activities meets certain requirements. Specifically, generally *small diameter timber* may be cut, sold or removed if it meets one of the stated purposes listed in 294.13(b)(1) of the Rule, *and* will maintain or improve one or more of the roadless area characteristics described in 294.11 of the Rule.

Within the two units in the Red Lake IRA, the silvicultural prescription under both alternatives is young stand thinning, and only includes cutting small diameter timber (<8" diameter at breast height) which is consistent with the Rule. The cut trees would not be removed under either action alternative. Trees less than 5" diameter at breast height would be targeted for mulching.

To be consistent with the 2001 Roadless Rule, the actions must also be needed to meet one of the stated purposes such as to "maintain or restore the characteristics of ecosystem composition and structure…within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period" (294.13 (b)(1)(ii)). The Sawtooth Berry Fields were historically much more open and contained more huckleberry habitat. Due to fire suppression, conifer encroachment has altered the landscape and huckleberry production is on the decline. The action alternatives would thin stands within the inventoried roadless area and return the area to a more open landscape, capable of hosting more huckleberry plants.

Finally, actions in inventoried roadless areas must maintain or improve one or more of the roadless area characteristics. As defined in 294.11 of the Roadless Rule, traditional cultural properties and sacred sites are considered one example of resources or features that are often present in and characterize inventoried roadless areas. The objective of the project is to restore huckleberry habitat within the Sawtooth Berry Fields, an area of traditional cultural significance to the Yakama Nation and listed in the National Register of Historic Places as a traditional cultural property.

Vegetation Treatment Requirements: The proposed silvicultural treatment methods within the proposed stands meets all the requirements, conditions, and constraints for vegetation manipulation as specified in title 36 CFR 219.27 (b) and Appendix F of the Forest Plan. The vegetative treatment analysis also meets the requirements of the Mediated Agreement and the 1988 Record of Decision for Managing Competing and Unwanted Vegetation.

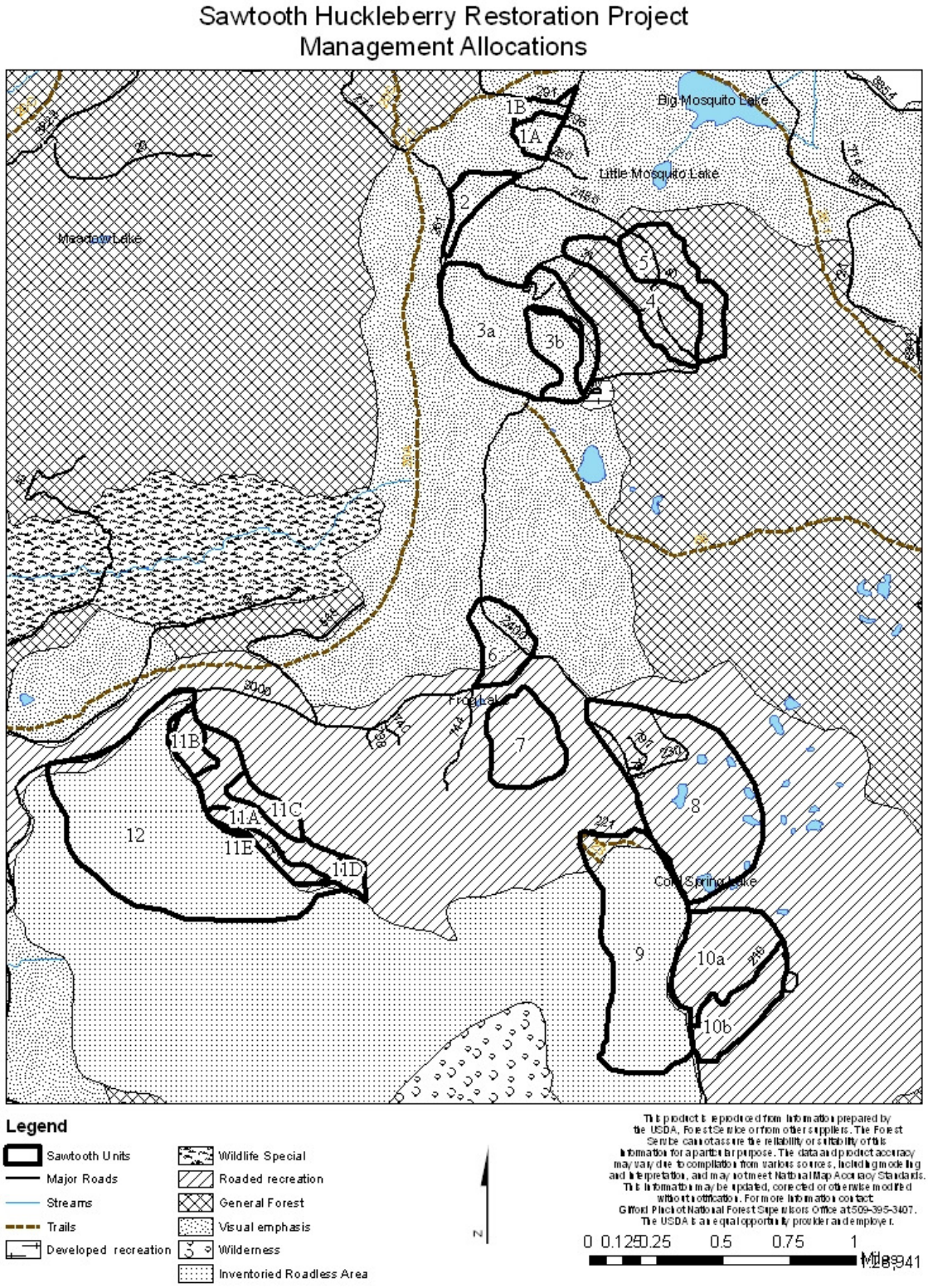

Figure 4. Gifford Pinchot National Forest management areas within the Sawtooth Huckleberry Restoration planning area.

Proposed Action

To enhance huckleberry production, the Forest Service would reduce forest canopy on approximately 1,212 acres. Both manual and mechanical treatments would be used to remove trees. Manual treatments would include girdling and hand cutting and piling. Mechanized treatments would include both cable and ground-based logging systems. Trees will be removed to achieve a canopy cover ranging between 10% and 50%, reflecting the variability in stand conditions, This may be achieved through thinning, or through regeneration harvest (Moderate Forest Retention) on lands where timber sustainability is required.

A complete description of the proposed action (referred to as Alternative B) is found in Chapter 2 of this document.

Decision Framework

The responsible officials (Mt. Adams District Ranger and the Mount St. Helens National Volcanic Monument Manager) will review the proposed action and the other alternatives to determine which of them best meets the purpose of and need for action in the Sawtooth Berry Fields. When making the decision, the responsible officials will also take into consideration the specific objective of developing an economically feasible project as well as the issues that have been raised by the interdisciplinary team and from comments received from the public, other agencies, and tribes in response to this analysis.

The final decision would be to either:

- select the proposed action for implementation;
- select an alternative or modification of an alternative for implementation;
- defer action at this time; or,
- conclude that significant impacts would result from the proposed action which would warrant the preparation of an environmental impact statement.

Public Involvement

The proposal was listed in the Gifford Pinchot National Forest Schedule of Proposed Actions beginning in April 2007. A field trip was conducted on 7/10/07 with representatives from the Mt. Baker-Snoqualmie National Forest and the University of Washington. A description of the proposal was sent to a mailing list of 99 individuals, organizations, agencies, and tribes for comment during scoping which was initiated on September 12, 2007. A field trip was conducted on 10/31/07 with representatives of the Gifford Pinchot Task Force.

During the initial scoping period, the Forest Service received 12 comment letters, emails or phone calls in response to the proposed action. Using these comments the interdisciplinary team developed the final proposed action, an alternative to the proposed action, and a list of issues that would be addressed in this analysis.

Due to the traditional importance of the Sawtooth Berry Fields to the Yakama Nation, they were invited to participate in the interdisciplinary process as a cooperating agency. An initial field trip to discuss the proposal was held on August 15, 2006, and several representative from the Yakama Nation attended. A representative from the Yakama Nation served as a member of the Interdisciplinary Team. A formal presentation of the proposed project was presented to representatives of the Tribal Council of the Yakama Nation on March 20, 2008.

In October of 2008, the Forest proposed cutting trees on a two-acre test plot within the Sawtooth Huckleberry Project area. The objective of cutting trees this year would be to allow the cut trees to dry out and a trial underburn scheduled in spring of 2009. This trial would help determine the feasibility, costs and ground-fuel requirements for underburning in this area before a larger contract was let on the project. A scoping letter describing this trial effort was sent to the Sawtooth mailing list on October 9, 2008. Several comment letters were received, mostly responding to the larger Sawtooth Huckleberry Restoration Project effort. These comments were also incorporated into the project design and can be found in the project file. The Columbian newspaper ran an article on the trial and three radio stations (in Vancouver and Goldendale, Washington) also aired the story.

Issues

The issues were developed through public as well as internal scoping. Each of the issues raised was either used to refine the proposed action through the incorporation of specific design features, or addressed through application of standards and guidelines or best management practices from the Gifford Pinchot Land and Resource Management Plan.

The following issues were identified by the Forest Service interdisciplinary team or the public, and were used to modify the proposed action, develop an alternative to the proposed action and develop mitigation measures to each alternative.

Prescribed Burning

Thinning Alone

- To enhance huckleberry productivity over the long term, opening up the canopy by removing trees may not be as effective as prescribed burning.

  Measure: Huckleberry productivity index over time.
  Alternative C was designed to address the potential effectiveness of underburning following timber removal. Discussion of this issue can be found in the alternative section in Chapter 2, the Silviculture section and the Fire and Fuels section in Chapter 3.

Slash Disposal and Slash Quantity

- The removal of trees may result in excessive post-treatment slash in some units and burning that material may cause negative effects to the soils and huckleberry plants in those units.

  Measure: Estimated huckleberry plant mortality and soil damage in units with excessive amounts of slash.
  Mitigation measures were included in the design of the project to avoid negative effects to soils and huckleberry plants from excessive amounts of slash. Discussion of this issue can be found in the Mitigation Measures section in Chapter 2, the Soils section and the Fire and Fuels section in Chapter 3.

Smoke Management Adjacent to Wilderness

- Any prescribed burning (especially underburning) may cause excessive amounts of smoke which may affect air quality in the nearby Indian Heaven Wilderness.

  Measure: Particulate matter released
  Design features were included in the design of the project to avoid generating excessive smoke during slash treatment. Discussion of this issue can be found in the Fire and Fuels section in Chapter 3.

Roadless Area Entry

- Removing trees and constructing firelines within units 9 and 12, which fall within the Red Lake Inventoried Roadess Area (IRA), may not comply with the 2001 Roadless Rule to maintain or improve the roadless area characteristics.

  Measure: Diameter of trees cut and miles of fireline constructed in units 9 and 12.
  The project is consistent with the 2001 Roadless Rule and is expected to maintain the roadless area characteristics in the Red Lake IRA. Discussion of this issue can be found in the Management Direction section in Chapter 1 and the Recreation section in Chapter 3.

Pacific Crest Trail

- Cutting trees and opening up the canopy near the Pacific Crest Trail may compromise the experience of hikers who use this trail.

  Measure: Trees cut near the trail; huckleberry production increased along trail
  Mitigation measures were added in the project design to avoid impacts to the Pacific Crest Trail. Discussion of this issue can be found in the Mitigation measures section in Chapter 2 and the Recreation section in Chapter 3.

Spotted Owl Habitat

- Decreasing the canopy and opening up units 3, 4 and 5 may degrade nesting habitat and adversely affect Northern spotted owl habitat.

  Measure: Acres of reduced dispersal habitat
  Discussion of this issue can be found in the Wildlife section in Chapter 3.

Cultural Value of Huckleberries

- Continued loss of productive huckleberry habitat in the Sawtooth Berry Fields will negatively impact availability of a treaty resource, as well as continued traditional tribal use of the area.

  Measure: Acres of productive huckleberry habitat lost
  Discussion of this issue can be found in the Heritage Section in Chapter 3.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the Sawtooth Huckleberry Restoration project. This section includes a description of each alternative considered, and a map of the action alternatives. This section also presents the alternatives in comparative form, according to identified significant issues, defining the differences between each alternative for the public and providing a clear basis for choice among options by the decision maker.

Alternative A – No Action

The no action is a baseline for comparison. This alternative assumes none of the proposed activities would occur. No thinning of forest vegetation would occur. No manual or mechanical treatments would be used. No prescribed fire would be used as a tool to enhance huckleberry restoration. No entry would occur in the Red Lake Inventoried Roadless Area. It would also not treat any areas in proximity to the Pacific Crest Trail.

With no action, the overstory stand would not be reduced to permit more light to reach the existing berry bushes, thus berry production would not be increased in the area, nor would competing vegetation be removed to allow bushes to expand and occupy more growing space. The trend toward loss of berry production and loss of an important treaty and recreational resource over time due to conifer encroachment would not be addressed or slowed. The Forest would not be addressing its responsibility to the Yakama Nation to manage this treaty resource to insure its availability over time.

Alternative B—Proposed Action

In this alternative, the Forest Service proposes to thin forest vegetation on approximately 1,212 acres. The proposed action will include treatment of a total of 19 units (1A through 12; see Table 1 below).

The proposed action was developed by selecting stands within the historic Sawtooth Huckleberry Fields landscape that were likely to respond well to treatment. Historic maps and aerial photos were used to select stands that had functioned as berry fields within the past 75 years. Information on productivity of these stands was derived from a field inventory of 2380 acres of the Sawtooth Huckleberry Fields that was conducted in 1967 and 1968. This inventory included classification of huckleberry cover and productivity. This data was used to aid in the selection of treatment stands. The majority of stands selected for treatment had at least 40% huckleberry cover, and were classified as having “good” huckleberry productivity in 1968.

After stands were selected, methods to reduce tree cover on these stands were developed. These methods reflected the variable size and density of tree cover within the stands. For stands where tree cover was sparse, manual treatments were proposed. Manual treatments would include girdling, and hand cutting and piling. For stands where a dense cover of small trees is present, use of mechanical mulching equipment was proposed. For stands with larger trees, both cable and ground-based logging systems are proposed. In stands where mature trees are present,

thinning will be done from below (i.e., smaller trees will be removed and larger trees will be retained). Leave trees will be selected in order to provide diversity of age and species. As described above, for the two proposed units in the most open portions of the berryfields, only minimal hand treatments are proposed.

In an attempt to limit damage to the huckleberry rhizomes, over snow, ground-based logging is prescribed for several stands that are in close proximity to Forest Service Road 30, the principal haul route. Over-the-snow logging is proposed for units 2, 6, 7 and 11A, to potentially reduce short-term impacts to the huckleberry plants during stand treatment. Log skidding should occur over a snow pack of 2 to 4 feet, to provide additional protection to the above and below-ground portions of the huckleberry shrub. Over-snow logging is problematic in this area, however, due to a pattern of generally early, heavy snowfall. This area typically has an 8-12 foot snow pack in the winter with rapid snow accumulation occurring in December. On average, the operating window to feasibly log over snow would only be 2-3 weeks. The ability to implement this requirement will be dependent on an unusual winter that results in favorable conditions. If conditions are such that over-the-snow logging is not feasible, harvest may ultimately take place in warmer months, but over-the-snow will be the preferred method.

Connected actions include the construction of 1.4 miles of temporary roads. Eight of the 19 units would include piling and burning to reduce activity fuels. In other units where activity slash is expected to be generated, it would be lopped and scattered throughout the unit. No prescribed fire would occur in this alternative.

The following table gives a description of the alternative for each proposed stand. A complete narrative broken down by management allocation follows.

Table 1. Details of Activities Proposed in Alternative B.

Unit	Acres	Vegetation Treatment	Implementation Method	Road Construction	Fuels Treatment	Timber Cut (mbf)
1A	13	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
1B	9	Moderate retention regeneration	Ground-based machinery	None	Pile and burn near roads	270
2	19	Commercial thinning	Ground-based machinery; over snow	None	Pile and burn near roads	440
3A	102	Commercial thinning	Ground-based machinery and skyline	0.1 miles specified	Pile and burn near roads	990
3B	40	Moderate retention regeneration	Ground-based machinery and skyline	0.1 miles specified	Yard tops attached	1010

4	56	Commercial thinning	Ground-based machinery	0.1 miles temporary	Pile and burn near roads	170
5	51	Moderate retention regeneration	Ground-based machinery	0.1 miles temporary	Pile and burn	510
6	35	Commercial thinning	Ground-based machinery; over-snow logging	0.1 miles temporary	Pile and burn near roads	100
7	52	Commercial thinning	Ground-based machinery; over-snow logging	0.2 miles temporary	None	390
8	182	Young stand thinning	Hand tools	None	Lop and scatter	None
9	166	Young stand thinning	Hand tools	None	Lop and scatter	None
10A	55	Commercial thinning	Ground-based machinery	0.2 miles temporary	Pile and burn near roads	580
10B	59	Commercial thinning	Ground-based machinery	0.1 miles temporary	Pile and burn near roads	400
11A	50	Commercial thinning	Ground-based machinery; over-snow logging.	0.4 miles Temporary	None	1210
11B	17	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
11C	15	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
11D	3	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
11E	17	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
12	271	Young stand thinning	Ground-based machinery; mulch trees	None	None	None
Total	**1,212**	**NA**	**NA**	**1.4**	**NA**	**6,070**

Roaded Recreation

Treatments in the Sawtooth Berryfields Roaded Recreation area would promote huckleberry productivity by hand cutting small trees, mulching small trees, and removing commercial quantities of medium sized trees by thinning.

Lands within the Roaded Recreation allocation are unsuitable for sustained timber production. Where timber harvest is proposed, it is primarily to meet the Roaded Recreation objective of huckleberry enhancement, while protecting other resources. Levels of conifer stocking in these areas address the environmental requirements of huckleberry and wildlife, not timber sustainability.

Units 8 and 9 – Young Stand Thinning

These stands comprise the heart of Sawtooth Berryfields where the majority of berry picking occurs. Fruiting here is good, but numerous saplings and small trees threaten that productivity. Young stand thinning by hand treatment is proposed, given the high public use, good fruiting, and small size of the trees.

The thinning objective is to limit trees to 15-20% canopy cover. These units have some of the more level, frost prone slopes in the planning area. While this portion of the huckleberry field has been the most open, it historically had light cover (~10%) mostly from snags that remained after the last stand replacing fire. These snags are no longer present and tree cover has increased to an average of 30%. Reducing that tree cover can promote huckleberry growth and still provide frost protection.

A cover of 15-20% would be achieved by killing all but 60 trees per acre on roughly a 27 x 27 foot spacing. Spacing is not critical and the treatment may be facilitated by specifying diameter limits for trees to save. Hand tools (loppers, chainsaws) would be used to fell trees less than 8" dbh. Slash would be lopped and scattered. Where they are excess, trees 8-12" dbh would be killed by girdling. A minimum of 10 snags per acre would be created in Unit 8 by girdling. No additional downed woody debris is desired. Treatments may be repeated as necessary to keep the ingrowth of seedlings and saplings from causing excessive shade.

Units 11B, 11C, 11D, 11E and 12 – Young Stand Thinning

These stands are located near Forest Service Road 3000-580, which accesses the Huckleberry Access Picnic Sites. However, it is a lesser used portion of the berryfields, as fruiting is typically only moderate. Young stand thinning is proposed to reduce tree cover to 15-20%. Trees would be killed by mulching with ground based machinery to reduce labor cost and slash.

The thinning objective is to limit trees to 15-20% canopy cover. These units have slopes of 20% and a west aspect, where some canopy cover would be beneficial to mitigate frost and summer heat stress. These stands may have also had a historic light cover from snags that are no longer present (see Figure 2).

A cover of 15-20% would be achieved killing all but 60 trees per acre on roughly a 27 x 27 foot spacing. Spacing is not critical and the treatment may be facilitated by specified diameter limits

for trees to save. Trees less than 5" dbh would be targeted for mulching. No additional downed woody debris is desired.

Unit 6 and 7 – Commercial Thinning
Units 6 and 7 are located at or near the junction of Forest Service Roads 30 and 24. Unit 6 lies partially within the Visual Emphasis allocation. Both stands have high canopy closures that are hampering fruit production in their huckleberry understories. Relative density (RD) is 44 for the 225 trees/acre that are greater than 5" dbh. Because of the density and commercial size of the trees, a commercial thinning is proposed to reduce tree cover. The objective is to reduce canopy cover to 25-50%.

Variable density thinning would be used to maintain the high variability that already exists in these stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. Unit 6 is directly adjacent to Forest Service Roads 30 and 24, hence a post treatment canopy cover of 40% is proposed to maintain scenic quality. About half of the commercial sized trees in this stand would be cut. Additionally, slash within 100 feet of Forest Service Roads 30 and 24 would be piled and burned. Unit 7 is several hundred feet off Forest Service Road 30 and not readily visible. A heavier thinning cut is proposed that would reduce canopy cover to 25%. To reduce impact to existing huckleberry bushes, both units would be logged over a snow pack of 2-4 feet if feasible. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be maintained or created where needed.

Unit 10B – Commercial Thinning
This stand is located along Forest Service Road 24 and Forest Service Road 2400-210 that access the Cold Springs Indian Camp. Berry production in this stand is moderate due to the density and size of trees, but its location subjects it to high public use and scrutiny. Consequently, a commercial thinning using ground based equipment is proposed to reduce tree cover and promote huckleberries.

Current stand density is not high (RD of 41) such that it effects tree growth and mortality. However it is dense enough to affect huckleberry fruiting. The objective is to reduce canopy cover down to 30-50% and relative density to 25. The higher level cover in this case is to mitigate social impacts, given that this stand is adjacent to a campground and within the high-use portion of the berryfields. A variable density thinning would be used to maintain the level of variability that already exists in this stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. Within the commercial size class, 8 – 24" dbh, half of the trees would be removed. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be maintained or created where needed. To address visual quality and inadvertent human fires, slash within 100 feet of Forest Service Roads 24 and 2400-210 would be piled and burned.

Units 10A and 11A – Commercial Thinning
Unit 10A is also located along Forest Service Roads 24 and 2400-210, an area of high public use and scrutiny. Unit 11A is located off Forest Service Road 3000-580 to the Huckleberry Access Picnic Sites. Berry production in these stands is moderate due to the density and size of trees.

Commercial thinning using ground based equipment is proposed to reduce tree cover and promote huckleberries.

Tree density would be reduced by removing about two-thirds of the commercial sized trees by ground based machinery. Variable density thinning would be used to maintain the high variability that already exists in these stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be maintained or created where needed. Slash near Forest Service Roads 24 and 2400-210 would be piled and burned. Following treatment, relative tree density will be about half of pre-harvest levels. Tree canopy cover will vary between 20-30% with an average cover of 25%. A lower canopy cover target seeks to maximize huckleberry response in these stands. To reduce impact to existing huckleberry bushes, Unit 11A would be logged over a snow pack of 2-4 feet if feasible.

General Forest – Matrix

Treatments in these areas would stimulate huckleberry production by removing commercial quantities of trees by thinning or regeneration harvest. Sustainable timber harvest practices are followed on these productive forest lands.

Unit 4 – Commercial Thinning

Unit 4 has a moderate relative density (41) of small trees (9-21" dbh) that is causing poor huckleberry fruiting in an area that historically provided good fruiting. A commercial thinning is proposed to lower the relative density to 25. This opens the stand as much as possible, while maintaining sufficient tree stocking for sustainable forestry.

Tree density would be reduced by removing about a third of the commercial sized trees by ground based machinery. A variable density thinning would be used to maintain the level of variability that already exists in this stand. Thinning will generally be from below, leaving trees ≥25" dbh. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. Following treatment, tree canopy cover will vary between 25-70% with an average cover of 40%.

Unit 5 – Moderate Forest Retention

Unit 5 is dense (relative density of 74) with a greater large tree component and older average age than Unit 4. Growth is within 95% of culminating mean annual increment. The slope is nearly flat with poor air drainage. Moderate forest retention is proposed to regenerate the stand and provide maximum opening for the huckleberry understory. A moderate level of retention will provide sufficient canopy cover for frost protection of huckleberries and trees.

Tree removal would be by ground based machinery. The majority of commercial size trees would be removed. There would be 10.5% of the unit acreage retained in two uncut patches and a minimum of 20% of the average tree basal area retained in small clumps or individual trees. All trees ≥25" dbh would be retained where feasible. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. Logging slash would be machine piled and burned, including slash in and near Saddle Campground. Natural regeneration would be encouraged, and hand planting of conifers seedlings would occur if

needed to establish a minimum of 125 trees per acre. Following treatment, canopy cover will range from 15-90% with an average cover of 30%.

Visual Emphasis – Matrix

Treatments in areas that are visible or potentially visible from Forest Service Road 24 and 30 would promote huckleberry by mulching small trees or removing commercial quantities of trees by thinning or regeneration harvest. Sustainable timber harvest practices are followed on these productive forest lands. Unit shape and treatments are tailored to meet partial retention visual quality objectives on a stand basis and for the allocation as a whole.

Unit 1A – Young Stand Thinning

This stand has a high density of sapling and pole sized trees, with a small component of larger trees. Huckleberry fruiting is moderate. Young stand thinning is proposed to reduce tree cover and promote huckleberries. Trees would be killed by mulching with ground based machinery to reduce labor cost and slash. Approximately half of the smaller trees would be mulched, leaving about 200 trees/acre on a minimum 13 x 13 foot spacing. Following treatment, canopy cover will average 40%.

Units 2 and 3A – Commercial Thinning

Units 2 and 3A lie along Forest Service Road 24 and have high relative densities (RD of 64-75) of trees (9-30" dbh) over poorly fruiting huckleberry. Commercial thinning is prescribed to reduce density, provide space for huckleberries, and maintain scenery.

Tree density would be reduced by removing about half of the commercial sized trees by ground based machinery or skyline systems (Unit 3A). A variable density thinning would be used to maintain the level of variability that already exists in this stands. Thinning will generally be from below, leaving trees ≥25" dbh (Unit 3A) or ≥27" dbh (Unit 2). A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. Unit 2 would be logged over a snow pack of 2-4 feet if feasible, to reduce impact to existing huckleberry bushes. Logging slash within 100 feet of Forest Service Road 24 will be piled and burned. Following treatment, relative tree density will be about half of preharvest levels. Tree canopy cover will vary between 30-70% with an average cover of 50%.

Units 1B and 3B – Moderate Forest Retention

Unit 1B has a high relative density (86) with trees larger and older that 1A. It lies near Forest Service Road 24 covering 9 acres. Unit 3B had a moderate relative density but with a component of late-successional trees. Stand 3A separates Stand 3B from Road 24, making Stand B not readily visible from Forest Service Road 24. Growth is within 95% of culminating mean annual increment. Tree density has limited huckleberry fruiting in what was a historically good huckleberry area. Consequently, moderate forest retention cuts are proposed to regenerate the stands and provide optimal openings for the huckleberry understory. A moderate level of retention will provide sufficient tree cover to meet partial retention objectives for scenery. Moderate levels of retention will also moderate frost on the flat slope of Unit 1B and moderate droughty conditions on southwest aspect of Unit 3B.

Tree removal would be by ground based machinery and skyline system (Unit 3B). The majority of commercial sized trees would be removed. There would be 10.5% of the unit acreage retained in uncut patches and a minimum of 20% of the average tree basal area retained in small clumps or individual trees. Trees ≥25" dbh would not be cut where feasible. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. In Unit 1B, slash near Forest Service Road 24 would be piled and burned. In unit 3B, tree tops will be yarded to the landings and burned. Natural regeneration would be encouraged, and hand planting of conifers seedlings would occur if needed to establish a minimum of 125 trees per acre. Following treatment, canopy cover will range from 15-90% with an average cover of 30%.

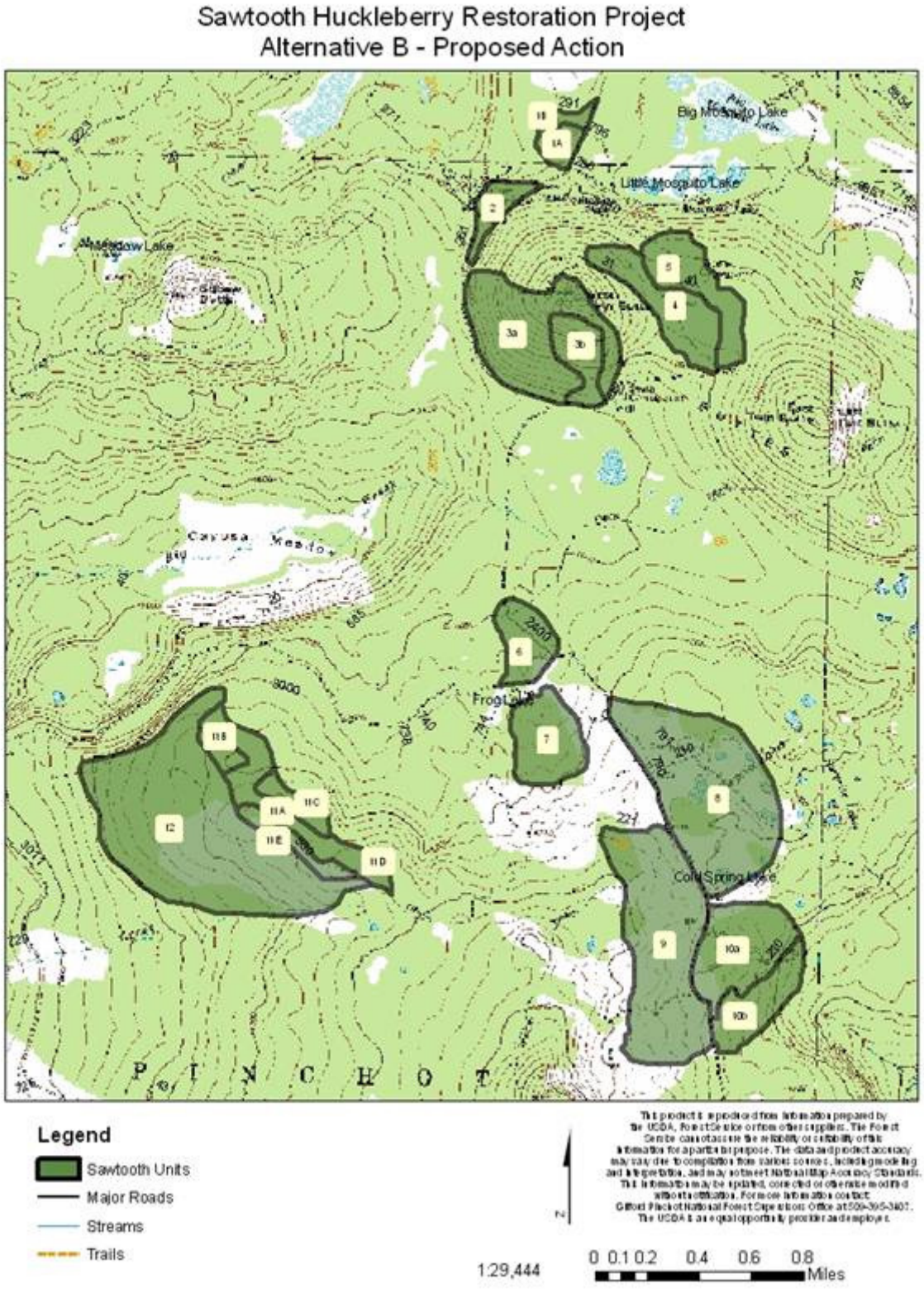

Figure 5. Alternative B – the Proposed Action.

Alternative C—Underburning

Alternative C has a mix of mechanical and hand treatments similar to Alternative B; however, low intensity underburning would be incorporated on a portion of the stands, as an additional or primary means to reduce tree cover. This alternative was developed in response to the concern that fire is a more effective tool for restoring huckleberry production than tree removal alone. Objectives for underburning are to kill tree seedlings and sapling and consume slash, while limiting high temperatures of long duration that would kill huckleberry rhizomes. The logistical constraints of underburning were considered in the selection of units. A final factor was the size and species of overstory trees, and their susceptibility to mortality from bark scorch.

In this alternative, the Forest Service would underburn units 2, 5, 7, 10a, 11a, 11b, 11c, 11d, 11e, and 12. Similar to the proposed action (Alternative B), the Forest would thin forest vegetation on approximately 1,212 acres over a total of 19 units (see Table 2 below).

As in Alternative B, over snow, ground-based logging is prescribed for several stands that are in close proximity to Forest Service Road 30, the principal haul route. To potentially reduce short-term impacts to the huckleberry plants during stand treatment, over-the-snow logging is proposed for units 2, 6, 7 and 11a. Log skidding should occur over a snow pack of 2-4 feet to provide additional protection to the above and below ground portions of huckleberry. Over-snow-logging is problematic in this area due to heavy, inconsistent snowfall each year; however these units are relatively flat units along the main road system. This area typically has an 8-12 foot snow pack in the winter with rapid snow accumulation occurring in December. On average, the operating window to feasibly log over snow would only be 2-3 weeks. The ability to implement this requirement will be dependent on an unusual winter that results in favorable conditions. If conditions are such that over-the-snow logging is not feasible, harvest may ultimately take place in warmer months, but over-the-snow will be the preferred method. The smaller trees in these units may need to be removed separately, if over-the-snow logging is infeasible for smaller diameter trees.

Connected actions include the construction of 1.4 miles of temporary roads, using previous skid trails and temporary roads where feasible. Five of the 19 units would include piling and burning to reduce activity fuels. In other units, where activity slash is expected to be generated, it would be lopped and scattered throughout the unit or underburned.

The following table lists details of the alternative for each proposed stand. A complete narrative, broken down by management allocation follows. The italic portion highlights the differences between Alternative B and C.

Table 2. Details of Activities Proposed in Alternative C.

Unit	Acres	Vegetation Treatment	Implementation Method	Road Construction	Fuels Treatment	Timber Cut (MBF)
1A	13	Young stand thinning	Ground-based machinery; mulch	None	None	None

			trees			
1B	9	Moderate retention regeneration	Ground-based machinery	None	Pile and burn near roads	270
2	19	Commercial thinning	Ground-based machinery; over-snow logging	None	*Underburn*	440
3A	102	Commercial thinning	Ground-based machinery and skyline	0.1 miles specified	Pile and burn near roads	990
3B	40	Moderate retention regeneration	Ground-based machinery and skyline	0.1 miles specified	Yard tops attached	1010
4	56	Commercial thinning	Ground-based machinery	0.1 miles temporary	Pile and burn near roads	170
5	51	Moderate retention regeneration	Ground-based machinery	0.1 miles temporary	*Underburn*	510
6	35	Commercial thinning	Ground-based machinery; over-snow logging	0.1 miles temporary	Pile and burn near roads	100
7	52	Commercial thinning	Ground-based machinery; over-snow logging	0.2 miles temporary	*Underburn*	390
8	182	Young stand thinning	Hand tools	None	Lop and scatter	None
9	166	Young stand thinning	Hand tools	None	Lop and scatter	None
10A	55	Commercial thinning	Ground-based machinery	0.2 miles temporary	*Underburn*	380
10B	59	Commercial thinning	Ground-based machinery	0.1 miles Temporary	Pile and burn near roads	400
11A	50	Commercial thinning	Ground-based machinery; over-snow logging.	0.4 miles temporary	*Underburn*	810
11B	17	Young stand thinning	Hand tools or ground-based machinery	None	*Underburn*	None
11C	15	Young stand thinning	Hand tools or ground-based machinery	None	*Underburn*	None
11D	3	Young stand thinning	Hand tools or ground-based machinery	None	*Underburn*	None

11E	17	Young stand thinning	Hand tools or ground-based machinery	None	*Underburn*	None
12	271	Young stand thinning	Hand tools	None	*Underburn*	None
Total	**1,212**	**NA**	**NA**	**1.4**	**NA**	**5470**

Roaded Recreation

Treatments in the Sawtooth Berryfields Roaded Recreation area would promote huckleberry by hand cutting small trees, mulching small trees, and removing commercial quantities of medium sized trees by thinning.

Lands within the Roaded Recreation allocation are unsuitable for sustained timber production according to the Forest Plan. Where timber harvest is proposed, it is primarily to meet the Roaded Recreation objective of huckleberry enhancement while protecting other resources. Levels of conifer stocking in these areas address the environmental requirements of huckleberry and wildlife, not timber sustainability.

Units 8 and 9 – Young Stand Thinning

These stands comprise the heart of Sawtooth Berryfields where the majority of berry picking occurs. Fruiting here is good, but numerous saplings and small trees threaten that productivity. Young stand thinning by hand treatment is proposed, given the high public use, good fruiting, and small size of the trees.

The thinning objective is to limit trees to 15-20% canopy cover. These units have some of the more level, frost prone slopes in the planning area. While this portion of the huckleberry field has been the most open, it historically had light cover (~10%) mostly from snags that remained after the last stand replacing fire. These snags are no longer present, and tree cover has increased to an average of 30%. A limited, live tree cover can now provide that frost protection to huckleberry shrubs.

A cover of 15-20% would be achieved by killing all but 60 trees per acre on roughly a 27 x 27 foot spacing. Spacing is not critical and the treatment may be facilitated by specified diameter limits for trees to save. Hand tools would be used to fell trees less than 8" dbh. Slash would be lopped and scattered. Where they are excess, trees 8-12" dbh would be killed by girdling. A minimum of 10 snags per acre would be created in Unit 8 by girdling. No additional downed woody debris is desired. Treatments may be repeated as necessary to keep the ingrowth of seedlings and saplings from causing excessive shade.

Units 11B, 11C, 11D, 11E and 12 – Young Stand Thinning

These stands are located near Forest Service Road 3000-580 to the Huckleberry Access Picnic Sites. However, it is a lesser used portion of the berryfields, as fruiting is typically only moderate.

*In **Alternative C**, tree reduction in Units 11B, 11C, 11D, 11E, and 12 would be accomplished primarily through underburning. Prior to underburning, a cured slash bed of 4-8 tons per acre would be created by felling trees by machine or hand (hand only for Unit 12). At 5"dbh, approximately 120 trees per acre would need to be felled to generate 6 tons. It is anticipated that underburning will consume or kill the majority of remaining conifers. Burning should create abundant snags and eventual downed woody debris. The post underburning objective is a tree canopy cover of 10-30%.*

Unit 6 and 7 – Commercial Thinning

Units 6 and 7 are located at or near the junction of Forest Service Roads 30 and 24. Unit 6 lies partially within the Visual Emphasis allocation. Both stands have high canopy closures that are hampering fruit production in their huckleberry understories. Relative density is 44 for the 225 trees/acre that are greater than 5" dbh. Because of the density and commercial size of the trees, a commercial thinning is proposed to reduce tree cover in Unit 6. The objective is to reduce canopy cover to 25-50%.

Variable density thinning would be used to maintain the high variability that already exists in these stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. Unit 6 is directly adjacent to Roads 30 and 24, hence a post treatment canopy cover of 40% is proposed to maintain scenic quality. About half of the commercial sized trees in this stand would be cut. Additionally, slash within 100 feet of Roads 30 and 24 would be piled and burned. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be maintained or created where needed.

Unit 7 is several hundred feet off Road 30 and not readily visible. *In **Alternative C**, Unit 7 would be underburned. The commercial thinning cut will be similar but of lesser intensity yielding 40-50% canopy cover. Underburning will result in addition tree mortality, dropping the residual canopy cover 20-30%. Creation of any additional snags or downed wood would be unnecessary.*

To reduce impact to existing huckleberry bushes, both units would be logged over a snow pack of 2-4 feet if feasible.

Unit 10B – Commercial Thinning

This stand is located along Forest Service Roads 24 and Road 2400-210 that access the Cold Springs Indian Camp. Berry production in this stand is moderate due to the density and size of trees, but its location subjects it to high public use and scrutiny. Consequently, a commercial thinning using ground based equipment is proposed to reduce tree cover and promote huckleberries.

Current stand density is not high (RD of 41) such that it effects tree growth and mortality. However it is dense enough to affect huckleberry fruiting. The objective is to reduce canopy cover down to 30-50% and relative density to 25. The higher level cover in this case is to mitigate social impacts. A variable density thinning would be used to maintain the level of variability that already exists in this stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. Within the commercial size class, 8 – 24" dbh, half of the trees would be removed. A

component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be maintained or created where needed. To address visual quality and inadvertent human fires, slash within 100 feet of Forest Service Roads 24 and 2400-210 would be piled and burned.

Units 10A and 11A – Commercial Thinning
Unit 10A is also located along Forest Service Roads 24 and 2400-210, an area of high public use and scrutiny. Unit 11A is located off Forest Service Road 3000-580 to the Huckleberry Access Picnic Sites. Berry production in these stands is moderate due to the density and size of trees. Commercial thinning using ground based equipment is proposed to reduce tree cover and promote huckleberries.

Tree density would be reduced by removing about *one-half* of the commercial sized trees by ground based machinery. Variable density thinning would be used to maintain the high variability that already exists in these stands. Thinning will generally be from below, leaving trees ≥25" dbh. A combination of diameter limits, species limits, and leave patches may be used. *In **Alternative C**, Units 10A and 11A would be underburned. The commercial thinning cut will be similar but of lesser intensity yielding 40-50% canopy cover. Underburning will result in addition tree mortality, dropping the residual canopy cover 20-30%. Creation of any additional snags or downed wood would be unnecessary.* Following treatment, relative tree density will be about a half of preharvest levels. Tree canopy cover will vary between 20-30% with an average cover of 25%. A lower canopy cover target seeks to maximize huckleberry response in these stands. To reduce impact to existing huckleberry bushes, Unit 11A would be logged over a snow pack of 2-4 feet if feasible.

General Forest – Matrix
Treatments in these areas would stimulate huckleberry production by removing commercial quantities of trees by thinning or regeneration harvest. Sustainable timber harvest practices are followed on these productive forest lands.

Unit 4 – Commercial Thinning
Unit 4 has a moderate relative density (41) of small trees (9-21" dbh) that is causing poor huckleberry fruiting in an area that historically provided good fruiting. A commercial thinning is proposed to lower the relative density to 25. This opens the stand as much as possible, while maintaining sufficient tree stocking for sustainable forestry.

Tree density would be reduced by removing about a third of the commercial sized trees by ground based machinery. A variable density thinning would be used to maintain the level of variability that already exists in this stands. Thinning will generally be from below, leaving trees ≥25" dbh. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. Following treatment, tree canopy cover will vary between 25-70% with an average cover of 40%.

Unit 5 – Moderate Forest Retention
Unit 5 is dense (relative density of 74) with a greater large tree component and older average age than Unit 4. Growth is within 95% of culminating mean annual increment. The slope is nearly flat with poor air drainage. Moderate forest retention is proposed to regenerate the stand and

provide maximum opening for the huckleberry understory. A moderate level of retention will provide sufficient canopy cover for frost protection of huckleberries and trees.

Tree removal would be by ground based machinery. The majority of commercial size trees would be removed. There would be 10.5% of the unit acreage retained in two uncut patches and a minimum of 20% of the average tree basal area retained in small clumps or individual trees. All trees ≥25" dbh would not be cut where feasible. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. *In **Alternative C**, all of Unit 5 would be underburned, foregoing the slash piling prescribed in Alternative B. Following treatment, canopy cover will range from 15-90% with an average cover of 30%.* Natural regeneration would be encouraged, and hand planting of conifers seedlings would occur if needed to establish a minimum of 125 trees per acre. Following treatment, canopy cover will range from 15-90% with an average cover of 30%.

Visual Emphasis – Matrix

Treatments in areas that are visible or potentially visible from Forest Service Roads 24 and 30 would promote huckleberry by mulching small trees or removing commercial quantities of trees by thinning or regeneration harvest. Sustainable timber harvest practices are followed on these productive forest lands. Unit shape and treatments are tailored to meet partial retention visual quality objectives on a stand basis and for the allocation as a whole.

Unit 1A – Young Stand Thinning

This stand has a high density of sapling and pole sized trees, with a small component of larger trees. Huckleberry fruiting is moderate. Young stand thinning is proposed to reduce tree cover and promote huckleberries. Trees would be killed by mulching with ground based machinery to reduce labor cost and slash. Approximately half of the smaller trees would be mulched, leaving about 200 trees/acre on a mimimum13 x 13 foot spacing. Following treatment, canopy cover will average 40%.

