USDA

United States
Department of
Agriculture

Forest
Service

March 2008

Environmental Assessment

Porcupine Vegetation and Road Management Project

Shasta-McCloud Management Unit, Shasta-Trinity National Forest
Siskiyou County, California

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Introduction

The Shasta-McCloud Management Unit of the Shasta-Trinity National Forest is proposing to improve forest health and reduce the risk of catastrophic wildfire in the Porcupine project area, which is located about 20 miles northeast of McCloud, California (Figure 1). Treatments using commercial timber harvest are proposed on approximately 4,400 acres of National Forest lands to reduce the density of forest stands, remove ladder fuels and to restore aspen and meadow areas.

The Forest Service has prepared this environmental assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Document Structure

The document is organized into four parts:

- **Introduction:** The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- **Comparison of Alternatives, including the Proposed Action:** This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- **Environmental Consequences:** This section describes the environmental effects of implementing the proposed action and other alternatives. Within each section, action alternatives are described first, followed by the effects of the no action alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- **Agencies and Persons Consulted:** This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Shasta-McCloud Management Unit Office in Mount Shasta.

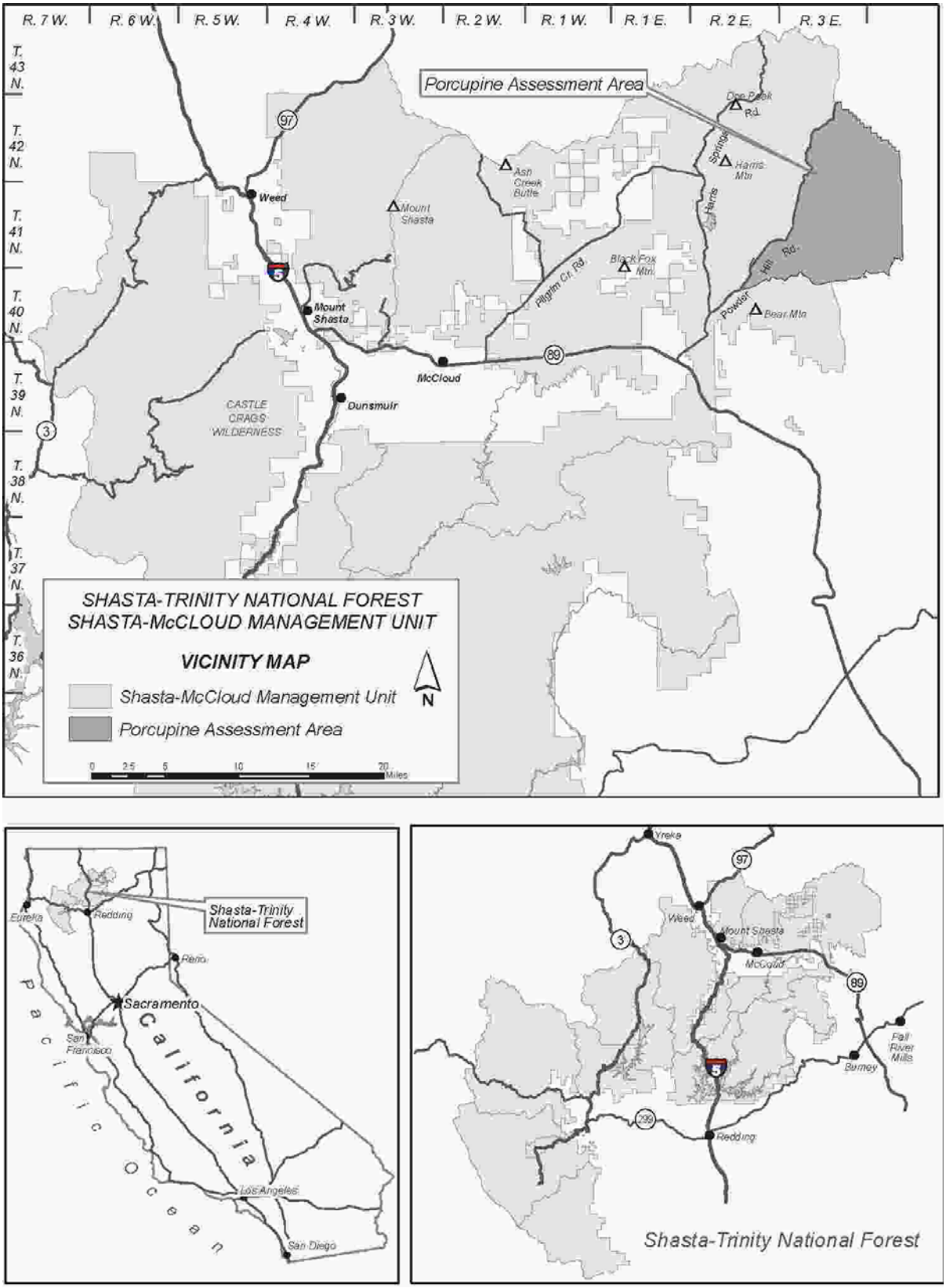

Figure 1. Porcupine project area and vicinity

Purpose and Need for Action

The need for action was determined by comparing project area conditions with the desired future condition of the Porcupine Butte and McCloud Flats management areas. The *Shasta-Trinity National Forest Land and Resource Management Plan*[1] (Forest Plan) identifies a desired condition for each of these management areas. The Forest Plan also identifies management objectives for the five management prescription areas within the project area. Existing conditions were identified in the *Porcupine Watershed Assessment*[2] and through project area field review. The Porcupine Watershed Assessment identified management recommendations to achieve desired conditions described in the Forest Plan.[3] These recommendations were considered in the development of this project.

The majority of the 50,255-acre project area is within the Matrix land allocation[4] (93 percent). The project area includes three other land allocations: Administratively Withdrawn Area[5] (4 percent), Riparian Reserves[6] (1 percent), and Late-Successional Reserves[7] (2 percent). The Matrix allocation includes management prescriptions for Roaded Recreation, Wildlife Habitat Management, and Commercial Wood Products Emphasis. The Riparian Reserves allocation includes a prescription for Riparian Management. The Administratively Withdrawn Area allocation includes a prescription for Special Area Management. Management direction for each management prescription can be found in Chapter 4 of the Forest Plan.

A small portion of the project area (approximately 50 acres) falls within the Shasta-Trinity National Forest Administered by the Lassen National Forest. This area is within Lassen National Forest Management Area 1, Wiley, and the General Forest Land Allocation[8].

The project interdisciplinary team (IDT) identified existing conditions that differ from desired resource conditions described in the Forest Plan. The comparison of conditions provides the basis of the purpose and need for the proposed action. These conditions are briefly discussed below:

- **Improve Forest Health and Growth** - Approximately 4,400 acres of forest stands in the Porcupine project area have become very dense over time. Competition for water and nutrients make these stands susceptible to insect attack, especially during periods of drought.

[1] U.S. Department of Agriculture, Forest Service 1995. Shasta-Trinity National Forest Land and Resource Management Plan, as amended (Forest Plan) Redding, CA: U.S. Department of Agriculture, Forest Service, 282 pp.
[2] U.S. Department of Agriculture, Forest Service. 2003. Porcupine Watershed Analysis. Unpublished report on file at Shasta-Trinity National Forest. Redding, CA. 110 p.
[3] USDA Forest Service 2003 (see footnote 2), pages A1-A2.
[4] USDA Forest Service 1995 (see footnote 1), pages 4-61 through 4-68.
[5] USDA Forest Service 1995 (see footnote 1), pages 4-45 through 4-51.
[6] USDA Forest Service 1995 (see footnote 1), pages 4-53 through 4-60.
[7] USDA Forest Service 1995 (see footnote 1), pages 4-37 through 4-44.
[8] U.S. Department of Agriculture, Forest Service. 1992. Lassen National Forest Land and Resource Management Plan, as amended. Susanville, CA: U.S. Department of Agriculture, Forest Service, 192 pp.

The dense stands have decreased the growth of understory shrubs, which are important for forage and cover in areas managed for wildlife habitat.

- **Reduce Fuels** - Dense timber stands, combined with an understory of white fir, incense cedar, and ponderosa pine, have created ladder fuel conditions that could carry a wildfire from the ground into the tree crowns. Brush also serves as a ladder fuel.
- **Maintain Aspen Stands and Meadows** - Aspen and meadow habitat are being lost due to encroaching ingrowth of conifer trees. Existing roads in meadow bottoms are channeling water drainage and encouraging motorized use, leading to soil erosion and compaction.

A detailed explanation of the existing and desired conditions relative to the purpose and need are described in the following section.

Improve Forest Health and Growth

Desired Conditions

Within the Porcupine Butte and McCloud Flats management areas, forest stand densities are managed to maintain and enhance growth and yield and to improve and protect forest health and vigor, while recognizing that fire, insects, disease, and other components have a key role in the ecosystem. Stand understories appear more open with less ingrowth, particularly on sites where wildfire plays a key role in stand development[9]. Old-growth pine stands are maintained and promoted along the Modoc Scenic Byway, because they are an important component of the highly scenic road to Medicine Lake[10].