Units 2 and 3A – Commercial Thinning

Units 2 and 3A lie along Forest Service Road 24 and have high relative densities (RD of 64-75) of trees (9-30" dbh) over poorly fruiting huckleberry. Commercial thinning is prescribed to reduce density, provide space for huckleberries, and maintain scenery.

Tree density would be reduced by removing about half of the commercial sized trees by ground based machinery or skyline systems (Unit 3A). A variable density thinning would be used to maintain the level of variability that already exists in this stands. Thinning will generally be from below, leaving trees ≥25" dbh (Unit 3A) or ≥27" dbh (Unit 2). A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. Unit 2 would be logged over a snow pack of 2-4 feet if feasible, to reduce impact to existing huckleberry bushes. Logging slash within 100 feet of Forest Service Road 24 will be piled and burned in Unit 3A. Following treatment, relative tree density will be about half of preharvest levels. Tree canopy cover will vary between 30-70% with an average cover of 50%.

*In **Alternative C**, Unit 2 would be underburned. Underburning will result in addition tree mortality, dropping the residual canopy cover 40%. Creation of any additional snags or downed wood would be unnecessary.*

Units 1B and 3B – Moderate Forest Retention

Unit 1B has a high relative density (86) with trees larger and older that 1A. It lies near Road 24 covering 9 acres. Unit 3B had a moderate relative density but with a component of late-successional trees. Stand 3A separates Stand 3B from Road 24, making Stand B not readily visible from Road 24. Growth is within 95% of culminating mean annual increment. Tree density has limited huckleberry fruiting in what was a historically good huckleberry area. Consequently, moderate forest retention cuts are proposed to regenerate the stands and provide optimal openings for the huckleberry understory. A moderate level of retention will provide sufficient tree cover to meet partial retention objectives for scenery. Moderate levels of retention will also moderate frost on the flat slope of Unit 1B and moderate droughty conditions on southwest aspect of Unit 3B.

Tree removal would be by ground based machinery and skyline system (Unit 3B). The majority of commercial sized trees would be removed. There would be 10.5% of the unit acreage retained in uncut patches and a minimum of 20% of the average tree basal area retained in small clumps or individual trees. Trees ≥25" dbh would not be cut where feasible. A component of down logs (240 linear feet/acre) and snags (2.6 snags/acre) would be created or maintained. In Unit 1B, slash near Road 24 would be piled and burned. In unit 3B, tree tops will be yarded to the landings and burned. Natural regeneration would be encouraged, and hand planting of conifers seedlings would occur if needed to establish a minimum of 125 trees per acre. Following treatment, canopy cover will range from 15-90% with an average cover of 30%.

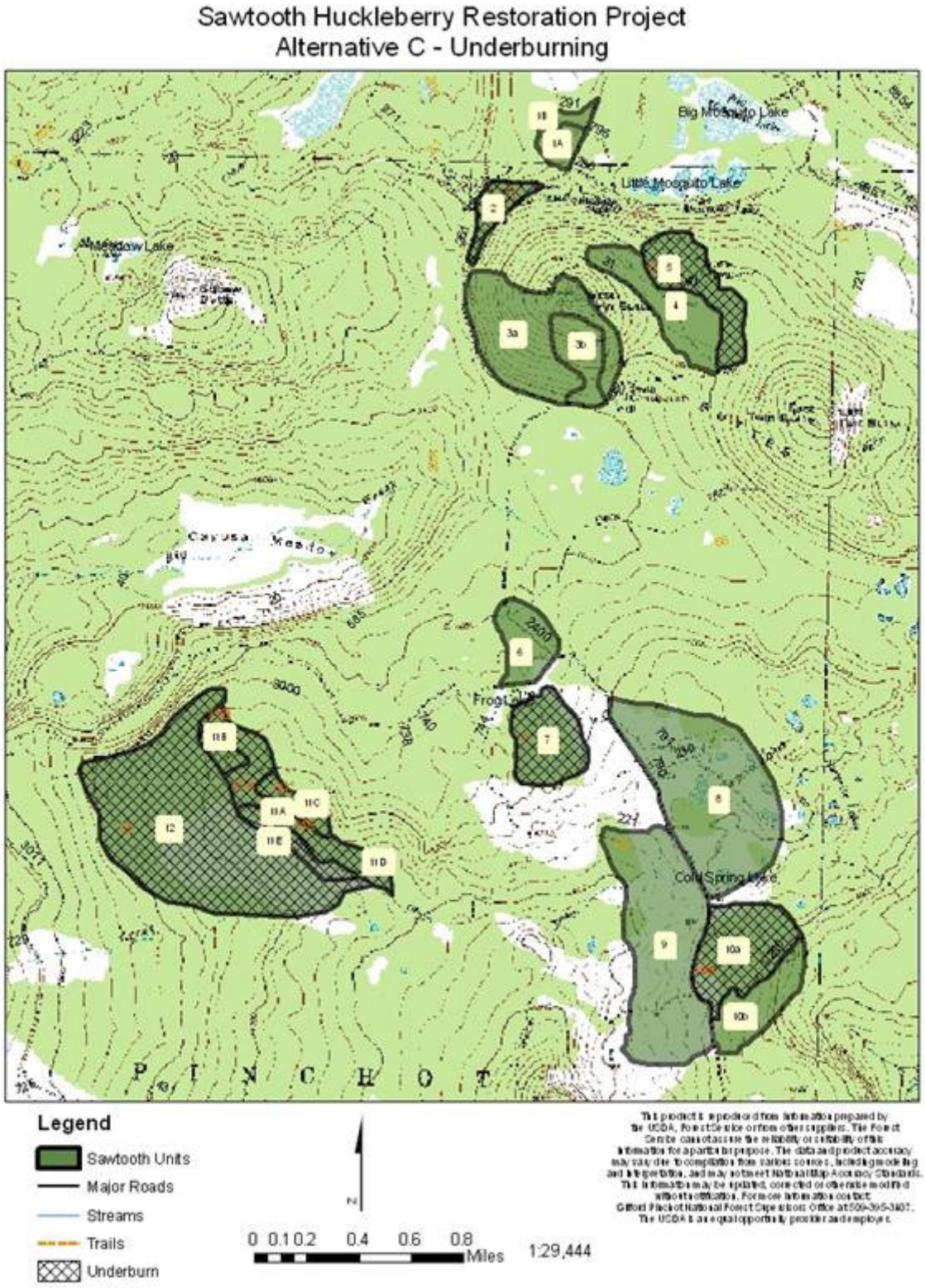

Figure 6. Alternative C—Underburning.

Table 3. Comparison of Alternatives by Significant Issues.			
Significant Issue	**Alternative A**	**Alternative B (Proposed Action)**	**Alternative C**
Harvest without burning may not enhance huckleberry production	Huckleberry Productivity Index Over Time: *Current* = 2087 *+5 years* = 2087 *+20 years* = 1560	Huckleberry Productivity Index Over Time: *Current* = 2087 *+5 years* = 2660 *+20 years* = 2858	Huckleberry Productivity Index Over Time: *Current* = 2087 *+5 years* = 1891 *+20 years* = 3215
Activity slash may cause negative effects to the soils and huckleberry plants	No huckleberry plant mortality or soil damage; however plant still declining from conifer encroachment	Short-term decline in huckleberry production (0-5 years); Negligible soil damage from pile burning	Short-term decline in huckleberry production (0-10 years); Potential soil damage in underburned units if burned too hot
Prescribed burning may cause excessive amounts of smoke and affect air quality in Indian Heaven Wilderness	0 particulate matter released	2.5-10 microns particulate matter released; regulated by the State of Washington	2.5-10 microns particulate matter released; regulated by the State of Washington
Compliance with the 2001 Roadless Rule	0 large diameter trees cut in IRA; no spur roads constructed	0 large diameter trees cut in IRA; no spur roads constructed	0 large diameter trees cut in IRA; no spur roads constructed
Cutting trees near the PCT may compromise the experience of hikers	No trees cut near the PCT; no huckleberry production enhancement near trail	Trees cut and removed near trail; however, mitigation in place to reduce visual impact; huckleberry production increased along trail	Trees cut and removed near trail; however, mitigation in place to reduce visual impact; huckleberry production increased along trail
Removal of dispersal habitat	0 acres of dispersal habitat reduced	432 acres of dispersal habitat reduced	432 acres of dispersal habitat reduced
Cultural Landscape	Continued loss of huckleberry productivity due to tree encroachment	Short-term decline in production in some areas; long term increase in production over most treated acres	Short-term decline in production in some areas; long term increase in production over most treated acres

Alternatives Considered but Eliminated from Detailed Study ___

Underburning Majority of Units
During the scoping process several commenters expressed concern that huckleberry enhancement wouldn't be effective without the use of fire. The Interdisciplinary Team considered an alternative that would use prescribed fire in all of the units in the project area. The team determined that, given the quantity of slash that would be generated in some units, there was a concern for our ability to control the intensity of a fire, and not cause harm to the huckleberry rhizomes. In addition, an intense fire could result in excessive tree mortality in some units. There was a concern that some of the units would not carry a fire or carry it uniformly enough to be effective in huckleberry enhancement. The team decided to focus underburning efforts in units where fire intensity could be kept at a minimum, and where tree mortality would not be excessive.

Design Features/Mitigation Measures for All Alternatives _____

Heritage:

1. Limit crossings of historic trail in Units 4 and 5 to one crossing in each unit.
2. Protect heritage features in Unit 10B by providing a 200 foot buffer. No project activities will take place within this buffer.
3. No project activities will occur within 200 feet of designated heritage sites in Units 8 and 9.

Soils

1. Ground-based machinery will not operate where soil water content is high enough to cause rutting that exceeds 6 inches in depth (for a length of ten feet or more) in accordance with Region 6 Standards and Guidelines (USDAFS, PNW 1998). Deviation from this measure should involve consultation with the appropriate resource specialist. This measure will limit the degree of detrimental soil rutting and puddling as well as reduce the potential for sediment delivery to streams. Applicable BMP: T-13. Erosion Prevention and Control Measures During Timber Sale Operations.
2. One-end log suspension will be required for ground-based and cable yarding systems (except during winching or lateral yarding). No yarding is permitted over class I, II, III, or IV streams and skyline corridors shall not extend into or through no cut buffers. This will reduce the risk of soil compaction and displacement from dragging logs along the ground. The objective of this measure is to minimize erosion and potential sediment delivery to streams. Applicable BMP: T-13 - Erosion prevention and control measures during timber sale operations.
3. All ground based equipment will be confined to approved temporary roads, skid trails and landings during yarding and brush disposal operations. Exceptions may be made in consultation with a resource specialist. Exceptions will include equipment operation over slash beds that are as thick and continuous as practicable. An exception has already been approved for mechanized masticators that are proposed in units 1A, 11B, 11C, 11D, 11E

and 12; there will be no temporary roads, landings or skid trails in these units. Landings, temporary roads, skid trails and skyline corridors will be approved by the sale administrator prior to timber felling. Skid trails must be located at least 100 feet from any stream channel. Skid trails will be spaced a minimum of 150 feet apart for tractors and 400 feet apart for loaders. When possible, temporary roads and skid trails will be re-used at previous skid trail locations rather than constructing new ones. These trails and roads will be treated to restore hydrologic function as needed. Temporary roads will not be constructed within Riparian Reserves, unless pre-approved in collaboration with the aquatics or soils resource specialist, or specified in the EA (e.g. gaining access to Unit 7). The objective of this measure is to minimize the extent and the degree of soil damage, displacement, and disturbance, and to allow sediment filtration. Applicable BMP: T-11. Tractor Skid Trail Location and Design.

4. Ensure Forest Plan Standards and Guidelines (USDA 1990 and Wade 1992) for ground-based equipment are met. Soil Map Units in Table 12 and Figure 9 show which areas are permissible for tractor logging, which generally equites to slopes less than 30 percent. Although designated temporary roads and skid trails are proposed on a Soil Mapping Unit in Sawtooth Unit 3 that restricts tractor logging, temporary roads and skid trails will not be permitted on slopes greater than 30 percent in Unit 3. This measure will limit the amount of erosion, soil compaction and displacement associated with use of equipment on steep slopes.
5. Temporary roads and landings will be subsoiled to a depth of 18 inches (minimum). Subsoiling must be done immediately following logging activities and create an uneven, rough surface without furrows. Any proposed alternative methods to subsoiling must be approved by the sale administrator in consultation with the Zone aquatic specialist or soil scientist. To prevent re-compacting of the treated roadways and landings, no ground-based equipment will be operated on subsoiled portions of roads and landings after subsoiling is completed. Cross-drains or water bars will be installed every 150 feet or more frequently where slopes exceed 5%. Available logging slash will be placed across the subsoiled road landing surface. (Acceptable grass seed mix; type of weed free mulch; and application rates will be specified by a qualified specialist). Post harvest motorized access to temporary roads will be prevented by construction of an approved closure device (e.g., construction of a 4-foot high earth berm at the entrance to the road or landing). Closure to vehicles is required to prevent these areas from being re-compacted and to allow vegetation to develop. The objective of this measure is to rehabilitate areas compacted during management activities, accelerate recovery of compacted soils, and facilitate water infiltration and revegetation on those disturbed areas. This measure will also provide ground cover for exposed soils in order to reduce the potential for offsite erosion and maintain soil organic matter to prevent nutrient and carbon cycle deficits. Applicable BMP: T-13. Erosion Prevention and control measures during timber sale operations; T-14 - Revegetation of area disturbed by harvesting activities; T-16. Erosion control on skid trails.
6. Prescribed burning activities must result in less than 10 percent of the burned activity area rated as a severe intensity. Because less heating of the soil occurs in moist soil (in fires of short duration), a relatively “cool” prescribed burn will occur while soils are still fairly moist. This is expected to occur in the late spring to early summer. This measure will limit losses of mycorrhizae, soil fertility and soil organic matter.

7. Machine piling of logging slash within the unit will be accomplished with as small a tracked vehicle as is practicable, equipped with a grapple. Equipment should begin piling at the end of the unit furthermost from the access road and work its way back, operating on top of the slash – resulting in a maximum of one pass on bare mineral soils. Large (greater than 20 inches diameter, 20 feet long) downed logs should not be incorporated into the piles. It should be left as down woody debris. This measure will minimize soil damage from slash piling and maintain necessary organic matter to provide for essential nutrient cycling processes.

Aquatics and Fisheries

1. With the exception of approved over-snow logging and hauling, all road maintenance and construction activities, and all timber hauling will occur in the dry period (typically June through September) to minimize sediment production and delivery to the aquatic system. This measure applies to all roads in the project area. Haul will continue into the fall only if conditions are good and haul-related sediment production is not increased as a result of fall precipitation levels. Conditions typically meriting a waiver include: 1) daily precipitation levels remaining below the average daily maximum precipitation for the June through September period (1.05 inches as measured at the Carson National Fish Hatchery); and 2) two-week cumulative total precipitation of less than the average maximum two-week precipitation levels during the June through September period.
2. To minimize the amount of sediment delivered to streams along the haul route, dispose soils 100 feet from any perennial or intermittent stream at a location approved by the Sale Administrator. In addition, place sediment barriers (straw bales, slash filter windrow, and/or sediment fence) where the ground is disturbed from haul route maintenance and temporary road construction activities as sediment has the potential for delivery to streams. Sediment filters should be left in place where possible to naturally degrade. If non-biodegradable filters are used, precautions should be followed to minimize transport of trapped sediment material during removal, including the following: a) work during the dry season, and/or b) relocate captured sediment to a stable location.
3. All constructed temporary roads will be designed to control surface road drainage to minimize erosion and sedimentation, as per direction from the project engineer and hydrologist.
4. In all harvest units, ground-based machinery will not operate where soil water content is high enough to cause rutting that exceeds 6 inches in depth for a length of ten feet or more in accordance with Region 6 Standards and Guidelines (USDA Forest Service 1998). Deviation from this measure should involve consultation with the appropriate resource specialist. This measure will limit the degree of detrimental soil rutting and puddling as well as reduce the potential for sediment delivery to streams. Applicable BMP: T-13. Erosion Prevention and Control Measures During Timber Sale Operations.
5. All streams within or adjacent to harvest units will be protected to maintain or improve riparian reserve conditions in accordance with the Aquatic Conservation Strategy of the Northwest Forest Plan. No cut buffers shall be identified along all streams and wetlands by Aquatic Specialists, and these buffers will be designated on the ground. Timber harvest is prohibited in these areas. Ground-based equipment cannot enter these areas except on Forest Service road systems or approved temporary roads. Applicable BMPs: T-6 - Protection of unstable lands; T-7. Streamside Management Unit Designation; T-13 -

Erosion prevention and control measures during timber sale operations; T-17 - Meadow protection during timber harvesting.

6. Harvested trees will be felled away from streams, wetlands or other riparian reserve features, including no cut buffers around hydrologic features. Any portion of a felled tree that lands in the no cut buffer will be left on the ground. The objective of this measure is to prevent damage to riparian vegetation and soils within Riparian Reserves. Applicable BMPs: T-6 - Protection of unstable lands; T-13 - Erosion prevention and control measures during timber sale operations T-17 - Meadow protection during timber harvesting.
7. On temporary roads and landings, use rock only when necessary to reduce erosion, puddling and compaction. Rock will be applied only where needed ("spot rocking"). Rock will be incorporated into the roadbed by ripping or scarification following harvest activities (see mitigation measure which requires subsoiling). The objective is to provide better substrate for vegetative growth and water infiltration following logging and harvest activities.
8. All permanent road drainage structures (e.g. culverts) will be designed to accommodate bankfull flow flood events if left in place into the wet season to be consistent with Gifford Pinchot Land Resource Management Plan Standards and Guidelines (USDA 1995). The objective of this measure is to ensure channel transport function and channel longitudinal connectivity. Applicable BMP: T-13. Erosion prevention and control measures during timber sale operations. Alternatives B and C: Applicable forest road systems include Forest Roads 3000000, 2400000, which are among the primary haul routes, and 2480000 and 2400261, which are secondary roads.
9. Prior to the wet season or any expected seasonal period of precipitation and runoff, slash will be placed across skyline corridors and skid trails, and water bars, cross drains or grade breaks will be installed on all temporary roads and landings. Drainage features, such as water bars or cross drains, will be placed with increasing frequency as road or trail slope increases, e.g. every 75-300 feet to disperse any road runoff or subsurface drainage that enters the road bed from the road cut slopes. These features will be designed to facilitate proper drainage of surface water and to prevent ponding and must be installed in areas where drainage will not destabilize road fills. The objective of this measure is to reduce risk of soil displacement through rill, gully and splash erosion processes. Applicable BMP: T-13 - Erosion prevention and control measures during timber sale operations.
10. Subsequent to burning piled slash, burned areas greater than 100 square feet (not on permanent roads or landings) will be seeded and mulched (refer to the Gifford Pinchot National Forest seeding/planting prescription). This measure will mitigate the effects of severe burning on the soil.
11. A spill plan will be developed and pre-approved prior to project implementation. The plan will include appropriate operational measures for handling hazardous materials. A Hazardous Material kit will be on site, and would contain materials to control/contain a spill of fuel, oils, and/or hydraulic fluid. Fueling equipment will be located outside of riparian reserves. All service work on heavy machinery and refueling will be done on an established system road at a site approved by the Forest Service. The objective of this measure is to reduce the potential for damage to the stream and flood plain as a result of a hazardous material spill. Applicable BMPs: T-4 - Use of sale area maps for designating

water quality protection needs; T-7 - Streamside management unit designation; T-17. Meadow protection during timber harvesting; T-22 - Modification of the TSC (Timber Sale Contract); R-12 - Control of construction in streamside management units.

12. Areas of gouging or soil displacement resulting from suspended cable yarding systems and/or mobile yarding systems will be treated to prevent rill and gully erosion and possible sediment delivery to stream courses. Erosion control treatment may include, but is not limited to, repositioning displaced soil to re-contour disturbed sites, creating small ditches or diversions to redirect surface water movement, and scattering slash material to create flow disruption and surface soil stability. Erosion control measures implemented by the purchaser will be complete by October 1, and approved by an aquatic resource specialist prior to the close of the timber sale. The objective of this measure is to prevent surface soil erosion resulting from timber related ground disturbance. Applicable BMPs: T-6 - Protection of unstable lands; T-13. Erosion Prevention and Control Measures During Timber Sale Operations.
13. Monitoring will be performed by the sale administrator in order to prevent/rectify resource damage that may occur as a result of ground disturbing activities. Resource damage includes: ponding, rutting, rilling, culvert blockages, stream channel instability, and the occurrence of scour or sediment transport and deposition downstream of cross drains. This resource damage may be encountered on adjacent system roads, temporary roads, skid trails, landings, stream crossings, riparian reserves or within harvest units where ground disturbance has occurred. Project activities will be curtailed, and corrective action taken, before work is allowed to resume, if resource damage is occurring. Monitoring of BMPs will be documented by the sale administrator and made available to the aquatic resource specialist to assess conditions of haul routes, landings, and skid trails, in order to determine when adjustments need to be made to prevent excessive resource damage. Applicable BMPs: T-4. Use of Sale Area Maps for Designating Water Quality Protection Needs; T-6. Protection of Unstable Lands; T-7. Streamside Management Unit Designation; T-13. Erosion Prevention and Control Measures During Timber Sale Operations; T-17. Meadow Protection during Timber Harvesting ; T-22. Modification of the TSC (Timber Sale Contract); R-12. Control of Construction in Streamside Management Units.
14. To minimize the amount of sediment entering the stream and possible damage to stream banks and channel bottoms, stream crossings and activities in the stream are prohibited except as prescribed in the designated road work and construction of approved stream crossings. For instream work related to stream crossings: to minimize the amount of sediment entering the stream channel, the operation period would be limited to low flow period (consult Fish Biologist for specific dates, which are location dependent). This measure will help minimize disturbance to aquatic organisms and their habitat.Tiers to Washington State law (WAC 220-110-070) and provisions of the USDA Forest Service Memorandum of Understanding with the Washington State Department of Fish and Wildlife (2005).
15. For stream crossings and work adjacent to streams: to minimize the amount of sediment reaching the stream and to accelerate the re-vegetation process, rehabilitate areas compacted during management activities, and accelerate recovery of compacted soils, subsoil the compacted areas and plant native vegetation to restore any areas used as access points by equipment. Alternatives to subsoiling should involve consultation with

the appropriate resource specialist and documentation in project files to track for monitoring purposes. Tiers to Washington State law (WAC 220-110-070) and provisions of the USDA Forest Service Memorandum of Understanding with the Washington State Department of Fish and Wildlife (2005).

16. Landings and skid trails will be located outside of riparian reserves, unless pre-approved by Forest Personnel, to minimize the amount of sediment reaching streams. Applicable BMP: T-13. Erosion Prevention and Control Measures During Timber Sale Operations.

Botany

1. Pothole lakes/wetlands/seeps within the project area (including those in Units 6, 7, 8 and 10) will be protected with a 75' buffer, and no ground disturbing activities will occur adjacent to these habitats. This project design feature will help preserve the diversity of *Carex* spp. within the planning area, and protect the less common species of huckleberry shrubs from damage.
2. In addition, large noble fir throughout the project area will be favored for retention in silvicultural prescriptions. In particular, in Unit 3 and Unit 10 the largest trees (24" dbh and larger) will be protected (of all species), and clumps of mature noble fir will be designated as leave islands.

Invasive Plants

1. To prevent the introduction of noxious weeds into the project area, all heavy equipment, or other off- road equipment used in the project is to be cleaned to remove soil, seeds, vegetative matter or other debris that could contain seeds. Cleaning should be done before entering National Forest Lands, and when equipment moves from or between project sites or areas known to be infested into other areas, infested or otherwise. Cleaning of the equipment may include pressure washing. An inspection will be required to ensure that equipment is clean before work can begin. (Equipment cleaning clause Wo-C6.35) (Standard 2).
2. Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed free using the North American Weed Fee Forage Program standards or a similar certification process (Standard 3). Mulch species shall preferably be from native seed sources or annual rye or cereal grain fields. Local contacts for weed free straw include: Ken Chase (broker contact) at 530-572-2759; Russ Martin at 541-426-3332 (acting Wallowa County Veg. Manager who will be able to tell you if there is any straw available from that program), or Elwyn Crutcher at 360-939-2334 (he will deliver for a charge).
3. Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (Standard 8).
4. Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help revent the establishemtn of invasive species), 2) as an

interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently alterned plant communities. Under no circumstances will non-native invasive plant species be used for revegetation. (Standard 13). Contact South Zone botanist for appropriate seeding and site preparation prescription. When seed is used it should be either certified noxious weed free or from Forest Service native seed supplies.

5. During the season before the ground disturbing phase of project implementation begins, access roads and associated spur roads within the project area will be surveyed for invasive plant infestations located within ½ mile of units (to make sure there are no new infestations established between the time of initial surveys and project implementation). If invasive plants are located during surveys, they shall be treated prior to the beginning of project implementation, to prevent seed dissemination. This is particularly important for this project, since the forest canopy will be opened substantially in some units, providing habitat that is very susceptible to invasion by noxious weeds and/or other invasive plants.
6. During seasons of project implementation weed re-occurrences along access roads shall be controlled as specified above.
7. For two field seasons following project completion, weed re-occurrences at landings, and along access roads, shall be controlled as specified above. In addition, harvest units shall be surveyed for invasive plant establishment and/or encroachment. If new invasive plant populations are located within harvested units, population data shall be collected for entry into the Natural Resource Inventory System (NRIS) database, and invasive plants shall be controlled, as specified above.
8. After two years, the South Zone Botanist shall re-evaluate the weed control needs within the project area and determine whether further treatment is needed. It is likely that, at some sites, weed control beyond two years will be necessary.
9. All invasive plant control actions shall be entered into the FACTS database on an annual basis.

Wildlife:

1. Protect the two known Malone's jumping slug sites near the top of Twin Butte in Unit 3 by designating an aggregate reserve patch around the sites. Likewise, protect the lower two sites in Unit 3 if feasible within the logging system.
2. Protect all existing down logs that are remnants of the previous stands to the extent possible. If snags must be felled for safety reasons, leave the resulting log in place.
3. To the extent feasible, ensure that existing large remnant logs are not affected by slash treatments. Ensure that these features are not incorporated into slash piles, and avoid damaging them when burning slash.
4. Increase the amount of large down wood in units 1b, 2, 3, 4, 5 and 11a. Create at least 240 linear feet per acre of logs that are representative of the size of the trees in the stands.
5. Create snags as needed in Units 2, 3, 4, 5 and 11a so that there are at least 2.6 hard snags per acre.

Recreation:

1. No project activities will occur within 100 feet of Pacific Crest Trail (PCT).
2. Trees will be directionally felled away from the PCT.

3. Use designation by description methods of identifying trees to be removed in Unit 5, or if paint is needed, mark trees on the side of the tree facing away from PCT.
4. Pull slash 100 feet from PCT. Use topography to hide slash piles from trail where possible.
5. No skidding across or within 100 feet of the PCT.
6. Temporary roads will be located at least 100 feet from the PCT.
7. Winter haul on Forest Road 24, Forest Road 30 and Forest Road 8851 will be mitigated by only plowing one lane. The other lane will be not be plowed, and if feasible, left for winter recreation use.
8. Log hauling will only be allowed on weekdays. There will be no hauling allowed on Memorial Day, the Fourth of July, and Labor Day holidays.
9. Roads 24 and 2400210 will be rehabilitated after logging and hauling to accommodate passenger vehicle use.
10. Trees will be directionally felled away from campground facilities. Three sites will be designated for protection in Saddle Campground.
11. Campground facilities, such as picnic tables, fire rings, signs and parking areas, damaged by project operations will be repaired or replaced.
12. No operations will occur in units 8, 9 and 10 between August 15 and September 30 to minimize disturbance to campgrounds and berry pickers during the berry season.
13. Operations within units 2, 3, 4, 5, 10, 11, and 12 will be scheduled so that no more than two campgrounds will be disrupted at any time.
14. All major haul routes will be signed as directed by contract administrators, to warn visitors of log hauling.

CHAPTER 3. ENVIRONMENTAL CONSEQUENCES

This chapter describes the current environment in the project area. It also displays potential effects (direct/indirect, beneficial/adverse, and cumulative) on resources that could occur if either of the two alternatives described in Chapter 2 were implemented. By comparing current conditions of each issue to future conditions as altered by management activities, the decision-maker can assess the benefits of the alternatives, evaluate trade-offs posed by the environmental consequences, and determine if the relevant issues and concerns have been adequately addressed.

This evaluation is based on data gathered by members of the interdisciplinary team, data from silvicultural examinations and the Wind River Watershed Analysis, as well as information provided by resource specialists and the public. The application of all design features/ mitigation measures listed above as well as standards and guidelines, and Best Management Practices, is integral to the assessment of impacts.

General Comments Regarding Cumulative Effects
Each resource section that follows discusses cumulative effects to evaluate measurable effects from the action alternatives combined with past, present and future actions that overlap in space and time. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies heavily on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

The following table lists activities that were included in the cumulative effects analysis for each resource.

Table 4. Actions Considered in Cumulative Effects Analysis

Action	Description	Date
Past		
Catastrophic fires	All Sawtooth units are fire-originated stands.	1890s – 1904
Timber harvest within the activity areas	Adjacent managed stands were clear-cut harvest followed by planting. Thinning and regeneration harvest of Skeeter Timber Sale units adjacent to (not overlapping) some units of the proposed action.	Between 1957 and 1971
Huckleberry Restoration	Units 8, 9, 10 and 12 have had previous huckleberry enhancement treatments	1960s to present
Present and/or Ongoing		
National Forest System roads	Use of system roads on lands within the listed sub-Basins.	Ongoing
Huckleberry picking as a forest product	Commercial harvest and sale and free use of forest products.	Ongoing; Seasonal
Forest Trails	Management of forest trails including erosion work, route signing, and maintenance. Minimal extent and impact.	Ongoing

Table 4. Actions Considered in Cumulative Effects Analysis		
Action	**Description**	**Date**
Recreation Facilities Analysis	Prioritizes recreational facilities. Sites identified for closure or decommission include Saddle, South and Tillicum campgrounds.	Ongoing
Future		
Other Silvicultural Treatments	Subwatershed is dominated by "matrix" land allocations, which can be subject to timber harvest.	Not expected in immediate future
Road Decommission	No road decommissions are known to be proposed at this time. However decommissioning will likely continue where roads are harmful to natural resources.	Unknown
Global climate change effects	Human induced changes to atmospheric conditions, notably increased temperatures and heavy precipitation events.	Unknown

Vegetation

Existing Condition for Vegetation

Proposed treatments units lie in plateau between Sawtooth Mountain and West Twin Butte. Aspects vary as do the slopes with gradients between 0 and 50%.

Plant Associations
The Sawtooth planning area lies within the Southern Washington Cascades Province of the Pacific Northwest (Franklin & Dyrness 1973). The vegetation is temperate coniferous rainforest. The stands proposed for treatment (Table 5) are within the Pacific Silver Fir or Mountain Hemlock Zones (Brockway 1983).

The plant associations are Pacific silver fir / big huckleberry / beargrass (ABAM/VAME/XETE), Pacific silver fir / big huckleberry / queencup beadlily (ABAM/VAME/CLUN) and mountain hemlock / big huckleberry (TSME/VAME).

- ABAM/VAME/XETE association sites represent high elevation, frost prone sites with moderate productivity. These sites afford moderate opportunities for intensive timber management and produce stands of mixed species. Site Index, at 100 years, averages 103 feet (height) for western hemlock.

- ABAM/VAME/CLUN association sites represent herb poor, high elevation sites with moderate productivity. These sites also afford moderate opportunities for intensive timber management. Site Index, at 100 years, averages 99 feet (height) for western hemlock.

- TSHE/VAME association sites represent areas of heavy winter snowpacks with possible frost during the growing season. Timber opportunities are limited and a residual stand of trees is needed to mitigate the frost concerns. Overall productivity is low. Site Index, at 100 years, averages 89 feet (height) for western hemlock.

Table 5. Plant Associations in the Sawtooth Planning Area.

Plant Association	Site Characteristic	Timber Productivity	Project Units
Pacific silver fir/big huckleberry/beargrass (CFS251)	High elevation sites	moderate	2, 3, 5, 8, 9, 10AB, 11ABDCE, 12
Pacific silver fir/big huckleberry/queencup beadlily (CFS256)	High elevation sites	moderate	1AB, 4
Mountain hemlock/big huckleberry (CMS210)	Cold and high	low	6 , 7

Stand History, Structure, and Composition

Most present timber stands within the Sawtooth area were naturally established following stand replacement wildfires (1897) and reburns (Twin Buttes Fire – 1910). Other smaller and unrecorded fires likely occurred. Fires were ignited by lightning or Native Americans, who may have lit some fires at higher elevations in order to perpetuate the huckleberry gathering areas (Mack 2001). Since the 1930s, fire suppression efforts here have been successful in curtailing the occurrence of large-scale fires. This has allowed trees to become established and grow. Most stands are now considered mid-successional, and they comprise a large, contiguous patch extending east of the planning area. Mid-successional stands are defined as open and closed stands of small trees (9-21" dbh).

The mid-successional stands at Sawtooth have overstory trees that typically range from 9-13 inches dbh. They have a very large component of sub-merchantable trees. Stand exams revealed up to 7,380 sub-merchantable trees per acre, less than or equal to 5 inches dbh.

In portions of the burns with more surviving trees and where slopes have allowed cold air to drain, it appears reforestation was quicker and trees are now larger and denser. Stands on West Twin Butte have a pre-burn cohort (10-20 trees per acre) that are 24+ inch dbh. These overtory trees helped promote an understory that is now of commercial size.

Stands in main portion of Sawtooth Berryfield have few large trees, but by now have obtained similar high tree densities though most are less than 5 inches dbh. Lack of seed sources, soils, and the cold climatic regime have slowed reforestation here but not stopped it.

The predominant tree species are western hemlock (*Tsuga heterophylla*), Pacific silver fir (*Abies amabilis*), subalpine fir (*Abies Lasiocarpa*), and mountain hemlock (*Tsuga mertensiana*). Secondary species are noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), western

red cedar (*Thuja plicata*), western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and black cottonwood (*Populus trichocarpa*).

There are many endemic natural pathogens and insects causing tree mortality in the planning areas. They include laminated root rot, armillaria root rot, balsam wooly adelgid, and fir engraver. While affecting individual trees or small groups, these agents have had little impact at the stand level due to the diversity of tree species present.

One notable pathogen is western white pine blister rust (*Cronartium ribicola)*, an introduced disease that is very common on the western white pine trees in the planning area. The blister rust is a branch and stem canker disease. Damage includes mortality, topkill, branch dieback, and predisposition to attack by other agents, including bark beetles. It is a major killer of regenerating five needle pines and makes reestablishment of wild populations of these species on high hazard sites difficult or impossible. Currently, various levels of rust resistant western white pine seed is available for planting, and subsequent lower branch pruning helps alter the microclimate around the tree making conditions less favorable for infection.

Limited timber management began in and around the planning area in late 1960's. West and north of the planning area, Big and Squaw Timber Sales were cut in 1986-89. They utilized a patch clearcut method with 20 to 40 acre cutting blocks targeting stands of mature timber. Regeneration efforts have largely been successful despite some difficulties with fall planting; spring time planting was better. Near year 2000, Skeeter Timber Sale was implemented at West Twin Butte. Treatments included light retention (15-20% canopy retention) and moderate retention (30% canopy retention) regeneration cuts followed by hand planting. Reforestation was successful and blowdown of the residual trees has not been a significant problem. Residual trees in these units were left in two acre patches and smaller clumps.

Current stand data for treatment units in the Sawtooth Restoration Project is in the following table. There has been little to no past management actions in these stands to manipulate vegetation. In Units 8, 9 and 10 there has been some limited hand falling and experimental mechanical mulching of tree seedling and saplings. Some small trees were also girdled.

Table 6. Sawtooth Stand Data (formal stand exams and walkthrough exams in 2007)

Unit	Acres	DBH	TPA	BA	RD	Vol/Ac	Age	Plant Assocation	Soil Type
1A	13	<5" 10.8 - >5"	7,350 - <5" 141 - >5"	90	27	14	43	CFS256	45
1B	9	<5" 10.6 – >5"	1,500 - <5" 280 - >5"	280	86	56	83	CFS256	17
2	19	<5" 16.6 - >5"	2,300 - <5" 203 - >5"	307	75	79	73	CFS251	24
3A,B	142	<5" 14.8 - >5"	2,550 - <5" 207 - >5"	247	64	47	63	CFS251	92, 45
4	56	<5" 9.2 - >5"	3,450 - <5" 269 - >5"	125	41	14	44	CFS256	24, 45
5	51	<5" 9.6 - >5"	2,925 - <5" 462 - >5"	230	74	25	53	CFS251	45
6	35	<5" 10.9 - >5"	7,380 - <5" 224 - >5"	144	44	22	44	CMS210	45
7	52	<5" 10.9 - >5"	7,380 - <5" 224 - >5"	144	44	22	44	CMS210	45

8	182	<5" 10.7 - >5"	1,972 - <5" 73 - >5"	46	14	4	27	CFS251	45, 46
9	166	<5" 10.0 - >5"	4,575 - <5" 46 - >5"	25	8	3	34	CFS251	45, 46
10A,B	114	<5" 12.6 - >5"	3,375 - <5" 168 - >5"	168	47	26	33	CFS251	45,46,92
11A	50	<5" 10.3 - >5"	3,900 - <5" 471 - >5"	272	85	45	70	CFS251	45
11B,C,D,E	52	<5" 8-30" - >5"	6,433 - <5" 20-30 - >5"	--	--	<10 Est.	<40 Est.	CFS251	46
12	271	0.6 - <5" 9.6 - >5"	1,270 - <5" 230 - >5"	--	--	<10 Est.	<40 est.	CFS251	46
Total	1,212 acres								

Table notes:

- DBH – Average stand diameter (inches) measured at breast height (4.5" above ground).
- TPA – Average number of trees per acre.
- BA – Average stand basal area measured in square feet per acre.
- RD – Relative Density (Curtis).
- Vol/ac – timber volume per acre in mbf (thousand board feet)
- Age – At DBH. There are several older, larger trees present within most of the stands

All of the forest stands proposed for treatment are within the open or closed, small tree structural stage class (Hall et al. 1985).

Required Findings

Competing and Unwanted Vegetation

It is the policy of Region 6 to manage competing and unwanted vegetation per the Mediated Agreement and December 1988 ROD on Managing Competing and Unwanted Vegetation FEIS (USDA-FS 1988). The objective is to manage competing and unwanted vegetation under the preferred prevention or no action strategies. In the context of this project, conifers are the competing and unwanted vegetation within the Sawtooth Berryfields Roaded Recreation allocation. This project proposes maintenance actions (Units 8 and 9) and mechanical control actions (Units 6, 7, 10A, 10B, 11A, 11B, 11C, 11D, 11E, 11F, and 12) to reduce tree cover.

Throughout all stands beargrass (*Xerophyllum tenax*) is a native competitor with huckleberry and conifers. Like huckleberry, it can increase its cover following disturbance and reductions in tree cover. Efforts to minimize disturbance to huckleberry will also help to limit exposed soils and the spread of beargrass. This follows a prevention strategy. No control actions are envisioned to reduce beargrass cover.

Late-Successional and Old-Growth Forest

The Forest Plan, amended by the Northwest Forest Plan requires a minimum of 15% of the capable land within federal ownerships of a fifth-field watershed be comprised of late-successional and old-growth forest. Late-successional and old growth are terms that are often used interchangeable, but they have specific definitions. Late-successional forests are 80 years and older, have trees that are generally greater than 21" dbh, and may have only a single canopy

layer (FEMAT 1993). Old-growth forests are a subset of late-successional forests and are primarily older and with larger trees. Within the Pacific Silver Fir Plant Series, old-growth forest are a minimum of 180 years of age, have trees greater than 26" dbh, and have multiple canopy layers (USDA-FS 1992).

While the average age of most of the stands in this project is less than 80 years, many stands have a late-successional cohort of trees that are greater than 80 years of age. These are trees that survived the burns of the early 1900s or were established soon afterwards. None of these stands are old-growth.

Table 7. Sawtooth Stands with a Late-Successional Cohort.

Unit	Acres	Average Age	Oldest cohort Age	Proposed Treatment
1B	9	83	160	Moderate Forest Retention
2	19	73	100	Thinning
3A	102	63	150	Thinning
3B	40	63	150	Moderate Forest Retention
5	51	53	130	Moderate Forest Retention
6	35	44	100	Thinning
7	52	44	100	Thinning
10A,B	114	33	100	Thinning
11A	50	70	100	Thinning

Sawtooth Huckleberry Restoration project would thin 372 acres of forest with late-successional trees. Most late-successional trees would remain post-treatment and these stands would retain their late-successional attributes. There would be 100 acres of forest regenerated with a moderate forest retention cut. These stands would loose much of their late-successional attributes. These 100 acres comprise 0.06% of the capable forest in the Upper Lewis River Fifth Field Watershed. Considering the cumulative effects of this project, and all other planned vegetation projects, late-successional and old growth forest would still comprise 82% of the capable federal land in the Upper Lewis River Fifth Field Watershed. There would be no change in late-successional and old-growth forest in the Upper White Salmon River Fifth Field Watershed.

Opening Size

Treatment of Unit 5 will result in a cut opening of 51 acres, exceeding the standard 40 acre maximum size for silvicultural activities in the Silver Fir Plant Association (non Douglas-fir forest type). The layout of Unit 5 allows the use of more economically feasible logging systems, reducing landings and road construction, and lessening disturbance to both the soil resource and the existing huckleberries, the primary objective of this project. This results in a more desirable combination of net public benefits. As this opening does not exceed 60 acres, no further review or additional public notice is necessary. All other cut openings to be created this project will be less than 40 acres.

National Forest Management Act

The proposed silvicultural treatments meet all the requirements, conditions, and constraints for

vegetation manipulation, where applicable, as specified in title 36 CFR 219.27 (b) and Appendix F of the Forest Plan. This meets National Forest Management Act requirements as clarified in the Pacific Northwest Regional Guide.

Treatment units within the Roaded Recreation allocation are unsuitable for sustained timber production, due to being administratively withdrawn (Forest Plan allocation RM) and on soils that are unproductive for timber (soil mapping unit 46). Required findings for timber cover manipulation on productive forest land do not apply. Where timber harvest is proposed, it is primarily to meet the Roaded Recreation objective of huckleberry enhancement and while protecting other resources. Levels of conifer stocking in these areas address the environmental requirements of huckleberry ecology, not timber sustainability. Required findings for timber cover manipulation, specifically 36 CFR 219.27b (2) "Assure that lands can be adequately restocked," do not apply.

All proposed treatments are consistent with the allocations and guidelines of the Forest Plan, amended by the Northwest Forest Plan.

Environmental Effects

Huckleberry Production

In an attempt to display the estimated relative productivity of huckleberry shrubs within each alternative, an index was created by multiplying a value for fruit production by the unit acreage, summed for all units. Fruit production was assigned a value of either 1 (poor), 2 (moderate), or 3 (good).