Wildlife Habitat management areas emphasize management for early and mid-level seral stage development species. Forest stands are managed to maintain lower tree stocking levels and greater amounts of understory cover and forage. The landscape within this area ranges from openings of early seral stage plants and trees, to open mature stands often containing multiple understory layers of trees and shrubs[11].

Late-Successional Reserve RC-358 Porcupine (Porcupine LSR) is located in the Saddle Hills area. The landscape appears natural with much of the area in late-successional forest vegetation. Late-successional forest stands are managed to maintain health and diversity components using prescribed fire and thinning from below. Younger to mature forest stands are managed to replace older dead and dying stands. Late-successional stands contain large numbers of old-growth trees with large branching, flattened or dead tops and high levels of decadence. These older stands are structurally diverse, often being multiple-storied[12]. Diversity includes a mix of species. Ponderosa pine will be the dominant species, intermixed with white fir, sugar pine, and incense cedar. Decadence in the stand includes snags and coarse woody debris. Deformed, broken and diseased

[9] USDA Forest Service 1995 (see footnote 1), pages 4-76 and 4-79.
[10] USDA Forest Service 1995 (see footnote 1), page 4-78.
[11] USDA Forest Service 1995 (see footnote 1), page 4-76.
[12] USDA Forest Service 1995 (see footnote 1), page 4-77.

trees are common enough to provide wildlife nesting and roosting habitat. An average of two to four snags per acre[13] 20 inches in diameter and greater are scattered across the landscape.

Commercial Wood Products emphasis areas promote timber growth and yield. In these areas, the forest is more even-aged, with ingrowth and understory vegetation treatments designed to enhance timber stand growth and yield, improve forest health and protect the forest from stand-destroying wildfires.[14]

Existing Conditions

Timber stands within the project area were field examined to determine current stand conditions including age, stocking, mortality, fuel loading, and presence of insects and disease. Additional discussion of existing conditions can be found in the environmental consequences section of this document and the project record.

Stands are dense and overstocked across the project area. Approximately 3,831 acres of 40- to 80-year-old pine and mixed pine/white fir stands range from 160 to 280 square feet of basal area with corresponding stand density indices in the overstory stand component from 240 to 470[15]. Approximately 410 acres are stocked with mature ponderosa pine and white fir, 150 years age or older, with an understory of 40- to 80-year-old pine and fir[16]. Stand densities in overstocked areas range from 180 to 340 square feet of basal area per acre. These stands exceed the maximum stocking levels of 150 square feet of basal area and stand density indices of 230 recommended by research scientists for resistance to insect infestation[17]. These overstocked stands are not meeting Forest Plan objectives regarding resistance to insects and disease, or growth. Trees are dying from bark beetle infestations, which are exacerbated by root disease, overstocking and periodic drought. White fir are impacted by fir engraver beetles (*Scolytus ventralis*); ponderosa pine are impacted by western pine beetles (*Dendroctonus brevicomis*) and red turpentine beetles (*Dendroctonus valens*). Pockets of dead trees

Basal Area – The cross-sectional area of all stems of a species or all stems in a stand measured at breast height and expressed per unit of land area.

Stand Density Index – the relationship between tree size and the number of trees per acre.

Stocking – an indication of growing space occupancy relative to a pre-established standard.

[13] U.S. Department of Agriculture, Forest Service 1999. Shasta-Trinity National Forest Forestwide Late Successional Reserve Assessment. Unpublished report on file at Shasta-Trinity National Forest. Redding, CA. Chapter 3.
[14] USDA Forest Service, 1995 (see footnote 1), page 4-77.
[15] All or portions of units: 39-52, 56, 58, 60, 63, 64, 65, 68; 43-20; 44-60; 47-100, 101, 102, 103, 104; 48-200, 201, 202, 203, 204, 205, 206, 209, 210, 211, 212, 213, 215, 216, 217, 218, 219, 220, 224, 225, 226; units identified as standard thinning or biomass thinning on Porcupine Proposed Action Map
[16] Units: 39-51, 53, 54, 57, 59, 61, 62, 66, 67; units identified as mature stand thinning or hazard reduction thinning on Porcupine Proposed Action Map.
[17] Oliver, William W., and Fabian C. Uzho. 1997. Maximum Stand Densities for Ponderosa pine and red fir and white fir in Northern California. In: Proceedings 18th Annual Forest Vegetation Management Conference; 1997 January 14-16; Sacramento, CA. Forest Vegetation Management Conference, Redding, CA. page 62-63.

range from ¼ acre to areas greater than 1 acre.[18] High stocking levels of overstory trees have led to poor growing conditions for bitterbrush and forage species within wildlife habitat management area.