Table 8. Huckleberry Productivity Index Over Time Post Treatment By Alternative

Alternative	Current	+ 1 Year	+ 5 Years	+ 10 Years	+ 20 Years
A – No Action	2087	2087	2087	1960	1560
B - Proposed	2087	1884	2660	3449	2858
C - Underburn	2087	1891	2112	3472	3215

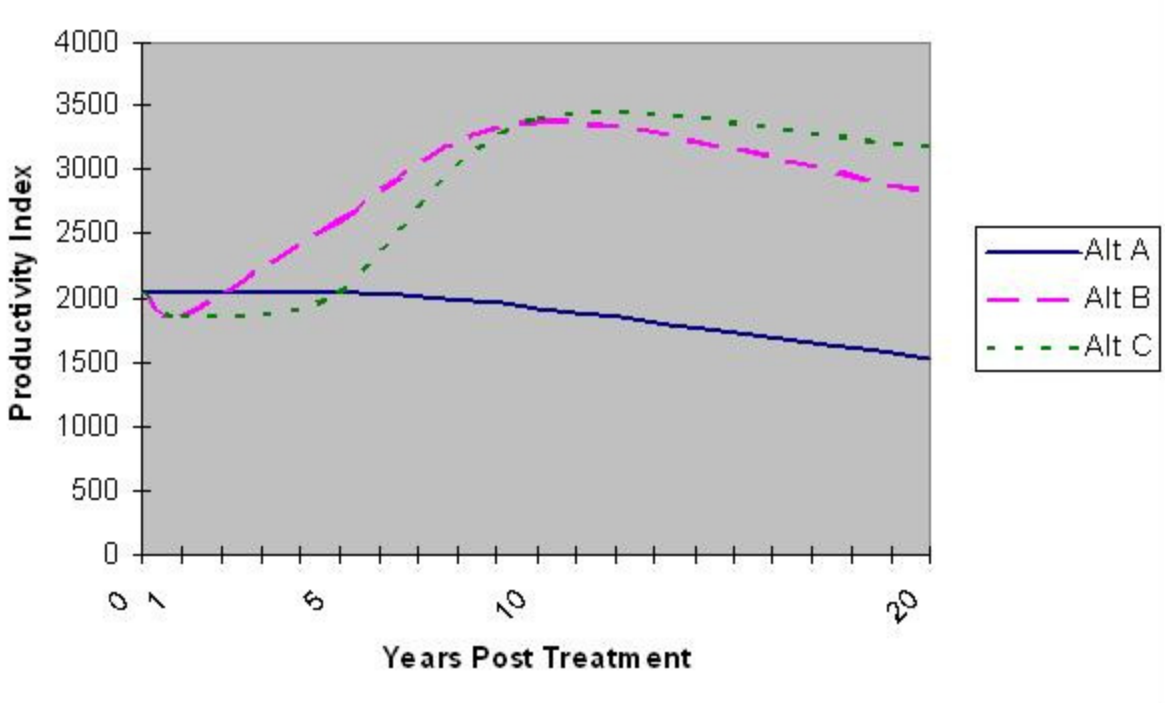

Figure 7. Huckleberry Productivity Index Over Time Post Treatment By Alternative.

Alternative A – No Action
Direct and Indirect Effects
Numerous species of huckleberries and bilberries may be found in Sawtooth Berryfields and nearby Twin Buttes. The principle species is big huckleberry (*Vaccinium membranaceum*) which covers more area and is most frequently picked. You may also find Cascade huckleberry (*Vaccinium delociosum),* oval-leafed bilberry (*Vaccinum ovalifolium*) bilberry (*Vaccinium uliginosum*), and dwarf huckleberry (*Vasscinium caespitosum*).

These high elevation huckleberries are similar in ecology. Regeneration by seed may occur, but most huckleberry regeneration is rhizominous. This fact makes huckleberries tolerant of fire. While the above ground portions of the plant may be consumed by surface fire, if the underground rhizome remains intact, the plant will readily sprout. Hence, huckleberries can dominate early successional forest following disturbance. But over time, huckleberry fruiting declines as trees become established and grow. The Sawtooth Huckleberry Field was formerly known as the Twin Buttes Huckleberry Fields, and it stretched between Sawtooth and Twin Buttes occupying 8,000 acres of old burn (Stamy 1970). It has since dwindled to about 2,000 acres of the productive berryfields. In the berryfields that have been occluded by tree cover, the bushes are still present, but they are not robust and produce little fruit.

Under no action, the continued growth of trees in Sawtooth Berryfield and on Twin Buttes will reduce the abundance of fruiting huckleberry (see Table 8 and Figure 7). Total cover of huckleberry may change little, but fruiting will decline. Areas of low huckleberry productivity on Twin Buttes and its vicinity (Units 1-6) would further decline. Lacking natural disturbance such as fire or wind fall to create new openings, there would be no new production.

In today's main Sawtooth Berryfields, tree growth will be quite noticeable as saplings grow above berry bush height and their crowns expand. There are also 2,000 to 4,000 seedlings per acre in Units 8 and 9 which will fill in the gaps not currently occupied by larger trees. In 20 years, canopy cover over the huckleberry bushes is likely to range from 15-60%. Whereas these berryfields are highly productive today, in 20 years they may begin to decline remarkably.

Other parts of Sawtooth Berryfields would see a similar decline. These areas already receive less picking pressure, because tree cover has limited huckleberry fruiting.

Huckleberry would remain a dominate shrub in the understory, even as the stands advance successionally. All of these stands would retain their potential for restoration, though the available options and impacts would change as the trees get larger.

The following table lists the current fruit production of each stand and how that may change over time with no action.

Table 9. Alternative A-No Action Current and Predicted Huckleberry Fruit Production.

Unit	Acres	Current Fruit Production	Predicted Fruit Production			
			+1 Year	+5 Years	+10 Years	+20 Years
1A	13	Moderate	Moderate	Moderate	Poor	Poor
1B	9	Poor	Poor	Poor	Poor	Poor
2	19	Poor	Poor	Poor	Poor	Poor
3A	102	Poor	Poor	Poor	Poor	Poor
3B	40	Poor	Poor	Poor	Poor	Poor
4	56	Poor	Poor	Poor	Poor	Poor
5	51	Poor	Poor	Poor	Poor	Poor
6	35	Poor	Poor	Poor	Poor	Poor
7	52	Poor	Poor	Poor	Poor	Poor
8	182	Good	Good	Good	Good	Moderate
9	166	Good	Good	Good	Good	Moderate
10A	55	Moderate	Moderate	Moderate	Poor	Poor
10B	59	Moderate	Moderate	Moderate	Poor	Poor
11A	50	Poor	Poor	Poor	Poor	Poor
11BCDE	52	Moderate	Moderate	Moderate	Moderate	Poor
12	271	Poor	Poor	Poor	Poor	Poor
Productivity Index		***2087***	***2087***	***2087***	***1960***	***1560***

Productivity Index is the result of fruit production multiplied by unit acreage and summed for all units. Fruit production is given a value of 1 (poor), 2 (moderate), or 3 (good). For Unit 1A at one year post treatment the productivity index is: 2 [moderate] x 13 [acres] = 26.

Alternative B – Proposed Action
Direct and Indirect Effects
There have been some formal experiments and informal field trials to invigorate huckleberry fields that have declined due to forest succession. It appears the best results have come from killing just the trees while causing the least amount of damage to both the above ground huckleberry and its below ground rhizome. One of Don Minore's (Minore et al. 1979) most successful treatments with pole sized trees was to inject them with herbicide and allow the trees to die in place causing no ground disturbance. Three years after treatment, berry cover was unchanged, but berry production had doubled. In an area with smaller, younger trees, grazing by sheep was able to yield a similar result.

A huckleberry restoration / timber harvest project on the Warm Springs Indian Reservation in 2001 sought to remove about half of the trees growing in an historic berryfield. The logging was conducted with ground based equipment over snow in order to provide some protection to the above ground bushes and near complete protection to the rhizomes. Anecdotally, huckleberry cover increased the following year and fruit production increased three years after treatment (Jimenez 2008).

Typical summer logging operations can set back huckleberry production. The more passes equipment and logs make over the ground the greater the detriment. A single pass would cause slight damage to the above ground bush, but multiple passes, such as on skid roads, would likely damage huckleberry rhizomes. Skeeter Timber Sale logged three stands on West Twin Butte in 2001 without special regard for their huckleberry understory. Many regenerated huckleberry bushes one foot tall are now evident, and they are fruiting seven years after treatment.

While high amounts of shade and competition are detrimental to huckleberries, some shade may actually be beneficial (Minore et al. 1979). Late frosts can kill huckleberry leaves, new shoots, and flowers. Trees can provide thermal cover to limit frost. This may be more important on flat, frost prone areas where cold air can pool. Shade from trees can delay snowmelt, and retard early season growth until after killing frost (Minore 1972). Shade may also be a factor in moderating summer moisture stress (Barney 2007).

Minore et al. (1979) suggests a light partial shade provided by snags or a thin overstory canopy as beneficial. Minore's report includes photos of the Sawtooth Berryfields from the 1930's for his reference of ideal conditions. Based on the 1930's photos, overstory canopy appears to have been very low (<10%) during this period of optimum berry production (see Figures 2 and 3).

Research on globe huckleberry in Montana found declining berry production when shade exceeded 30% (Martin 1979). In a survey of Warm Springs Reservation berryfields resulting from old burns or logging, the highest fruit production was on stands with 35-50% canopy cover, although their sample only included stands with canopy covers exceeding 34% (Anzinger 2003). Container grown huckleberries grew best under shade cloth providing 30% cover (Barney 2007).

In wildlands, the ideal cover is likely a factor of slope and aspect. Greater cover may be needed on frost prone slopes and hotter west facing aspects. Slopes with good air drainage on north to east aspects may need little cover at all in most years. On a landscape basis, a range of light

(10%) to moderate cover (50%) may best address annual weather variations that strongly effect fruit production.

Huckleberry research was applied to the unique conditions of these stands, both physical and social, to develop huckleberry restoration treatments. The following table details predicted fruit production in the years following treatment.

Table 10. Alternative B – Current and Predicted Huckleberry Fruit Production

Unit	Acres	Current Fruit Production	Post Treatment Fruit Production				Un-Productive Acres
			+1 Yr	+5 Yrs	+10 Yrs	+20 Yrs	
1A	13	Moderate	Poor	Moderate	Moderate	Poor	0.5
1B	9	Poor	Poor	Poor	Good	Good	0.5
2	19	Poor	Poor	Good	Good	Moderate	0.5
3A	102	Poor	Poor	Moderate	Moderate	Poor	1.0
3B	40	Poor	Poor	Moderate	Good	Good	1.0
4	56	Poor	Poor	Poor	Good	Moderate	3.0
5	51	Poor	Poor	Poor	Good	Good	3.5
6	35	Poor	Poor	Good	Good	Moderate	1.0
7	52	Poor	Poor	Good	Good	Good	0.5
8	182	Good	Good	Good	Good	Good	-
9	166	Good	Good	Good	Good	Good	-
10A	55	Moderate	Poor	Poor	Good	Good	3.0
10B	59	Moderate	Poor	Poor	Good	Moderate	3.0
11A	50	Poor	Poor	Good	Good	Good	0.5
11BCDE	52	Moderate	Poor	Moderate	Good	Moderate	1.0
12	271	Poor	Poor	Moderate	Good	Moderate	5.5
Productivity Index		***2087***	***1884***	***2660***	***3449***	***2858***	

Productivity Index is the result of fruit production multiplied by unit acreage and summed for all units. Fruit production is given a value of 1 (poor), 2 (moderate), or 3 (good). For Alternatives B and C, unit acres are reduced by the area made unproductive due to temporary roads, landings, skid trails, and burn piles. For Unit 1A at one year post treatment the productivity index is: 1 [poor] x 12.5 [13-0.5] = 12.5

Post treatment changes in fruit production were based on the degree of site impact caused by the logging and slash treatments, resultant canopy cover, and expected speed of conifer recovery, both in crown expansion and ingrowth.

Hand treatments (Units 8 and 9) cause the least physical disturbance to huckleberry bushes and rhizomes, and these disturbances should have little adverse effect on productivity. To the extent canopy cover is kept below 40% and ideally near 20% (based on Minore's research), fruit production should stay at high levels. Units 8 and 9 encompass the areas of Sawtooth Berry field that currently receive the greatest intensity of huckleberry harvest.

Removing trees with ground based equipment would cause damage to huckleberry shrubs and set back fruit production. Ground based logging systems would effect fruit production for

approximately seven years, based on observations of Skeeter Timber Sale and huckleberry research (Minore 1972, Minore et al. 1979). Operations over snow would greatly limit this impact as would skyline logging systems. Where logged over snow or by skyline (Units 3A, 6, 11A) fruit production would be set back or remain at low levels for only three years (Jiminez 2008).

Once huckleberry plants recover from the disturbance of tree removal, increased light, water, and nutrients should result in sufficient carbohydrate reserves to initiate fruiting. A light to moderate canopy cover should moderate weather extremes to allow fruiting to be completed. Fruit production should move to moderate or good levels. Competing tree seedlings, beargrass, lupines, and other grasses and forbs could temper these expected gains if they outcompete huckleberry for cover.

The duration of increased huckleberry production will depend on how long it takes for trees to increase their cover. Once the stand returns back to 60% cover, fruit production will likely drop back to low levels (Anzinger 2003, Barney 2007). Young stands that are thinned to only 40% canopy cover (Unit 1A) will more rapidly attain canopy closure to 60% and above. The same is true of older stands commercially thinned to 40% and containing many saplings (Units 3A, 6) Tree crown response and ingrowth in these units may limit the period of improved huckleberry fruiting to only a decade or so.

A much longer period of sustained berry production will occur in stands where the canopy cover is reduced below 30% and where the numerous saplings are eradicated by mulching, slashing, or mechanical damage (Units 2, 3B, 5, 7, 10A, 11,)

When comparing the productivity index, Alternative B as a whole would cause a decline in huckleberry fruiting immediately after treatment. Five years after treatment, fruiting should increase, and remain better than no action for the next 15+ years (see Table 8 and Figure 7).

Alternative C – Underburning
Direct and Indirect Effects
Burning treatments have been successful in removing tree cover but have taken longer for huckleberry to recover. In most berryfields where fires have been tested, there were insufficient surface fuels to carry a fire. Minore (1979) used bulldozers, herbicides, and hand falling to create cured vegetation and fuels. Bulldozing trees over and hand falling created sufficient fuels to carry a surface fire. These treatments consumed and blackened huckleberry bushes. Huckleberry cover declined initially but then increased due to rhizominous sprouting. Other competing vegetation such as beargrass, lupines, and grasses also increased. Big huckleberry shoots begin to flower and fruit during the third growing season after fire, but abundant fruit production was delayed by seven years (Minore 1984).

While there may be a fruit production lag as a result of burning, it may have benefits that are expressed over a longer term. New shoots may provide fruit productivity for a longer time. Burning may delay the ingrowth of trees, killing off seedlings, saplings, and seed sources. There may be benefits in charcoal providing long term nutrient availability (Erickson 2008). High intensity, stand replacing fire is the natural disturbance event that created these berryfields, and

Native Americans maintained huckleberry fields in early seral conditions by periodic, low intensity fires (French 1999, Mack 2001).

Alternative C was developed to include some options for low intensity underburning. Objectives for underburning were to consume slash, tree seedlings and saplings, while limiting high temperatures of long duration that would kill huckleberry rhizomes. The logistical constraints of underburning were also considered in the selection of units. A final factor was the size and species of tree overstory, and its susceptibility to mortality from bark scorch.

The following table details predicted huckleberry fruit production following implementation of Alternative C.

Table 11. Alternative C – Current and Predicted Huckleberry Fruit Production

Unit	Acres	Current Fruit Production	Post Treatment Fruit Production				Un-Productive Acres
			+1 Yr	+5 Yrs	+10 Yrs	+20 Yrs	
1A	13	Moderate	Poor	Moderate	Moderate	Poor	0.5
1B	9	Poor	Poor	Poor	Good	Good	0.5
2*	19	Poor	Poor	Poor	Good	Good	0.5
3A	102	Poor	Poor	Moderate	Moderate	Poor	1.0
3B	40	Poor	Poor	Moderate	Good	Good	1.0
4	56	Poor	Poor	Poor	Good	Moderate	3.0
5*	51	Poor	Poor	Poor	Good	Good	2.5
6	35	Poor	Poor	Good	Good	Moderate	1.0
7*	52	Poor	Poor	Poor	Good	Good	0.5
8	182	Good	Good	Good	Good	Good	-
9	166	Good	Good	Good	Good	Good	-
10A*	55	Moderate	Poor	Poor	Good	Good	3.0
10B	59	Moderate	Poor	Poor	Good	Moderate	3.0
11A*	50	Poor	Poor	Poor	Good	Good	0.5
11BCDE*	52	Moderate	Poor	Poor	Good	Good	-
12*	271	Poor	Poor	Poor	Good	Good	-
Productivity Index		***2087***	***1891***	***2112***	***3472***	***3215***	

* Underburn Units

Productivity Index is the result of fruit production multiplied by unit acreage and summed for all units. Fruit production is given a value of 1 (poor), 2 (moderate), or 3 (good). For Alternatives B and C, unit acres are reduced by the area made unproductive due to temporary roads, landings, skid trails, and burn piles. For Unit 1A at one year post treatment the productivity index is: 1 [low] x 12.5 [13-0.5] = 12.5

The immediate impact of underburning with regards to huckleberries is the likely mortality of the above ground portion of the plant. Sprouting from the rhizome should lead to a rapid recovery. Fruiting, however, will be delayed when compared to the mechanical treatments (Units 2, 7, and 11A) that are to be conducted over snow in Alternative B. The productivity index at one and five years after Alternative C treatments are less than no action. At five years, productivity index remains less than Alternative B (see Table 8 and Figure 7).

Ten years after treatment, the fruit production is predicted to be much better than that of no action, and even slightly better than Alternative B due to less site degradation from mechanical equipment and burning slash piles.

Twenty years after treatment, the underburned units are likely to still have high productivity, specifically for Units 2, 11BCDE, and 12. This is because underburning should be effective in killing tree seedlings and saplings, helping to keep canopy cover closer to the initial post treatment condition for a longer term. In Alternative B, tree saplings will have transitioned to pole-size trees, contributing to canopy closure and adversely affecting fruit production.

Huckleberry Resource Cumulative Effects (Similar for all alternatives)
A number of relatively small projects aimed at improving huckleberry productivity have occurred over the past 75 years within the Sawtooth Berry Fields. As early as 1937, Forest Service managers recognized that portions of the berry fields were reforesting. In 1937, all trees were felled and limbs lopped on a five acre plot in the Sawtooth Berry Fields, north of Road 30. The response of the berry bushes to this treatment was monitored until 1941.

In 1963 trees were felled on 72 acres in the berry fields, north of Road 30. A 20 foot-wide fireline was constructed around the area, and the southern half of this area was proposed for broadcast burning. Burning never occurred, however. In the northern half of the area, six acres were disked in an attempt to mechanically prune the bushes. Production was not measured.

Between 1965 and 1966, small trees were removed with hand tools on 68 acres north of Surprise Lakes (within Unit 8) and 52 acres across from the entrance to Cold Spring Camp (within Unit 9).

In 1969 Dr. Perry Crandall of Washington State University conducted replicated herbicide treatments and mechanical pruning trials (50% to 80% top removal with a rotary saw) on a series of adjacent 20' x 20' experimental plots in the Sawtooth Berry Fields. He found the herbicide treatments to be ineffective, damaging the shrubs rather than improving them. The pruning trials were inconclusive.

Between 1972 and 1977, Don Minore with the Pacific Northwest Forest and Range Experiment Station conducted a six-year study on ways to reduce competing species without reducing huckleberry production. His trials were conducted on 20 square 1/3 acre plots (120 feet on a side), in a 620 x 510 foot area. He did four replications of five treatments, which included sheep grazing (putting 80 sheep in a 1/3 acre pen for 3 days), cut and burn, burn, borax application and no treatment. Berries were picked and weighed to measure productivity. Burning was accomplished with diesel fuel and a flamethrower, since the slash had not been cured in the cut units. The control plots far outproduced any of his study plots throughout the six-year study. Borax had no beneficial effect, grazing did after two years, and burning reduced it. The burn, cut and burn and control plots were reinventoried in 1988 by Forest Service personnel, and the control plots still had much higher productivity than the burned plots.

In 1991 a two acre experimental plot north of Road 30 was treated with a hydro-axe, in order to remove trees and prune the huckleberry bushes. This was followed by treatment of a 20 acre parcel in and adjacent to the Cold Springs Campground (partly within Sawtooth Unit 10).

In 1995 a series of four different manual treatments were conducted within a 60 acre parcel within Sawtooth Unit 9. In one portion of this parcel all trees less than 8" DBH were cut or girdled; in another area all trees less than 8" DBH were thinned to 20' x 20' spacing, while trees over 8" were pruned; and in another area trees less than 8" DBH were thinned to 20' x 20' spacing. All slash was lopped and scattered.

Later in the 1990s and early in 2000, a number of small (<40 acre) parcels within Sawtooth Huckleberry Restoration Units 8 and 9 were treated with a variety of hand treatments, including girdling, lopping, and cutting. A total of approximately 100 acres was treated. Although broadcast burning of a 20 acre parcel within Sawtooth Unit 9 had been proposed as part of the project, burning was never conducted.

Skeeter Timber Sale was implemented in 2001 and included three regeneration cuts on and near west Twin Butte. Those cutting units were 15 to 40 acres in size and abut Sawtooth Units 3A, 3B, 4 and 5. While huckleberry restoration was not an explicit objective for Skeeter Timber Sale, huckleberry bushes have nonetheless responded to the increased light and growing space. Huckleberry stems have resprouted and abundant fruting was noted in 2007 and 2008.

While no specific future projects are planned within the Sawtooth restoration units; huckleberry picking will continue. Native Americans will continue to have exclusive collection rights to berries north of Road 24 in the Sawtooth Berry Fields (Sawtooth Units 8, 10A, 10B,). General personal use collection will continue in all other areas. Commercial collection will continue to be permitted on the outskirts of Sawtooth Berry Fields, such as Twin Buttes (Sawtooth Units 1A, 1B, 2, 3A, 3B, 4 and 5). Collection of berries will have little to no impact on overall huckleberry vigor and fruiting potential. There may be some localized impacts from soil compaction or the illegal use of rakes causing loss of leaves and stems, but these impacts are overshadowed figuratively and literally by much the greater and widespread impact of increasing tree cover.

Fire and Fuels _____

Existing Condition

Fire Ecology

The plant association groups described above are part of fire group 8—warm, moist western hemlock and Pacific silver fir group. Areas in this classification generally contain deep duff and large logs while lacking fine fuels. In most years, fuels remain wet most of the year and are slow to dry in the summer. However, the dry duff will carry fire if exposed and prolonged smoldering in deep duff and punky logs can result in a high severity burn that severely damages the soil. Fire in this group serves to create a mosaic of stand structures and age classes across the landscape while preparing seed beds for certain species and contributing to within-stand species diversity (Evers et al, 1996). The diversity in stand structure currently present among the

proposed project units could have possibly resulted from more recent burns or varying intensities of burns and availability of seed sources.

The succession sequence is such that high intensity fire at any stage will send a stand to a shrub/herb dominated stage. Even moderate intensity fires may eliminate Pacific silver fir due to its extremely low fire resistance. It has thin bark; shallow roots; a low, dense branching habit; high stand densities; high foliage flammability, and heavy epiphytic lichen loads, leaving it susceptible to easy cambium and root kill, scorch, and crowing (Evers et al, 1996). The predominant composition of Pacific silver fir in the stands of Sawtooth project area suggests high probabilities for mortality in any burn scenario. As stands progress in succession, the probability of low to moderate intensity fires remains low through the stem exclusion phase due to lack of available fuel. Fires become more probable later in the successional pathway when stands reach the stem re-initiation phase and natural fuel accumulations build (Evers et al, 1996). Most of the stands in the Sawtooth project area are in early to mid-successional stages and, therefore, lack natural fuel accumulations as they have not yet reached the point of stem re-initiation.

Wildfire hazard in this fire group is low to moderate depending on the weather in any given year as well as the amount and extent of canopy gaps. Smoldering and creeping spread rates are most common in these fuel types and most active burning occurs in a single burning period though it can span several. The exception occurs in the event of dry east winds and prolonged drought (3+ years), which dries the forest floor enough to allow fire spread and can stimulate much higher intensity fires. The aforementioned conditions resulting in the probability of large fire spread occur approximately every 30 years (Evers et al, 1996). Under current stand conditions, stand replacing fires will dominate during large fire scenarios, and most fires will be either very small (<10 acres) or very large (>1000 acres) (Evers et al 1996; Agee, 1993). The highest levels of fire danger occur mid-September through October (Evers et al, 1996).

Fire History

Before European settlement, fires in the area typically burned anywhere from several weeks to a couple of months. Long term smoldering and small crown fire runs created more mid-sized fires than are witnessed today and a finer scale mosaic of stand conditions across the landscape. These burn patterns as well as topography may have had more influence on fire shape and size. Underburns may also have been more common. Fires that continued to burn into September and October faced the potential for a strong east wind event that triggered the large, fast-moving, high intensity burns. Fire exclusion since European settlement may have some effect on current fire behavior and size (Evers et al, 1996).

Age class analyses show extremely variable fire return intervals ranging from 90-730 years with no discernable mode (Evers et al, 1996). While stands at lower, drier elevations experience fire every 100-300 years, the Sawtooth project area is comprised of more moist sites where the return interval ranges from 300-600 years (Agee, 1993).

Native American burning for huckleberry production was prevalent prior to European settlement across all proposed units in the Sawtooth Huckleberry Restoration project according to oral tradition of the Yakima Indian Nation. According to historical maps, a large fire swept through all of the proposed Sawtooth Huckleberry Restoration units prior to the turn of the twentieth

century. Another fire in 1905, whose exact perimeter is unknown, re-burned in the area of units 8, 9, 10, 11, 12, and potentially 6 and 7. The scarcity of duff and the open canopy throughout much of those units provide evidence of that re-burn. Finally, units 1 and 2 burned again in the late summer of 1910 in the Twin Buttes fire. Numerous spot fires from these large fires and small, Native American started fires added to the mosaic created during that time period. Thus, in the 20 years surrounding the turn of the century, fire visited the area frequently and burned all of the proposed units, most of them as many as three times. Fire activity since the movement towards fire suppression and exclusion in the 1910s has been minimal with the majority of fires being human caused and contained at <10 acres and oftentimes < one acre in size. Current fuels loads vary across the units, but they are sparse overall, typically lacking in fine fuels with minimal larger logs and varying amounts of duff. See the silviculture section for a description of stand composition.

Prescribed Fire Information and Feasibility

In general, prescribed fire is not seen as a particularly useful management option because under controllable conditions, prescribed fires will not spread (Agee, 1993). High decomposition rates suggest mechanical or manual treatments may adequately manipulate fuels and address fuel hazards without the use of fire (Evers et al, 1996; Agee, 1993). However, some burning may be appropriate to maintain high-producing huckleberry fields and to clean logging slash in visually sensitive and high use areas (Evers et al, 1996), but burning in these plant groups on cooler sites with soils lacking in fertility and where nutrient cycling and tree growth proceed at slow rates will likely result in decreased site fertility and productivity. Nitrogen capital is concentrated in the forest floor and above ground vegetation, resulting in 60 percent of the fine root residing in the organic horizons of the forest floor (first 2-4 inches). Even light burns may seriously decrease nitrogen capital and kill advanced regeneration. Therefore, prescribed fire ideally would not exceed “light” intensity—surface temperatures less than 200 degrees Celsius, surface duff layer charred but not consumed, other woody debris partly burned and logs not deeply charred (Brockway et al, 1983) and should occur only when duff moisture is high to avoid prolonged smoldering that can result in soil damage, seedbank scarification, and the volatilization of too much nitrogen to maintain site productivity (Evers et al, 1996).

As mentioned, most huckleberry fields of the Northwest, including those in the Sawtooth project area, originated following large, stand-replacing wildfires that were more common prior to modern fire suppression. However, as stands age invading trees and other brush crowd the huckleberry bushes and eventually out-compete them as the community progress toward climax forest. Without fire or other large scale forest disturbances, the berry production gradually declines as the other trees and shrubs come to dominate the site. This describes the present trend in the Sawtooth huckleberry restoration area. As the old burns continue to be reforested and new burns are rare, the formerly abundant huckleberry fields are decreasing in size and production. Although some studies have been conducted, there is an overall lack of conclusive research as to effective management practices for the maintenance and restoration of huckleberry fields. Little has been done since the Native Americans stopped burning, primarily due to lack of knowledge and limited financing (Minore, 1972), but prescribed burning is a potential option for maintaining the necessary open canopy under which huckleberries grow and for pruning the plants of older, less productive shoots.

Again, the units in the Sawtooth Huckleberry restoration project area fall into the Pacific Silver Fir and Mountain Hemlock plant groups: high elevation, moist forest with cold winter conditions, a large snowpack, little wildfire risk, and long fire return intervals. Dominant tree species in this plant group are typically thin-barked and not well-adapted to fire because the average fire return interval is quite long. Among these species present are primarily Pacific silver fir (*Abies amabalis)*, subalpine fir (*Abies lasiocarpa*), and mountain hemlock (*Tsuga mertensiana)*, with a smaller component of noble fir *(Abies procera)*, Engelmann spruce (*Picea engelmannii)*, lodgepole pine (*Pinus contora)*, western white pine (*Pinus monticola*), and western hemlock (*Tsuga heterophylla)*. Douglas-fir (*Pseudotsuga menziessii)* is also present but is much better adapted to fire than the aforementioned species. Due to the high susceptibility of the predominant trees to fire, mortality projections in the event of fire are typically high, even under desired conditions and close fire management.

Throughout the project area, fuelbeds are unreceptive to fire much of the year and surface fuels are compacted rapidly. The greatest fire threat is present in late summer during the brief period when fuels are receptive and a large number of human visitors come to the area to gather forest products, particularly huckleberries. Human-caused fires are not uncommon this time of year. Thus, the recommended treatment under Alternative B to reduce the threat of human-caused ignition is to pile and burn all activity fuels within 100 feet of Forest Roads 24, 30, and 210, Cold Springs Indian Camp, and Saddle Camp. All of Unit 5 will be piled and burned for site preparation purposes. On the other hand, Alternative C proposes the use of prescribed fire as a tool for huckleberry enhancement in Units 2, 5, 7, 10A, 11A-E, and 12. Based on specialist input for desired future condition under Alternative C and studies that have occurred, the analysis that follows is based on a prescription for a low intensity, fast moving underburn that will maintain huckleberry rhizome structure and the plant crown while pruning old limbs and allowing for some top kill.

The foliage of huckleberry plants is of low flammability and the plants are only consumed by fire when adequate fuels are present to dry and preheat stems and foliage (Miller, 1977). Therefore, the Forest Service fuels specialist will need to work closely with the Forest Service sale administrator to achieve a desirable post-harvest condition that will lend itself to a light intensity, fast-moving fire. This condition includes four-eight tons of fine fuels per acre (less than 3 inches in diameter) with two-five of those tons in the one- and 10-hour fuel category (less than or equal to one-inch diameter). As much of the material three inches and greater as possible should be removed. All slash left onsite needs to cure and overwinter one year. Post-harvest fuel bed depth should be between 18 and 24 inches, reducing to eight-twelve inches of relatively continuous fuel after winter compaction. The fuel moisture content of the surface fuels should be as follows:

1-hour fuels (<0.25” = 5-8%)
10-hour fuels (0.25” – 1.0” = 8-10%)
100-hour fuels (1.0-3.0” > 13%)
1000-hour fuels (>3.0” at the moisture of extinction or >25%)

The presence of an adequately moist duff layer will help protect huckleberry rhizomes. Fires conducted when duff is relatively moist and only partially consumed result in heavy re-sprouting from rhizomes (Boyd, 1999), while those that consume large amounts of duff are most harmful

to regeneration (Miller, 1977). The amount of heat that penetrates the soil layers where rhizomes occur as well as the amounts of duff and soil moisture are contributing factors to the post fire sprouting capability of the huckleberry plants (Miller, 1976). In general, low severity burns result in heavy sprouting from rhizomes (Donnelly, 1993), while moderate to severe fires on coarse textured soil or areas with a thin organic layer kill underground rhizomes and result in heavy huckleberry mortality (Coates, 1986). The moist duff and soil present during spring burns can serve as a heat shield to protect the adventitious buds on rhizomes. The same duff and soil moisture content is more difficult to achieve in fall burns.

The results from fire modeling programs along with experience were combined to produce these results and recommendations for using fire as a tool in the proposed units of the Sawtooth Huckleberry Restoration:

- **Units 1A, 6, 7, and 11A-** Overall lack of large fire-resistant trees in these stands results in high mortality projections. Underburning in these units could result in a significant additional loss of canopy cover, which would need to be addressed in the silvicultural prescription.
- **Units 1B, 2, 3, 4, 5, and 10A-** These units possess potential for burning. There are some large Douglas-fir trees present, particularly in units 2, 5, and 10, which increases the possibility for canopy cover retention. In areas where terrain in steep, fuel loading should be reduced to 1.5-4.0 tons (rather than 2-5) per acre of materials less than 1 inch in diameter to account for preheating. Units 4 and 5 contain smaller diameter material than the others, resulting in slightly higher mortality predictions. Considerations for piling prescriptions include direct site sterilization from localized high intensity heat and compaction in landing areas as evidenced in previously treated units.
- **Units 8 and 9-** The lop and scatter prescription here is appropriate. These units fall within the area of the main Sawtooth Huckleberry fields and a production setback from prescribed fire is undesirable. Fire hazard created will be negligible based on fuel type and amount and climate in the area.
- **Units 11B-E and 12-** No mortality analysis was done for these small diameter stands because only fixed-plot data were available. However, the desired post-harvest conditions listed earlier apply to these stands as well if burning is to occur. The lack of duff in some areas makes the soil subject to more intense heating and the rhizomes more vulnerable to mortality. The requisite of a light intensity, fast-moving fire is critical in these units to minimize damage to rhizomes and recovery time of huckleberry bushes. The small size of trees and species composition will result in high mortality.

Environmental Effects

Alternative A –No Action

Direct and Indirect Effects

If no action occurs there will be no effects to soils, no vegetation or wildlife mortality resulting from fire, no smoke emissions, and no risks to public safety due to impaired visibility from smoke, smoke inhalation, and fire itself. There will be no interruption to the gathering of special forest products or to hikers on the Pacific Crest Trail.

Current encroachment by conifers and more shade tolerant shrubs will continue in huckleberry fields with no opportunities for restoration by fire if no action is taken. The tree canopy will continue to become denser without fire altering stand composition and structure. Fire occurrence is expected to remain the same in the area. The long fire return interval typical of the site makes it so that no changes in fire frequency or severity are expected in the next few decades. Fires would continue to be small in size and primarily human-caused.

Alternative B – Proposed Action
Direct and Indirect Effects
Alternative B calls for pile burning in Units 1B, 2, 3A, 4, 5, 6, 10A, and 10B within 100 feet of Roads 24, 30, 210, Cold Spring Indian Camp, and Saddle Camp, and throughout Unit 5 for site preparation. The potential effects include site sterilization when the burning results in intense and prolonged soil heating (particularly pile burning), short term changes in microsite composition and characteristics, vegetation mortality, relatively insignificant threats to wildlife, and the output of greenhouse gases, including carbon monoxide, nitrous oxides, volatile organic matter, and particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) and less than 10 microns (PM_{10}). The quantity of emissions is related to the intensity and rate of spread of the fire, which is determined by the weather, fuels and topography. Because these factors are highly variable, modeling outputs fluctuate widely. All burning operations will comply with the State of Washington Department of Natural Resources Smoke Management Plan, which meets the requirements of the Washington Clean Air Act (RCW 70.94), Forest Protection Laws (RCW 76.04), and the United States Clean Air Act (42 USC 7401 et seq.). Smoke emissions will be regulated through compliance with the plan. In addition, the burn plan will provide for mitigation measures to minimize smoke exposure and fire hazards to firefighting personnel and the public. These measures include public education, particularly for local communities and to harvesters of special forest products; clear signage; abiding by all regulations regarding burning near the Pacific Crest Trail in units of concern, and closing any road/areas where hazards do exist. The units are sufficient distance from any population centers and will therefore not affect any sensitive communities. The Intergovernmental Panel on Climate Change (IPCC) has stated "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC, 2007). Scientific analyses seem to indicate, but cannot prove at this point, that rising levels of greenhouse gases in the atmosphere are contributing to climate change (as theory predicts). However, the scale of the project and lack of available data for analysis preclude climate change as a significant issue in this project.

Alternative C—Underburning
Direct and Indirect Effects
Alternative C also calls for pile burning in Units 1B, 3A, 4, 6, and 10B within 100 feet of Roads 24, 30, 210, Cold Spring Indian Camp, and Saddle Camp as well as underburning 4-8 tons per acre of activity slash in Units 2, 5, 7, 10A, 11A-E, and 12. In the case of Alternative C, where the use of fire would be maximized in order to utilize it as a tool to meet other treatment objectives, namely huckleberry enhancement, the effects of this increased use of fire were analyzed using various software applications. The First Order Fire Effects Model (FOFEM) was used to examine the probability of overstory tree mortality following prescribed fire

underburns in each of the proposed units of the Sawtooth Huckleberry Restoration project. The model analyzes the inputs of tree species, diameter, number per acre, height, and crown ratio along with flame length to determine the percent mortality, percent basal area killed, and the percent canopy cover pre and post fire. Algorithms for fire resistance are built into the program based on factors such as species bark thickness, size, and crown ratio. The model, BehavePlus, was also used and the outputs compared to those of FOFEM. BehavePlus serves best as a model for fire spread rather than mortality and tends to overpredict; therefore, the results from BehavePlus were considered secondarily to those of FOFEM.

The leave trees for input into FOFEM were chosen based on a prescription of leaving the largest 48 trees per acre to achieve 25-40% canopy cover. In areas where the percent canopy cover falls below those levels it is because the leave trees are smaller in those stands so more trees would need to be left to achieve the same amount of canopy cover. However, leaving more trees does nothing to the postfire percent canopy cover predictions because the trees left would be of small diameter and highly susceptible to fire.

Units 7, 11B-E, and 12 were not analyzed because only fixed plot data was gathered for these stands of small diameter material. The stand structure and composition of unit 7 is similar to that of unit 6 and therefore can be expected to have similar mortality projections and a low burnability. Units 11B-E and 12 are moderately burnable and discussed more above. Units 8 and 9 were not analyzed because burning is not an option in these stands of the current berry fields.

Flame lengths of 2-3 feet are desirable and above 4 ft. should be avoided to prevent high level of mortality across tree species. Based on outputs, units 2, 3, and 10 present the greatest opportunities for success in maintaining the desired canopy cover due to leave tree size, species, and resulting percent mortality. If larger openings are allowable, units 1B, 4, 5, 11B-E, and 12 can be burned as long as desired post harvest prescription parameters are met.

Additional potential effects of underburning include short term changes in microsite composition and characteristics, vegetation mortality, relatively insignificant threats to wildlife, and the output of greenhouse gases, including carbon monoxide, nitrous oxides, volatile organic matter, and particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) and less than 10 microns (PM_{10}). The quantity of emissions is related to the intensity and rate of spread of the fire, which is determined by the weather, fuels and topography. Because these factors are highly variable, modeling outputs fluctuate widely. All burning operations will comply with the State of Washington Department of Natural Resources Smoke Management Plan, which meets the requirements of the Washington Clean Air Act (RCW 70.94), Forest Protection Laws (RCW 76.04), and the United States Clean Air Act (42 USC 7401 et seq.). Smoke emissions will be regulated through compliance with the plan.

Cumulative Effects for Action Alternatives

There are no cumulative fire/fuels effects for the proposed units in this project. All potential cumulative effects of smoke are regulated through compliance with the State of Washington Department of Natural Resources Smoke Management Plan, which meets the requirements of the Washington Clean Air Act (RCW 70.94), Forest Protection Laws (RCW 76.04), and the United

States Clean Air Act (42 USC 7401 et seq.). All prescribed burning including that occurring on federal/public, private, and state land is subject to the regulations and requirements of smoke reporting through the Department of Natural Resources. Therefore, the level of smoke emissions will not exceed the standards allowed by the state and federal policy.

Heritage Resources

In compliance with Section 106 of the National Historic Preservation Act (NHPA), a heritage resource survey of the proposed project was completed in 2007. A number of heritage resources were identified within the project area. These include the Traditional Cultural Properties (TCP) of *Skis wa-tum* and *Kpss-wa-nite*, along with several individual properties. Traditional Cultural Properties are defined as eligible for inclusion in the National Register of Historic Places because of their association with the cultural practices or beliefs of a living community that are rooted in the community's history and are important in maintaining the continuing cultural identity of the community. Forest Plan direction (IV-50) states that heritage resources determined eligible for the National Register will be protected from potential effects of project activities or their values conserved through appropriate mitigation. The Traditional Cultural Property of *Skis-wa-tum* includes the cultural landscape of the Sawtooth Huckleberry Fields, an area of traditional cultural importance to the Yakama Nation. The Forest Plan (IV-50) also includes direction regarding traditional food and plant material gathering sites used by Native Americans, and states that these may be manged for continued production of berries and other plant materials (such as beargrass and medicinal roots) traditionally gathered from that landscape.

Existing Condition

Native American Use

Ethnographic and informant information indicates that the Twin Buttes, Surprise Lakes and Sawtooth Mountain areas were heavily used by Yakama Indians for huckleberry collection near the turn-of-the-century (Hajda et al. 1995). The Sawtooth Huckleberry fields contain several named ethnographic site locations, as well as documented prehistoric properties. The presence of prehistoric archaeological sites indicates use over an extensive time period.

Information regarding native management of this ethnographic landscape can be found in several sources. Fred G. Plummer, in an early report for the United States Geological Survey (1900), discussed the various causes of forest fires in what is now the Gifford Pinchot National Forest. This includes a large fire located partly within the project boundary which burned sometime between 1880 and 1897 and reburned in 1904, creating what is now known as the Sawtooth Huckleberry Fields. Plummer (1900) wrote that "Indians also start fires for the purpose of promoting the growth of huckleberries, blackberries and raspberries, and also to drive game." Forest Service Fire Reports for the years 1904 and 1905 attribute half of the fires on the forest to intentional burning by Indians (Allen 1904, 1905), including a 5,760 acre fire in 1904, which re-burned much of what we consider the Sawtooth Huckleberry Fields. According to French (1957) the Indians in this area considered trees to be like weeds overrunning their huckleberry fields. The solution to this problem was to start fires under controlled conditions. This has been corroborated in recent interviews with elderly Yakama informants, who describe how certain men were chosen specifically for the task of staying behind at the end of the season to burn the

fields. The informants stressed that this was not done every year, but only when needed. Accepting that Yakama Indians used fire as a tool for enhancing huckleberry production, it is also likely that the locations of huckleberry fields would simply shift as naturally-occurring fires opened up new areas, and older burns reforested.

In the 1910 Special Fire Report for the Columbia National Forest (Stabler 1910:10), the Forest Supervisor stated that "A great many Indians camp in and around Twin Buttes during July and August, and these camps need constant looking after because fires frequently owe their origin to logs used . . . in drying huckleberries." The report also states that the area is "a camping ground for about 500 Indians from the Yakima Indian Reservation and Columbia River points" (1910:6). W. G. Hastings (1915) described the primarily public uses of the township in 1914 as "Camping for the purpose of pleasure or gathering blueberries and grazing." He went on to state that "For a long time, possibly for a century or more, the region has been visited annually by hundreds of Yakima and Columbia River Indians."

In a 1974 interview, Mrs. Bessie Quaempts of Underwood discussed how "We . . . went up to Twin Buttes on horse back. We . . . picked lots of huckleberries. Then we would build a fire against a log, fix a cloth, and roll the berries around back and forth to dry them. I would like to go up there again…that is a long time ago."

In the 1930's Ray Filloon, a professional photographer who worked as a Forest Guard in the Sawtooth Huckleberry Fields, attempted to photographically document traditional practices at Cold Spring, Surprise Lakes, and Meadow Creek Indian camps. He photographed women drying huckleberries in front of drying logs, as well as men using the sweat lodge. At Surprise Lakes and Cold Spring Indian Camps, the remains of several huckleberry drying trenches have been documented, some of which may have been the ones photographed by Filloon in use in the 1930's.

The Traditional Cultural Property of *Skis wa-tum* (45SA207) includes the ten lake basins which comprise the North Surprise and South Surprise Lakes Indian Camps, as well as the Sawtooth Huckleberry Fields cultural landscape. Nine individual historic properties (45SA317, 45SA364, 45SA365, 45SA366, 45SA367, 45SA368, 45SA375, 45SA432, and 07081403) are included within the boundaries of this TCP.

The Traditional Cultural Property of *Kpss-wa-nite*, or Cold Spring Indian Camp (45SA265) contains both historic properties as well as the site of a modern longhouse. It was the location of the 1932 Handshake Agreement, and for the past 25 years has been the site of an annual traditional religious ceremony honoring the huckleberry.

Handshake Agreement

The Sawtooth Huckleberry Fields are important not only as the site of traditional huckleberry fields, but also as the site of a series of councils held between Forest Service and Indian representatives in the 1920's and 1930's. These councils were held because of growing concern by Indian people over encroachment by non-Indian people into their traditional berry-picking areas. During the Depression, thousands of non-Indians traveled to the huckleberry fields to pick berries, establishing camps in areas that had previously been used almost exclusively by Indian

people. Grazing of sheep in the berry fields was also a long-standing source of conflict. On the one hand, Indians felt that the sheep damaged the huckleberry bushes and ate grass that should have served as feed for Indian horses. On the other hand the sheep herders and many of the early Forest Service rangers felt that Indian horses, which were brought to the berry fields and turned loose to graze, were taking grass that was being "paid" for by sheep herders.

A series of councils were held between 1928 and 1936, where the Forest Supervisor of the Columbia National Forest and the District Ranger of the Mt. Adams Ranger District met with representatives of various bands of the Yakima Nation to discuss the situation. Over the years three different Forest Supervisors (F. V. Horton, J. R. Bruckart, and K. P. Cecil) and two District Rangers (H. A. Welty and K. C. Langfield) participated in these meetings, and most of them were sympathetic to the concerns expressed by the Indians. Internal memos and meeting notes from that time period reiterate that Forest Service personnel were aware that this area was traditionally used by Indian people, and also that it was part of the ceded lands discussed in the 1855 treaty between the United States and the Yakima Indian Nation. They recognized that Indian people had reserved the right to hunt, fish and collect roots and berries in these traditional areas at any time.

To address the concerns of the Indians, Forest Supervisor J. R. Bruckart agreed in 1932 to set aside a portion of the Sawtooth Huckleberry Fields for the exclusive use of Indian people, and also to reserve the four campgrounds in the huckleberry fields for exclusive Indian use. This agreement was formalized by a handshake between Bruckart and Chief William Yallup, chief of the Kamiltpah band.

At that time Forest Service personnel had no legal and binding way to enforce this agreement, so they used whatever means they had at their disposal. A 1936 USFS brochure for the Twin Buttes Recreation Area contains a map which shows a portion of the huckleberry fields as "reserved for Indians". The brochure also contains the following narrative:

> Hundreds of Indians make annual pilgrimages to these huckleberry fields. Their use of the area is assured by an old treaty which gives them the right to gather roots and berries in this region for all time. A portion of the berry fields have been reserved for their use. The public is asked to respect their rights (USDA-FS 1936).

The agreement has been honored since that time. An interpretive sign was placed at the site in 1992, commemorating the Handshake Agreement and providing information on the history of Indian use of the Sawtooth Huckleberry fields.

Summary of Native American Use

Human use of the project area spans the last 7000 years, the known period of use of the Forest. The ethnographic pattern for the project area is one of warm season use. The collection and processing of huckleberries was the primary focus of activities, along with opportunistic use of game animals and fish. Within the project boundary, huckleberries were intensively utilized, both as an over-winter staple and as an item of trade. It is likely that Indians utilized fire as a tool to "manage" and maintain huckleberry fields, in order to enhance their productivity.

Huckleberries are important to contemporary Yakama Indians both as a subsistence resource and as a sacred food. The Traditional Cultural Properties of *Skis-wa-tum* and *Kpss-wa-nite* are of contemporary cultural signficiance to Yakama Indians, and are important to the perpetuation of traditional cultural and religious practices of Yakama people.

Forest Service Administration and Land Management
West Twin Butte was reportedly being used as a lookout point as early as 1910. A ground lookout with a cupola was built on the summit in 1918. This lookout was replaced in 1940 with a 14' x 14' Aladdin on a 15' tower. A garage and storage shelter were constructed at the site in 1934 and 1937, likely by the Civilian Conservation Corps. This lookout was destroyed (burned) by the Forest Service in the early 1970's. The only structure remaining at the site is an outhouse.

The Mosquito Lakes Guard Station was the primary work center and administrative site on the Mt. Adams District in the 1930's and 1940's. It contained a total of eight buildings, along with a corral and pasture. The first structure was built at the site in 1926, and the remainder in the early 1930's. The site was dismantled in the late 1960's.

The Civilian Conservation Corps (CCC) maintained a camp, called Camp Twin Buttes, immediately outside of what is now Tillicum Campground. One unusual project undertaken by CCC enrollees at Camp Twin Buttes was "mosquito control" efforts at both Big and Little Mosquito Lakes. They diverted one stream into Mosquito Lake, and constructed a dam at the lake's outlet in an attempt to raise the water level. They then constructed an intricate series of ditches through the swamps and meadows between Big and Little Mosquito Lakes, in an attempt to drain them. These ditches were created using successive charges of dynamite. Although the dam and diversion were successful in raising the water level of Big Mosquito Lake, the attempt to drain the swamps was not successful.

A 1938 USDA Forest Service recreation report states that the majority of campgrounds in the area developed as a direct outgrowth of the huckleberry fields (Langdon 1938). The report also states that none of these campgrounds were artificially started – development followed established use of an area. Four of these campgrounds continue to be used exclusively by Indian people, including Surprise Lakes, South Surprise Lakes, Cold Spring and Meadow Creek. The 1938 recreation report refers to the four Indian camps with statements such as "the camp is one long used by the Indians", and "…is a…camp that has been used for years by the Indians". The four Indian Campgrounds, along with Tillicum Campground, were initially developed by the Forest Service in the late 1920's and early 1930's.

Environmental Effects

Alternative A – No Action
Direct and Indirect Effects
There will be No Effect to the portion of the Indian Highway Trail situated in units 4 and 5 of the Sawtooth Restoration Project.

The No Action alternative will not provide for restoration of the Sawtooth Huckleberry Fields cultural landscape, resulting in continued loss of productive huckleberry habitat. The Yakama Nation has increasingly expressed concern over loss of a treaty resource.

Cumulative Effects
Over time, trees will continue to shade out huckleberries, and huckleberry production will ultimately decline as trees reforest the area. Traditional and religious use of the area by Indian people would likely decline as the availability of huckleberries decreased.

Alternative B
Direct and Indirect Effects
The project will enhance huckleberry productivity in areas currently managed as huckleberry fields, and it will provide additional productive habitat in areas that were historically used as huckleberry fields, but which have since reforested. This will allow for continued use of the traditional Cultural Properties of *Skis-wa-tum* and *Kpss-wa-nite* by the Yakama Nation.

Several heritage resource properties were identified within the Area of Potential Effects for the proposed action.

The proposed action will have "No Effect" on the values that contribute to the eligibility of the Traditional Cultural Property of *Skis-wa-tum*. Restoration of huckleberry habitat within the Sawtooth Huckleberry Fields area will enhance continued traditional use of this area. Tribal representatives have repeatedly requested that the Forest Service undertake these actions. Project activities will be scheduled so as not to interfere with huckleberry collecting and traditional family campsite use. Since project activities within the boundary of the property of *Skis-wa-tum* (units 8 and 9) will involve only the use of hand tools, no impacts to any of the individual properties recorded within the area are anticipated. The project will have No Effect on the Traditional Cultural Property of *Skis-wa-tum*

The proposed project is situated immediately adjacent to the Traditional Cultural Property of *Kpss-wa-nite***.** The project will be designed to avoid all cultural features within the boundaries of *Kpss-wa-nite*. The boundary of unit 10 will be situated at least 60 meters from identified features. The project will have No Effect on the Traditional Cultural Property of *Kpss-wa-nite.*

Portions of the Indian Highway Trail (07081101) are situated within units 4 and 5 of the Sawtooth Restoration Project. Of the 4.9 non-continuous miles of this trail that have been documented, approximately 2000 feet of a 1.2 mile segment occurs within units 4 and 5. This constitutes 31% of that 1.2 mile segment, and 8% of the entire 4.9 miles. Ground-based machinery will be used in the harvest of these units, but this machinery will be limited to designated skid trails. Since equipment access is possible from both sides of the trail, crossings will be limited to one trail crossing in each unit. The remainder of the trail will be flagged and designated for protection. This project will have No Adverse Effect on the Indian Highway Trail.

The Twin Buttes Lookout is located outside of the Area of Potential Effect of this project, and will not be impacted.

Cumulative Effects
With the action alternatives, huckleberry productivity would likely be increased over the long term, and traditional use of the area by Native Americans would continue.

Alternative C
Direct and Indirect Effects
Effects to the Traditional Cultural Property of *Skis-wa-tum*, would be the same as in Alternative B, since underburning is not proposed within units 8 or 9. Underburning within Unit 10A will have No Effect on the Traditional Cultural Property of Kpss-wa-nite, since the project will be designed to avoid all cultural features within the site's boundary. The boundary of unit 10 will be situated at least 60 meters from identified cultural features.

Tribal representatives have expressed support for the use of fire as a traditional tool for managing huckleberry fields, and have also expressed a concern that fire is necessary in order to improve huckleberry productivity. Based on information in historic files, fully half of the fires documented on the Forest in 1904 and 1905 were attributed to purposeful Indian burning, and all of these fires occurred in or adjacent to existing burns that were in use as huckleberry patches. What was being described in these reports was in essence traditional Indian land management practices, intended to ensure a continuing supply of huckleberries over time. By 1907 the Forest Service presence in the area had increased to the point where these practices were essentially curtailed.

Cumulative Effects
Cumulative effects would be similar to Alternative B, except that the benefits of increased huckleberry productivity in Units 2, 5, 7, 10A, and 11 A-E would likely continue for a longer period, since more seedlings would have been killed through underburning.

Soils

This section summarizes the assumptions and conclusions included in the Sawtooth Huckleberry Restoration Project Soils Report. The full report is located in the project file.

Existing Condition

Physiographic Setting
Soils of the project area were mapped as part of the Soil Resource Inventory (Wade, et. al., 1992). This information is available at the Gifford Pinchot National Forest Headquarters.

Soils in the activity areas are suitable for timber harvest in alignment with timberland suitability classification (FSM 2415.2) except in wetlands and wet meadows (Soil Management Unit 3) or where vegetation consists of scattered, noncommercial trees, i.e. SMU 46. SMU 46 occurs on Sawtooth units 8, 9, 10, 11, and 12, and appears to be in agreement with the vegetation prescription of "young stand thin."

Landtype Association mapping (USDAFS GPNF 1999b, gplta) stratifies the activity area into three basic landforms. Sawtooth Huckleberry Restoration Units 4, 5, 6, 7, 8, 9, 10, 11, and 12 are mapped as "gently sloping till plains," with soils derived from "glacial drift and volcanic tephra." Units 2 and 3 are on "steep, moderately dissected mountain slopes" with soils derived from "colluvium from marine volcanics and volcanic tephra." Unit 1 is on a "scoured, potholed volcanic plateau" with soils derived from "volcanic tephra and organic matter."

The project area is entirely in the Cryic soil temperature regime, in the Mountain Hemlock Zone (USDAFS GPNF 1999c, gppvg), although according to the Sawtooth Silviculture report (Nakae 2008) all the activity areas except for units 6 and 7 are in the Pacific silver fir (big huckleberry) zones. Of the three temperature regimes on the forest, cryic is the coldest soil type. Formed in a cold, wet climate, these soils have a low nutrient availability and low rate of organic matter decomposition – resulting in relatively thick forest floor layers. These layers however were mostly consumed by large fires that occurred in the area (see discussion of Fire Disturbance below).

Soils are generally low in fertility and low to moderate in regeneration potential (Table 12). The majority of topsoils in the activity areas are sandy loams and loamy sands. The cold, wet climate generally results in low rates of organic matter decomposition and thick forest floor layers (USDA 1997).

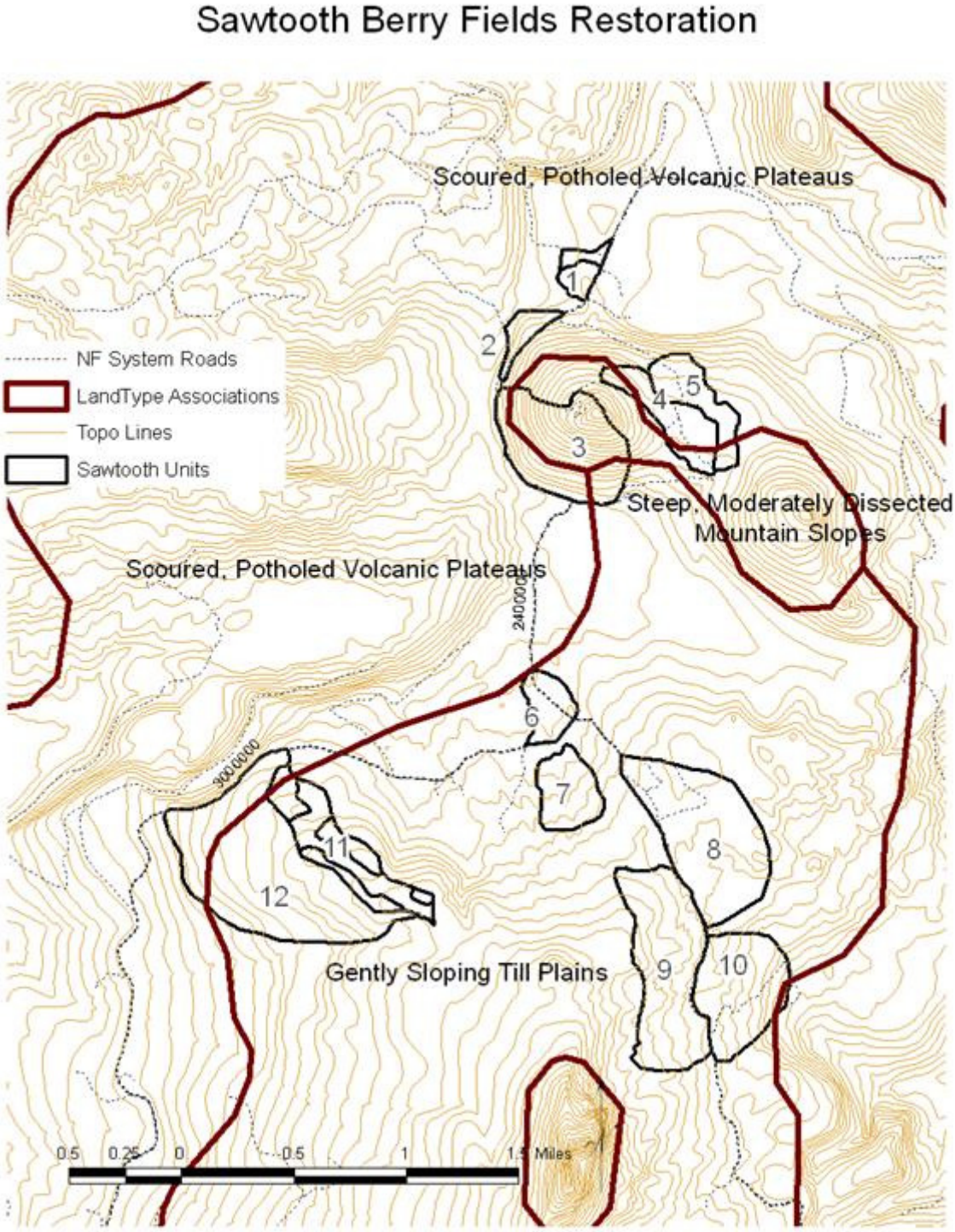

Figure 8. LandType Association Mapping of Proposed Action (USDA 1999).

Table 12. Selected Soil Mapping Interpretations.									
Soil Map Unit (SMU)	Acres in Project	Landform	Fertility	Slope Percent	Surface Erosion	Displacement	Compaction	Regeneration	Tractor Logging
3	3	Wet Meadows	Moderate	0 – 5	Slight	Low	High	Noncommercial Lands	N/A
17	7	Valley Bottoms, Toe-slopes	Low	0 – 30	Slight	Moderate	Moderate	Low to Moderate	Permitted
18	29	Smooth Side slopes	Low	30 +	Moderate	N/A	N/A	Low to Moderate	Not Permitted
24	33	Smooth Side slopes	Low to Moderate	0 - 50	Moderate	Moderate	High	Low to Moderate	Permitted
45	441	Various Bench-like Landforms	Low	0 - 30	Moderate	Moderate to High	Moderate to Low	Low	Permitted
46	580	Various Rough Bench-like Landforms at Higher Elevations	Low	0 - 30	Moderate	Moderate to High	Moderate to Low	N/A	N/A[1]
92	99	Ridgetops and upper side slopes	Low	30 - 70	Moderate	N/A	N/A	Low to Moderate	Not Permitted
95	5	Ridge tops, Benches	Low	0 - 30	Moderate	Moderate	High	Low to Moderate	Permitted

[1] Recommend as permissible. See discussion in "Forest Plan Consistency" below.

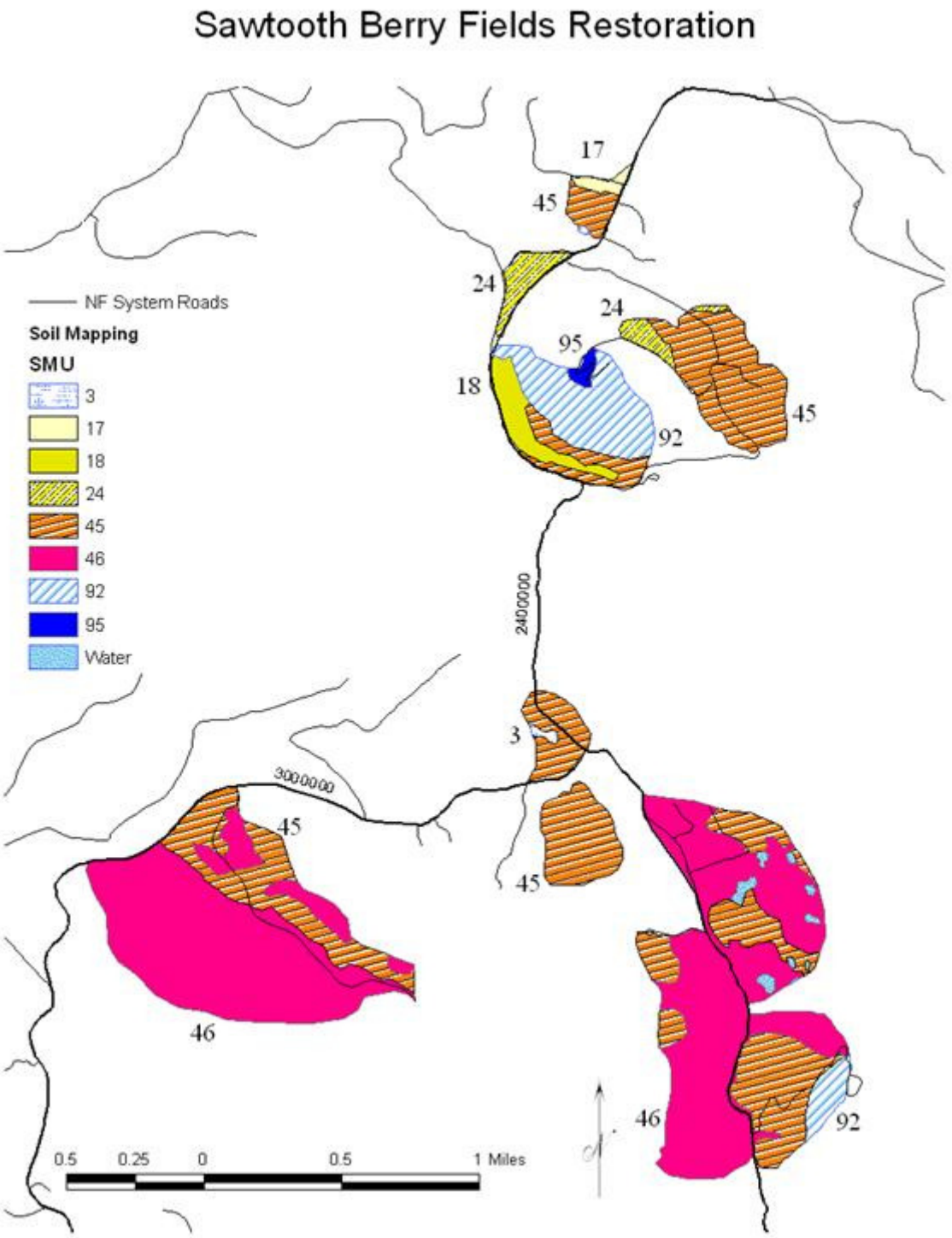

Figure 9. Soil Mapping of Sawtooth Huckleberry Restoration Units.

Soils in the project area have been converted to an essentially non-productive condition in the long term (greater than fifty years), where detrimental soil conditions exist. Evidence of forest products harvest and recreational use exist within the Sawtooth Restoration unit boundaries.

Roads
National Forest system and non-system roads currently occupy between approximately 0 and 13.4 percent of the activity areas. Non-system roads range from 0 to 1.3 percent of the activity areas.

System roads convert productive soils to an essentially non-productive condition in the long term (greater than fifty years). Most of the precipitation that falls on the compacted surfaces becomes surface runoff. System roads were estimated using Geographic Information Systems (GIS) analysis and include roads within and adjacent to each unit boundary (See soils report for GIS analysis)

Fire Disturbance
Forest soils in and near project units have been affected by large forest fires which occurred near the turn-of-the-century (Middle Lewis Watershed Analysis, 1995). According to the Sawtooth Huckleberry Restoration Fire and Fuels report, "in the 20 years surrounding the turn of the century, fire visited the area frequently and burned all of the proposed units, most of them as many as three times." Historically, Native American groups set fire to logs for drying berries, and lingering fires sometimes spread. Fires may have also been set intentionally to maintain berry fields or keep hunting areas open (Middle Lewis Watershed Analysis, 1995).

Organic matter in the soils profile is relatively intact near the center of the project area, but there is little to no layer of organic material above the mineral layers. Further north and south of the activity areas, the organic layer is thicker, up to 6 centimeters northwest of Sawtooth Unit 1, and 2 centimeters southwest of Unit 9.

It is likely that large fires have reduced soil organic matter in the litter and duff layer and potentially reduced soil productivity. Soils in these Land Type associations (Figure 9) are usually found to have thicker litter and duff layers than some of those in the project area.

Slopes steeper than 30 percent in Units 3 and 10 (in SMU 92) are particularly susceptible to damage by fuel treatment activities, which could completely consume the duff and litter layers. See discussion on how these would be affected under Alternative C, "Prescribed Burning", below.

Soil Organisms
Knowledge of specific fungal, bacterial, and arthropod populations is not available for analysis in this project. Biological soil crusts, commonly found in arid or semi-arid environments (USDA NRCS 1997) are not known to exist in the activity areas.
Populations of soil organisms include mycorrhizal fungi, soil-dwelling arthropods, nematodes and bacteria. Loss of organisms in the short term likely occured through direct destruction from equipment operations on previously harvested units and from loss of habitat or substrate. It is expected that areas where losses occured have since re-populated and improved in proportion to recovery of soil physical properties and soil quality.

Slope Stability
The Soil Resource Inventory did not identify potentially unstable slopes within the Sawtooth Huckleberry Restoration units. All fo the soils within the activity areas are identified as "Very

Stable", "Very Stable to Stable" or "Stable". The Gifford Pinchot National Forest geology GIS layer (USDAFS GPNF 1999, gpghz) did not identify any active or past active slides. Field investigations found no unstable slopes in the activity areas.

Summary of Existing Condition
Ground-based timber harvest and large forest fires have altered soil properties and potentially decreased soil productivity in the project vicinity, although no harvest has occurred within proposed units. Damage to soil physical properties between skid trails and away from landings has recovered over time, but soil quality was reduced where ground-based skidding operations displaced organic surface layers or caused deep compaction.

Detrimental conditions are limited to less than 20% of the activity areas, and so are within Forest Plan standards for soils.

Environmental Effects

Soil Productivity

The degree or intensity of soil productivity losses is variable depending on the nature of the impacting mechanism. Losses to soil productivity associated with permanent features of the transportation system, including system roads, are essentially permanent. Restoration by subsoiling, fertilization, and revegetation would initiate recovery of productivity, but is unlikely to return the soil to its original condition and productivity.

Alternative A – No Action
Direct, Indirect and Cumulative Effects
The Sawtooth Huckleberry Restoration or other related actions would not occur. There would be no losses in soil productivity expected in this alternative. Existing National Forest system roads and landings would not be restored and remain as an irretrievable commitment.

Alternative B – Proposed Action
Direct and Indirect Effects
Direct effects due to soil disturbing activity occur on site and affect only the area where they occur. Potential effects of the proposed activities on soil productivity are due to compaction, puddling, displacement, erosion, severe burning and loss of soil organic matter. Irretrievable losses in soil productivity due to soil disturbing activities are limited to permanent features of the transportation system including National Forest System roads, non-system roads, landings and skid trails that are not subsoiled because they are not part of the proposed action.

Locally concentrated losses in soil quality would occur in the short term due to additional compaction and displacement caused by the proposed activities. The extent of soil disturbance to areas previously undisturbed is expected to be less than 4.6 percent of any activity area with the prescribed logging system design (Table 13).

Alternative C – Underburning
Direct and Indirect Effects

Direct and indirect effects of Alternative C are generally the same as for Alternative B above, except as noted below under "Fuels Treatment".

Fuels Treatment

Alternative A - No Action
Direct, Indirect and Cumulative Effects
There are no catastrophic fires expected due to the no-action alternative. Thus, no detrimental effects to soil organic matter or soil organisms is expected. Erosion rates would neither increase nor decrease.

Alternative B – Proposed Action
Direct and Indirect Effects
Burning Piles
Effects of slash burning on soils in the activity areas would likely be negligible. Slash pile burning is not considered a serious concern because the extent of burning in the activity areas would be relatively small. Estimates of pile sizes for machine piles are less than 0.2 percent of each activity area (Harm 2003). Distribution of slash piles would be spread out across units, which further reduces the potential for impacts to soil productivity.

Detrimental soil damage due to hand piles is considerably less than machine piling because of the lack of compaction and displacement due to heavy equipment and the smaller size of piles, which consequently burn with less intensity than larger machine piles.

Severe burning is not analyzed as an effect on soils on landings because of the overriding impact of the landing construction and associated use, especially since the large burn piles would occur on landings. Therefore consideration or calculations of soil disturbance due to burning do not include piling or burning slash on roads or landings.

Machine Piling
Compaction of soils may result from passes by ground-based equipment, especially adjacent to piles where equipment may have already driven during logging operations. Mitigation Measure #7 would minimize soil damage from slash piling and maintain necessary organic matter to provide for essential nutrient cycling processes.

Forest Plan Monitoring and discussions with other Forest Service specialists attest that two passes or less rarely causes detrimental compaction on resilient soils. Thus no additional soil compaction is expected due to machine piling. Additional soil displacement could occur due to machine piling on undisturbed soils; however it is not likely to be significant or measurable due to mitigation measure #7 which requires operations on logging slash when in the unit.

Alternative C – Underburning
Direct and Indirect Effects

The effects to the soil resource due to fuels treatment are different between Alternative B and Alternative C in that (prescribed) underburning is proposed as the fuels treatment in Sawtooth units 2, 5, 7, 10A, 11, and 12.

Burn Piles
The effects to the soil resource due to machine pile fuels treatment are less for Alternative C than Alternative B, notably in the units proposed for prescribed underburning. As discussed in the effects of Alternative B, machine piles are more likely to cause localized severe soil burning on a small, dispersed scale. Because no severe burning of soils would occur in the units mentioned above, this alternative is slightly more protective of soil physical properties than Alternative B, except as noted for prescribed burning, below.

Prescribed Burning
Unlike Alternative B, Alternative C proposes prescribed burning in Sawtooth units 2, 5, 7, 10A, 11, and 12. Prescribed burning has the potential to reduce soil nitrogen and mycorrhizae. Mitigation measure 6 and the project design would minimize soil and litter disturbance, as required by the Forest Plan (p.2-58). The risk of increased damage is moderate to low, in that much of the soils' litter and duff layers have been previously burned as noted in the fire history discussion.
In the units with large openings, some exposure of mineral soil (20-30 percent, evenly distributed) with a cool prescribed burn may be desirable to accelerate the warming of the soil because the resulting black surface absorbs more solar energy (USDAFS PNW 1997).

In the unplanned event of a hot burn, significant soil resource damage would occur, adversely affecting nutrient cycling and soil organism interactions. It could potentially cause erosion and an increase in soil bulk density, because consuming (burning off) of organic matter could make the soil denser.

Prescribed burning that removes less than 5 percent of the duff layer and conserves coarse woody debris will likely cause little or no soil damage (Wade, et. al. 1992b). The Soils Mitigation Measures & Project Design Criteria (#6), would require that "No more than 10 percent of the activity area would result in soil burning rated as a severe intensity." Therefore, no net loss in soil productivity due to prescribed burning is predicted in Sawtooth units 2, 5, 7, 10A, 11, and 12.

Timber Harvest

Alternative A – No Action
Direct, Indirect and Cumulative Effects
There would be no change in soil productivity due to logging related compaction, puddling, displacement.

Alternative B – Proposed Action
Direct and Indirect Effects
Soil Compaction and Displacement
No loss in soil productivity due to ground-based equipment travel is predicted in any of the Sawtooth units. Table 13 displays the expected and worst-case scenarios if the mitigation

measures listed in Chapter 2 could not be implemented. An average of 5% of each activity area was estimated to be compacted or displaced by temporary roads and landings.

Those non-system roads that are not used would not be restored, and would likely remain in a detrimental condition for the long term as an irretrievable commitment. Temporary road and landings would be restored to accelerate their recovery and reduce losses in soil productivity.

Table 13. Prediction of remaining detrimental conditions of proposed road and landing construction (based on calculations and assumptions included in the Soils Report)

	No Action	Alternative B	Alternative C
Cumulative Disturbance without mitigation measures (detrimental impact)[2]	Same as existing condition	5% to 18.5%	1.4% to 18.5%
Predicted compaction post-mitigation measures (detrimental impact)	Same as existing condition	0% to 13.4%	0% to 13.4%

The impact of skid roads is less than temporary roads and landings. Up to approximately 23.9 percent of the Unit 2 (if 150 foot skid road spacing were used) would involve some form of ground disturbance of soils for the Proposed Action, Alternative B. The amounts of soil disturbance over 13.4% in that unit is due to skid roads, which would not be detrimental on their entire areas. Measures such as subsoiling, revegetation and fertilization are intended to restore productivity, further reducing the extent of impacts. Skid roads are not expected to result in losses in soil productivity, and would therefore not create detrimental soil conditions greater than 20 percent of the activity area in Unit 2.

In general, the intensity of short term losses in soil quality would be relatively low in skid roads to moderate in temporary roads and landings (15). The losses in soil quality would lessen with time. This would translate to similar effects on soil productivity; however Mitigation Measure 3 would ameliorate the soil compaction and allow a relatively rapid recovery

The proposed action would potentially affect soils on SMU 46 which is not rated (Table 12) for ground based logging. This soil occurs in units 8, 9, 10, 11 and 12. Based on the characteristics of the soils there, and its similarity to SMU 45, ground based logging can reasonably be assumed to have similar effects on those soils as SMU 45.

Logging on Steep Slopes

Tractor logging is not permitted by the Forest Plan on *most* slopes greater than 30 percent. Because the Forest Plan tiers to the Soil Resource Inventory and does not state a slope restriction, an exception to the 30 percent rule is SMU 24, which can reach slopes up to 50 percent and does permit ground based equipment travel for logging (Table 12). Refer to the Soil Resource Inventory (Wade, et. al., 1992). Sawtooth Units 2 and 4 are the only units where this occurs.

[2] Assuming 16 foot wide trails, an estimated 10.5% of unit 2 is disturbed by 150 foot trail spacing and 3.5% by 400 foot trail spacing.

Table 14. Magnitude, Duration and Intensity of Losses to Soil Quality		
Duration	**Intensity of Soil Productivity Loss**	**Magnitude (Extent)**
Short term, *Alternative B, Proposed Action*	Low: skid roads (w/ mitigation measures) and logging on snow Moderate: temporary roads and landings	Small to Moderate (Sawtooth unit 2)
Short term, *Alternative A, No Action*	None	None
Long term, (more than 50 years), *Alternative B*	Low on temporary roads and landings with mitigation measures (subsoiling)	Small

Alternative C
Direct and Indirect Effects
The effects to the soil resource due to tree removal are the same for Alternative B and C, except that in Alternative C, no ground-based equipment would be used in Unit 12. Hand tools are a possible alternative in Unit 11, but ground based equipment is not excluded. Because no increased compaction or displacement would occur in that unit, this alternative is slightly more protective of soil physical properties than Alternative B.

Soil Organisms

Alternatives B and C
Direct and Indirect Effects
Mitigation Measures & Project Design Criteria which protect soil productivity would also protect or benefit soil organisms and their habitat. Magnitude, duration and intensity of effects to soil dwelling organisms are likely to be similar to that of soil quality effects listed above (Table 13 and Table 14).

Limiting the degree and extent of the effects listed above provides protection for the majority of the populations of soil organisms within the activity areas. These effects are assumed to be temporary and recover naturally, after restoration efforts like subsoiling and seeding/planting.

Logging and site preparation can affect the numbers of species and abundance of soil organisms. Soil dwelling organisms are not specifically addressed by standards and guidelines at Forest or Regional levels, but the magnitude, duration and intensity of effects to soil dwelling organisms are likely to be similar to that of soil quality.

Soil compaction, lack of vegetation, or lack of plant litter covering the soil surface tends to reduce the number of soil arthropods (Soil Quality Institute 2002). The proposed activities may change soil habitats and the food web, and alter soil quality, or the capacity of soil to perform its functions (Tugel, A.J., 2001, Chapter 2).

Some of these organisms, called Mycorrhizae, have been shown to profoundly affect forest growth and productivity. Mycorrhizal fungi assist trees in absorbing water, nutrients and provide protection from pathogen attack. Soil compaction, loss of soil organic matter, and changes in vegetation can effect soil organisms and result in productivity loss.

In the long term (more than 50 years), populations of soil dwelling organisms would have essentially recovered. Restoration by subsoiling, fertilization and revegetation, which was intended to accelerate recovery of soil productivity, would improve conditions in disturbed areas. The organisms then can re-colonize the disturbed areas when conditions become favorable.

Alternative A – No Action
Cumulative Effects
There would be no cumulative effects caused by the No Action alternative. The cumulative effects of foreseeable management activities would in general be similar to the proposed action alternatives, collectively improve soil productivity in the long term, mostly due to reductions in soil compaction by road decommissioning or similar restoration activities, but creating short-term losses in soil quality. However, the total effect is not greater than the sum of the individual effects, questioning whether the effect is truly cumulative. Future timber sales would typically subsoil all temporary roads and landings following their use.

Alternative B – Proposed Action
Cumulative Effects
Cumulative effects on the soil resource include all past, present, and reasonably foreseeable actions that cause soil disturbance within the project area (Table 4).

The contribution of soil disturbing impacts by the proposed action would not cumulatively degrade soil productivity or the soil resource with proper implementation of mitigation measures and design features. The proposed activities (with incorporated design features), in combination with past or reasonably foreseeable future actions on nearby federal land and adjacent private land, would not likely increase the amount of detrimental soil conditions in the long term. Soil disturbance from natural events and past management activity were described in the Affected Environment section. Roads represent the greatest amount of permanent detrimental soil conditions.

The minimal extent of slash pile burning would not have a cumulative effect on soil productivity. There would not be losses in soil quality or soil productivity due to catastrophic fires because fuels treatments would greatly reduce the risk.

None of the Skeeter Timber Sale units coincide with units of the proposed action, although Sawtooth Units 3 and 4 are adjacent.

Sawtooth Huckleberry Restoration would cumulatively neither improve nor cause losses in soil productivity at the watershed scale. Because no new permanent roads will be constructed as part of this project, the amount of detrimental soil conditions would not increase across the watershed.

Foreseeable Activities

The action alternatives combined with all past, present, and reasonably foreseeable management activities would affect soil productivity and populations of soil dwelling organisms in the project area. Foreseeable activities in the project area includes include timber harvest, restoration activity, National Forest System road management and maintenance, and Forest trails management and maintenance, and global climate change (global warming).

The combined effects of foreseeable management activities would collectively improve soil productivity in the long term, mostly due to reductions in soil compaction by road decommissioning or similar restoration activities. . However, the total effect is not greater than the sum of the individual effects, questioning whether the effect is truly cumulative. Timber sales typically subsoil all temporary roads and landings following their use. These and other foreseeable activities would neither increase nor significantly decrease soil productivity or populations of soil dwelling organisms.

An effect on soil productivity as a result of changing climate conditions, i.e. global warming, and consequently due to increased heavy precipitation events include an increase in soil erosion during periods when soils are exposed. There may also be an increase in productivity as soil temperatures are warmer for longer seasons, thus increasing biological and soil-forming activity at these high altitude sites.

Carbon losses through disturbance of forest soils could result in more carbon dioxide entering the atmosphere (a positive feedback that strengthens climate change) (USEPA 2007). Disturbances that can increase carbon losses include soil warming that volatilizes organic carbon and burning of soil organic matter.

Degraded soils could theoretically absorb more carbon and store it as organic carbon, if they were managed correctly, and remove carbon dioxide from the atmosphere.

Alternative C – Underburning

Cumulative Effects

Negative cumulative effects to soils due to prescribed burning are not expected for Alternative C. Past burns, natural or otherwise, have reduced soil organic matter in the project area. Prescribed burning effects to soil organisms and soil productivity would be localized and short term, lessening over time. Mitigation measure 6 would leave adequate amounts of soil nitrogen and soil organisms. There would be no measureable losses to soil productivity or mycorrhizae, thus their levels are expected to be maintained in the long term. The remaining cumulative effects to the soil resource are the same for Alternative B and C, except that little to no cumulative effects would occur in Unit 12.

Forest Plan Consistency

The Gifford Pinchot National Forest Land and Resource Management Plan, Amendment 11 (Forest Plan), p. 2-58 to 2-62, requires losses in soil productivity be limited to 20 percent or less of the activity area. In the standard, “activity area” is the total area for which ground-disturbing activity is planned and includes the transportation system, in and directly adjacent to, the activity area.

The Forest Plan Standards and Guidelines for soils would be achieved in all activity areas for both Alternative A, the no action alternative; and Alternatives B and C, through proper

implementation of management requirements and the prescribed mitigation measures. Detrimental soil conditions would remain less than 20 percent of the activity areas, including existing skid trails. See discussion title "Soil Compaction and Displacement" above for detrimental soil conditions due to skid trails.

Ground-based equipment is proposed on SMU 46[3] in Units 8, 9, 10, 11 and 12. In the Forest Plan, SMU 46 is rated as "N/A" for permitting tractor logging. The proposed action in these activity areas is not likely to be detrimental to soil quality relative to other soils in the activity areas. Because the Soil Resource Inventory does not limit ground based equipment on Soil Map Unit 46 and the need to limit the equipment is not apparent, it is reasonable to assume that the use of ground-based equipment would be consistent with Forest Plan Guidelines in these activity areas.

Tractor logging is permitted by the Forest Plan on slopes greater than 30% in SMU 24, which can reach slopes up to 50 percent (Table 12). Therefore use of ground-based equipment would be consistent with Forest Plan Guidelines in Sawtooth Units 2 and 4.

Figure 9, the map of soil management units shows that unit 3A is within SMU 18 which does not permit tractor logging. This mapping effort done as part of the Forest's Soil Resource Inventory which was done at a broad scale. The intent of the effort was that project-level analysis would verify and correct the broadscale interpretation. Evaluation during the Sawtooth analysis determined that the areas within unit 3A that are proposed for tractor logging contain less than 30% slopes and fall into SMU 17 which does allow tractor logging; therefore, this project is consistent with guildlines proposed in the Soil Resource Inventory and the Forest Plan. See Mitigation Measure 4 and the discussion of "Logging on Steep Slopes" above. Therefore, use of ground-based equipment would be consistent with Forest Plan Guidelines in Sawtooth Unit 3A, where slopes are less than 30 percent.

[3] SMU 46 is on slopes less than 30 percent.

Hydrology

A hydrology effects analysis was completed as part of this project and is summarized below. The compete report can be found in the project file at the Mt. Adams Ranger District.

Existing Condition

The treatment units, along with the other associated project activities, are located in the Upper Lewis River (1708000201) and White Salmon River (1707010510) HUC-5 watersheds and in the Tillicum Creek (170800020106), Big Creek (170800020110), Rush Creek (170800020111), and Upper Trout Lake Creek (170701051004) HUC-6 sub-watersheds. The first three sub-watersheds are within the Upper Lewis River HUC-5 watershed, and the last sub-watershed is in the White Salmon River HUC-5 watershed. The planning area is located in Skamania County, Washington, on forested land managed by the Gifford Pinchot National Forest, Mt. Saint Helens National Volcanic Monument (for the Upper Lewis River watershed portion of the project) and in the Mt. Adams Ranger District (for the White Salmon River watershed portion of the project).

Stream Temperature

Current Condition

Stream temperatures are monitored periodically in streams downstream of the project area. In the Upper Lewis River Basin, both Big Creek and Rush Creek have been found to meet state water temperature standard of 16.0° C for the 7-Day Average of Daily Maximum temperatures, and as such sections of these creeks that are located downstream of the project area have been rated as 303(d) Category 1 streams, which have been found to meet tested standards as clean waters. Water temperature in the Tillicum Creek drainage has not been monitored. Creeks within the Upper Trout Lake Creek subwatersheds have exceeded state water temperature standards, but these streams have not been monitored consistently. Sections of Trout Lake Creek, Mosquito Creek, and Cultus Creek that are located downstream of this project area have been rated as 303(d) Category 2 streams, i.e. waters of Concern.

Table 15. Stream Temperatures monitored in the Upper Lewis River and White Salmon River watershed (USDA 2008).

Station Name	Year	Maximum Annual 7-Day Average Maximums °C
Rush Creek at FR 30 crossing	2004-2006	10.65, 10.53, 11.15
Lewis River above Big Creek	2004-2006	17.77, 17.98, 17.64
Lewis River above Curly Falls Viewpoint	2004-2005	16.18, 16.70
Trout Lake Creek above Mosquito Creek	1998	15.57
Cultus Creek at River Mile 1.4	1998	16.5
Mosquito Creek at mouth	1998	16.57
Trout Lake Creek above FR 8810 bridge	1998	17.34

Alternative A – No Action
Direct and Indirect Effects
The no action alternative would result in the existing vegetation continuing to grow and provide more shade to streams over time. Several culvert locations are undersized and/or damaged and have a high potential to washout and produce more sediment to streams. These sites are located on one perennial stream at mile post 33.87 of Forest Road 30, and at several intermittent stream-crossings at mile posts 33.95 and 34.25 of Forest Road 30. One additional site has a need for a culvert to direct an intermittent stream from flowing across Forest Road 2480 at mile post 0.5. Under the no action alternative, all of these sites could result in a road washout that would increase sediment delivery to streams. The sediment that would be deposited has a low potential to increase stream temperature beyond background levels, and stream temperature would not increase in any currently listed 303(d) streams within or downstream of the project area.

Alternative B and C
Direct, Indirect, and Cumulative Effects
Water temperatures will not be affected by any action alternative considered in this project.

Several culvert replacements and one culvert installation are proposed on system roads used as haul routes in the action alternatives, and no temporary stream crossings are proposed on either skid trails or temporary roads. The proposed culvert work would not increase water temperatures through either vegetation removal or increased sediment delivery to streams. This road work may include the removal of some stream-side vegetation. All but one of these culvert replacements would be located in intermittent streams or would replace ditch relief culverts that are not connected to the stream network. Culvert work at these sites has no potential to increase stream temperature beyond water temperature standards, since any associated streams would be dry during the mid to late summer when stream temperature exceedences generally occur.

One culvert replacement is planned on a perennial stream-crossing at mile post 33.87 of Forest Road 30, which could include the removal of stream-side vegetation. The extent of vegetation to be removed will not be sufficient to increase stream temperature in this stream or any downstream fish-bearing or 303(d) listed streams.

Furthermore, some sediment would be delivered to streams at these culvert work sites. The expected sediment delivery from the project will not increase stream width, which can have the potential to increase stream temperatures by decreasing water column depth. As such, the proposed culvert work included in both alternatives has a low potential to increase stream temperatures. Although some shade producing vegetation may be removed or damaged during culvert replacement activities, these activities would provide less water quality impact than the no action alternative over time, since road washouts produce more sediment to streams and can result in more stream-side vegetation removal.

Also as part of the action alternatives, no huckleberry vegetation treatment would occur in close proximity to streams. No-treatment buffers have been prescribed on all streams, ponds, and wetlands to protect existing shade-producing trees from being damaged or removed. The minimum distances proposed for each unit are equal to the riparian reserve definitions outlined in the Forest Plan, which are equal to either one or two site potential tree height, using an average

site potential tree height of 150 feet. One site potential tree height was found to provide most components necessary to ensure sustainable ecological function of riparian systems including shading (FEMAT 1993). Based on these findings the minimum no cut buffers in this project will maintain adequate shade on all the perennial streams and avoid increases in stream temperatures. Therefore, the probability of increased temperatures as a result of this project is low due to the project design features of this project, and no cumulative effect on stream temperatures would occur.

Suspended Sediment-Intergravel DO/Turbidity

Current Condition

Suspended sediment in streams within this project area comes from a variety of sources. Of the various surface erosion processes at work in the watershed, sediment delivery via roads is the most prevalent (USDA 2002). Road networks are the most important source of accelerated delivery of sediment to anadromous fish habitats in forested watersheds of the Pacific Northwest (Ice 1985; Swanson et al. 1987). Two of the greatest factors affecting rates of sediment production from surface erosion on roads are road traffic levels and precipitation. Studies done on the Olympic Peninsula and in southwest Washington found that sediment production was increased by two orders of magnitude when comparing lightly trafficked and heavily trafficked forest roads during periods of runoff (Reid and Dunne 1984, Sullivan et al 1989). These studies also found that when traffic levels remained heavy during a runoff event, sediment concentrations in road drainage waters remained at a relatively high level throughout the storm. As such, the current road system and the amount of traffic in this area has created sediment delivery mechanisms to streams.

The existing road network contributes sand-size and smaller sediment throughout the year, with the largest amounts probably being delivered during runoff events occurring during the months that the area is still accessible by motor vehicles. Principal mechanisms for sediment delivery to streams from roads in the analysis area are surface gravel from exposed cut-and fill-slopes, side-cast and fill-slope failures, and undermining of roadbeds due to gully erosion associated with insufficient road prism drainage. In general, roads lacking surface rock, those with steep grades and steep sideslopes, and those that cross streams or are in proximity to streams are the greatest contributors of sediment from surface erosion. Not all sediment production from roadways reaches the aquatic system, because surface runoff from road surfaces and ditches is often directed to unchanneled slopes below the road where runoff has the potential to infiltrate the ground surface or the sediment settles out onto the forest floor before the water enters the streams. Additionally, a lack of road maintenance has increased the risk of culvert failure, which could provide additional sediment delivery to streams. Unlike the composition of landslide sediments, finer materials including sand and silts are believed to dominate the largest fraction of sediments delivered via roads to stream channels. Most fines are transported from roads to streams during storms that mobilize fine sediments from the road surface. Road drainage is typically delivered to streams through roadside ditches and culvert outlets.

Sediment delivery from roads and management-related landslides has changed the natural sediment regime by increasing the amount of sediment that streams must process. Roads with sediment delivery of 20 tons or greater per mile were designated as “high risk” in the Gifford

Pinchot NF Roads Analysis. Landslides were reviewed and designated based on proximity to roads or harvest units, through either and professional judgement by a geologist/soil scientist.

Alternative A – No Action
Direct and Indirect Effects
The no action alternative would result in a continued delivery of sediment from road drainage. It is expected that sediment delivery to streams would maintain at current levels until additional road washouts occur due to lack of road maintenance. Specifically, several culvert locations are undersized and/or damaged and have a high potential to washout and produce more sediment to streams. These sites are located on one perennial stream at mile post 33.87 of Forest Road 30, and at several intermittent stream-crossings at mile posts 33.95 and 34.25 of Forest Road 30. One additional intermittent stream is currently flowing across Forest Road 2480 at mile post 0.5. This site has the potential to deliver sediment to the stream under the no action alternative. All of these sites have a high potential to washout and result in increases of suspended sediment in streams. This fine sediment would eventually wash downstream or become deposited in floodplains, streambanks, or on the stream bottoms, e.g. in pools. Fine sediment deposited outside of the stream would affect vegetation adjacent to the stream. Fine sediment deposited within the streambanks will have several effects including increased substrate embeddednes, which can negatively affect fish.

Alternative B and C
Direct and Indirect Effects
Sediment delivery to streams and suspended sediment will be affected by this project as a result of pre-haul road work and log haul activities. Vegetation restoration treatments, such as thinning, mulching, or burning, will not increase sediment delivery to streams since they will not be occurring within riparian reserves.

No huckleberry vegetation treatment will occur in close proximity to streams. No-treatment buffers have been prescribed on all streams, ponds, and wetlands to protect riparian vegetation from being damaged or removed. The minimum distances proposed for each unit are equal to the riparian reserve definitions outlined in the Forest Plan, which are equal to either one or two site potential tree height, using an average site potential tree height of 150 feet. Although both action alternatives would displace soil outside of riparian reserves to improve huckleberry development, the probability of this material entering the stream is low because of several project design features. Water bars will be created post-harvest on all paths of ground disturbances to disrupt overland flow. The area of untreated forest between the thinning area and the stream would provide significant opportunities for any sediment-laden surface runoff to infiltrate the ground or be detained so that sediment settles out as the water flows across the undisturbed forest floor. Overall, the combination of project design features (water bars), distance of the activities from streams, and the presence of intervening riparian areas provides filtering of any sediment laden surface discharges from thinning and yarding outside of Riparian Reserves. Due to these mitigating factors, the magnitude of any sediment reaching the stream from thinning and yarding activities would be low and probably not detectable above background levels.

Several types of road-related activities have the potential to produce sediment in this project. These actions include equipment and log haul and the associated road work, specifically:

- Equipment and Log Haul Routes
- Road maintenance and reconstruction
- Temporary road construction
- Temporary landing construction

No new permanent roads will be constructed under this project, but several temporary features will be needed to provide effective access to timber units, including temporary roads and landings. Of these road-related activities, all temporary roads and landings will be located outside of riparian reserves and therefore not increase sediment delivery to streams. Log haul and road maintenance or reconstruction are the only activities in the action alternatives that may increase sediment delivery to streams.

Approximately 42 miles of road within the Gifford Pinchot National Forest will be used to haul equipment and to haul out any extracted trees that are commercially viable. Primary haul routes for this project would be the Wind River Highway, as well as Forest Roads 24 and 30 and some combination of arterial and local roads.

Prior to hauling, portions of the Forest Service System road network (system roads) will be treated to repair and improve drainage structures, improve the running surface of the road, and to clear vegetation along roadsides. Following haul, portions of the haul route will again be treated to repair damage done during logging and to restore the roads to a condition that supports normal forest uses and to ensure proper drainage and stability of the roads. Portions of the haul route that are in particularly poor condition will be reconstructed prior to haul activities. Road reconstruction includes application of surface rock, replacing damaged or poorly functioning culverts, adding ditch relief culverts where necessary, replacing or stabilizing fill and subgrade materials, and removing roadside vegetation that is encroaching on the road surface and preventing vehicular passage. No new permanent road construction will occur with this sale.

Road maintenance and reconstruction has the potential to increase sediment delivery to streams. The specific road maintenance that can potentially increase sediment delivery to streams in the action alternatives include culvert upgrades or installations and heavy road maintenance that occurs within riparian reserves.

Of this 42-mile long haul route, the entire 24.3 miles located on the Wind River Highway are maintained by Skamania County. The remaining 17.5 miles of secondary roads to be used for log and equipment haul are maintained by the Forest Service, and 14.8 miles of these roads will need some pre-project maintenance in order to execute the action alternatives. Planned maintenance activities for all open permanent roads includes construction of typical drainage control device (e.g. resloping road grades and reestablishing ditch drainage), but several miles of road will need reconstruction.

Heavy reconstruction that will occur within riparian reserves will have the greatest impact on sediment delivery to streams. Of the 14.8 miles of existing road that would be pre-treated for implementation of this project, only 0.4 miles will receive heavy reconstruction and nearly all of

that will occur within riparian reserves. Heavy reconstruction will improve access to units, replace culverts, and improve road-drainage by rebuilding ditch lines. Table 16 summarizes the pre-treatment road work proposed on system roads under this project as well as the aquatic risk rating for each road. Table 17 provides more detailed information of the pre-haul and post-haul road treatments that are proposed in both action alternatives of this project.

Table 16. Categorized pre-treatment of systems roads in the Sawtooth Huckleberry Project.

Road Number	Current Management	Length of Heavy Reconstruction (miles)	Replace Existing Stream Culverts (# sites)	Install New Ditch Relief Culverts	Aquatic Risk Rating
2400000	Open	<0.1	1	-	M to H
2400210	Open		-	-	L
2400261	Open	<0.1	2	2	L
2480000	Partially open	<0.1	1	1	L
2480031	Open		-	-	L
2480040	Open		-	-	L
3000000	Open	0.12	3	-	L
3000580	Open		-	-	L
3000744	Closed	<0.1	-	-	L
Total Lengths		**0.4**	**7**	**3**	**-**

Table 17. Harvest-related road treatments for system roads in the Sawtooth Huckleberry Project.

Road Number	Access to unit(s)	Treated Miles	Pre-harvest treatment	Post-harvest treatment
24	8,9,10	1.8	Reconstruction - Spot rock surface and possibly install 1 new culvert at MP 14.6. Maintenance - Perform prehaul maintenance including road side brushing, blading and drainage maintenance as needed.	Restore road to a self-maintaining condition.
2400210	10	0.73	Reconstruction - Spot rock surfacing. Maintenance - Perform prehaul maintenance including road side brushing and drainage maintenance as needed.	Restore road to a self-maintaining condition.

2400261	2	0.61	Reconstruction - Replace culverts at MP 0.0 and 0.4, and install new ditch relief culvert at MP 0.15 and 0.05. Spot rock surfacing if the road is to be plowed.	Restore road to a self-maintaining condition.
2480000	3,4,5	1.35	Reconstruction - Spot rock surfacing and install up to 1 new culverts at MP 0.5 and a new ditch relief culvert at MP 0.2. Maintenance - Perform prehaul maintenance including road side brushing, blading and drainage maintenance as needed.	Restore road to a self-maintaining condition.
2480031	3,4	0.7	Maintenance - perform prehaul maintenance including road side brushing, blading and drainage maintenance as needed.	Restore road to a self-maintaining condition and construction of waterbars.
2480040	4,5	0.19	Maintenance - perform prehaul maintenance including road side brushing, spot rock surfacing, blading and drainage maintenance as needed.	Restore road to a self-maintaining condition.
30	All	8.08	Reconstruction - Replace up to 3 culverts (at MP 33.87, 33.95, and 34.25) and reconstruct 350 feet of shoulder/ditch at MP 34.25.	None. Typical maintenance will be ongoing.
3000580	11A,B,C, D&E, 12	1.3	Maintenance - perform prehaul maintenance including road side brushing, blading and drainage maintenance as needed.	Restore road to a self-maintaining condition.
3000744	7	0.09	Reconstruction - Sub grade preparation and pitrun surfacing. Maintenance - Perform prehaul maintenance including road side brushing and drainage maintenance as needed.	Restore surface road drainages in a self-maintaining condition, construction of waterbars and install road closure berm

Temporary Road Construction

Approximately 1.4 miles of temporary road construction will be needed to enable treatment activities in both action alternatives, but none of these roads will cross stream channels. Temporary roads will be managed throughout the life of the project and then obliterated. If in use more than one season, roads will be weatherized prior to the onset of wet weather in the fall. Following completion of harvest, all temporary roads and skid trails will be treated including out-sloping, sub-soiling to a depth of approximately 18 inches to reduce ground compaction (in areas where greater than 60 feet of continuous soil compaction or displacement as identified by 6-inch deep ruts has occurred), and seeding and mulching. Native seed will be applied as described in mitigation measures below. Prior to any expected seasonal period of precipitation

and runoff, and after sale activities are complete, cross drains and grade breaks will be installed on all temporary roads.

Summary of Effects of Road Activities
There is high likelihood that some sediment from the road surface will enter streams from road-related activities in both action alternatives. Road maintenance, reconstruction work, and timber hauling will all create conditions that would allow increased sediment delivery to streams. In particular, small amounts of sediment are expected to reach streams from the 0.3 miles of non-paved roads that will be used for haul within 100 feet of streams (portions of FR 24, 2400261, 2480, and 2400210). Furthermore, sections of road within 100 feet of streams that will need repair or reconstruction also have the highest likelihood of increasing stream turbidity, such as the culvert replacements seen in Tables 17 and 18. Since the action alternatives do not differ in regards to road-related activities, the potential to increase stream sediment is equal for both action alternatives. These effects are different, and potentially less, from those in the no action alternative, since culvert replacements generally involve small increases in stream turbidity, whereas at least one culvert washout is likely to occur in the no action alternative, which would have a tremendous input of sediment to streams.

Although some fine sediment may reach the stream through road activities, the effects of this sediment are expected to be short-term and should not reach detectable quantities above the baseline condition, since mitigation measures will be used to minimize the effects. For example, the operating season for road reconstruction and maintenance work, except snow plowing, has been limited to the months of June through September. This has been done to reduce the amount and duration of erosion that occurs from the road-related activities. Nevertheless, disturbance of the road surface both by construction-related activities and by hauling will generate sediment and dust, and some of this material will be transported to the aquatic system either during the time of disturbance or during subsequent periods of runoff.

Although best management practices will be used to minimize the actual sediment introduced to the stream during the culvert replacement process (see Mitigation Measures), there is no way to completely avoid sediment introduction and disturbance of the stream channel. Fortunately, 6 of the 7 streams to receive culvert replacements only flow intermittently and are expected to be dry at the time of the culvert work. One culvert replacement is expected to affect a perennial stream crossing (FR 30 at MP 33.87). Mitigations will be employed to reduce turbidity increases in this stream as a result of this culvert replacement; This site will be dewatered prior to work activities, and once complete, streamflow will be returned gradually to prevent a large flush of water and sediment from occurring. Erosion and potential sediment delivery would occur when flow returns in these streams as loose fill material and soil is mobilized. As transportable material is removed from each disturbed site, the turbidity levels decrease rapidly to near pre-project levels. These effects would be relatively short term pulses of increased turbidity and sediment movement in each affected stream, but these channels have capacity for sediment deposition prior to reaching any fish-bearing streams. As such these temporary stream crossings are expected to only have effects on a site scale, and these effects will not be propagated downstream to any fish-bearing streams.

Snow plowing also has some potential to increase sediment delivery to streams. Since several units are prescribed to be harvested over a snowpack of 2 to 4 feet (units 2, 6, 7 and 11A), log haul can happen on FR 24, 30, and 3000580) throughout the year. This area ranges in elevation between 3900 and 4700 feet, and on average receives over 90 inches of precipitation (Sumioka et al, 1998), including over 200 inches of snow (USGS Streamstats, 2008). With these high levels of snow pack, timber operations, snow plowing, and subsequent log haul are expected to be minimal during winter months due to the short window in which snowpack is only between 2 to 4 feet in depth. Furthermore, haul and related plow-activities are expected to generate minimal sediment disturbance, since the roads needed for winter haul are paved with asphalt. Plowed snow may be deposited in open stream courses, but since this snow is being removed off a paved road surface, it is expected to have little gravel component, which would be the primary source of plow-related sediment delivery increases. As such, the amount of material actually transported to streams during winter plowing and log haul is expected to be at a relatively low level that is not detectable beyond background levels.

Road work and hauling are expected to occur primarily in the dry months, since winter months are dominated by snow rather than rain precipitation events. As such, most of the sediment delivery from these actions would occur in the fall when precipitation and runoff levels increase, as well as potentially in the spring during snowmelt runoff. During the first significant runoff event of the fall, there would be flushing of sediments from road surfaces and roadside ditches into tributaries and surface channels that are connected to the stream. Based on research conducted elsewhere in the state of Washington, turbidity and suspended sediment levels would climb rapidly as ditchflow begins to occur during the first fall freshet, but would then rapidly decline as roads and ditches are essentially cleaned by the precipitation and runoff (Reid 1981, Reid and Dunne 1984, Bilby 1985). Assuming all road work occurs during the dry months and that there are no unseasonable precipitation events, the amount of material actually transported to streams due to maintenance or reconstruction is expected to be at a relatively low level that is not detectable beyond background levels.

Temporary roads are not expected to increase sediment to streams due to their distance from water features. No temporary roads will cross streams, and all temporary roads will be constructed at least 250 feet from water features, which will provide a sufficient vegetative buffer to capture any sediment that may runoff of these temporary features. Only one small section (approx 30 feet) of temporary road will be constructed within a riparian reserve, which is the temporary road needed to treat unit 7. This temporary road will parallel the edge of riparian reserve adjacent to Frog Lake in an area that is not heavily forested. All other temporary roads will be constructed outside of riparian reserves. None of these temporary roads will have an impact to stream turbidity.

Alternatives B and C
Cumulative Effects

The effects described above for both action alternatives would be cumulative with other forms of sediment production and introduction in the area. No detrimental cumulative effects are expected as a result of sediment delivery because of the establishment of Riparian Reserves, and the implementation of mitigation measures and road repair projects designed to reduce existing erosion and sedimentation problems. General forest road use and maintenance contribute

sediment to the river system. Road uses from other projects vegetation removal projects contribute sediment to the related stream system, and would add to the sediment estimates provided in this analysis. Some additional work may be completed by the Forest Service in this area in regards to road stabilization, but none were identified at this time. The obliteration of temporary roads will successfully restore infiltration rates if vegetation is reestablished during the growing season immediately following disturbance. Fertilization and/or composting and mulching of obliterated surfaces may be necessary in some locations. The timber sale contract would specify application rates of seed, fertilizer and mulch. The cumulative effects for the Sawtooth Huckleberry Restoration project and these other projects will result in a trend toward restoring the long-term function and process of the aquatic ecosystem by improving vegetation diversity and reducing the effects of roads on stream sediment production.

Change in Peak/Base Flows due to Vegetation Removal

Background

Vegetation manipulation can affect hydrologic processes at the stand scale, including changes in the interception of precipitation, changes in evapotranspiration, changes in snow accumulation, and changes in rates and timing of snowmelt. These hydrologic changes brought about by vegetation modification can affect the amount and timing of water that is available for runoff from a site, and thus can cumulatively affect streamflows. The degree to which these stand scale changes are manifested at the subwatershed scale in terms of changes in streamflow is dependent upon a number of factors related to both the extent and intensity of the forest manipulation, and characteristics of the site and subwatershed.

The sensitivity of subwatershed changes peak-flow magnitude and timing is in part based on the hydrologic maturity of stands. Hydrologic maturity is defined for this purpose in terms of the ability of a forest stand to intercept snow and reduce winds across a snowpack. Studies have shown that in forest openings, or areas that have had forest cover removed, snow accumulation is increased due to the loss of canopy interception. Furthermore, rates of snowmelt can be higher in the openings, particularly during rain-on-snow conditions, because of the turbulent transfer of latent heat from warm, moist air masses to the snowpack. With higher levels of snow accumulation and increased rates of snowmelt, these openings in the forest generate more water during rain-on-snow events, which can contribute to increased peak stream flows. As an increasing portion of a watershed is put into an open or hydrologically immature condition, the potential for peak flows to be increased becomes greater.

Grant et al found also that watersheds located in the rain-dominated region are less sensitive to peak flow changes than those in the transient rain-on-snow region. This study also predicted that harvest effects on peak flow increases diminishes as basin size increases, and that if peak flow increases do occur, they were detected only in flows of moderate frequency and magnitude at a return period of six years or less (2008).

A model-generated index called the Aggregate Recovery Percentage (ARP) has been used to represent the proportion of a watershed in a "hydrologically mature" condition. As timber harvest occurs, a portion of the watershed land cover is no longer hydrologically mature, thus the ARP for that drainage is reduced from 100%. Over time, vegetation grows back and will eventually return to a hydrologic mature condition, thereby “recovering.” The GPNF considers

above 90 percent to represent a low risk of increased peak flows causing stream damage, while values between 80 to 90 represents a moderate risk and values below 80 percent represent a high risk. Any subwatersheds identified as high risk through ARP modeling would require further analysis to more accurately determine the risk to potential adverse impacts from increased peak flows. ARP is most appropriately applied to small, true watersheds, which encloses a single integrated stream network that drains to a single watershed outlet. The peak flow risk cannot be adequately modeled using ARP for composite or frontal watersheds, which typically include a group of tributaries flowing directly a main stream (Philbin, 1998). This model was established based smaller than average subwatershed sizes. Using this model on larger scale watersheds is problematic in that affects to certain reaches may be greater than others and/or the single stream at the watershed outlet, and watershed characteristics may have countering affects negating or exacerbating increased peak flows towards the base of the larger scale watershed.

The second prediction factor for estimating peakflow sensitivity due to vegetation removal is by calculating Water Available for Runoff (WAR) percentages. WAR is an estimate of the predicted increase in streamflow due to changes in vegetative cover based on rainfall, tree size, temperature, antecedence snow accumulation and elevation. This prediction factor is only appropriate for use in drainages where 25 percent or more of a sub-basin is located within the rain-on-snow zone (Philbin, 1998).

The GPNF considers WAR percentages below 10% to be below the ability to accurately measure flow (no or low risk). WAR percent changes above 10% have the potential for adverse effects to streams and require further analysis (moderate or high risk). Site specific information is necessary to accurately determine affected streams, since some streams have a higher inherent sensitivity to peak flow increases. Channel morphology, stream bed composition, and stream gradient all influence the potential sensitivity to peak flow increases. For example, particles smaller than cobble are more easily mobilized than those cobble or larger (Philbin, 1998) and consequently less effects to streams from a similar increase in peak flows would occur in streams with larger substrates.

Current Condition

Each watershed is unique in terms of how it processes precipitation inputs and water discharge from the watershed. Conditions inherent in the watershed such as geology, soils, topography can strongly influence how incoming precipitation is processed before it leaves the watershed as streamflow or is returned to the atmosphere. The general shape of the watershed can influence the temporal sequencing of runoff responses occurring from different parts of the watershed. Soil depths, and geology and slope can all influence the storage time and capacity in a watershed, and can affect the rates at which precipitation is routed to the stream network.

Streamflow has historically been measured at several sites downstream of the project area by the U.S. Geological Survey (USGS). The closest gages are not currently in operation but have sufficient records to represent the flow patterns of the project area. The Meadow Creek and Big Creek gages are located closer to the project area than the Trout Lake Creek gage, thus these sites likely more accurately represent the flow patterns of streams in the project area.

To investigate the potential magnitude of change in streamflow levels based on past harvest, the Washington State Department of Natural Resources' Hydrologic Change Module was run for each major drainage in the project area (USDA 1998, USDA 1995a, USDA 1996). Using this model, the magnitude of the 2-year (recurrence interval) streamflow was estimated for current vegetative conditions and compared against the estimated 2-year flow under 100% hydrologically mature forest conditions. Results of these modeling efforts are listed as Water Available for Runoff (WAR) values as seen in Table 18.

Table 18. Predicted Peak flow increases due to vegetation removal in the Sawtooth Huckleberry Project area.

Subwatershed	WAR (Percent Increase in Peak flow During a 2 Yr. Event)
Upper Trout Lake Creek (170701051004)	3 - 7 %[1]
Big Creek (170800020110)	2.0 - 4.3 %[2]
Rush Creek (170800020111)	3.8 - 8.4 %[2]
Tillicum Creek (170800020106)	2.1 - 9.3 %[3]

[1]Values from 1996, as found in *Trout Lake Creek Watershed Analysis* (USDA 1996).
[2]Values from 2001, as found in *Shoo Timber Sale EA* (USDA 2001).
[3]Values from 1998, as found in data files used to develop *Upper Lewis River Watershed Analysis, Second Iteration* (USDA 1998).

All of the subwatershed WAR values in Table 18 are below 10 percent, which is the threshold the State of Washington uses to determine whether there is a "high risk" of peak flow increases due to vegetation removal. All of these values are potentially higher than current conditions due to vegetation growth since they were modeled. The values in Table 18 represent increases in 2-year flood conditions due to vegetation removal between 1996 and 2001. Since this time, little to no timber harvest activities have occurred in the project area, and thus these values have likely decreased due to more areas reaching hydrologic maturity. As such, the vegetative conditions have improved since this change module was run, thus the 2-year peak flows are not currently considered to be elevated.

Alternative A – No Action Alternative
Direct and Indirect Effects
Under the no action alternative, the project area subwatersheds would continue to recover in terms of hydrologic maturity, and peak flow increases due to vegetation removal would be reduced. Canopy cover averages for each stand would continue to increase from current levels.

WAR values for this area are projected to decrease further unless forest cover is reduced by timber harvest or some other means.

Alternatives B and C
Direct and Indirect Effects
This project is expected to have no measurable effect on peak or base flows in project area streams since riparian areas will not be treated in this project and the treated upland areas represent a small percent of the subwatershed areas. Upland areas will experience a reduction in canopy cover, which has the potential to increase water available for runoff.

The peak flow analysis process outlined in the Gifford Pinchot National Forest Cumulative Effects Manual (USDA 1989) models hydrologic recovery of timber stands to determine the relative effect on peak flows. In the absence of research findings, quantifying levels of change in snow accumulation, snowmelt, or evapotranspiration in thinned stands as compared to untreated stands, hydrologists on the Gifford Pinchot National Forest have determined 40 percent canopy closure as a breakpoint between stand conditions that are more reflective of a mature forest and stand conditions that are more representative of open conditions. It is recognized that the actual change in snow accumulation and in snowmelt doesn't occur at a point, but occurs as a continuum of incremental changes in a number of parameters. For purposes of evaluating the effects of proposed projects on peak flow increases, the collective professional judgment of the hydrologists was used to establish this common reference point. Areas that are thinned to a canopy closure of less than 40 percent are therefore used to determine which subwatershed areas may result in the increased magnitude of peak flow events, particularly in regards to effects on a subwatershed scale.

Approximately 284 acres of this project will receive a thinning prescription with a post-treatment canopy closure of at least 40 percent, which is considered a hydrologically mature condition. The action alternatives being considered would reduce average stand canopy cover below 40 percent on approximately 928 acres in both Alternatives B and C. Both alternatives may result in slight changes to the microclimate within each stand. These changes would be most prevalent during low flow conditions and or during runoff events occurring when soil water levels are at annual lows. Snow accumulations on the ground would be expected to increase as a result of decreased interception in the forest canopy. Snowmelt may be more rapid in this area, as snowpacks have greater exposure to wind and other elements that cause snowmelt. In addition, the removal of some portion of the forest would tend to allow increased soil moisture levels as a result of lower evapotranspiration.

The relative effect of these alternatives on peak and base flows of streams at the site scale would be mitigated by vegetation retention in all riparian areas. No-treatment buffers have been placed around all water features at either one or two tree height potential distances depending on the type of water feature. These buffers vary from 150 to 300 feet in width, which is consistent with and tiers to recommendations in our Forest Plan (USDA 1990). Since these buffers provide a substantial distance from treatment areas to defined waterways, the magnitude of the change in water available for runoff at the site scale is expected to be small and not measurable in streams.

Finally, the action alternatives reduce canopy cover on a relatively small headwater proportion of the affected subwatersheds. The action alternatives of this project would only treat between 0.1 and 2.7 percent of the affected subwatersheds. The accumulation of small changes in water available for runoff at the site scale would have relatively small impact at the subwatershed or planning area scale. Translation of the changes at the site scale to changes in stream discharge is further dependent on flow paths and water routing through the subwatershed, which would tend to accentuate or attenuate differences in water available for runoff found at the site scale. Because this project is located at the highest elevation headwater areas of these watersheds and these watersheds have substantial capacity for retention of water in surface and subsurface locations, actual changes to stream discharge are expected to be very small and below measurable levels.

Alternatives B and C
Cumulative Effects
The effects of this project must also be assessed in combination with currently ongoing and any proposed future projects to fully assess the cumulative effects on peak and base flow conditions. As mentioned previously, the peak flow analysis process outlined in the Gifford Pinchot National Forest Cumulative Effects Manual (USDA 1989) relies on the 40 percent canopy cover threshold to model hydrologic recovery of timber stands and determine their relative effect on peak flow increases. The action alternatives of this project have the potential to reduce canopy cover below 40 percent on 534 acres in the Upper Lewis River subbasin, as well as 394 acres in the White Salmon River sub-basin. Other canopy cover reducing projects in these sub-basins include other timber harvest projects, such as the completed Shoo and Tile timber sales, as well as any restoration projects. None of these projects resulted in measurable increases in peak flows at either the subwatershed or sub-basin scale. Similarly, since this huckleberry project is not expected to generate measurable increases in peak flows at the subwatershed scale, the effects at the sub-basin scale would also not be measurable, since sub-basins are larger than subwatershed. As such, this project is not expected to create detrimental cumulative effects at either the subwatershed or sub-basin scale.

Change in Peak/Base Flows due to Increases in Drainage Network
Background
Roads can increase the total volume of water available for rapid transport to stream channels in two ways. Roads intercept precipitation, which results in overland flow over compacted surfaces – reducing infiltration rates. Secondly, shallow subsurface flow may be intercepted at road cut-banks and converted to rapid surface runoff. This process effectively increases drainage density in a watershed, which can indicate increased peak flows (Wemple et al. 1996; Washington Forest Practices Board 1997).

Stream channel network extension estimates were estimated based on a modification of methods described by Wemple et al. (1996). Drainage density is widely accepted as an index of drainage efficiency, and is defined as the sum of stream length ($\mathbf{L}_S$) over the drainage area (A):

$$D_d = (\sum \mathbf{L}_S) \div A$$

Wemple et al. proposed that roads modify drainage density by extending the total length of effective surface flow; in other words, extending the stream channel network. This stream channel network extension can be estimated by adding the length of road segments discharging

runoff directly to stream channels, and by adding the length of newly eroded gullies located on hillslopes where channels did not previously exist. Unfortunately gully information was not available for this analysis, so a modified formula was used to represent the stream channel network extension in each subwatershed, where $\mathbf{L}_{RC}$ represents the length of road segments discharging runoff directly to stream channels:

$$D'_d = [\sum(\mathbf{L}_S + \mathbf{L}_{RC})] \div A$$

Road drainage ditches and road surfaces capture surface runoff and surface flows. Where roads cross streams, they route the captured water flows to streams. In other words the roads act as extensions of the stream channels. This has two effects. First, it decreases the time it takes water to reach streams and increases peak flows. Second, water captured by the road's surface and ditches sometimes carries fine grained sediments to the streams.

Current Conditions

The drainage network extension is rated as "Functioning at risk" at the subwatershed scale and project scale. The drainage density in the project area ranges from 2.48 to 3.58 miles per square mile, and this length is assumed to be extended by roads in relation to the number of road-stream crossings. The latest GIS database of streams and existing system roads (as of 8/28/2008) was used to find stream crossings in the project area. The amount of road that contributes to the drainage network was assumed to be limited to the length of road between road-stream crossings and the next adjacent ditch relief culvert. Table 19 summarizes the road density, drainage density, and estiamted range of drainage network increases expected if culvert spacings range between 200 to 500 feet on each side of the stream.

Table 19. Summary of Road Density, Stream Crossings, and Drainage Network Increase for the Sawtooth Huckleberry Project area.

Subwatershed	Subwatershed Area (mi^2)	Road Density (mi/mi^2)	Natural Drainage density, (mi/mi^2)	Stream Crossings	Drainage Network Increase (% of mapped stream miles)[1]
Big Creek (170800020110)	15.8	2.54	2.48	26	5.0 - 12.5 %
Rush Creek (170800020111)	26.4	1.76	2.92	61	6.0 - 15.0 %
Tillicum Creek (170800020106)	12.0	3.17	3.58	74	13.0 - 32.5 %
Upper Trout Lake Creek (170701051004)	44.4	2.43	3.42	146	7.3 - 18.2 %

[1] Assumes distances between stream crossings and relief culverts is between 200 to 500 feet. Drainage network increase is considered high "risk" >20% and moderate 5% to 20%.

The resulting "post-road" drainage density is a direct reflection of relationships among stream channel length, number of stream crossings, average distance between culverts and drainage area. The GIS information used to estimate stream length and stream crossings has not been comprehensively field verified. Additionally, the distance between culverts likely varies across the subwatershed. As such, some differences may exist between these numbers and what is actually occurring on the ground. Nonetheless, these estimates were developed using the best available information and provide an estimated range of road-related drainage network increase.

Stream channel network extensions were estimated to range between 5 and 33 percent in the project area with the highest values located in Tillicum Creek. Drainage network increase is considered at a "moderate risk" when increases are estimated between 10 and 20 percent and at a high risk when over 20 percent. This level of risk indicates a moderate likelihood that sediment transport and streamflow, particularly high flows, are increased as a result of existing roads. As such, the project area is generally at a moderate risk of increased peak flows due to drainage network extension with the greatest increases in Tillicum Creek where the drainage area is small and stream crossings are relatively high.

Alternative A – No Action
Direct and Indirect Effects
Road-related drainage network extensions have been decreasing over time in the project due to road decommission projects. This trend is expected to continue under the no action alternative, but only at a minimal rate. Although the direction of the Forest Service is to decommission unnecessary roads, the subwatersheds that encompass this project area are dominated by land allocated as "matrix" which will continue to provide multi-use purposes into the future. Drainage network extension may also be decreased in the future by actions that disconnect the road network from the stream network, such as water bar and cross drain construction and ditch relief culvert installation and maintenance.

Alternatives B and C
Direct and Indirect Effects
Drainage network extension would not be increased as a result of either action alternative. No permanent roads would be constructed, thus no new permanent road-stream crossings would be constructed. Both action alternatives include the reconstruction and/or construction of temporary roads to access landings and thinning units. These temporary features will be restored after use to ensure they will not affect drainage density post-project. Any temporary roads constructed for logging that are not decommissioned prior to the wet season would be weatherproofed through the construction of waterbars, crossdrains and grade breaks. This will ensure that surface waters do not concentrate on the road surface and contribute directly to increases in drainage network density.

This project has a slight potential to decrease drainage network extension, since it will include the installation of 3 new ditch relief culverts. The relative impact of these new culverts would only be measurable at the site scale, and the relative decrease in network extension for the subwatershed will be immeasurable.

Alternatives B and C

Cumulative Effects

Several projects have the potential to decrease drainage network density within the project area sub-basins. Road decommissioning activities are the primary actions expected to effect drainage network extension by removing road-stream crossings. No road decommissions are proposed for these subwatershed at this time. Although other road maintenance activities would further reduce drainage network extension, the relative effects of such activities would be minimal. Continued management within matrix and other lands of this area are not expected to further increase drainage network increases as no new road construction are expected to occur. Most timber sale activities will likely construct temporary roads to access landings and thinning units, but drainage densities will not change due to temporary roads since these roads will be removed after use. Any temporary roads constructed for logging that are not decommissioned prior to the wet season would have stream crossings removed and be weatherproofed through the construction of waterbars, crossdrains and grade breaks. This will ensure that surface waters do not concentrate on the temporary road surface and contribute directly to increases in drainage network density.

Riparian Reserves, Wetlands, and Floodplains

Background

Riparian Reserves were established under the Northwest Forest Plan as one of four primary components of the Aquatic Conservation Strategy. Riparian Reserves are located along all aquatic features and around unstable or potentially unstable soils. Because of the importance of riparian areas to aquatic conditions and habitats, management objectives within these areas are focused on maintaining and improving conditions for aquatic-and riparian-dependent species.

Riparian forests are critical components of healthy aquatic ecosystems. Some of the key functions of riparian forests are to: intercept precipitation, protect the forest floor from erosion, produce organic inputs in the form of detritus and large wood, provide root strength for channel stability, and provide shade and microclimate protection for riparian and aquatic environments

Current Condition

Historically, riparian reserves in these subwatersheds were harvested for timber. The removal of vegetation has left streams vulnerable to erosion and aquatic habitat degradation. Over 30 percent of riparian reserve in internal drainages of the Rush Creek subwatershed (USDA 1995a) and Tillicum Creek (USDA 1998) have been harvested for timber. These areas are currently developing late-successional reserve characteristics, since no active land management is occurring in these areas.

Riparian Reserves (RR) for the project area were identified along all water features and wetlands consistent with the ROD (USDA 1994). These features (Table 20) were found to be in varying states of succession, including some that are dominated by grasses while others have a greater woody component, including alder and conifer trees.

Table 20. Riparian Reserves within Sawtooth Huckleberry Project Unit areas.			
Unit the RR falls within	**Area of RR (acres)**	**Distance used to create RR buffer (ft)**	**What is the source of this RR?**
2	0.1	150	Intermittent spring outside unit to northeast
2	0.1	150	Intermittent spring east of FR 2400261
6	0.3	300	Edge of Frog Lake
6	7.1	100	Dry meadows in middle of unit
7	0.9	300	Edge of Frog Lake
8	53.0	300	Surprise Lakes
8	24.0	300	Surprise Lakes
9	10.5	150	Intermittent Stream within unit
10	0.4	300	Small lake outside unit to the northeast
10	14.4	150	Intermittent Stream within unit
12	5.2	150	Intermittent Stream on southwest side of unit
12	13.7	300	Meadow Creek, fish-bearing stream

Alternative A – No Action
Direct, Indirect, and Cumulative Effects
There would be no detrimental effects to riparian reserves, wetlands, or floodplains under the no action alternative, since no treatment would occur in these areas. These riparian reserve areas, as well as the riparian reserve areas in the associated subwatersheds and subbasins, will continue to develop late-successional reserve characteristics. Stands that aren't thinned would remain dense and not benefit from improved health or growth acceleration from reduced competition from other trees. They would also not experience any short-term negative effects from timber harvest activities.

Alternatives B and C
Direct, Indirect, and Cumulative Effects
There would be no effects to riparian reserves, wetlands or floodplains under either action alternative, since no vegetation treatment will be undertaken in riparian reserves. Furthermore, the project design criteria and mitigation measures included in the action alternatives will prevent any adverse effects to riparian reserves during project activities. Although field review was completed to identify the riparian areas that are located within the project area, there is a small chance that new water features will be discovered during unit layout. These features will be protected in accordance with the project design criteria, which is consistent with and tiers to

the ROD and Standards and Guidelines described on page 2-6 of Forest Plan Amendment 11 (USDA 1990).

Fisheries

A fisheries biological evaluation was completed as part of this project and is summarized below. The compete biological evaluation can be found in the project file at the Mt. Adams Ranger District.

The report summarizes the effects from the proposed project on (PETS) fish species. Fish species listed are taken from the Pacific Northwest Region, USDA Forest Service Threatened, Endangered, and Species Proposed for Listing document, updated March 2008. When No Effect or No Impact is determined, those species will not be described or discussed in detail in this Environmental Assessment. The one exception to this will be some description of Columbia River bull trout. Even though they are approximately 8 RM away from the nearest unit, and there is no riparian entry or treatment proposed for this unit, there will be some discussion to substantiate the "no effect" determination for Columbia River bull trout.

Existing Condition

Action Area, Fish Species and Critical Habitat

The action area used for this analysis includes portions of the Upper Lewis River 5th-field watershed (in the Tillicum Creek, Big Creek, and Rush Creek sub-watersheds) and the White Salmon River 5th-field watershed (in the Upper Trout Lake Creek sub-watershed). The stream and lake systems that are within the action area and are in the Upper Lewis River watershed are: (1) the perennial, (unlisted) resident fish-bearing, headwaters of Meadow Creek, (2) an unnamed, intermittent, non fish-bearing, headwater tributary to Meadow Creek, and (3)non fish-bearing Frog Lake. The stream systems that are within the action area and are in the White Salmon River watershed are: (1) intermittent, non fish-bearing, headwaters of Meadow Creek, (2) intermittent, non fish-bearing, headwaters of Mosquito Creek, and (3) and Surprise Lakes that are stocked yearly by the Washington Department of Fish and Wildlife with hatchery fish.

Resident fish species found in the Upper Lewis River 5th field watershed are: rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarki*), sculpin (*Cottus* spp.), mountain whitefish (*Prosopium williamsoni*), bull trout (*Salvelinus confluentus*), eastern brook trout (*S. fontinalis*), and suckers (*Catostomus* spp.). Of these fish species, only the Columbia River bull trout is federal- or state-listed (federally-listed as threatened).

The same resident fish species are present in the White Salmon River 5th field watershed, with the exception of the Columbia River bull trout. The only listed fish species in this watershed occur in the lower few miles of the mainstem White Salmon River, which is approximately 40 miles downstream from the analysis area. These listed fish are in the *Oncorhynchus* genus.

The Gifford Pinchot National Forest (GPNF) has a total of 8 fish species that are either endangered, threatened, or sensitive. None of the 8 fish species are found within the project planning area or are within a reasonable distance downstream from the planning area to warrant

an effect determination other than "no effect" from the implementation of any of the alternatives. The closest listed fish species to the project area is the Columbia River bull trout, whose spawning and rearing life stages can be found approximately 8 river miles downstream in the lower 1.78 river mile of Rush Creek. They are blocked from migration further upstream by a natural barrier, a 27 feet tall waterfall at river mile 1.78.

Columbia River bull trout (*Salvelinus confluentus*)

The Gifford Pinchot National Forest is located within the Columbia River bull trout evolutionary significant unit in Oregon and Washington. Within the Lewis River system, three local bull trout populations exist, as described in the draft Lower Columbia River bull trout recovery plan (USFWS 2002a.). All three populations are considered adfluvial; that is, they spawn in streams but migrate downstream into lakes before returning to their natal streams to spawn. Merwin, Yale, and Swift dams segment the North Fork Lewis River and do not allow upstream fish passage. The occurrence of limited downstream passage by bull trout over these dams or through the turbines is assumed based on observed adult bull trout in Merwin Reservoir and in the Lewis River below Merwin Dam. No known spawning streams are accessible to bull trout in tributaries to Merwin Reservoir. Therefore, isolated bull trout in Lake Merwin are not considered a subpopulation. Bull trout have not been documented in the East Fork Lewis River, and the East Fork has not been identified by the recovery planning team as a research needs area.

In addition to the three reservoirs, bull trout are currently known to occupy approximately 34 miles of rivers and streams in the Lewis River. Bull trout spawning habitat is limited to approximately 14.7 miles of tributary streams in Pine, Rush and Cougar Creeks. Other streams in the area, including the Lewis River below Swift Reservoir, two Swift Reservoir tributary streams, and the upper Lewis River from Swift Reservoir upstream 12.83 miles to a natural barrier at Lower Falls, provide foraging, migration, and overwintering habitat for bull trout. The upper Lewis River above Lower Falls has been identified by the recovery planning team as a research needs area (USFWS 2002).

The primary limiting factor for Lewis River bull trout production seems to be the availability of adequate spawning and rearing habitat. The only known bull trout spawning area of the Yale subpopulation occurs in Cougar Creek. The fact that only 1¾ miles of spawning and rearing habitat in Cougar Creek exists for the Yale population may explain the chronically low numbers of spawning adults observed each fall since records have been kept. With the exception of possible rearing habitat in Ole and Rain Creeks, there are limited opportunities for expanding or improving habitat for the Yale bull trout population. Bull trout spawning surveys conducted since 1988 in Cougar Creek are so variable it is impossible to establish a trend (range 0 to 40 spawners per year) (PacifiCorp 2003). Recently implemented trap and haul efforts at the upper end of Lake Merwin (below Yale Dam) resulted in the transfer of 68 adult bull trout to the mouth of Cougar Creek in Yale Lake from 1995 to 2003, significantly increasing the Cougar Creek spawning population in some years (PacifiCorp 2003). The status of the Yale Lake subpopulation is considered to be depressed with an unknown trend (USDI 1998).

The Swift Reservoir subpopulation spawns in Pine and Rush Creeks (WDFW 1998). Radiotelemetry studies conducted on bull trout in Swift Reservoir indicate that migrating adults use both Rush and Pine Creeks with no evidence of reproductive isolation. Bull trout

distribution is limited to the lower 1.7 miles of Rush Creek due to an impassable falls, and the expansion of bull trout range within other tributaries in the upper Lewis River watershed may be limited by unsuitable temperature regimes (Faler and Bair 1996; Hiss et al. 2004). Recent spawning surveys on Pine and Rush Creeks show a possible increasing trend in population size, but the variability of the data makes this determination difficult (range 101 to 911 estimated spawners per year) (PacifiCorp 2003).

Unlike the Yale Lake subpopulation, bull trout in Swift Reservoir have a larger spawning area and connectivity between spawning grounds (Pine and Rush Creeks), which may buffer this subpopulation against stochastic events. For example, after the 1980 eruption of Mt. St. Helens when habitat throughout the Pine Creek drainage was severely altered (Faler and Bair 1996; Hiss et al. 2004), migratory bull trout from Swift Reservoir subsequently recolonized Pine Creek. The status of the Swift Reservoir subpopulation is considered to be depressed with a stable trend (USDI 1998).

Many other streams in this watershed are potentially accessible to bull trout but the species has not been documented in them, either due to the absence of bull trout or to the scarcity of fish surveys targeted on that species. In the summer of 2003, WDFW personnel sighted three adult bull trout in the Muddy River, approximately 1.5 miles upstream from the Lewis River confluence. It is unknown if these fish spawned in the Muddy River watershed, or to what extent bull trout may occur within the Muddy River watershed (Hiss et al. 2004). For the purposes of this consultation, the Service assumes that all fish-bearing waters that are potentially accessible to migratory bull trout above Swift Reservoir to be potential bull trout habitat.

Bull trout critical habitat in the Lewis River basin is designated only along streams located on non-federal lands that have greater than ½ mile of river frontage (USDI 2004a). The critical habitat designation immediately adjacent to the GPNF includes approximately 1.6 miles of stream along the upper Lewis River (USDI 2004a). This area is known to provide essential foraging and migration habitat for bull trout (USDI 2002). Critical habitat has also been designated on 6 miles of streams along Pine Creek (USDI 2004a). Pine Creek was designated because it provides essential spawning and rearing habitat for the Swift Reservoir subpopulation of bull trout (USDI 2002). This area is comprised primarily of lands owned and managed for timber production by the Plum Creek Timber Company. Due to the combined effects of the 1980 Mt. St. Helens eruption and a history of extensive timber harvest, there is essentially no mature riparian forest in the Pine Creek subwatershed. Road densities on private lands in the lower Pine Creek subwatershed average over 6 miles per square mile, some of the highest in the basin (USFWS 2002a).

Critical Habitat

There is no designated critical habitat for any listed species in the portions of the Lewis River and White Salmon River 5th -Field watersheds that constitute the analysis area for the Sawtooth Huckleberry Restoration Project. This is caused by the migration blockages at the three hydroelectric dams on the Lewis River and at Condit Dam on the White Salmon River.

Environmental Effects

No thinning within riparian reserves occurs with this project. This section does not discuss thinning outside riparian reserves because there are substantial buffers around all waterbodies in the analysis area and, therefore, the thinning activities outside the buffers are not expected to affect any species or habitat indicators. Activities that fall within the scope of this project and may have effects on fisheries include: log hauling and road activities.

Log Hauling

Alternative A – No Action Alternative

Direct and Indirect Effects

No hauling will occur under the Alternative A, the No Action Alternative. Therefore, all elements of critical habitat would be maintained and no effects to special status fish species are expected.

Alternative B – Proposed Action

Direct and Indirect Effects

Sediment would be delivered to streams from hauling activity during the dry season. In general, roads lacking surface rock, with steep grades and sideslopes and with stream crossings or in proximity to streams are the greatest sediment contributors from surface erosion. Timing of haul limited to dry months and to only dry periods of the early fall would reduce rates of sediment delivery to streams.

With this project, there is a high probability that a small amount of sediment from the road surface would enter two unnamed, intermittent, non fish-bearing streams (an unnamed tributary to Big Creek and Big Creek) from log haul-related activities on Forest Road 3000 and 2400. However, the amount of sediment is expected to be minimal because these roads are main system roads, Best Management Practices and mitigation measures will be implemented, and the units requiring these routes for log haul are relatively small in size. Therefore there is no effect expected to Columbia River bull trout that are present approximately 8 river mile downstream in the mainstem Lewis River from turbidity, sedimentation, and substrate embeddedness. There is also no effect from log haul to unlisted, resident fish species that may be present in the analysis area.

For the White Salmon River Fifth-Field watershed, there is a high probability that a small amount of sediment would enter perennial reaches of Meadow and Cultus Creeks, as well as several of their intermittent tributaries from log haul-related activities. The perennial stream reaches have unlisted resident fish present. The log haul routes that may cause some instream turbidity, sedimentation, and possibly some substrate embeddedness are FR 2400 and 2400-210. For the same reasons as listed above in the Upper Lewis River haul route analysis, these water quality and habitat indicators are not expected to affect any unlisted resident fish in this watershed (listed fish are only present approximately 40 river mile downstream).

Summer blading of the road surface, ditch cleaning, maintenance and reconstruction work and timber hauling would similarly create conditions that would allow increased erosion and sediment delivery to the aforementioned streams. Some sediment introduction would be expected during summer months from dust created by these activities and by subsequent vehicle

traffic on newly treated roads. Most sediment delivery from road work and hauling during the dry months would occur later in the fall when precipitation and runoff levels increase. During the first significant runoff event of the fall, substantial flushing of sediments from road surfaces and roadside ditches into tributaries and surface channels that are connected to the stream would occur. Based on research conducted elsewhere in Washington State, turbidity and suspended sediment levels would climb rapidly as ditchflow begins to occur during the first fall freshet, but would then rapidly decline as roads and ditches are essentially cleaned by precipitation and runoff (Reid and Dunne 1984). Subsequent periods of traffic on the roads would cause additional sediment delivery.

This sediment production from the haul routes leads to increases in turbidity and suspended sediment in receiving surface waters. Since most of the roads in the planning area have active inboard ditches, these channels form the avenue for routing this sediment to streams. Ditches are drained at some spacing along roads by either ditch relief culverts or live streams. Some portion of the ditch relief culverts do not deliver sediment to the stream system because they discharge to unchanneled slopes where water can infiltrate the ground surface and/or sediment can be filtered and dropped out of suspension. No measure of the number of culverts in this planning area that deliver to streams or that discharge to forested slopes exists, but it is likely that the proportion would change based on the intensity and duration of the runoff event.

Alternative C -- Underburning
Direct and Indirect Effects
The difference between Alternatives B and C is that, in Alternative C, the Forest Service would underburn units 2, 5, 7, 10a, 11a, 11b, 11c, 11d, 11e, and 12. There would be no underburning within riparian areas, therefore, this action is not expected to affect any fish or fish habitat parameters. Since the action alternatives do not differ with regard to haul activities, the potential to increase stream sediment, turbidity, and substrate embeddedness is equal for both action alternatives.

Road Activities

Alternative A – No Action Alternative
Direct and Indirect Effects
No temporary roads would be constructed in the no action alternative; therefore, no increased turbidity, sediment delivery, substrate embeddedness, or fish migration barriers would occur.

Alternative B – Proposed Action
Direct and Indirect Effects
Roads and culverts can alter the flow pattern of water, large wood, organic material and gravels through streams by creating physical barriers at road stream crossings. This can affect upstream and downstream movement of fish and invertebrates affecting fish migration and food availability and interrupt the downstream movement of large wood and other organic material and sediment, including gravels suitable for spawning. However, the sections of temporary road construction that are proposed for Alternative B do not cross any streams and are outside the Riparian Reserve buffers for streams, so this alternative will not result in a negative effect to fish or fish habitat from increased turbidity, sediment delivery, substrate embeddedness, or fish migration barriers.

Alternative C – Underburning
Direct and Indirect Effects
Since the action alternatives, Alternatives B and C, do not differ with regard to road-related activities, the potential to increase stream sediment is equal for both action alternatives.

Alternatives A, B and C
Cumulative Effects
The potential to experience cumulative sedimentation effects to perennial fish-bearing streams is neutral with the implementation of Alternative A, the No Action Alternative, and low with Alternative B, the Proposed Action and Alternative C, the second action alternative. One timber sale near the Sawtooth Huckleberry Restoration Project planning area is the Shoo Timber Sale. The potential for cumulative sedimentation or turbidity effects is low from the combined actions of the Sawtooth Huckleberry Restoration Project and the Shoo Timber Sale due to road improvements and similar mitigation measures and Best Management Practices being implemented at both. Fish and their habitat would potentially be impacted in the short-term because of the amount of sediment generated through the first winter flush, but no listed fish species or their Critical Habitat would be affected. However, it is reasonable to assume that it would be difficult to discern the amount from natural variability in watersheds with previous land treatments and road building. Long-term benefits would be derived from road improvements because of standards that provide for full fish passage or adequately sized culverts and natural processes within ephemeral/intermittent drainages.

Effects Determinations
No anadromous fish access the project planning area located in the Upper Lewis River and White Salmon River watersheds. In the case of the Upper Lewis River HUC-5 watershed, instream fish passage on the Lewis River is blocked by dams at Lake Merwin, Yale Lake, and Swift Reservoir. The first of these dams to block the upstream migration of all anadromous fish is Merwin Dam. This dam is approximately 30 miles downstream from the nearest Sawtooth Huckleberry Restoration Project unit (Unit 12). For the White Salmon River HUC-5 watershed, instream fish passage is blocked by Condit Dam at river mile 3.3 of the mainstem White Salmon River. The nearest anadromous fish to the Sawthooth Huckleberry Restoration Project are approximately 40 river mile downstream from the nearest unit (Unit 8).

The nearest bull trout population to the Sawtooth Huckleberry Restoration Project action area is at Rush Creek, below a set of three waterfalls. All three falls are barriers to fish. The first 27 feet waterfall is at river mile 1.78. Therefore, bull trout (all life stages) are present approximately 8 river mile from the nearest project unit, Unit 12, where there is no riparian treatment proposed (same for all the units in this project).

The project would have a localized short-term increase in sediment within the immediate, intermittent, non fish-bearing streams along FR 3000, 2400, and 2400-210 in the Upper Lewis River watershed and two perennial, unlisted resident fish-bearing streams in the White Salmon River watershed. For the streams in the Upper Lewis River watershed, there is no effect expected to Columbia River bull trout because they are approximately 8 river mile downstream and the sedimentation effects will be mild and short-term. For the streams in the White Salmon

River watershed, there is no effect to any of the listed anadromous fish in the basin because they are located approximately 40 river miles downstream.

The analysis determined that the effects of both alternatives, inclusive of all project elements discussed above, will have **no effect** on Columbia River bull trout, coastal Puget Sound bull trout, Lower Columbia River (LCR) steelhead trout, Critical Habitat for LCR steelhead trout, LCR chinook, Critical Habitat for LCR chinook, LCR coho, and Essential Fish Habitat for coho and chinook. In addition, the implementation of either alternative of the Sawtooth Huckleberry Restoration Project will have **no impact** on Puget Sound coastal cutthroat trout, interior redband trout, or pygmy whitefish. These effects determinations are mainly due to the fact that the harvest units and the majority of log haul/road related activities are located in HUC-6 sub-watersheds where there are no anadromous fish due to hydroelectric dams and only the Rush Creek HUC-6 sub-watershed has listed Columbia River bull trout (8 RM downstream). Therefore, turbidity, sediment, and substrate embeddedness that results from road activities and log hauling will have dissipated to background levels long before Columbia River bull trout or any other listed fish and their Critical Habatat.

Magnuson-Stevens Fishery Conservation & Management Act

The Sustainable Fisheries Act of 1996 (Public Law 104-267) amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect "Essential Fish Habitat" (EFH). Essential Fish Habitat is defined in the Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Essential Fish Habitat includes all freshwater streams accessible to anadromous fish, marine waters, and intertidal habitats. Essential Fish Habitat excludes areas upstream of certain impassable artificial barriers and long-standing naturally impassable barriers.

There are certain areas of the Gifford Pinchot National Forest that are designated as EFH for Lower Columbia River chinook and coho. The action alternatives would have **no effect** on EFH for Chinook and coho because this habitat designation does not occur within the project area and it does not until approximately 40 river mile downstream. Chinook and coho are present below 3 hydroelectric dams on the Lewis River that stand between these species and the analysis area, and they are present below Condit Dam that stands between these species and the analysis area.

Watershed Analysis recommendations that are pertinent to this project include the following:

- Regeneration harvest scheduled this decade should be focused in the upper elevations of the watershed first, to limit further concentrations of large openings in the rain-on-snow zone (Trout Lake Creek Watershed Analysis, p 91). The Sawtooth planning area lies above 4,000 feet elevation, above the zone where rain-on-snow events typically occur.
- The Cultus/Meadow Subbasin of Trout Lake Creek Watershed is primarily small tree stands ready for commercial thinning (Trout Lake Creek Watershed Analysis, p. 97). Sawtooth planning area overlaps a portion of this subbasin
- Frequency, pattern and distribution of historical natural disturbances should be used to design regeneration harvest entries. Harvest design should begin at the landscape level and include considerations from this watershed analysis as well as more detail analysis of

ecological condition and disturbance regimes (Middle Lewis River Watershed Analysis, p. 159). Sawtooth planning area incorporates historic berryfields in context with the large scale burns which helped create them.

- In timber emphasis allocation [general forest –matrix] within western hemlock and silver fir zones consolidate harvest openings. Minimize staggered setting openings dispersed through large and small tree stands. Progressively harvest adjacent to established manage stands to create polygons of similar age classes that will eventually becomes several hundred acres in size. Design harvest units with remnant green trees, snags, down logs, and stand edge patterns that resemble openings created from natural disturbance such as fire and windfall (Middle Lewis River Watershed Analysis, p.159).

Aquatic Conservation Strategy

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

The Sawtooth Huckleberry Restoration project will meet this objective by restoring the diversity and complexity of the vegetation in the upland acres and at the same time protecting riparian areas from the side effects of canopy reduction and timber harvest. The Forest proposes to reduce canopy outside of Riparian Reserves on approximately 1,200 acres to restore conditions that benefit the continued production of native huckleberries (*Vaccinium membranaceum).* The action would thin the overstory stand to permit more light to reach the existing berry bushes, thus increasing berry production, and removing competing vegetation to allow bushes to expand and occupy more growing space. By returning this portion of the watershed and its landscape-scale features to a patchwork of huckleberry fields and uneven-aged tree stands, the distribution, diversity, and complexity would be restored in those portions outside of Riparian Reserves. No treatment is proposed within Riparian Reserves and design features and mitigations are in place to protect riparian areas from harvest activities.

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

The Sawtooth Berryfields straddle a plateau between the Upper Lewis River Watershed and the White Salmon River Watershed. There are very few streams in this area, but there are several lakes and ponds (Surprise Lakes, Frog Lake). No-treatment buffers have been prescribed on all streams, ponds, and wetlands to protect riparian vegetation from being damaged or removed. The Sawtooth Huckleberry Restoration project will maintain spatial and temporal connectivity within and between watersheds maintaining riparian reserve vegetation, replacing several failing culverts, and maintaining the current number of stream crossings. No treatment is proposed within Riparian Reserves and design features and mitigations are in place to protect riparian areas from harvest activities. No permanent roads would be constructed, thus no new permanent

road-stream crossings would be created. Existing failing culverts would be replaced and roads restored so that they are less likely to contribute sediment to streams.

3. ***Maintain and restore the physical integrity of the aquatic systems****, including shorelines, banks, and bottom configurations.*

The Sawtooth Huckleberry Restoration project will maintain or slightly restore the physical integrity of aquatic systems. Several currently undersized or failing culverts will be replaced as part of the action alternatives. Although these new culverts will result in some short-term increases in stream turbidity, these new culverts will restore streamflow and sediment regimes to a more natural condition by improving stream-crossing capacity. Other project activities will have no affect on the physical integrity of aquatic systems of the project area. Vegetation restoration treatments, such as thinning, mulching, or burning, and the construction of temporary roads and landings will not affect shorelines or streambanks, nor will they increase sediment delivery to streams, since they will not be occurring within Riparian Reserves. Although both action alternatives would displace soil outside of riparian reserves to improve huckleberry development, the physical integrity of aquatic systems will not be affected by these activities due to mitigation measures (rehabilitation of bare soils) and project design features, such as the large distance between activities and aquatic features. Some fine sediment may reach the stream through road activities, including log haul and culvert replacement work, but the effects are expected to be short-term in nature and should not reach detectable quantities. Water temperature will not be affected by either action alternative because no treatment is proposed within Riparian Reserves and design features and mitigations are in place to protect riparian areas from harvest activities.

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

Water quality is expected to be maintained in the Sawtooth Huckleberry Restoration project. The two water quality parameters that often have the potential to be affected by timber harvest are turbidity and temperature. However, for this project, vegetation restoration treatments will not increase sediment delivery to streams or increase instream temperatures since vegetation removal will not be occurring within Riparian Reserves. All temporary roads and landings will be located outside of Riparian Reserves and therefore not increase sediment delivery to streams, and any small amounts of fine sediment that reach streams through road activities are expected to result in short-term and undetectable from background levels. Although some fine sediment may reach streams through road activities, the effects are expected to be short-term in nature and should not reach detectable quantities. Water temperature will not be affected by either action alternative because no treatment is proposed within Riparian Reserves and design features and mitigations are in place to protect riparian areas from harvest activities.

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

The Sawtooth Huckleberry Restoration project will maintain or slightly restore the current sediment regime under which the aquatic ecosystems evolved. Several currently undersized or failing culverts will be replaced as part of the action alternatives. Although these new culverts will result in some short-term increases in stream turbidity, these new culverts will restore streamflow and sediment regimes to a more natural condition by improving stream-crossing capacity. Other project activities will have no affect on the physical integrity of aquatic systems of the project area through the use of project design features and mitigation measures. Vegetation restoration treatments, such as thinning, mulching, or burning, and the construction of temporary roads and landings will not increase sediment delivery to streams, since they will not be occurring within Riparian Reserves. Although both action alternatives would displace soil outside of riparian reserves to improve huckleberry development, this surface erosion is not expected to reach aquatic systems due to mitigation measures (rehabilitation of bare soils) and project design features, such as the large distance between activities and aquatic features. Some fine sediment may reach the stream through road activities, the effects are expected to be short-term in nature, beneath background levels, and not affect the existing sediment regime.

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

The project will maintain in-stream flows by having no measurable effect on peak or base flows. Although the runoff from upland areas may slightly increase as a result of low post-treatment canopy cover, these areas represent a small percent of the subwatershed and, therefore, no detectable difference in in-stream flows would be expected from treating an area this small. Mitigation measures , such as temporary road and skid trail rehabilitation (ripping and re-seeding), will help improve ground interception and reduce surface runoff by decompacting soils to maintain soil permeability.

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

This project would maintain the timing, variability and duration of floodplains, meadows and wetlands because no treatment is proposed within Riparian Reserves and design features and mitigations are in place to protect riparian areas from harvest activities. No-treatment buffers have been prescribed on all streams, ponds, and wetlands to protect riparian vegetation from being damaged or removed.

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

This project will maintain current species composition and structural diversity in riparian areas. No treatment is proposed within Riparian Reserves (including wetlands) and design features and mitigations are in place to protect riparian areas from harvest activities. This is expected to maintain species composition, structural diversity, and overall function of the Riparian Reserves.

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

Riparian-dependent plant and animal species in the planning area would be unaffected by either action alternative because no riparian treatment is proposed under the Sawtooth Huckleberry Restoration project.

Overall, the Sawtooth Huckleberry Restoration project meets the objectives of the Aquatic Conservation Strategy.

Botanical Species and Invasive Plant Species

A complete botanical biological evaluation was completed and is included in the project file. A summary is included below.

Existing Environment

In order to determine whether the activities proposed in this project pose a potential threat to Regional Forester's Threatened, Endangered, Proposed or Sensitive (TEPS) a pre-field review was performed. This review consists of an analysis of the potential effects of the project on known sites of species of concern, or on potential habitat for these species. Aerial photographs, the July, 2004 Regional Forester's Sensitive Plant list (USDA Forest Service 2004b), forest GIS information, Interagency Species Management System databases (ISMS/GEOBOB), data from CVS Random Grid Surveys (2005), district files, and Sensitive Plants and Noxious Weeds of the Gifford Pinchot National Forest (USDA Forest Service 1992) were consulted for the pre-field review. Based upon this information, the list of TEPS species can be narrowed to focus on those species potentially present in the project area.

The Regional Forester currently lists 88 TEPS botanical species documented or suspected to occur on the Gifford Pinchot National Forest . This list was updated in July 2004 and includes 52 vascular plants, 18 lichens, 4 bryophytes and 14 fungi; Appendix A lists these species (USDA Forest Service 2004b). Although the Regional Forester's Sensitive species list was again updated in January of 2008, Sawtooth Huckleberry Restoration Project was initiated in 2007; as a result, botanical surveys were conducted in 2007, and the 2004 list was used.

The pre-field review for this project was performed during June, 2007. Pre-field review documentation is on file at Mt. Adams Ranger District, in the Project Botany files. Table 21 lists all TEPS and other Survey and Manage botanical species documented or suspected to occur within the project area.

Table 21. TES and S&M Species Documented or Suspected to Occur on the GPNF and Likelihood of Presence within the Sawtooth Huckleberry Restoration Project

Scientific name (Sensitive unless otherwise noted)	Documented (D) or Suspected (S) on Forest	Site within project area?	Documented (D) within adjacent 5th field watershed (both Upper Lewis and White Salmon)	Likelihood that species is present within the project area? (based on professional opinion of pre-field review preparer) **
Vascular Plants				
Agoseris elata	S	No		Low
Bolandra oregana	D	No		Low
Botrychium montanum	D	No	D	Low
Calochortus longebarbatus var. *longebarbatus*	S	No		Low
Carex heteroneura (C. atrata var. *erecta)*	D	No		Low
Carex densa	S	No		Low – Moderate (historic known site in Upper Lewis River watershed)
Carex stenophylla (C. eleocharis)	S	No		Low
Chrysolepis chrysophylla	D	No	D	Low
Cicuta bulbifera	S	No		Low
Cimicifuga elata	D	No	D	Low
Coptis asplenifolia	S	No		Low
Coptis trifolia	S	No		Low
Corydalis aquae-gelidae	D	No		Low
Cryptantha rostellata	S	No		Low
Cyperus bipartitus (C. rivularis)	S	No		Low
Cypripedium fasciculatum	D	No	D	Low - Moderate
Cypripedium montanum	D	No	D	Low - Moderate
Damasonium californicum	S	No		Low
Erigeron howellii	S	No		Low
Erigeron oreganus	S	No		Low

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Eryngium petiolatum	S	No		Low
Euonymus occidentalis	S	No		Low
Fritillaria camschatcensis	S	No		Low
Galium kamtschaticum	S	No		Low
Heuchera grossulariifolia var. *tenuifolia*	S	No	D	Low
Howellia aquatilis (Threatened)	S	No		Low
Linanthus bolanderi	S	No		Low
Liparis looselii	S	No		Low
Lomatium suksdorfii	S	No		Low
Luzula arcuata	D	No		Low
Meconella oregana	S	No		Low
Microseris borealis	D	No	D	Low - moderate
Mimulus jungermannioides	S	No		Low
Mimulus pulsiferae	S	No		Low
Mimulus suksdorfii	S	No		Low
Montia diffusa	D	No	D	Low
Navarettia tagetina	S	No		Low
Ophioglossum pusillum	S	No		Low
Parnassia fimbriolata var. *hoodiana*	S	No		Low
Pedicularis rainierensis	S	No		Low
Penstemon barrettiae	D	No		Low
Pityopus californica	S	No		Low

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Platanthera orbiculata var. *orbiculata*	S	No		Low
Platanthera sparsiflora	S	No		Low
Poa laxiflora	S	No		Low
Poa nervosa	S	No		Low
Polemonium carneum	S	No		Low
Potentilla breweri	S	No		Low
Ranunculus populago	D	No		Low
Ranunculus reconditus	S	No		Low
Rorripa columbiae	S	No		Low
Scribneria bolanderi	S	No		Low
Sidalcea hirtipes	D	No		Low
Sisyrinchium sarmentosum	D	No	D	Moderate - High
Utricularia intermedia	D	No	D	Low
Veratrum insolitum	S	No		Low
Lichens				
Bryoria subcana	D	No		
Cetrelia cetrarioides	D	No		Low
Chaenotheca subroscida	D	No		Low - moderate
Collema nigrescens	D	No		Low
Dendriscocaulon intricatulum	D	No	D	Low
Dermatocarpon lurdum	D	No		Low
Hypogymnia	S	No		Low

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duplicata				
Hypotrachyna revoluta	S	No		Low
Leptogium burnetiae	S	No		Low
Leptogium cyanescens	S	No		Low
Leptogium rivale	D	No	D	Low
Lobaria linita var. *tenuoir*	D	No		Low
Nephroma bellum	D	No	D	Low
Nephroma occultum	D	No	D	Low
Pannaria rubiginosa	S	No		Low
Peltigera neckeri	S	No		Low
Peltigera pacifica	D	No	D	Low
Pilophorus nigricaulis	D	No		Low
Platismatia lacunosa	D	No		Low
Pseudocyphellaria rainierensis	D	No	D	Low
Tholurna dissimilis	D	No	D	Low - Moderate
Usnea longissima	D	No	D	Low
Bryophytes				
Encalypta brevicola var. *crumiana*	S	No		Low
Schistostega pennata	D	No	D	Low - Moderate
Scouleria marginata	S	No		Low
Tetraphis geniculata	D	No	D	Low - Moderate
Fungi List includes species that are Sensitive; Survey and Manage species that do not require surveys are listed in Appendix C. With the exception of *Bridgeoporus nobillisimus*, all species listed below are considered survey				

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Scientific name (Sensitive unless otherwise noted)	**Documented (D) or Suspected (S) on Forest**	**Site within project area?**	**Documented (D) within adjacent 5th field watershed (both Upper Lewis and White Salmon)**	**Likelihood that species is present within the project area? (based on professional opinion of pre-field review preparer) ****
impractical.				
Albatrellus ellisii	D	No	D	Low
Albatrellus flettii	D	No	D	Low - Mod
Bondarzewia mesenterica	D	No	D	Low - Mod
Bridgeoporus nobilissimus	D	No		Low
Cantharellus subalbidus	D	No	D	Low - Mod
Chrysomphalina grossula	D	No		Low
Clavariadelphus ligula	D	No		Low
Clavulina castanopes var. *lignicola*	D	No		Low
Clitocybe subditopoda	D	No		Low
Cordyceps capitata	D	No		Low
Cortinarius barlowensis	D	No		Low
Cortinarius bouderensis	D	No		Low
Cortinarius cyanites	D	No		Low
Cortinarius olympianus	D	No		Low
Entoloma nitidum	D	No		Low
Galerina cerina	D	No		Low
Galerina heterocystis		No		Low
Galerina vittaeformis	D	No		Low
Gastroboletus ruber	D	No	D	Low - moderate
Glomus radiatum	D	No		Low
Gomphus bonarii	D	No	D	Low - moderate

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Gomphus clavatus	D	No		Low
Gomphus kauffmanii	D	No		Low
Gymnomyces albietis	D	No		Low
Gyromitra californica	D	No		Low
Helvella elastica	D	No		Low
Hydnotrya subnix	D	No		Low
Leucogaster citrinus	D	No		Low
Leucogaster microsporus	D	No		Low
Mycena hudsoniana	D	No		Low
Mycena monticola	D	No		Low - moderate
Mycena overholtsii	D	No		Low
Mycena tenax	D	No		Low
Otidea smithii	D	No		Low
Polyozellus multiplex	D	No	D	Low - moderate
Ramaria amyloidea	D	No	D	Low - moderate
Ramaria celerivirescens	D	No		Low
Ramaria cyaneigranosa	D	No		Low
Ramaria gelatiniaurantia	D	No		Low
Ramaria rubrievanescens	D	No		Low - moderate
Rhizopogon evadens var. *subalpinus*	D	No	D	Low - moderate
Sarcodon fuscoindicus	D	No		Low
Sowerbyella rhenana	D	No		Low
Sparassis crispa	D	No		Low

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Spathularia flavida	D	No		Low
Tremiscus helvelloides	D	No	D	Low - moderate
Tyopilus porphyrosporus	D	No		Low

** The methodology used to determine the likelihood of occurrence was based on an example thought process for evaluating likelihood of occurrence and/or project effects prepared by R6 Interagency Special Status Sensitive Species Program staff, and which is posted for use on the Interagency Special Status Sensitive Species Program website at: http://www.or.blm.gov/ISSSP/Conservation_Planning-and-Tools.htm (USDA Forest Service 2004c).

Field Surveys

Botanical surveys were conducted in Sawtooth Huckleberry Restoration Project planning area from July through early October, 2007 (for complete survey documentation, consult Mt. Adams Botany Project file). Surveys were conducted for Sensitive botanical species, based on the Regional Forester's July 2004 list (USDA Forest Service 2004b); surveys for Category A and C Survey and Manage botanical species were also conducted.

Due to the seasonal nature of plant identification it is not always possible to completely survey a given area with a one time survey, however, the knowledge of plant-habitat relationships, growth habit, and flowering dates helps the investigator in this regard. The phenology of lichens, bryophytes and the fungus *Bridgeoporus nobillisimus*, is such that they can be identified throughout most of the year. Based upon this, surveys for these species are generally conducted at the same time as surveys for vascular plants.

In the 2004 Survey and Manage Record of Decision (USDA & USDI 2004a, pg. 6), the assumption was made that species being transferred from the Survey and Manage Program to the Sensitive Species Program that were not considered "survey practical" under the Survey and Manage Standards and Guidelines (most category B & D species, including most fungi), would not require survey under the Sensitive Species Program. Rather, other components of pre-project clearances (habitat evaluations etc.) will be utilized to evaluate potential risks to the species resulting from project activities. This evaluation is then used to prescribe project design features and/or mitigations to address these risks. Species that fall into this category are indicated in Appendix A. Of the Sensitive species not specifically targeted during surveys, the project area may provide habitat for 13 fungi and one lichen species. These species are addressed within the Determination of Effects section of this report.

No Federally-listed or Forest Service sensitive plant species were located within the project area. No survey and manage species were found in the project area.

Other Botanical Resources of Concern
Pothole lakes/wetlands/seeps within the project area (including those in Units 6, 7, 9 and 10) provide valuable habitat for moisture loving botanical species, particularly *Carex*. These areas also support a higher diversity of *Vaccinium* species. Although the Sensitive species *Sisyrinchium sarmentosum* (pale blue eyed grass) was not found within the project area, there are known sites located nearby, and these sites are associated with seasonally wet areas with canopy openings.

In addition, the Unit 3 hosted a diverse herbaceous understory, and large, mature, noble fir. These large noble fir are potential habitat for rare epiphytes, including pin lichens and *Tholurna dissimilis*, and for the Fuzzy Mendoze fungus (*Bridgeoporus nobillisimus*).

Environmental Effects

Threatened, Endangered & Proposed Plant Species
At this time there are no federally listed (proposed, endangered, threatened - TEP) plant species known to occur on the Forest, however one federally threatened species (*Howellia aquatilis*) is suspected. *Howellia aquatilis* was not located during project surveys. Thus, the alternatives will have **no effect** on federally listed botanical species.

Sensitive Species
Surveys performed within the project area failed to locate any Sensitive species. For this reason, the will be **no impact** on any survey practical Sensitive plant species in any of the alternatives.

Survey-impractical Sensitive Species
Within the Sawtooth Huckleberry Restoration Project, there was a low to moderate likelihood of occurrence for a number of Sensitive species, including 13 fungi species and 1 lichen species that were not specifically targeted during surveys, because they are considered survey impractical. These species are all thought to be associated primarily with late-successional/old growth forests (USDA & USDI 1994, 2001), though some of these species have been located in forests less than 80 years old. Because fungi "fruit" (produce visible sporocarps) unpredictably (i.e. may not fruit each year, vary in fruiting timing from year to year), surveys are not reliable indicators of presence or absence (absence of evidence is not evidence of absence). In addition, many fungi species require laboratory examination by an taxa expert for reliable identification. As a result, it is probable that many Sensitive fungi species are under-reported and under-collected across their ranges. In addition, the habitat requirements for many of the species are too broad or too poorly understood to allow for reasonable mitigations at a project scale, particularly when no sporocarps have been located within the project area.

It is unknown whether the survey impractical Sensitive species occur within the project's area of impact. For the purpose of analysis, we assume that there is potential for occurrence within the

project area and estimate whether the likelihood of occurrence is low, moderate or high, using guidelines set by Region 6 of the Forest Service (USDA Forest Service 2004c); the impact analyses (see below) reflect this assumption.

Lichens

Alternatives A, B and C
Direct and Indirect Effects

Chaenotheca subroscida
This species is an epiphytic "pin lichen". It grows deep in the furrows of the bark of mature and old-growth conifers. On the Gifford Pinchot National Forest, there is one known site for this species on the Cowlitz Valley Ranger District (ISMS Query, 2005). The site is located at 4600 ft. elevation, just SE of the junction of Killen Creek and Forest Service Road 2329, in a mixed stand of *Picea englemannii*, true firs and pine in an area of the 1918 Cispus Burn. The species was found growing on a mountain hemlock (*Tsuga mertensiana*) at this site. Three additional sites for this species are recorded in ISMS, all from the Six Rivers National Forest, Lower Trinity Ranger District.

Sawtooth Project area includes habitat that is somewhat similar to that of the known site on the Cowlitz Valley District, though the known site is not located in an adjacent or contigous area. Within the project area, large, old conifers (like those found in the West Twin Butte unit), are the most likely habitat for this species. *Chaenotheca subroscida* is a small, cryptic species that takes specialized knowledge to identify accurately (for these reasons this species is considered survey impractical), it is likely under-reported and under-collected. For these reasons, we presume that the likelihood of occurrence for this species within the project area is low – moderate. The proposed action will ensure the preservation of the largest conifers, particularly noble fir, within the West Twin Butte unit. In addition, the Steamboat Mountain RNA, located within 1 mile of the project area, will continue to provide undisturbed true-fir forest as habitat. In addition, based on the known site habitat description from the Gifford Pinchot National Forest, we presume that the montane habitat located within the mountain hemlock zone (such as that located on the slopes of Mt.Adams, within the Mt. Adams Wilderness area) will continue to provide undisturbed habitat for this species outside of the Sawtooth Planning area. For these reasons, Alternatives B and C *may impact Chaenotheca subroscida* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to this species.

Fungi

Timber harvest has demonstrated negative effects upon fungi (Amaranthus & Perry 1994; Byrd et al. 2000; Kranabetter & Kroeger 2001; Kranabetter & Wylie 1998; Perry et al. 1989; and others). Direct effects include removal of host trees necessary to sustain mycorrhizae, and destruction of mycelial networks. Indirect impacts include a reduction in the moisture retention capability of soils, duff and woody debris that provide habitat for fungal species, as a result of increased solar and wind penetration into stands. In addition, land based harvest techniques

result in soil compaction that can harm mycelia in the soil. The same techniques also tend to disturb existing woody debris and duff layers that support sabrobic species of fungi.

Because land based harvest techniques result in soil distubance and compaction, alternatives incorporating these techniques negatively impact fungi more than alternatives such as skyline yarding or helicopter logging. For this reason, it is likely that alternatives incorporating these techniques are less effective in preserving fungal diversity, including rare fungal species. Alternatives that incoporate helicopter harvest techniques that cause less ground disturbance are likely to cause the least damage to fungi species that may be present in the project area.

Alternatives A, B and C
Direct and Indirect Effects

Albatrellus ellisii
This species is a mycorrhizal fungus that grows solitary, scattered, gregarious, or in fused clusters on the ground in forests. It fruits in late summer and autumn. We know very little about the habitat needs of this species, except that it is a forest dwelling species. It is known from widely scattered sites (15 sites reported in 2005 ISMS query; 0 from random grid CVS plots) from California, Oregon and Washington State. On the Gifford Pinchot National Forest, this species is known from the south side of Mt. Adams, in the Morrison Creek and Hole-in-the-Ground drainages, which are located east of the Cascade Crest. The one site currently recorded from the Forest in ISMS (2005) is located at 3680 ft. elevation. It is unknown whether the area encompassing Sawtooth Huckleberry Restoration area hosts this species, but the likelihood of occurrence within the area is estimated to be low, since the habitat from which it has been reported on the Gifford Pinchot National Forest is dissimilar to that found within the project area, and located at great distance from the known site. Based on these factors, Alternatives B and C **may impact** *Albatrellus ellisii* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to this species.

Cordyceps capitata
This species is a fungus that grows as a parasite on *Elaphomyces* species (another fungus); *Elaphomyces* are sequestrate (below ground) fungi. *Elaphyomyces* spp. may be mycorrizally associated with various conifer spp. *Cordyceps capitata* is recorded from 16 sites across California, Oregon and Washington State (ISMS query 2005); it is known from one site on the Gifford Pinchot National Forest, from a 1997 collection from Skamania County (Forest Sciences Laboratory (FSL) database query 2005); no additional habitat information is available for this site. It is unknown whether the area encompassing Sawtooth Huckleberry Restoration Project hosts this species, but if *Cordyceps capitata* grows within the project area, it is likely associated with the conifer species that grow within the timber sale area (the association would be indirect through direct association with *Elaphomyces*). The likelihood of occurrence within the area is estimated to be low, since only one site for this species has been located on the Forest, and there were no random grid "hits" for this species, suggesting that it is quite rare across the range of the Northwest Forest Plan. The proposed action will retain some forest canopy within each of the treated stands, which would increase the potential for the species to persist within the units, despite harvest activities, if it is indeed present. Forest outside the boundaries of the project area,

including Steamboat Mountain RNA, located within 1 mile of the project area, will continue to provide undisturbed true-fir forest as habitat. Therefore, Alternatives B and C **may impact** *Cordyceps capitata* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will have **no impact** on *Cordyceps capitata*.

Gomphus kauffmanii

This species is a mycorrhizal fungus that fruits in Autumn, and grows closely clumped to caespitose, partially hidden in deep humus, and appears to be associated with *Pinus* and *Abies* spp. It was collected in 1998 from Skamania County in October (3 sites) (Forest Sciences Laboratory Database 2005). The species is recorded in ISMS from 22 additional sites across California, Oregon and Washington (ISMS query 2005); CVS random grid surveys located 3 sites for this species, 2 from the Willamette National Forest, and 1 site from the Shasta Trinity National Forest (CVS query 2005). If *Gomphus kauffmanii* grows within the project area, it is likely associated with western white pine (*Pinus monticola*), grand fir (*Abies grandis*) or silver fir (*A. amabilis*). The likelihood of occurrence within the project area is estimated to be low, since the Sawtooth project area does not tend to have deep humus. In addition, few sites for this species have been located on the Gifford Pinchot National Forest, none within the 5th field watershed adjacent to the project area. Therefore, Alternatives B and C **may impact** *Gomphus kauffmanii* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will have **no impact** on *Gomphus kauffmanii*.

Gyromitra californica

This species is a saprobe on wood and litter, and normally fruits in June (late April – early July) on or adjacent to well-rotted conifer stumps or logs, or on soil that incorporates a lot of well rotted woody debris. This species is known from 34 sites in California, Oregon and Washington (ISMS query 2005). Random grid surveys across the Northwest Forest Plan area located five sites for this species on the Willamette, Mt. Baker-Snoqualmie and Olympic National Forests. Five additional sites for this species (4 in Washington State and 1 in Oregon) are recorded in Forest Science Laboratory database (query 2005). On the Gifford Pinchot National Forest, the species is known from one site on the Cowlitz Valley District, in an old-growth riparian forest near East Canyon Creek, at 2400 ft. It is not known from either the Upper Lewis or White Salmon River watersheds. Based on the habitat attributes of the known site on the Forest, and dissimilarity to the habitat available within the project area, we estimate a low likelihood of occurrence for this species within the project area. Therefore Alternatives B and C **may impact** *Gyromitra californica* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will have **no impact** on *Gyromitra californica*.

Leucogaster citrinus

This species is a Pacific Northwest endemic, fall fruiting, sequestrate fungus that is a mycorhizzal associate of conifer species including *Abies concolor*, *A. lasiocarpa*, *Pinus contorta, P. monticola*, *Pseudotsuga menziesii*, and *Tsuga heterophylla* from 280 to 2,000 m elevation. It is recorded in ISMS from 12 sites across the Northwest Forest Plan area (ISMS query 2005); the FSL database lists 7 sites from Thurston County,Washington, Linn, Benton and Curry Counties

in Oregon, and in Siskiyou County, California (query 2005). CVS random grid surveys detected this species at 52 sites, 10 of which occurred on the Gifford Pinchot National Forest – these locations are scattered across the forest (CVS query 2005). This data suggests that the species may be fairly well distributed across the Gifford Pinchot National Forest. Because it is a sequestrate (below ground) fungus, it is likely under-reported. However, the elevational range in which this species is reported is substantially lower than than that of the montane to subalpine habitat found within the project area. Based on lack of suitable habitat, there appears to be a low likelihood of occurrence within the project area. Therefore, Alternatives B and C **may impact** *Leucogaster citrinus* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Leucogaster citrinus*.

Mycena monticola

This species is mostly fall fruiting (though it was collected from Klamath County, Oregon in March). It is a sabrobe on wood or litter, and is generally restricted to conifer forests (especially with *Pinus* spp. present) above 1,000 meter in elevation. It is a Pacific Northwest endemic species; ISMS lists 143 sites for this species within the range of the Northwest Forest Plan (ISMS query 2005). The Forest Sciences Laboratory database records an additional 20 sites throughout Oregon, Washington and California (2005 query). CVS random grid surveys detected this species at 16 sites across California, Oregon and Washington, two of these detections occurred on the Gifford Pinchot National Forest. On the Gifford Pinchot National Forest, it has been found growing west of Goose Lake, and South of Council Lake, growing nearby road 60, adjacent to the Big Lava Bed (Mt. Adams District), and in a Silver-fir/vanillaleaf-beadlily plant community at 3100 ft. on the Mt. St. Helens District. Based on the habitat attributes of known sites on the Gifford Pinchot National Forest, the fact that random grid surveys detected this species on the Gifford Pinchot (suggesting that it is more widespread than probably is recognized), and superficial similarity to habitat found within the project area, we estimate a low - moderate likelihood of occurrence for this species within the project area. We presume that similar habitat found outside the project area (in Indian Heaven wilderness, and along the crest of the Cascades), will continue to provide habitat, if undetected occurrences do exist within the project area. Therefore, Alternatives B and C **may impact** *Mycena monticola* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will have **no impact** upon *Mycena monticola*.

Otidea smithii

This species grows as a saprobe on wood and litter, and grows solitary to gregarious, often under *Populus trichocarpa*, *Pseudotsuga menziesii*, and *Tsuga heterophylla*. The species fruits in late summer and fall. ISMS records this species from 10 sites across California, Oregon and Washington; 3 from the Gifford Pinchot National Forest. The Forest Sciences Laboratory database records an additional 12 sites for this species, 2 from the Gifford Pinchot National Forest. CVS random grid surveys failed to detect this species. On the Gifford Pinchot National Forest, this species has been located on the Cowlitz Valley District, near the confluence of the Cispus River and Yellowjacket Creek, and near the Camp Creek Falls trailhead. It is unknown whether the project acrea provides suitable habitat for this species. Based on the habitat attributes of the Cowlitz Valley District sites, dissimilarity to the habitat available within the project area, and substantial distance of known sites from the project area, there appears to be a

low likelihood of occurrence for this species within the project area. Therefore, Alternatives B and C **may impact** *Otidea smithii* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Otidea smithii*.

Ramaria cyaneigranosa

This species is a Pacific Northwest endemic, fall fruiting fungus (mostly in October) recorded in ISMS from 32 sites in California, Oregon and Washington (ISMS query 2005). The Forest Sciences Laboratory database records an additional 15 sites from California, Oregon and Washington. CVS random grid surveys failed to detect any sites for this species. On the Gifford Pinchot National Forest, the species is known from a single site within the Cispus River drainage (within the Cispus burn area), at 1900 ft. It is likely a mycorrhizal species. It is generally associated with conifer species, including *Abies* spp., *Pseudotsuga menziesii*, and *Tsuga heterophylla*. It is unknown whether the project area provides suitable habitat for this species. Based on the habitat attributes of the Cowlitz Valley District site (damp, west Cascades, in an area where extensive burns had occurred early in the century) there appears to be little similarity between habitat at this site and that found within the Sawtooth project area, which is higher elevation, montane to subalpine habitat. In addition, the known occurrence for this species on the Forest is widely disjunct from the project area. Based on this information, we estimate that there is a low likelihood of occurrence for this species within the project area. Therefore Alternatives B and C **may impact** *Ramaria cyaneigranosa* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Ramaria cyaneigranosa*.

Ramaria gelatiniaurantia

This species is a Pacific Northwest endemic, fall fruiting mycorrhizal fungus. ISMS reports this species from 24 sites in California, Oregon and Washington (none from the Gifford Pinchot National Forest). The FSL database records 11 additional sites for this species within these states, including one site from Skamania County, on the Gifford Pinchot National Forest (Forest Sciences Laboratory database query 2005). CVS random grid surveys failed to detect this species. *Ramaria gelatiniaurantia* is generally associated with conifer species, including *Abies* spp., *Pseudotsuga menziesii*, and *Tsuga heterophylla*. It is unknown whether the project area provides suitable habitat for this species. Since little is known about the habitat characteristics of the site in Skamania County, it is impossible to know whether it corresponds closely with habitat found within the project area. However, most of the sites reported for this species within ISMS and the Forest Sciences Laboratory database seem to be from moist westside conifer forests (sites in California are from coastal counties, and those reported from nearby Mt. Hood National Forest are all from Clackamas County, which is west of Mt. Hood). Such broad scale interpretation of habitat characteristics does not provide substantive information on which to base an estimate of likelihood of occurrence. Lacking further information about this species, and the Skamania County site where it is found, we estimate that the likelihood of occurrence is low to moderate. The prescriptions for thinning within the project area will – in many units - retain a diverse mixture of species within the stands. In addition, similar habitat located adjacent to the project area, in Steamboat Mountain RNA, the Indian Heaven Wilderness, and along the crest of the Cascades, will presumably continue to provide undisturbed habitat for this species, if it is present in the area. Presumably, this will result in the maintenance of some of the mycelial

networks that may currently exist within these stands. Therefore, Alternatives B and C **may impact** *Ramaria gelatiniaurantia* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Ramaria gelatiniaurantia*.

Ramaria rubrievanescens

This mycorrhizal species fruits in humus or soil, and matures above ground in June, September and October. *Ramaria rubrievanescens* is associated with Pinaceae spp. This species is recorded in ISMS from at least 53 sites across California, Oregon and Washington State (ISMS query 2005). The Forest Sciences Laboratory database records the species from 20 additional sites within these states. CVS random grid surveys detected this species at 4 sites, all in Oregon State. On the Gifford Pinchot National Forest, this species is reported from one site, near Takhlakh Lake, at 4300 ft. in elevation, on the western foot of Mt. Adams. The Sawtooth project area hosts both western white pine (*Pinus monticola*) and lodgepole pine (*Pinus contorta*). Superficially it appears that the habitat from which this species is known to occur on the Forest is somewhat similar to that located within the project area. The known site, however, is quite disjunct from the project area. For this reason, the likelihood that this species occurs within the project area is considered low - moderate. Similar habitat located adjacent to the project area, in the Indian Heaven Wilderness and along the crest of the Cascades, will presumably continue to provide undisturbed habitat for this species, if it is present in the area. Based on this information, Alternatives B and C **may impact** *Ramaria rubrievanescens* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Ramaria rubrievanescens.*

Sarcodon fuscoindicus

This mycorrhizal species fruits on soil, in autumn and winter. In the Pacific Northwest, the species is most often found in conifer forests, and appears to associate with hemlock and pine. In ISMS, this species is recorded from at least 41 sites across California, Oregon and Washington – 2 sites from Gifford Pinchot National Forest (ISMS query 2005). The Forest Sciences Laboratory database reports 56 additional sites; 2 from Skamania County and 1 from Lewis County. CVS random grid surveys detected this species from 9 sites across the Northwest Forest Plan area, 5 on the Gifford Pinchot National Forest. On the Gifford Pinchot National Forest, this species is known from the Cowlitz Valley District, at LaWisWis Campground, and from two sites in Skamania County (one on the Mt. St. Helens National Volcanic Monument). It is unknown whether the project area provides suitable habitat for this species; little is known about the specific habitat characteristics of random grid sites on the Forest, or sites reported by FSL to occur in Skamania County. Lacking more detailed information, but based on the proximity of the known sites to the project area, the likelihood of species occurrence within the project area is estimated to be low to moderate. We presume that similar habitat located adjacent to the project area, in the Indian Heaven Wilderness area and along the crest of the Cascades, will continue to provide undisturbed habitat for this species, if it is present in the area. As a result, Alternatives B and C **may impact** *Sarcodon fuscoindicus* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Sarcodon fuscoindicus*.

Sowerbyella rhenana

This species in a saprobe on litter, known from 68 scattered sites from California to Washington (2005 ISMS query); the Forest Sciences Laboratory database reports this species from 21 additional sites across this range; one site from Lewis County, on the Gifford Pinchot National Forest. A 2005 ISMS query reports 2 additional sites near the confluence of the Cispus River and Yellowjacket Creek on the Gifford Pinchot National Forest. The CVS random grid study failed to detect this species. Its habitat appears to be moist duff in relatively undisturbed, older conifer forests. Since (in contrast) the stands comprising Sawtooth have a long disturbance history prior to active fire suppression, and very little forest duff, and because the project area habitat is quite different from that hosting known sites of the species on the Forest, the likelihood of species occurrence within the project area is estimated to be low. As a result, Alternatives B and C **may impact** *Sowerbyella rhenana* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Sowerbyella rhenana.*

Spathularia flavida

This species is a saprobe on litter, and grows in clusters or fairy rings on woody debris in forests, fruiting in summer-fall. ISMS reports this species from 38 sites across the Northwest Forest Plan area (ISMS query 2005). CVS random grid surveys detected this species at 10 locations, 5 from the Gifford Pinchot National Forest. The Forest Sciences Laboratory database also reports this species from the Cispus Environmental Learning Center on the Gifford Pinchot National Forest. From the wide variety of reported areas where this species has been found, this species appears to have a rather wide ecological amplitude and environmental tolerance. It is unknown whether the project area provides suitable habitat for this species, but based on habitat information from records of known sites, it appears to have a low-moderate likelihood of hosting the species. We presume that similar habitat located adjacent to the project area, within Indian Heaven Wilderness, Steamboat Mountain RNA, and along the crest of the Cascades, will continue to provide undisturbed habitat for this species, if it is present in the area. As a result, Alternatives B and C **may impact** *Spathularia flavida* individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species. The no action alternative will result in **no impact** to *Spathularia flavida.*

Alternatives A, B and C

Cumulative Effects

Montane to subalpine habitat

Since the advent of active fire suppression, early successional habitat in montane to subalpine areas within the Pacific Northwest's Cascade Range has been steadily reduced. The associated plant communities have, as a result, shifted to favor development of mature to late-successional habitat in these areas. Maintenance of natural disturbance regimes, or management that mimics these regimes, is important for retaining plant community diversity in this ecosystem. Sawtooth Huckleberry Restoration Project seeks to return a portion of the historic berry fields to an early (or earlier) successional state, to increase the diversity of age classes and structures within the project area. Though restoration activities will cause short term, localized distubance to soils and vegetation, over time, there will be a substantial benefit in added plant and habitat diversity. Because silvicultural management for the purpose of timber sales is generally restricted to lower elevation forests without a large component of Pacific Silver Fir, there are few other similar

activities occurring on the Gifford Pinchot National Forest within this ecosystem type, so the cumulative effects of this project area are likely to be small.

Sensitive species
Currently, there are multiple efforts proceeding across Region 6 of the Forest Service to gain more information about the habitat associations, distribution and abundance of Sensitive species (compilation of the results and statistical inferences based on the CVS random grid study is one example). Additional information gained through these surveys and studies will help us better identify potential habitat, judge risk, and mitigate for impacts for these species in the future. Based on our present understanding, none of the Sensitive botanical species, other rare and uncommon botanical species, or potential habitat for these species, is either so limited in distribution, habitat, or number that project activities (with incorporated design features), in combination with past or reasonably forseeable future actions on nearby federal land and adjacent private land, are likely to lead to a trend towards federal listing for these species, or threaten the viability of entire populations or species as a whole.

Existing Condition and Risk Assessment of Invasive Plant Species

Within thinning units which aren't harvested over snow, and within controlled burn units, there will be a substantial amount of ground disturbance and opening of the canopy during the course of timber harvest activities. Ground disturbance exposes available habitat for noxious weeds, while timber harvest exposes newly created disturbed areas to increased solar radiation, ideal conditions for early seral, weedy species. Areas experiencing ground disturbance within the project area will, therefore, be highly susceptible to noxious weed and invasive plant colonization, particularly since there are already invasive species growing along access roads to the units (see list below). In order to control noxious weed colonization and spread under Alternative A, weed-spread prevention and weed eradication activities should be implemented before, during and after project activities.

No invasive plants were observed along Forest Roads 2400, 2480, or along spurs within or directly adjacent to the project area. Tansy ragwort (*Senecio jacobaea*) becomes frequent and well distributed at lower elevations along Forest Road 30, and more scattered (but present) at lower elevations along Forest Road 24. In addition, *Centaurea stoebe* (spotted knapweed) is known from an isolated sites along the 3200000 and 320743, a few miles to the north of the project area. Both these species are designated Class B weeds by Washington State.

Of the three types of weed classifications in Washington state, Class A weeds require immediate eradication efforts. Class B weeds require active control. Class C weeds require monitoring, and project work, with the eventual goal of elimination.

Non-native plants include those species introduced intentionally or unintentionally to areas where they do not naturally occur. Invasive non-native plants in the Pacific Northwest most often originate from Europe and Asia. Problems can arise when the associated natural predators and diseases that controlled these species in their native habitats are not present in the habitat where they are introduced. If a species is unchecked by predators, it may become invasive, dominating the site and altering ecosystem balance. The results may include changes in biodiversity, fire frequency, soil erosion and hydrology of a site. Other effects include poisoning of livestock and

reducing the quality of recreational experiences. In 2006, there were an estimated 2,000 invasive and noxious weed species in the U.S and 130 class A, B & C weeds in Washington State.

Forest Service Manual direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, recent Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.03, 11/29/95). In addition, the Pacific Northwest Region Invasive Plant Program Record of Decision for Preventing and Managing Invasive Plants (USDA 2005) provides invasive plant prevention and treatment/restoration standards and direction on all National Forest Lands within Region 6.

The Sawtooth Huckleberry Restoration Project has a *moderate* risk of introducing or spreading noxious weeds. The following vectors contribute to this assessment:

- Heavy equipment (implied ground disturbance including compaction or loss of soil "A" horizon.)
- Recreationists (hikers, mountain bikers, etc)
- Forest Service or other project vehicles

Project design criteria and prevention measures have been included (see Chapter 2) to reduce this risk.

Wildlife

This section summarizes and incorporates by reference the Sawtooth Wildlife Biological Evaluation. The full biological evaluation is located in the project file.

The purpose of this section is to determine the effects of the project on federally listed species, and their critical habitats, and to determine the need for consultation or conferencing with the U.S. Fish and Wildlife Service. This examination also includes analysis of and impacts to the Region 6 Sensitive species and wildlife species covered under the February 1995 *Gifford Pinchot National Forest Land and Resource Management Plan, Amendment 11*(Forest Plan).

The analysis area used for the wildlife effects analysis includes all lands that are within 1.82 miles of the proposed units. This distance is the average home range radius for spotted owls in the western Cascades. Of the management indicator species for the Gifford Pinchot National Forest that may occur in the area, the spotted owl has the largest home range during the breeding season. For this reason, it is appropriate to base the impact analysis on the potential effects to spotted owls. The analysis area totals 22,164 acres.

Table 22 lists the TES species considered in this evaluation, and summarizes the effect to each with each action alternative.

Table 22. Summary of effects to threatened, endangered, proposed, and sensitive species.				
Species Name	**Species Status**	**Species habitat present within or adjacent to the project area?**	**Species documented in the project area?**	**Effect Summary – Action Alternatives**
Gray Wolf *Canis lupus*	Endangered	Yes	No	No Effect
Grizzly Bear *Ursus arctos*	Threatened	No	No	No Effect
Canada Lynx *Lynx canadensis*	Threatened	No	No	No Effect
Pacific Fisher *Martes pennanti pacifica*	Candidate	No	No	No Impact
California Wolverine *Gulo gulo*	USFS Sensitive	Yes	No	No Impact
Western Gray Squirrel *Sciurius griseus*	USFS Sensitive	No	No	No Impact
Townsend's Big-eared Bat *Corynorhinus townsendii*	USFS Sensitive	No	No	No Impact
Bald Eagle *Haliaeetus leucocephalus*	Protected	Yes	No	No Effect
Northern Spotted Owl *Strix occidentalis caurina*	Threatened	Yes	No	May Affect, Not Likely to Adversely Effect
Critical Habitat for the Northern Spotted Owl	Designated	No	No	No Effect
Marbled Murrelet *Brachyramphus marmoratus*	Threatened	No	No	No Effect
Critical Habitat for the Marbled Murrelet	Designated	No	No	No Effect

Table 22. Summary of effects to threatened, endangered, proposed, and sensitive species.

Species Name	Species Status	Species habitat present within or adjacent to the project area?	Species documented in the project area?	Effect Summary – Action Alternatives
Common Loon *Gavia immer*	USFS Sensitive	No	No	No Impact
Ferruginous Hawk *Buteo regalis*	USFS Sensitive	No	No	No Impact
American Peregrine Falcon *Falco peregrinus anatum*	USFS Sensitive	No	No	No Impact
Green-tailed Towhee *Pipilo chlorurus*	USFS Sensitive	No	No	No Impact
Northwestern Pond Turtle *Clemmys marmorata marmorata*	USFS Sensitive	No	No	No Impact
Striped Whipsnake *Masticophis taeniatus*	USFS Sensitive	No	No	No Impact
California Mountain Kingsnake *Lampropeltis zonata*	USFS Sensitive	No	No	No Impact
Oregon Spotted Frog *Rana pretiosa*	Candidate	Yes	No	No Impact
Larch Mountain Salamander *Plethodon larselli*	USFS Sensitive	No	No	No Impact
VanDyke's Salamander *Plethodon vandyke*i	USFS Sensitive	No	No	No Impact
Cope's Giant Salamander *Dicampton copei*	USFS Sensitive	No	No	No Impact
Cascade Torrent Salamander *Rhyacotriton cascadae*	USFS Sensitive	No	No	No Impact
Mardon Skipper	Candidate	No	No	No Impact

Table 22. Summary of effects to threatened, endangered, proposed, and sensitive species.				
Species Name	**Species Status**	**Species habitat present within or adjacent to the project area?**	**Species documented in the project area?**	**Effect Summary – Action Alternatives**
Polites mardon				
Puget Oregonian *Cryptomastix devia*	USFS Sensitive	No	No	No Impact
Burrington's Jumping Slug *Hemphillia burringtoni*	USFS Sensitive	Yes	No	No Impact
Warty Jumping Slug *Hemphillia glandulosa*	USFS Sensitive	Yes	No	No Impact
Malone's Jumping Slug *Hemphillia malonei*	USFS Sensitive	Yes	Yes	May impact individuals, no trend towards federal listing
Panther Jumping Slug *Hemphillia pantherina*	USFS Sensitive	Yes	No	No Impact
Columbia Duskysnail *Lyogyrus n. sp. 1 (Amnicola sp. 4 - G2)*	USFS Sensitive	No	No	No Impact
Blue-gray Taildropper *Prophysaon coeruleum*	USFS Sensitive	Yes	No	No Impact
Dalles Sideband *Monadenia fidelis minor*	USFS Sensitive	No	No	No Impact

Species Dropped from Further Analysis

Only those species that were identified in the table above as having a potential to be affected by this project because the analysis area contains suitable habitat will be discussed further in this

analysis. For a complete description of the rationale for not including other species, see the Wildlife Biological Evaluation in the project file.

Existing Condition and Effects Analysis

Federally-Listed Species

Northern Spotted Owl

Species Account

The northern spotted owl (*Strix occidentalis caurina*) was listed as a threatened species throughout its range in Washington, Oregon and northern California effective July 23, 1990 (USDI, 1990a). Loss of late-successional forest habitat from timber harvest was the primary reason for the listing.

The status review for the northern spotted owl completed in 2004 found that the major threats at this time include effects of past and current timber harvest, loss of habitat from fire, and competition with barred owls. Of the threats identified at the time of listing, only one, predation linked to forest fragmentation, does not now appear well supported (Courtney et al. 2004).

Old forest habitat in and near the analysis area has been affected historically by large wildfires and more recently by past timber harvest. In addition to natural fire starts, Native Americans set fire to logs for the purpose of drying berries, and lingering fires sometimes spread. Fires were also set intentionally to maintain berryfields or to keep hunting areas open. The northern half of the analysis area was burned in the 1902 Lewis River Fire (Middle Lewis Watershed Analysis, 1995). Most present timber stands within the Sawtooth area were naturally established following stand replacement wildfires (1897) and reburns (Twin Buttes Fire – 1910) (Silviculture Report). Portions of the acres burned in these fires burned completely and these areas are often characterized today by dense single-story stands with medium to small diameter trees. Other stands appear to have burned less completely, and these contain remnant larger trees with a dense small tree understory.

About 6,400 acres in the analysis area is mapped in the Forest's GIS database as suitable habitat for spotted owls. Of this, 4,093 acres is mapped as nesting/roosting/foraging habitat, and 2,308 acres is mapped as foraging habitat. Most of this mapping work was done through interpretation of aerial photographs, with little or no ground-truthing. On the ground inspections of the stands mapped as suitable habitat revealed that many are younger fire-regenerated stands that have remnant old trees that survived the fire. They are not typical old multi-story stands, and in some the understory conifers are quite dense, which limits the ability of spotted owls to use them. Proposed treatment Units 1, 3, 4, and 5, which are all mapped currently as suitable spotted owl habitat, are examples of this. Aerial photos taken in 1948, 1958, 1973 and 1989 show that, until the early 1990s, proposed Units 1, 4, 5, and most of Unit 3 were all relatively open with scattered large trees that had survived the fires. Now that understory trees have grown larger, they appear on the newer air photos to be multi-story older stands, but dense understories and general lack of large logs and snags limits the value for spotted owls.

In addition, of much of the habitat that is mapped as suitable for spotted owls probably has limited value due to the relatively high elevation. In the western Cascades of Washington, spotted owl nesting is generally limited to coniferous forests that are below 4,000 feet in elevation (Vince Harke USFWS pers. comm. 2007; Interim Spotted Owl Management Plan, Gifford Pinchot National Forest, 1980) although nest sites have been documented above 4,000 feet. Approximately 42 percent of the analysis area is above 4,000 feet elevation, including 40 percent of the mapped suitable spotted owl habitat. The Sawtooth units that are mapped as suitable spotted owl habitat are mostly above 4,000 feet. There are no historic spotted owl activity centers in the analysis area, although there are several surrounding the analysis area at lower elevations. The combination of the disturbance history that created open stands that lasted until recently, and the relatively high elevation indicate that the proposed units, and the analysis area in general, probably do not provide important spotted owl nesting and foraging habitat.

The lower fringe of proposed Unit 3 has structural characteristics that are found in suitable nesting and foraging habitat, however it is at about 4,000 feet elevation, and there is no known history of spotted owls using this stand based on the locations of historic activity centers. As recently as 1973 this stand was fairly open and was not suitable spotted owl habitat based on air photos. Even the 1989 air photos show that the unit probably did not provide suitable habitat at that time.

The importance of the analysis area for spotted owls however, may be as part of a movement corridor between the Lewis Late-Successional Reserve (LSR) west of the analysis area, and the Peterson LSR southeast of the analysis area. Currently, the analysis area contains about 13,630 acres that would support spotted owl dispersal (at least 40 percent canopy cover and 11 inch average dbh.). This is about 61 percent of the analysis area. It is generally accepted that spotted owls can successfully disperse through a landscape as long as at least 50 percent of the area supports dispersal habitat.

Figure 10 below shows the location of the proposed units in relation to suitable habitat above and below 4,000 feet elevation, and relative to LSRs on the Forest.

There is no Critical Habitat in the analysis area.

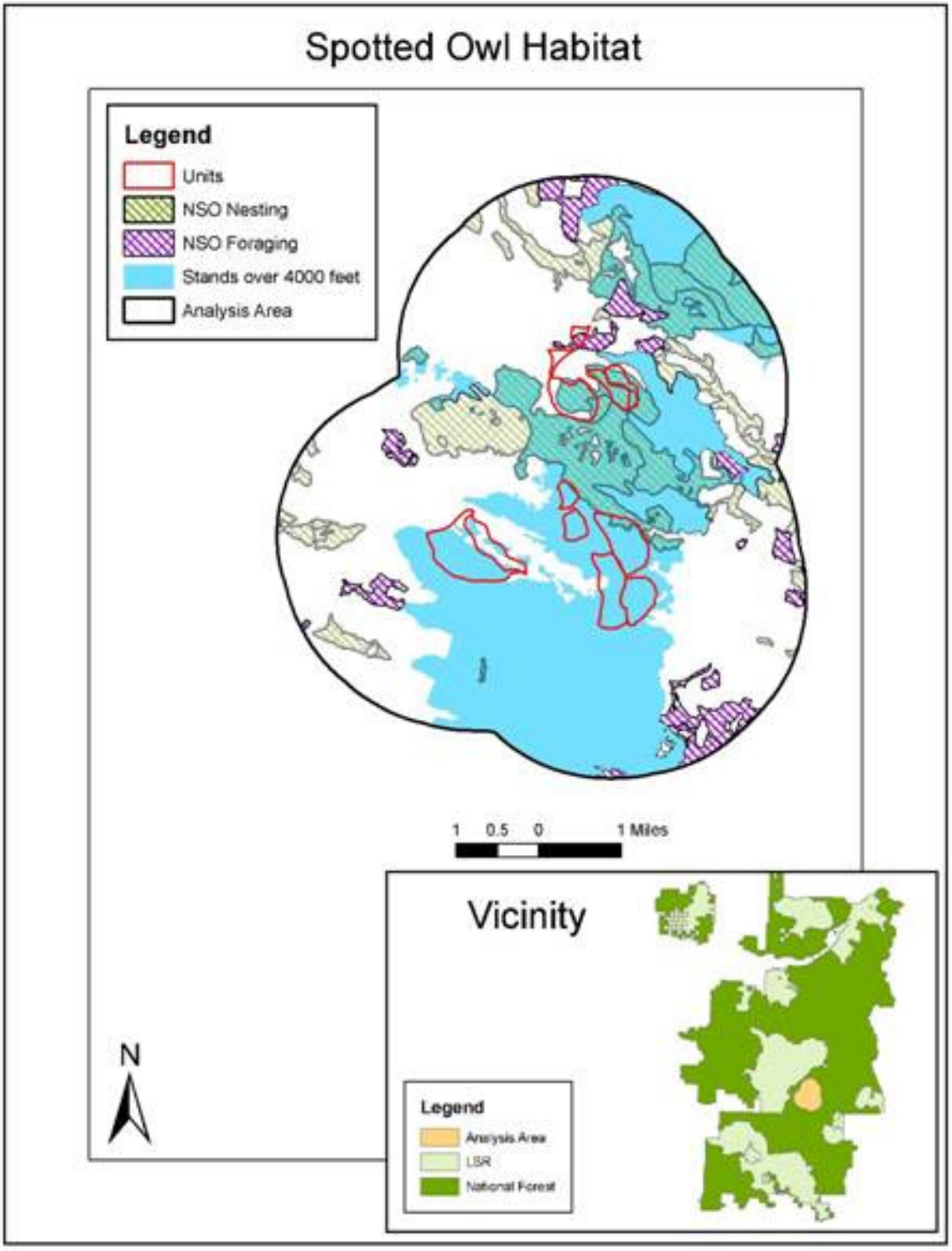

Figure 10. Suitable spotted owl habitat in the analysis area relative to elevation and the LSRs.

Alternative A -No Action
Direct and Indirect Effects
With this alternative, the stands proposed for treatment would continue to develop naturally. In the absence of fire or other major disturbance, the stands that currently do not provide dispersal habitat would develop that capability over time, gradually increasing the amount found in the analysis area. Some stands, especially Unit 3 that currently have large remnant trees, would probably develop into nesting habitat over time, but the relatively high elevation of the area makes it unlikely that spotted owls would nest there. There would be **no effect** to spotted owls or Critical Habitat and there would be no cumulative effects.

Alternative B - Proposed Action
Direct and Indirect Effects
With this alternative, there would be no effects to historic spotted owl activity centers, and no effect to suitable spotted owl nesting or foraging habitat due to the high elevation and disturbance history of the Sawtooth units. Proposed Units 2, 3 A & B, 4, 5, 10 A & B, and 11a provide habitat that could be used by spotted owls to move through the analysis area between LSRs and other lower elevation suitable habitat.

Treating these units to improve huckleberry production would require canopy reduction to a level that the stands would no longer be suitable for dispersal. This would reduce dispersal habitat in the analysis area by 432 acres, and reduce the percent of dispersal habitat in the analysis area from about 61 percent to about 60 percent. Since the available habitat in the analysis area would remain above 50 percent, spotted owls would still be able to move through the analysis area. These stands will all be treated with a moderate retention regeneration harvest or heavy thin. They will not be replanted, but natural regeneration will be allowed to grow. A minimum of 20 percent canopy cover would be maintained in these units after harvest, so these stands could become multi-story stands suitable for spotted owl dispersal in the future.

This alternative **may affect but is not likely to adversely effect** spotted owls. There would be **no effect** to Critical Habitat.

Alternative B – Proposed Action
Cumulative Effects
The current level of suitable habitat is the analysis area described above reflects all the past timber harvest, including the Skeeter Timber Sale, which was the most recent to be harvested in the analysis area.

Another timber sale, Shoo, has four units near the western edge of the analysis area (Units 10, 11, 12, and 13). This sale was planned and sold in 2003, but no timber has yet been cut. The four Shoo units were mapped as spotted owl dispersal habitat, and Unit 12 also contains about 11 acres of foraging habitat. With the Shoo Timber Sale approximately 40 acres of dispersal habitat was downgraded to non-habitat, 65 acres of dispersal habitat was degraded but remained dispersal habitat, and 11 acres of foraging habitat was downgraded to dispersal.

The Sawtooth project would remove an additional 432 acres of dispersal capable habitat. Since the amount remaining in the analysis area would be well over the 50 percent threshold, these cumulative effects would be minor.

Alternative C – Underburning
Direct and Indirect Effects
With this alternative the same units would be treated, although with more use of fire to kill small trees. The use of fire may create more standing small snags, but it is assumed that the units would still be opened up to the point of being unsuitable habitat. Prescribed burning is expected to occur in the late spring to early summer, after the fuels have dried, but while soils are still fairly moist. Normally this is the time of year when nesting owls could be affected by smoke from prescribed burning. Since there are no historic spotted owl activity centers, and nests are not expected to occur there due to the elevation, there would be no effects to spotted owls related to smoke.

Since the same units would be treated, with similar effects to habitat, the effects to spotted owls with this alternative, including cumulative effects, would be the same as described with the Proposed Action.

This alternative **may affect but is not likely to adversely affect** spotted owls. There would be **no effect** to Critical Habitat.

Gray Wolf
Species Account
Important wolf habitat is found in areas that support an abundant prey base, especially elk and deer, and have relatively low road densities (less than 1 mile per square mile). Gray wolves are not known to inhabit the Gifford Pinchot National Forest, and many areas of the Forest have road densities that are too high to provide secure long-term wolf habitat. The analysis area has a road density between 1.5 and 2 miles per square mile, so even though it supports some of the elements of wolf habitat, the high road density and year-round recreation use the area receives reduces the suitability. It is adjacent to Indian Heaven Wilderness, so it is near an area that would offer secluded habitat. Given the wide-ranging abilities of wolves, and the fact that wolves from Idaho have made their way into eastern Washington in the past, and it appears that wolves from Canada have made their way into north central Washington, it is possible that wolves will again inhabit portions of the southern Washington Cascades at some future time.

Alternative A - No Action
Direct and Indirect Effects
There would be no forage production increase that would result from tree cutting, for elk and deer with this alternative, and there would be a gradual decrease in forage production in the proposed units as conifers continue to fill in the openings. Since wolves are not likely to inhabit the area for some time, this alternative would have no effect, and there would be no cumulative effects.

Alternatives B and C
Direct and Indirecrt Effects
There would be a temporary increase in road density with construction of about 1,000 feet of road to access the top of Unit 3, and about a mile total of temporary road construction in other units. These roads would be closed and rendered undriveable after the harvest activity. Neither of the action alternatives would result in new permanent road construction so there would be no change in road density in the long-term. Removal of trees to benefit huckleberries would also maintain or increase forage production for elk and deer, helping to maintain ungulate populations. For these reasons, there would be no effect to gray wolves with either alternative. There would be no cumulative effects

USFS Pacific Northwest Region Sensitive Species

California Wolverine
Species Account
Like the gray wolf, the wolverine is a large carnivore that requires vast areas of undeveloped landscape encompassing a wide range of forest, shrub, riparian and alpine habitat types. This species is rare in Washington, and are known in the state to primarily inhabit the North Cascades, and Selkirk Mountains of northeastern Washington.

Wolverines are generally described as opportunistic omnivores in summer and primarily scavengers in the winter. Large ungulates comprise an important part of the wolverines' diet year-round, but especially in fall and winter when carrion makes up a large part of their diet. Wolverines could not survive strictly on a diet of small mammals (Ruggiero et al. 1994).

A verified detection of a wolverine was made in 2006 on the Yakama Reservation using a remote camera bait station, and in the past several years there have been a few unverified sightings on the Gifford Pinchot National Forest. This suggests that these animals may be present in the southern Washington Cascades, but whether these sightings represent resident animals or transient individuals is unknown. There have been no reported sightings in the Sawtooth analysis area, but given the wide-ranging nature of wolverines, it is possible that transient individuals could occur in Indian Heaven Wilderness and other areas of the Forest near the analysis area that have low road densities and sufficient prey base. Year-round recreational activity in the analysis area, and relatively high road density make it less likely that a resident wolverine would be found there.

Alternative A -No Action
Direct and Indirect Effects
There would be no forage production increase that would result from tree cutting, for elk and deer with this alternative, and there would be a gradual decrease in forage production in the proposed units as conifers continue to fill in the openings. Since wolverines are not likely to be resident in the analysis area due to year-round recreational use, this alternative would have no impact, and there would be no cumulative effects.

Alternatives B and C
Direct and Indirect Effects
There would be a temporary increase in road density with construction of about 1,000 feet of road to access the top of Unit 3, and about a mile total of temporary road construction in other units. These roads would be closed and rendered undriveable after the harvest activity. Neither of the action alternatives would result in new permanent road construction so there would be no change in road density in the long-term. Removal of trees to benefit huckleberries would also maintain or increase forage production for elk and deer, helping to maintain ungulate populations. For these reasons, there would be no impact to wolverines with either alternative. There would be no cumulative effects

Bald Eagle
Species Account
Bald eagles were recently delisted from the federal Threatened and Endangered Species list, but are still protected by federal law. Bald Eagles have been recently known to nest on the Forest near Swift Reservoir on the Lewis River and near Goose Lake, which is just south of Indian Heaven Wilderness. They require large trees for nesting and roosting located near bodies of water that support waterfowl and fish as available prey base.

Mosquito Lake in the analysis area may provide suitable habitat depending on the availability of stocked fish, but there are no known nests or roosts in the analysis area. Bald eagles may occasionally pass through the analysis area during seasonal migrations to wintering areas near the Columbia River. Proposed Unit 5 is located about 0.4 mile from Mosquito Lake and has trees large enough to be roost trees.

Alternatives A, B and C
Direct and Indirect Effects
The actions that would occur in either action alternative would preserve the remnant old trees in Unit 5 that could potentially serve as roost trees. There would be no impacts to water quality at Mosquito Lake. Since bald eagles are not known to nest around Mosquito Lake, there is no concern for noise disturbance. For these reasons there would be no impacts to bald eagles with any alternative and no cumulative effects.

Oregon Spotted Frog
Species Account
The Oregon spotted frog inhabits waters and associated vegetated shorelines of perennial ponds, springs, marshes and slow-flowing streams and appears to prefer waters with a bottom layer of dead and decaying vegetation. It is found in aquatic sites in a variety of vegetation types, from grasslands to forests. Females are reported to lay egg masses in communal clusters at locations that may be used in successive years. Larger ponds and lakes (greater than 9 acres) are thought to be important because the larger surface area equates to higher water temperatures for larval development (McAllister K.R. and Leonard W.P. 1997). Larvae have a diet of algae, plant material and other organic debris. Adults eat insects (ants, beetles, mosquito larvae, grasshoppers), spiders, mollusks, tadpoles, crayfish and slugs (McAllister and Leonard 1997).

This species can be found in Trout Lake Marsh north of Trout Lake, Washington, and it has been known from one site on the Forest just northeast of Trout Lake Marsh. Mosquito Lake and surrounding smaller ponds may be suitable habitat for this species. Smaller ponds and lakes including Surprise Lakes and Frog Lake may be suitable as well. Mosquito Lake is about 30 acres in size, and is about nine miles from the known site on the Forest and about twelve miles from Trout Lake Marsh. Surprise Lakes are partially within Unit 8, and Frog Lake is situated between Units 6 and 7. It is not known if spotted frogs inhabit the ponds in the analysis area, but they are all 3 acres or less in size.

Alternatives A, B and C
Direct and Indirect Effects
None of the alternative would impact habitat at lakes or ponds in the analysis area. Under the Forest Plan, these areas would be buffered by at least 150 feet where there would be no treatment. This no-treatment buffer would be sufficient to protect habitat for frogs. In addition, other wetlands and streams that may act as dispersal corridors would be buffered. For these reasons there would be **no impacts** to spotted frogs and no cumulative effects.

Larch Mountain Salamander
Species Account
This species occurs in old-growth forest, young naturally regenerated forest with residual late-successional features (large logs, bark piles), shrub-dominated communities, scree, talus, and lava tubes entrances where debris has accumulated. The surface geology and soil formation in the central portion of its range has been influenced by pumice deposits from volcanic eruptions. In this area, which includes much of the Gifford Pinchot National Forest, the species appears to be closely associated with old-growth forest, and is often found under woody debris. In the remainder of its range, (including the Sawtooth analysis area) where surface rock is abundant, populations are found in numerous vegetation types, and animals are generally found under gravel and cobble, and under woody debris to a lesser extent.

Alternatives A, B and C
Direct and Indirect Effects
The proposed units were inspected to determine if any contained suitable habitat. None of the proposed units contain open or forested talus, or old-growth habitat with abundant large down wood on steep slopes that are indicative of suitable habitat on the Gifford Pinchot National Forest. Since the units do not contain suitable habitat, there would be **no impacts** with either alternative.

Van Dyke's Salamander, Cope's Giant Salamander, and Cascade Torrent Salamander
Species Account
Van Dyke's salamanders are often associated with rocky, steep-walled stream valleys. In the Cascade Range, they are usually found under cobble and sometimes wood, within a few meters of a stream. They are most often in loose rock piles, seeps in the valley wall with loose rock or gravel, splash zones at the base of waterfalls, or adjacent to chutes and cascades. Van Dyke's salamanders have persisted at numerous locations that were severely disturbed by the 1980 eruption of Mount St. Helens (Jones et al. 2005). In addition, this species can be found in upland talus sites similar to Larch Mountain salamander.

Cope's giant salamanders are usually found in small rocky streams in coniferous or mixed forests, and are most abundant under large rocks in the pools in these streams. They are most abundant in undisturbed forests, but are somewhat resilient to logging and usually recover as the forest matures (Jones et al. 2005). Fully metamorphosed adults are uncommon for this species, so they are nearly always found in the streams and the streams need to be flowing year-round. There are no known locations in the watershed.

Cascade torrent salamanders are found in similar habitats. They require cool, wet environments. Both larvae and metamorphosed individuals occur along high-gradient, cold, rock-dominated stream courses and near seeps. The aquatic larvae are associated with valley and headwall seeps and spray zones at the base of waterfalls and cascades, where gravel and cobble are present with shallow (<1 cm), low-velocity flows. Adults are often interspersed among the larvae or on stream banks under rocks or wood. They are usually within 1 meter of the water, but during prolonged rain they may be found more than 10 meters away. This species has persisted in streams impacted by the 1980 eruption of Mount St. Helens, suggesting that forest cover may not be a critical habitat feature at higher elevations (Jones et al. 2005).

Cascade torrent salamanders have been documented in the stream approximately one-quarter mile west of Unit 1, which is a tributary to Upper Tillicum Creek, and in Upper Tillicum Creek as well. Neither VanDyke's salamander nor Cope's giant salamander have been documented in the analysis area.

Alternatives A, B and C
Direct and Indirect Effects
A small intermittent stream flows through proposed Units 9 and 10. Since it doesn't flow water year-round, it's not likely that any of these salamanders would be found there. Neither of the action alternatives propose treating conifers near any suitable stream habitat. There is no talus in any of the units that might be habitat for Van Dyke's salamander. For this reason, there would be **no impacts** to these species from any of the alternatives. There would be no cumulative effects.

Terrestrial Mollusks
Species Account
Under the 2001 Record of Decision for Survey and Manage Species the following species are Category A (pre-disturbance surveys, manage known sites): *Cryptomastix devia, Cryptomastix hendersoni, Hemphillia burringtoni, Monadenia fidelis minor*, and *Prophysaon coeruleum*. The following species is Category C (pre-disturbance surveys, manage high-priority sites): *Hemphillia malonei* and *Hemphillia glandulosa*.

Blue-gray taildropper (*Prophysaon coeruleum*) is only known on the Forest from four sites, all are late-successional sites on the Cowlitz Valley District. *Cryptomastix hendersoni* is known from both sides of the Columbia River from The Dalles east to Rufus, and more recently from the Clackamas River, and Hood River Ranger Districts on the Mount Hood N.F. The management recommendations for this species reports that there is no reason to expect this species on the Gifford Pinchot N.F., but that surveyors should be able to recognize it.

Monadenia fidelis minor is known from sites within the Columbia River Gorge in the vicinity of The Dalles and at the mouth of the Deschutes River. It is considered to have occurred historically in the central and eastern Columbia Gorge and south up the Deschutes River. *Cryptomastix devia* is always found near big-leaf maple (*Acer macrophyllum*). There is no big-leaf maple in or near any of the units, and probably none in the analysis area based on the relatively high elevation. It is highly unlikely that these four species exist within any of the proposed units and unlikely that they would be affected by any of the alternatives.

Mollusk surveys have been conducted in various timber stands in the analysis area between 1999 and 2001 for other proposed projects (including Sawtooth Unit 2 which was then part of the proposed Till Timber Sale). A total of 92 Malone's jumping slug site were documented within the analysis area during these surveys (none were in Sawtooth Unit 2). All of these previously known sites were protected as required under Survey and Manage by buffering the sites or dropping units. The Till Timber Sale was dropped before the environmental analysis was completed.

Mollusk surveys were conducted for this project in proposed Unit 3 during the fall of 2007. This was the stand that, based on inspection, appeared to have at least marginally suitable habitat, and given the history of known sites in the area, surveys were appropriate. Habitat is marginal in this unit due to the general lack of large woody debris. Four Malone's jumping slug sites were found in Unit 3, bringing the total number of known sites in the analysis area to 96. None of the four sites are in the portion of the units that would be regenerated (harvest moderate retention).

Warty and Burrington's jumping slugs are found on the Forest in stands that have more riparian vegetation along with mature conifer trees. These species have not been detected in the analysis area, and the habitat in the proposed units appears fairly dry, lacking in down wood, and generally unsuitable. No other Survey and Manage/Sensitive species were detected in any of the surveys in the analysis area.

Alternative A - No Action
Direct and Indirect Effects
With this alternative, the marginally suitable habitat that exists in Unit 3 would continue to develop dead wood as overtopped trees die, or are blown over in weather events. An increase in the amount of dead wood on the ground, and development of larger trees through natural thinning would improve habitat for Malone's jumping slugs in the long-term This alternative would have no impacts to these mollusks.

Alternative B - Proposed Action
Direct and Indirect Effects
In general, terrestrial mollusk species could be impacted by reduction of the overstory canopy, which would result in warmer and drier conditions at the ground surface, and by destruction of large class IV logs during ground-based logging and slash treatment.

The Standards and Guidelines for Malone's jumping slug require that they be protected at high priority sites sufficient to ensure its persistence in a watershed. Under the management recommendation for Malone's jumping slug, given that the species is well-distributed in the

watershed, at least 70 percent of the suitable habitat in each sixth-field subwatershed must be managed as "high priority sites" before habitat disturbance can occur at any of the known occupied sites. When sufficient occupied habitat is identified as high priority sites, or habitat identified within reserves that can be assumed to be occupied given the number of known sites in the watershed, the habitat at known sites within the proposed units can be disturbed or modified.

Two of the sites detected in Unit 3 are in the Big Creek subwatershed, and two are in the Tillicim Creek subwatershed. Seventy-two percent of the Big Creek subwatershed has suitable habitat located in reserves under the Forest Plan. There is a high probability that suitable habitat in the reserves is occupied based on the number of detections in the subwatershed. In addition, the other known sites outside of reserves are currently protected. For these reasons, the two sites in Unit 3 are not needed to maintain the species well-distributed in the subwatershed. They are not high-priority sites that need to be protected. If possible however, these sites may be protected inside thinning skips.

Sixty-four percent of the Tillicum Creek subwatershed has suitable habitat located in reserves. Since there is insufficient habitat protected under the Forest Plan to insure that the species is well-distributed in the subwatershed, the two sites located near the top of Twin Butte require protection. These sites could be buffered within aggregate leave patches.

Since the proposed units would be managed for huckleberry production, the parts of the units outside of large reserve patches would be inhospitable to Malone's jumping slugs, and the project may result in the loss of two known sites that are not considered high-priority. In addition, while the habitat in Unit 3 is currently marginal, in the absence of any treatment, it would improve over time as overtopped trees die and fall, creating more woody debris. This alternative would reduce the suitable habitat in the analysis area by about 142 acres. However, given the number of known sites in the analysis area, this species would continue to be well-distributed.

This alternative **may impact individuals but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species**.

Alternative B – Proposed Action
Cumulative Effects
Malone's jumping slug sites have been detected at a total of 96 sites in the analysis area since 1999. The potential loss of two sites in Unit 3 would be cumulative to other losses that may have occurred when suitable habitat was logged before the requirement to survey for this species.

This species would have to be considered when planning any future project in the analysis area that would affect suitable habitat. For this reason, and since the reserves under the Forest Plan contain a high percentage of suitable habitat, it is likely that this species would continue to be well-distributed and the population would be maintained. The cumulative effect of the loss of two known sites is negligible.

Alternative C – Underburning
Direct and Indirect Effects
The effects of this alternative would be essentially the same as described for the Proposed Action, except that Unit 3 may be underburned to stimulate huckleberry shrubs. Mitigation to exclude fire from the reserve patches in Unit 3 would protect the sites that are maintained within the reserve patches.

This alternative **may impact individuals but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species**.

Alternative C – Underburning
Cumulative Effects
The cumulative effects would be the same as described for the Proposed Action.

Gifford Pinchot National Forest Management Indicator Species

Cavity Excavators
Species Account
Cavity excavators represent species requiring snags and down logs.
Much of the analysis area is lacking large snags due to the fire history, and large snags are generally lacking in and around the Sawtooth units. A large fire burned over much of the analysis area in 1902, and frequent fires set intentionally by Native Americans to maintain the berryfields kept trees small, allowing very few large snags to develop. Areas where the natural fires burned are currently characterized by very dense silver fir stands with trees that are relatively small diameter. Examples among the Sawtooth units are Units 1a and 4 where there are 7,350 and 3,450 trees per acre that are less than 5 inches dbh. respectively, and the trees over 5 inches average only about 275 per acre. The areas that had frequent fires are relatively more open with fewer trees per acre that are more than 5 inches diameter. Examples are Units 8, 9, and 10, which have averages respectively of 73, 46, and 168 trees per acre greater than 5 inches diameter.

Of the proposed units, Units 3 and 5 are characterized by having more large trees that survived the fires, and some large snags. Large portions of these units also have a dense silver fir understory. Of the other units, Unit 2 and Unit 11A have medium-sized trees that are large enough to potentially make it worthwhile to create snags. Some of the units that were part of the area burned frequently to maintain huckleberries (6, 7, 8, and 10) have widely scattered trees that are up to about 20 inches diameter, although the average diameter for trees above 5 inches is about 11 inches dbh. There are very few natural snags in these units, but some of these larger scattered trees could be girdled to create them.

In the Westside Lowland Conifer-Hardwood Forest Habitat Type, as described in DecAID, abundance of snags and down wood generally peaks in the first 50 years after a fire or other disturbance and is least abundant at about 150 years post disturbance, and increases again after about 200 years (DecAid, Mellen et al. 2006).

About 23 percent of the analysis area was regenerated before 1809. These stands are greater than 200 years old and likely contain the highest densities of larger snags and down wood, and may provide for the 80% tolerance level from DecAID. About 28 percent of the analysis area was regenerated between 1809 and 1880. These stands represent the stage in development where snag densities are fairly low but increasing as the age increases. They may provide habitat between the 30% and the 50% tolerance level from DecAID. About 31 percent of the analysis area was regenerated between 1880 and 1950, likely representing younger stands that were fire-regenerated. These stands may still contain scattered large remnant soft snags and large logs, but the only hard snags and logs are likely to be small in diameter. These areas probably provide snags and logs at the 50% tolerance level as described in DecAID. About 18 percent of the analysis area is made up of stands that were regenerated since 1950, likely representing clear-cut harvesting that occurred. These stands contain few if any large snags, and provide snags at or below the 30% tolerance level in DecAID.

Snag distribution on the landscape tends to be uneven and depends on the disturbance history. According to DecAID, 47 percent of the unharvested inventory plots in open canopy stands had 0 to 3 snags ten inches diameter or larger per acre, and another 41 percent had from 3 to 18 snags per acre this size. Fifty-two percent of the unharvested plots had no snags greater than 20 inches diameter. The fairly open stands in the analysis area that have experienced frequent fires reflect these plots with low snag numbers (Sawtooth units totaling 882 acres).

In closed small to medium tree stands, eighteen percent of the unharvested inventory plots had 0 to 3 snags per acre ten inches diameter or larger, and another forty percent had 3 to 18 snags per acre this size. Thirty-six percent of the unharvested plots had between 0 and 4 snags per acre at were at least 20 inches diameter.

Table 23 below shows the acres that would be treated in each structure stage with this project. (Unit 4 is mapped in the GIS database as a Large Tree stand, but field inspections found that a Closed Small Tree structure is a more accurate description).

Table 23. Acres by Structure Stage and percent of Total in Proposed Treatment Units

Structure Stage	Sawtooth Units	Acres Treated & Percent of Analysis Area		Total in Analysis Area
Large Tree	3, 5	193	4%	5,260
Closed Small Tree	1B, 2, 4, 11A, 11D	144	2%	7,240
Open Small Tree	1A, 6, 7, 10, 11B, 11E, 12	519	24%	2,125
Closed Sapling/Pole	11C	15	1%	1,900
Open Sapling/Pole	8, 9	348	12%	2,820

The units listed in the table above that are in the Small Tree or lower Structure Stages currently contain mainly small diameter hard snags and probably provide habitat at the 30% tolerance level or less. The Large Tree units contain both hard and soft snags and may provide habitat at the 50% tolerance level.

The Land and Resource Management Plan for the Gifford Pinchot National Forest (Amendment 11) provides guidelines for retention of snags and logs in areas of regeneration harvest. The silvicultural prescriptions for the project are essentially regeneration harvest combined with thinning. The Forest Plan calls for retaining or creating at least 2.6 snags per acre and 240 feet of logs that are at least 20 inches diameter and 20 feet long. Most of the proposed units do not contain trees that are large enough to meet these standards, but structures could be maintained or created that reflect the development of the stands.

Alternative A – No Action
Direct and Indirect Effects
With this alternative the there would be no effects to existing snags and down wood, and suppression mortality would occur in the proposed units. The tolerance level in the analysis area and in the watershed would gradually rise as the smaller trees die.

The opportunity to more quickly develop large trees by thinning 1,219 acres within the analysis area with this project would be forgone.

Alternative B - Proposed Action
Direct and Indirect Effects
This alternative would treat about 1,027 acres of small tree and sapling/pole stands that currently do not provide important habitat for cavity excavators due to a general lack of large snags. In addition, 193 acres of large tree stands would be treated that provide better habitat.

The habitat capability in the small tree stands would be increased in the short-term with implementation of mitigation to girdle or top trees to create snags. These snags would be generally small in diameter, reflecting the size of the trees in the stands, which means that not all cavity excavator species would be provided for. In the long-term, the trees that are left in the stands will grow and become large trees in the future. These trees would be growing in a fairly open stand, and would be subject to breakage by wind and snow loading. It's likely that some will become snags due to this type of damage. However, if the stands are kept in a relatively open condition to benefit huckleberry shrubs, they may never provide snags at a high level.

After harvest in Units 2, 3, 4, 5, and 11A (the units with larger trees), an average of 2.6 trees per acre that is at least 17 inches diameter will be left or topped to create snags. In addition, snags and logs would likely continue to develop naturally in the unthinned portions of these units. Some existing snags in Unit 3 may need to be felled to facilitate the cable yarding system. These would be left on the ground to add to the down wood density.

The thinning treatment would reduce the number of small diameter snags in the units that would be expected to develop over the next few decades because it would reduce natural mortality that would result from suppression of the smaller trees, and reduce the potential for insect and disease

mortality. The tolerance level in these stands would likely remain near 30 percent for snag density and diameter after treatment, and snag and log creation. At a watershed scale, the condition would be within the natural range of variability with the Sawtooth units representing the portion of the habitat type that has 0 to 10 snags per acre. Suppression mortality would continue to occur in the majority of the habitat type in the analysis area that is left unthinned, so the tolerance level at the watershed scale would gradually increase.

The thinning would accelerate the development of large trees in the units, and in the long-term these stands would be a source of large snags and logs.

The amount of down wood would increase in all units. Larger logs would be created as needed in Units 1, 2, 3, 4, 5, and 11. These are the closed canopy units with larger trees. In addition, it is likely that small trees will be cut and left in the more open units with smaller trees.

This alternative would meet the Forest Plan Standards and guidelines, and at least maintain and potentially improve habitat capability for cavity excavators.

Alternative B – Proposed Action
Cumulative Effects
The Skeeter and Shoo Timber sales in the analysis area had mitigation to create snags according the requirements in the Forest Plan. The snags were created in the Skeeter units soon after harvest. Since the habitat capability in the Sawtooth units would be maintained or increased, there would be no cumulative effects.

Alternative C – Underburning
Direct and Indirect Effects
This alternative is likely to result in higher density of small snags in many of the units due to the use of prescribed fire (Units 2, 5, 7, 10A, 11 A-E, and 12) than with the Proposed Action, This would reduce the need to create snags by topping and girdling. The tolerance level would be expected to increase in the analysis area more than with the Proposed Action.

Alternative C – Underburning
Cumulative Effects
The Skeeter and Shoo Timber sales in the analysis area had mitigation to create snags according the requirements in the Forest Plan. The snags were created in the Skeeter units soon after harvest. Since the habitat capability in the Sawtooth units would be maintained or increased, there would be no cumulative effects.

Pileated Woodpecker and Pine Marten
Species Account
Pileated woodpecker and pine marten represent species that require old-growth and mature forest conditions. According to the Habitat Suitability Index models developed by the U.S. Fish and Wildlife Service, optimal habitat for pileated woodpecker and pine marten has a canopy closure of 75% and 50% respectively, and both species require abundant large down wood and snags to provide habitat for their prey species, and nest/den sites. Currently, about 56 percent of the analysis area supports stands that are in the Large Tree, or Closed Small Tree structure stages.

These stands are likely to provide habitat for these species. About 23 percent (5,072 acres) of the analysis area is in the Large Tree Multi-Story structure stage, and would probably provide the best nesting/denning habitat.

The Forest Service NRIS Fauna database contains several records of marten sightings made in the analysis area dating back to the 1980s. There is only one recorded pileated woodpecker sighting in the database, but sightings of pileated woodpeckers have probably been recorded less often because it is not particularly unusual to see them.

Of the stands proposed for treatment in this project, Units 3 and 5 contain the best habitat. These are stands that regenerated following fire in 1902, and large remnant trees and snags remain from the previous stands, in fact, about half of the recorded marten sightings in the analysis area were made in or near these units. The overstory canopy cover in these stands is currently at optimum levels according the habitat suitability models. Unit 4 has some large remnant trees as well, but the understory is very dense (about 3,400 trees per acre less than 5 inches dbh) limiting its usefulness for pileated woodpeckers. The other units don't have large trees that provide nesting/denning structures, but probably all, with the possible exception of Unit 9, would provide sufficient cover for these animals to move through the stands.

At a Forest scale, these species are provided for by the allocations and Standards and Guidelines of the Northwest Forest Plan. The Late-Successional Reserves and Riparian reserves will provide habitat to maintain a well-distributed population across the Forest, and the stand-scale provisions to maintain large green trees, large woody debris and snags will provide habitat in Matrix treatment areas.

Alternative A – No Action
Direct and Indirect Effects
This alternative would maintain habitat as it currently exists in the analysis area. In the long-term, down wood levels would increase as trees die and fall due to inter-tree competition in the large tree and closed small tree stands. The opportunity to more quickly develop large trees by thinning 1,219 acres within the analysis area with this project would be forgone.

Alternative B - Proposed Action
Direct and Indirect Effects
Based on Habitat Suitability Index models for these species, reducing canopy cover to thirty to forty percent in Units 3 and 5 would reduce the habitat suitability for canopy cover to between 20 and 50 percent of optimum for marten , and 10 to 30 percent of optimum for pileated woodpecker in these stands. Mitigation to increase the amount of woody debris and to create snags would provide habitat at small scales.

There would be minimal effects to the existing logs and snags in most of the units, but the density of snags in Unit 3 would probably be reduced in the short-term to facilitate the cable yarding system. However, thinning would reduce the number of smaller snags and logs that would otherwise develop in these stands over the next few decades since it would reduce suppression mortality. This effect is minor in the context of the whole analysis area because the best habitat, which includes old-growth as well as fire-regenerated stands, is not being thinned.

All of the units are generally lacking in large down wood, and mitigation to create snags and logs, and to maintain snags that would be felled for safety as logs would result in an increase in large down wood in the units. This would benefit marten by potentially increasing the prey base.

In the long-term, habitat in the thinned stands would be improved for these species as growth on residual trees is accelerated, reducing the time needed to produce large trees and eventually large snags and logs.

The short-term loss of the ability to disperse through the stands is insignificant due to the amount of untreated habitat in the analysis area.

Alternative B – Proposed Action
Cumulative Effects
The impact of habitat reduction through overstory removal in the Sawtooth units would be cumulative to the acres that were harvested in the analysis area with the Skeeter Timber Sale (105 acres light to moderate retention harvest) and the acres that will be harvested in the Shoo Timber sale (40 acres light to moderate retention harvest). Even considering the cumulative effects of these older projects, the amount of habitat reduction in light of the protections in the Northwest Forest Plan is minimal.

Alternative C – Underburning
Direct, Indirect and Cumulative Effects
Impacts with this alternative would be similar to the Proposed Action because there would be similar decreases in canopy cover. The difference would be that the increased use of fire to accomplish the thinning may lead to creation of more small snags. The effects and cumulative effects would be essentially the same as Alternative B.

Deer and Elk
Species Account
Historically, elk and deer numbers in the western Cascades probably increased in response to large disturbance events, such as stand-replacing fires or volcanic eruptions, because the disturbances resulted in increased forage availability. These populations likely declined again as conifers eventually shaded out the forage plants in the disturbed areas. In general on the Gifford Pinchot National Forest, and especially in winter range areas, the reduction in regeneration timber harvest since the mid-1990s has reduced the amount of high quality forage available to the elk and deer herds, and populations are expected to decline.

The analysis area is in summer range for elk and deer. It contains large natural meadows, smaller meadows and wetlands, old partially recovered burns, and old timber harvest units that all provide forage. From studies that were done in the early 1990s, it is known that the elk that summer in the analysis area spend the winters in the lower elevations along the White Salmon River, the Wind River, and the Lewis River.

Conditions in the analysis area for large ungulates however, reflect what is happening on the Forest in general. Based on the 1999 vegetation database, about 25 percent of the analysis area

provides foraging habitat, 15 percent is hiding cover, 23 percent is thermal cover, and 36 percent is optimal thermal cover. It appears that the amount of optimal thermal cover is overstated in the database, in that many of these stands are not multi-story which is a characteristic of optimal thermal cover, and are actually thermal cover. Optimal summer habitat for elk and deer would have 50 to 60 percent of the area in dispersed foraging habitat and about 40 percent of the area in thermal and optimal cover, so it appears that the amount of forage available in the analysis area is a limiting factor.

High quality summer forage is important to allow the animals to go into the winter months with ample fat reserves, especially in light of the loss of winter forage areas due to reduced timber harvest on the Forest and residential and other development on private land. Since only 25 percent of the analysis area is open forage areas, forage is probably limiting and treatments that increase forage production would benefit elk and deer.

Alternative A – No Action
Direct and Indirect Effects
Since the proposed treatment would not be done with this alternative, in the absence of fire or other disturbance, forage production in the analysis area would continue to gradually decline as the overstory trees in the stands that currently produce forage close in. Currently about 770 acres within proposed Sawtooth units provide moderate to high amounts of forage. These acres would eventually be lost as significant forage production areas, further adding to the forage deficit in the analysis area.

Alternative B - Proposed Action
Direct and Indirect Effects
The proposed treatment to increase huckleberry production would also increase forage production in an area where forage is limiting. Reducing overstory tree cover to 20 to 40 percent would increase sunlight reaching the herbaceous and shrubby forage plants increasing growth. Units where the change in forage production would be the greatest would be those units that are currently thermal cover or optimal thermal cover. The amount of thermal cover or optimal thermal cover in the proposed units is about 340 acres and forage production increases would be most significant on these acres.

Units that are currently mapped as hiding cover are already somewhat open, as are the units that are already mapped as forage. In these areas the proposed treatment would increase forage production to a lesser degree or at least maintain what is currently there. The amount of hiding cover currently within the proposed units is about 472 acres, and the amount of forage area is about 302 acres.

However, elk and deer will likely not be able to make full use of the forage that becomes available since many of the units are flat and adjacent to roads that receive moderate use during the summer and early fall (Units 1, 2, 6, 8 – 11). Maintaining 30 to 40 percent tree cover in the units however, would mitigate this effect.

In the short-term, this alternative impacts elk and deer by increasing noise disturbance and human activity during the harvest process. This activity would likely cause animals to move

away from the activity. In the long-term the alternative would benefit elk and deer by significantly increasing forage production on about 340 acres, and maintaining or slightly increasing forage production on about 774 acres.

Alternative B – Proposed Action
Cumulative Effects
The benefit of increased forage production in the Sawtooth units would be cumulative to the acres that were harvested in the analysis area with the Skeeter Timber Sale (105 acres light to moderate retention harvest) and the acres that will be harvested in the Shoo Timber sale (40 acres light to moderate retention harvest). Even considering the cumulative effects of these older projects, the amount of forage available within the analysis area is still limiting but improved.

Alternative C – Underburning
Direct, Indirect and Cumulative Effects
The impacts of this alternative would be similar to the Proposed Action, except that the use of fire in some of the units will improve forage condition, increasing palatability more that what would be expected with cutting and removing the trees alone. If fire caries through the stands, it will remove the older woody browse material and wolfy herbaceous material and thatch. In place of this material will be younger shoots that are more palatable and digestable.

The cumulative effects would be the same as with the Proposed Action.

Wood Duck and Goldeneye Duck
Species Account
Wood ducks represent species that require mature and old-growth deciduous riparian habitat. Goldeneye ducks represent species that require mature and old-growth coniferous riparian habitat. Some of the lakes and ponds in the analysis area appear to be suitable habitat for these ducks, but surveys have not been done, and there are no sightings recorded in the NRIS Fauna database.

Alternatives A, B and C
Direct, Indirect and Cumulative Effects
None of these alternatives would affect habitat that is likely to be used by these species. No deciduous or conifer habitat close to suitable water bodies is proposed for treatment. There would be no cumulative effects.

Neotropical Migratory Birds
Species Account
A conservation strategy for land birds in coniferous forests in western Oregon and Washington was prepared in 1999 by Bob Altman of American Bird Conservancy for the Oregon-Washington Partners in Flight. The strategy is designed to achieve functioning ecosystems for land birds by addressing the habitat requirements of 20 “focal species”. By managing for a group of species representative of important components of a functioning coniferous forest ecosystem, it is assumed that many other species and elements of biodiversity will be maintained.

The following table displays the focal species potentially positively or negatively affected changes in habitat, and the forest conditions and habitat attributes they represent.

Table 24. Focal Bird Species		
FOREST CONDITIONS	**HABITAT ATTRIBUTE**	**FOCAL SPECIES**
Old-growth	Large snags	Vaux's swift *
Old-growth/Mature	Large trees	Brown creeper *
Old-growth/Mature	Conifer cones	Red crossbill
Mature	Large snags	Pileated woodpecker
Mature	Mid-story tree layers	Varied thrush *
Mature/Young	Closed canopy	Hermit warbler
Mature/Young	Deciduous canopy trees	Pacific-slope flycatcher
Mature/Young	Open mid-story	Hammond's flycatcher
Mature/Young	Deciduous understory	Wilson's warbler
Mature/Young	Forest floor complexity	Winter wren
Young/Pole	Deciduous canopy trees	Black-throated gray warbler
Pole	Deciduous subcanopy/understory	Hutton's vireo
Early-seral	Residual canopy trees	Olive-sided flycatcher *
Early-seral	Snags	Western bluebird
Early-seral	Deciduous vegetation	Orange-crowned warbler
Early-seral	Nectar-producing plants	Rufous hummingbird *

* Significantly declining population trends in the Cascade Mountains physiographic areas.

The proposed Sawtooth treatment units currently provide habitat for birds species found in Mature stands represented by brown creeper, red crossbill, pileated woodpecker, and varied thrush [Units 3, 4, and 5 (249 ac.)]; the Mature/Young closed canopy stands represented by hermit warbler [Units 1b, 2, 11a, and 11d (81 ac.)]; Mature/Young open mid-story represented by Hammond's flycatcher [Units 1a, 6, 7, 10, 11b, and 11e (519 ac.)]; and Pole-sized stands represented by Hutton's vireo [Units 8, 9, and 11c (363 ac.)].

Olive-sided flycatchers, a species thought to be declining, are known to occupy some of the meadow areas and old harvest units in and around the analysis area (James Wainwright USFS, personal observation).

Alternative A - No Action
Direct and Indirect Effects
With this alternative there would be no change in the current condition in the short-term. In the long-term, in the absence of other disturbance, there would be a gradual decrease in the amount of open and early-seral structures as the trees in these stands grow and canopy cover increases. At the same time, the older stands will develop more snags and down wood, benefiting species associated with Old-Growth/Mature habitat structure.

In the short-term, there would be no impacts to bird species, and in the long-term, in the absence of other disturbance, there would be benefits to species such as pileated woodpecker, brown creeper, red crossbill, and varied thrush, and the expense of the early-seral species.

Alternative B – Proposed Action
Direct and Indirect Effects
The action alternatives would significantly thin trees and open the stands. This would improve habitat for species shown in the table above that are associated with early-seral conditions, species that are associated with Mature/Young stands with an open mid-story, and species that are associated with pole-sized stands. This would be to the detriment to species that require Mature/Young closed canopy forests and Mature with mid-story tree layers.

Of the species from the above table that are thought to be declining, habitat for olive-sided flycatcher and rufous hummingbird would be improved and habitat for brown creeper and varied thrush would be reduced.

Currently, about 56 percent of the analysis area is in older mature closed conifer stands, and about 27 percent is in younger more open stands. This alternative would reduce the acreage with the most common vegetation structure and increase a less common structure. Habitat diversity would be increased area-wide, and overall impacts to the bird community would be beneficial.

Alternative C – Underburning
Direct and Indirect Effects
The effects of Alternative C would be similar to the proposed action, except that increased use of fire with this alternative would probably result in creation of more small snags that may benefit small cavity excavators.

Alternatives B and C
Cumulative Effects
These effects would be cumulative to the effects to the Skeeter and Shoo timber sales. With these sales, a total of 145 acres of Mature closed canopy conifer stands were converted to early-seral with residual canopy trees, and another 150 acres of Mature/Young closed canopy stands were converted to Mature/Young open mid-story stands (commercial thinning). These projects also treated the most common structures and created structures that are less common.

Recreation and Social Analysis

This section evaluates the potential effects of the Sawtooth Huckleberry Restoration Project alternatives on the Pacific Crest Trail, other existing recreation uses, and the visual quality along Forest Roads 3000, 2400, and 8851 travel corridors in order to determine consistency with current land and resource management direction and conflicts with other uses.

Existing Condition and Environmental Effects

Land Allocations – Roaded Recreation

Units 7, 8, 9, 10, 11, and 12 all lie within the Roaded Recreation Management Area Category (without timber harvest, RM) as described in the Gifford Pinchot Forest Plan. The Forest Plan (IV-95) states that lands within the RM allocation accomodate dispersed recreation such as hiking, camping and berrypicking, and include unique or distinctive portions of the Forest, such as berryfields. The Forest Plan states "Timber harvesting will not be scheduled, and timber salvage should not be permitted in Management Areas assigned the RM or RL prescriptions. Trees may be removed, however, to enhance recreation." Project activities were designed to be consistent with Forest Plan Standards. Units 8, 9, 11B-E and 12 propose young stand thinning. Small diameter trees will be cut and either scattered, mulched or burned. Units 7, 10 and 11A propose commercial thinning. Trees will be cut down to reduce the canopy cover in order to increase production of the huckleberries. Removal of the logs will allow for easier access for huckleberry pickers and will enhance the recreation experience.

Alternative A – No Action

The no action alternative will allow the tree canopy to continue to close and suppress the huckleberries. Recreationists as well as commercial harvesters would see a steady decline in huckleberry production and harvest.

Alternatives B and C

Direct and Indirect Effects

Both action alternatives will treat the same number of acres although Alternative C will underburn some of those acres. The burning has the potential to open the canopy a little more but will also be more likely to set back the huckleberry production for a few years while the bushes recover. This would affect the experience of the recreational and commercial harvesters.

Pacific Crest Trail

The Pacific Crest Trail is categorized as a Level 1 trail in the Gifford Pinchot Forest Plan that intersects Unit 8 and lies adjacent to Units 5 and 9. The Forest Plan Standards and Guidelines for managing the travel corridor along Level 1 trails requires a 500 foot buffer for harvesting timber allowing exemptions only if the harvest is beneficial to recreation. A 500 foot buffer will be provided in Units 8 and 9. In Unit 5, however, a narrower buffer is proposed. Trees will be removed within the established buffer of the trail, to enhance huckleberry productivity. The purpose of the buffer is to protect visual quality along the trail corridor, but still allow for enhancement of the huckleberry resource. Berry picking is a major recreational activity in this area, and enhancing huckleberry productivity should improve the recreational experience. The

Sawtooth Berryfields enhancement project will be beneficial to recreation if the goals of increasing berry production are met, however the harvest may also decrease the visual quality along the trail.

Figure 11. Pacific Crest Trail in Relation to Proposed Sawtooth Units.

Alternative A – No Action
Direct and Indirect Effects
In Alternative A, there would be no immediate changes to the Pacific Crest Trail or the surrounding landscape. Over the next ten to twenty years, the trees within units 8 and 9 will grow and obscure the views of the surrounding landscape, developing into stands of larger timber.

Alternative B – Proposed Action
Direct and Indirect Effects
The proposed action would thin trees in Units 5, 8 and 9 adjacent to the Pacific Crest Trail for the purpose of increasing huckleberry production. The removal of trees would create stumps, slash and skid trails that would detract from the aesthetics of the trail. These impacts will be mitigated by directional felling, flush cutting stumps, providing a buffer, and other mitigation measures. These impacts would remain approximately two to three years, until the huckleberries and other understory species fill in and obstruct the view to these impacts.

Unit 5 would also have an additional visual impact from burning of the slash piles. These impacts can be partially mitigated by pulling slash away from the trail and screening the burn piles from the trail with leave trees or using topographic features. These impacts would remain approximately two to three years, until the huckleberries and other understory species fill in and obstruct the view to these impacts.

Alternative C – Underburning
Direct and Indirect Effects
Alternative C differs from the proposed action only in the recommendations for treating the slash created from cutting and/or removing the trees. Unit 5 would be underburned in this alternative. Underburning would kill some of the understory vegetation and smaller trees, leaving charred plants and soil behind. Evidence of the underburning would remain visible from the trail an estimated three to five years, until the understory re-grows and enough needle-cast, leaves, and dust cover the charred soil to obscure it from view.

The impacts discussed under Alternatives B and C would be mitigated by providing a 500' buffer adjacent to Units 8 and 9, and by keeping project activities 100 feet from the trail in Unit 5. Refer to Mitigations Measures 1-7.

Conflicts with existing recreational use

Winter Recreation
Alternative A – No Action
Direct and Indirect Effects
No winter logging would occur and therefore there would be no effects to the winter recreation program.

Alternatives B and C
Direct and Indirect Effects
Winter logging may conflict with the winter recreation program. Forest Roads 2400 and 3000 are used as snowmobile trails during the winter months. These roads will likely be the major haul roads for this project. Log haul may conflict with recreational traffic. Winter haul has been successfully implemented on other Forests by requiring one lane of the roadway left unplowed in order to accommodate snowmobile traffic.

The impacts of winter logging in Alternatives B and C would be partially mitigated by plowing one lane, and leaving the other lane open for winter recreation use.

Availability of campgrounds and other facilities to accommodate recreational use
Several units within the proposed project are either in or adjacent to campgrounds or dispersed camping areas. Surprise Lakes Indian Camp, Cold Spring Indian Camp, South Campground, Saddle Campground, Tillicum Campground, and the Berryfields Access Area are all located within the project area.

Unit 8 would treat stands in and around Surprise Lakes Indian Camp, and Unit 10 would treat stands around the Cold Spring Indian Camp. Unit 8 is a young stand thinning with trees to be thinned using hand tools. Slash will be lopped and scattered. Unit 10 will be commercially thinned using ground-based machinery. Slash will be piled and burned near the roads in Alternative B and underburned in Alternative C.

Unit 5 would treat stands in and around Saddle Campground. Unit 2 would treat a stand near the entrance to Tillicum Campground. Unit 3B would treat a stand near the entrance to South Campground. Units 11A-E and 12 would treat stands within the Berryfields Access Area.

The Recreation Facility Analysis (RFA), completed in 2008, identified Tillicum Campground, Saddle Campground, South Campground, and the Berryfields Access Area as facilities that, in the long term, will be managed for dispersed recreation rather than as developed sites. These facilities are currently under-utilized, even during late summer and early fall when the huckleberries are at their peak.

There is currently a toilet facility at the Berryfields Interpretive Site, in the northeast corner of Unit 9.

Alternative A – No Action
Direct and Indirect Effects
No treatments would occur in this alternative and therefore there would be no increase in conflicts to recreationists at nearby campgrounds.

Alternatives B and C
Direct and Indirect Effects
During project operations some campgrounds may be closed temporarily, and there may be disruptions in recreational use due to project activities. The Surprise Lake Indian Camp and Cold Spring Indian Camp are used by local Indian Tribes for traditional huckleberry picking in

July, August and September. Noise from treatment activities would potentially disturb huckleberry pickers during this time and ground-based harvesting activities in Unit 10 have the potential to affect road access to the Cold Springs Indian Camp.

Unit 8 is located within the Surprise Lake Indian Camp. Unit 9 is located across the road from the Surprise Lake Indian Camp and the Cold Spring Indian Camp. Only hand tools (loppers, chainsaws) will be used during treatment of these units, but the noise from chainsaws could disturb recreationists.

Unit 5 would harvest trees within Saddle Campground. Although it is an under-utilized campground, timber harvest activities would disturb or displace the dispersed use that occurs there. Timber harvest also has the potential to damage the access road. Three campsites will be designated for protection within Saddle Campground during harvest activities, but the remainder of sites will be inaccessible in the short term.

The access roads to Tillicum Campground and South Campground are adjacent to harvest Units 2 and 3 respectively in the Sawtooth Huckleberry Restoration Project. Access to these campgrounds could be temporarily disrupted during project operations.

The Berryfields Access Area is a series of three parking lots on Forest Road 3000580. These parking areas are used by RV campers during the huckleberry season in late August and early September. Units 11 and 12 lie on either side of the road and the parking lots and treatment of these units will disturb or displace campers that use these areas if activities occur during the berry picking season. Conflicts in and adjacent to all of these campgrounds can be partially mitigated through restrictions in timing, and damage to facilities such as toilets or signs can be mitigated through avoidance and/or repair to damaged facilities.

Alternatives B and C
Cumulative Effects
If recreational use in the Sawtooth Huckleberry Fields were to increase in the long term as a result of increased huckleberry production, issues relating to garbage and human waste disposal could become a concern.

Conflicts with busy summer recreation
Log haul on Forest Roads during the summer months creates a hazardous situation by putting log trucks on the same roads with summer forest visitors. In order to minimize this hazard, the following mitigation measures will be implemented:

- Log hauling will be restricted to weekdays between Memorial Day and Labor Day. There will also be no hauling allowed on Memorial Day, the Fourth of July, and Labor Day.
- All major haul routes will be signed as directed by contract administrators, to warn visitors of log hauling.

Visual Quality Standards and Guidelines

The Forest Plan has designated a Visual Quality corridor along Forest Roads 3000, 2400, and 8851. The visual quality objective for these corridors is partial retention, meaning forest management activities must appear visually subordinate to the natural landscape as viewed from the designated travel routes.

The silviculture prescriptions for all harvest units have been designed to meet Forest Plan standards and guidelines. Units along Forest Roads 2400, 3000, and 8851 viewing corridors will have a minimum of 40% canopy closure, with trees 20 feet tall or taller along the roadside or entirely throughout the units. All units with average stocking levels reduced below 40% will be screened from view by stands with 40% or greater canopy closure.

This project (in either action alternative) would not create any new openings, however, there would be evidence of timber removal and harvest activities. Units 1, 2, 3, 6, and 10 would be noticeably more open, and cable logging corridors will be visible from Forest Road 2400 to the south of Unit 3. However, these activities should appear visually subordinate to the natural landscape because the silvicultural prescription is to commercially thin or in the case of units 1 and 3 where there is a moderate retention prescription in portions of the unit, those areas will be screened from view of the roads through the use of un-thinned retention clumps.

The following mitigation measure will be implemented to reduce the visual impacts of timber harvest along Forest Roads 2400, 3000, and 8851:

- The cable logging portion of Unit 3 will be yarded over slash as much as possible, to reduce the impacts to the understory vegetation and soil during yarding operations. This will also help to protect the huckleberry plants and allow the plants to fill in quicker.
- Erosion control seeding will be applied to skid trails and yarding corridors where the soil has been disturbed to minimize the amount of contrasting colors seen between the disturbed soil and vegetation. Seed will be applied as prescribed in the hydrology write-up.

Economic Analysis

Financial and economic analyses of the alternatives including mitigation measures were prepared to compare anticipated costs and revenues that are part of Forest Service monetary transactions or outside of the Forest Service.

Most of the project is assumed to be implemented within a five year time span. No inflationary rate, discount rates, or changes in real value were used for implementation costs and benefits. These rates and changes are assumed to be offsetting within this relatively short time span. All values displayed below are in present dollars.

Project Preparation and Administration
The project preparation and administration costs post-sale are considered first. These are up-front costs, typically not subject to direct reimbursement from any project revenue.

Environmental survey and analysis costs are considered spent and not included. The action alternatives are identical in acres treated. The differences in treatments and timber volume to be harvested would not result in meaningful differences in preparation and administration costs.

Table 25. Project Preparation and Administration Costs

Activity	$/Unit	Alternative B		Alternative C	
		Units	Value	Units	Value
Timber Sale Preparation	($60)/ac	528	($31,680)	528	($31,680)
Timber Sale Administration	($35)/ac	528	($18,480)	528	($18,480)
Service Contract Preparation	($10)/ac	336	($3,360)	336	($3,360)
Service Contract Administration	($12)/ac	336	($4,032)	336	($4,032)
Pre Timber Sale Weed Control	($108)/ac	56	($6,048)	56	($6,048)
Total Costs			**($63,600)**		**($63,600)**

Timber Sale

The treatment units in Alternatives A and B that would yield commercial quantities of timber (Units 1B, 2, 3A, 3B, 4, 5, 6, 7, 10A, 10B, and 12A) were considered together as a single project. Elements of the timber sale would be completed by the purchaser or the Forest Service. These Forest Service elements are typically funded through deposits from sale revenue.

Table 26. Timber Sale Revenue and Costs

Purchaser Elements	$/Unit	Alternative B		Alternative C	
		Units	Value	Units	Value
Temp Road Construction	($14,000)/mile	1.2	($16,800)	1.2	($16,800)
Temp Road Construction (sidehill)	($18,000)/mile	0.2	($3,600)	0.2	($3,600)
Road Reconstruction	($31,500)/each	1	($31,500)	1	($31,500)
Fell and Buck (not in logging cost)	($27)/mbf	6,070	($165,711)	5,470	($149,331)
Logging – Ground Based	($80)/acre	4,570	($365,600)	3,970	($317,600)
Logging – Skyline	($175)/acre	1,500	($262,500)	1,500	($262,500)
Winter Snow Plow	($10,000)/each	1	($10,000)	1	($10,000)
Log Haul	($40)/mbf	6,070	($242,800)	5,470	($218,800)
Slash Piling/Cover – Machine	($360)/acre	97	($34,920)	32	($11,520)
Erosion Control (landings & temp roads)	($400)/acre	21	($8,400)	21	($8,400)
Fireline Construction – Machine	($600)/mile	0	$0	5	($3,000)
Timber Value – Douglas-fir	$320/mbf	900	$288,000	850	$272,000
Timber Value – Other	$200/mbf	5,170	$1,034,000	4,620	$924,000
Subtotal Sale Revenue			**$180,169**		**$162,949**
Purchaser Profit and Risk (25%)			**($45,042)**		**($40,737)**
Subtotal Sale Revenue			**$135,126**		**$122,211**
Forest Service Elements					
Minimum Deposit to National Forest Fund	($0.50)/mbf	6,070	($3,035)	5,470	($2,735)
Road Maintenance Deposits	($11)/mbf	6,070	($66,770)	5,470	($60,170)
Slash Disposal – Burn Machine Piles	($165)/acre	97	($16,005)	32	($5,280)
Slash Disposal – Underburn	($1000)/acre	0	$0	227	($227,000)
Slash Disposal - Seed/mulch fire	($200)/acre	10	($2,000)	10	($2,000)

scars					
Required K-V Reforestation	$0/acre	0	$0	0	$0
Total FS Required Deposits			**($87,810)**		**($297,185)**
Total Sale Net Value			**$47,316**		**($174,974)**
Total Sale Net Value per MBF			**$8**		**($32)**

For Alternative B, the timber sale portion appears to be profitable to a purchaser and would yield revenue in excess of that needed to cover Forest Service required deposits. Excess receipts could be used to fund the alternative's other mitigations and treatments, and/or contribute to County funds (25% Fund Act). However, with a net value of only $8 per MBF, the sale may or may not generate a return. A decline of more than 3% in timber value would eliminate any excess receipts. Historically, timber values have increased in real dollars over time, yet they are currently declining and well below historical highs. Fuel prices are also an important variable that have lately been volatile. Fuel prices affect nearly all logging cost centers.

For Alternative C, the timber sale portion appears to be profitable to a purchaser, but it does not yield sufficient revenue to cover the required deposits for slash disposal and road maintenance. Underburning for Units 2, 5, 7, 10A, and 11A greatly increase the slash disposal costs of Alternative C. This would be a deficit sale as configured, and require other funds in order to implement.

Service Projects

Depending on the type of contract (normal timber sale or stewardship) used to implement the timber sale, some of the timber sale mitigation and other treatments could be funded directly by the timber sale if there are excess receipts. Otherwise, these mitigation and treatments would require other funds to implement. The costs of these treatments are listed in the following table.

Table 27. Service Projects

Activity	$/Unit	Alternative B		Alternative C	
		Units	Value	Units	Value
Invasive Weed Control (2 years)	($216)/ac	56	($12,096)	56	($12,096)
Snag Creation	($163)/ac	327	($53,301)	327	($53,301)
Downed Log Augmentation	($77)/ac	327	($25,179)	327	($25,179)
Mechanical Tree Mastication/Mulch	($500)/ac	336	($168,000)	13	($6,500)
Underburning	($650)	0	$0	323	$209,950
Hand felling small trees (volunteers)	$0/ac	348	$0	348	$0
Total Costs			**($258,576)**		**($307,026)**

Huckleberry Benefit

The objective of the project is to increase huckleberry production within each of the treatment units which would benefit both people and wildlife. While it is difficult to place an economic value on the benefit to wildlife, the human benefit can be assessed.

Past research in Sawtooth Berryfields estimated yields of 112 gallons per acre in 1969 (Nelson 1970). Minore (1979) measured yields as high as 100 gallons per acre in 1976 and 77 gallons per acre in 1977, a relatively poor year. These rates would apply to stands of good productivity.

However, huckleberry productivity is quite variable year to year owing to snow pack, precipitation, and late frosts. Some years can have virtually no huckleberries. Minore (1979) recorded a five-year average production to be only 70% of the highest yield year. To account for this variability, average productivity in "good" stands was assumed to be 80 gallons or 400 pounds per year "Moderate" yields in these projections are assumed to be much less. Again using Minore's 1979 study where he sampled stands that are similar to those classed as moderate in this assessment, the yields tended to be to one quarter of the good stands or 100 pounds per year. "Poor" production stands were assigned a yield of 10 pounds per acre, which corresponds to the 2008 pre-treatment measurements of Mowich Huckleberry Enhancement Project (Nakae 2008). People picking in poor productive stands will typically only pick the roadside bushes where there is more light and berries. Even in good areas, people do not pick all of the huckleberries present on every bush on every acre. A collection rate of 25% is assumed for all stands.

Huckleberry value was placed at $5.00 per pound or $25 a gallon. This is local retail price for wild picked huckleberries in the summer. Depending on location, huckleberry collection in this area is by Native Americans, the general public and commercial pickers under permit. Forest Service would realize money only from commercial permit sales. A commercial permit costs $40 for 40 gallons (approximately $0.20 per pound). Berries wholesale near $4.00 per pound.

Table 28. Huckleberry Value Assumptions

Productivity Rate	Average Pounds/Acre/Year	Collection Rate	$/Pound	$/Acre/Year
Good	400	25%	$5	$400
Moderate	100	25%	$5	$125
Poor	10	25%	$5	$13

Using the rates for Current and Predicted Huckleberry Fruit Production in the tables presented earlier, the total dollar value of huckleberries was calculated for all treatment acres over the next 30 years. Because of this long time period, a discount rate of 4% was used. Present values for the cumulative 30 years are presented in the following table, along with values annualized on a per acre basis

Table 29. Huckleberry Benefit Over the Next 30 Years

Unit	Alternative A		Alternative B		Alternative C	
	Present Value	Annual Per Acre Value	Present Value	Annual Per Acre Value	Present Value	Annual Per Acre Value
1A	$13,686	$35	$16,067	$41	$16,067	$41
1B	$1,945	$7	$34,303	$127	$34,303	$127
2	$4,107	$7	$80,785	$142	$74,659	$131
3A	$22,047	$7	$129,821	$42	$129,821	$42
3B	$8,646	$7	$174,086	$145	$174,086	$145
4	$12,104	$9	$153,284	$111	$153,284	$111
5	$11,024	$7	$191,692	$125	$191,692	$125
6	$7,565	$7	$148,470	$141	$148,470	$141

7	$11,240	$7	$283,777	$182	$207,835	$133
8	$1,050,747	$192	$1,258,860	$231	$1,258,860	$231
9	$958,374	$192	$1,148,191	$231	$1,148,191	$231
10A	$57,894	$35	$399,461	$242	$209,852	$127
10B	$62,105	$35	$161,960	$92	$161,960	$92
11A	$10,808	$7	$272,756	$182	$199,763	$133
11BCDE	$88,073	$56	$172,653	$111	$209,852	$135
12	$58,577	$7	$899,790	$111	$1,093,654	$135
Total	**$2,378,943**		**$5,525,956**		**$5,412,348**	
Average		**$39**		**$141**		**$130**

The action alternatives increase the value from huckleberries over the 30 year period; although, there are decreases in value the first 5-10 years, depending on the unit and treatment. In comparing the underburned units in Alternative C (Units 2, 5, 7, 10A, 11A, 11BCDE, and 12) to Alternative B, the economic benefit is not always expressed over the 30-year term. This is true in units that would be commercially harvested, where a long term benefit is already anticipated even without burning, and short term impacts are avoided by logging over snow.

Economic Measures
The 30 year present net value and benefit cost ratios were calculated using the above costs and benefits.

Table 30. Economic Measures

	Alternative A	Alternative B	Alternative C
Present Net Value	$2,378,943	$5,251,096	$4,866,748
Benefit Cost Ratio	N/A	$2.67:1	$2.43:1

Other Environmental Consequences

This section addresses those effects for which disclosure is required by National Environmental Policy Act regulations, Forest Service policy or regulation, various Executive Orders, or other laws and direction covering environmental analysis and documentation. In some cases, the information found here is also located elsewhere in the document.

Effects on Environmental Justice
Executive Order 12898 (February 11, 1994) directs federal agencies to focus attention on the human health and environmental condition in minority and low-income communities. The purpose of the Executive Order is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations. The principle behind Environmental Justice is that people should not suffer disproportionately because of their ethnicity or income level.

While the sale of National Forest timber would create or sustain jobs and provide consumer goods, neither of the alternatives would have a disproportionately high or adverse human health or environmental effect on minority and low-income populations. Either of the action

alternatives would provide a benefit to Native American communities that traditionally harvest berries in the Sawtooth Huckleberry Fields.

Effects on Wetlands and Floodplains

There would be no effects to wetlands or floodplains due to the implementation of project design criteria and mitigation measures included with the action alternative.

CHAPTER 4. CONSULTATION AND COORDINATION

Consultation with Other Agencies and Jurisdictions _____

The Washington State Department of Ecology (DOE) is responsible for enforcing the Clean Water Act of 1972. A Memorandum of Understanding prepared and agreed to by the Forest Service and DOE states that Best Management Practices, used by the Forest Service to control or prevent non-point sources of water pollution, would meet or exceed State water quality standards and other requirements, as outlined in the Washington State Forest Practices Rules. The project design criteria and mitigation measures in would comply with the Memorandum of Understanding.

The Washington State DOE is also responsible for enforcing the Clean Air Act of 1977. The State Smoke Implementation Plan provides guidelines for compliance which are intended to meet the requirements of the Clean Air Act. All burning plans for activities associated with this project would comply with this Plan if applicable.

The United States Department of Interior, Fish and Wildlife Service (USFWS) is responsible for protection and recovery of terrestrial and inland fish threatened and endangered species. The Forest consulted with USFWS on the Sawtooth Huckleberry Restoration project for the threatened, northern spotted owl. The effects determination for northern spotted owl with this project is may affect, but is not likely to adversely affect. The Forest received a Letter of Concurrence from USFWS dated May 29, 2008 that documented the USFWS' agreement that this determination is appropriate. The effects determination for bull trout was no effect and therefore consultation was not required.

The United States Department of Commerce, National Marine Fisheries Service (NMFS) is responsible for the protection and recovery of threatened and endangered anadromous fish species. The Sawtooth Huckleberry Restoration project would have no effect on any listed anadromous fish species or their designated or proposed critical habitat; therefore, consultation with NMFS is not required. The project would have no effect on Essential Fish Habitat and therefore consultation requirements under the Magnuson-Stevens Fishery Conservation and Management Act do not apply.

All steps in the heritage resource process are coordinated with the Washington State Department of Archaeology and Historic Preservation. Heritage Resource Site Reports are filed with and approved by the Washington State Historic Preservation Officer. Based on the information documented in the Heritage Resource Report, there would be no adverse effects to heritage resources by implementation of either alternative. Consultation with the Washington State Department of Archaeology and Historic Preservation, the Yakama Nation, and the Cowlitz Tribe was conducted.

List of Team Members

NAME	POSITION
Cheryl Mack	Team Lead/Archaeologist
Aldo Aguilar	Soil Scientist
Stephanie Caballero	Fisheries Biologist
Steve Hansen	Logging Systems
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Jon Nakae	Silviculturist
Andrea Ruchty	Botanist
Amy Lieb	Hydrologist
Mitch Wainwright	Wildlife Biologist
Neil Oliver	Engineer
Ben Scott	Engineer
Brent Demko	Yakama Nation Fire/Fuels Specialist
Jessica Hudec	Fire/Fuels Specialist
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