Past mortality and salvage harvest have created conditions for incense cedar and white fir to become established. These shade-tolerant species readily establish in the understory of pine, especially following disturbance such as salvage harvest. In the past, periodic wildfires would destroy the seedlings and saplings of these species, keeping their numbers at lower levels. However, due to fire suppression, these species have become prolific throughout the understory and mid-story of many stands[19].

Lodgepole pine stands in the southwest portion of the project area are past maturity and are experiencing high levels of mortality. Some lodgepole has been regenerated through strip clearcutting and is growing well, however nearby, overmature, mistletoe-infected trees have the potential to spread disease to the new stands.

Mature pine stands along the Modoc Scenic Byway and within the Porcupine LSR have an understory of white fir, incense cedar, and ponderosa pine. These dense understory conditions threaten the mature overstory trees through competition and increase the risk of insect infestation. In addition, the understory vegetation serves as ladder fuel that could kill the large, mature overstory trees during a wildfire. While some mortality is desired in late-successional forests, a complete loss of the overstory trees is not desired.

The Porcupine LSR is lacking late-successional habitat and has relatively high amounts of early and mid-successional habitat. Late-successional habitat makes up only 15 percent of the area, while early and mid-successional conditions account for 67 percent of the habitat[20]. Due to dry site conditions and relatively high levels of stocking, these stands may be slow to develop late-successional characteristics.

Actions Needed

- Within Commercial Wood Products Emphasis Areas, use thinning to reduce stand densities to stocking levels appropriate for ponderosa pine or white fir. Thinning stands to 100 to 120 square feet of basal area would reduce competition for moisture and improve the ability of trees to withstand drought conditions and insect attack. Reduced stocking would improve individual tree growth and vigor.[21],[22],[23]

[18] McCusker, N. 2008. Porcupine Vegetation and Road Management Project Silviculture Report. Unpublished report on file at: U.S. Department of Agriculture, Forest Service, Shasta-Trinity National Forest, Mt. Shasta, CA. 24 pages.
[19] U. S. Department of Agriculture, Forest Service. 2006. Fire Effects Information System (online). Available: http://www.fs.fed.us/database/feis. Rocky Mountain Research Station, Fire Sciences Laboratory.
[20] USDA Forest Service 1999, (see footnote 13) Chapter 2, page 2-38.
[21] Oliver, William W. and Fabian. C. C. Uzho. 1997. Maxiumum stand densities for ponderosa pine and white fir in Northern California. In: Proceedings 18th Annual Forest Vegetation Management Conference; 1997. January 14-16; Sacramento, CA: Forest Vegetation Management Conference, Redding, CA. pg. 62-63.
[22] Oliver, William W. 1988. Ten-year growth response of a California red and white fir sawtimber stand to several thinning intensities. Western Journal of Applied Forestry. 3(2)1988. page 43.

- Regenerate overmature, disease infected lodgepole pine in the vicinity of young pine plantations. Harvest to remove the disease source from the vicinity of the existing young stands and regenerate young, vigorous lodgepole pine.
- Reduce stand densities in wildlife habitat management areas to achieve stocking levels that would allow for the growth of shrubs and forage for early and mid-seral stage dependent species.
- Shift the species composition back to pine on dry sites that were historically pine. Favor the retention of fire-resistant pine and remove incense cedar and white fir during thinning.
- Thin overstocked early and mid-successional stands to promote the development of late-successional habitat along the Modoc Scenic Byway and the Porcupine LSR. Thinning would increase the growth of overstory trees.

Reduce Fuels

Desired Conditions

The combination of surface, ladder, and crown fuels result in predicted fire behavior that is not likely to destroy forest stands[24]. Stand understories are open with less ingrowth, particularly where wildfire plays a key role in stand development[25]. Thinning, prescribed burning, and natural fire management are used to treat fuels and enhance wildlife habitat[26]. Fuel treatments that replicate fire's natural role in the ecosystem are planned and implemented[27]

Late-successional stands are protected from threats of habitat loss that occur outside and inside the LSR[28]. Mid- and early-successional habitats are also protected from loss due to large-scale disturbance events.[29].

Existing Conditions

Stands throughout the project area have accumulated surface and ladder fuels that would threaten overstory trees in the event of a wildfire.[30] These fuels are due to several conditions, including the growth of understory cedar, fir, and brush. High levels of tree mortality are predicted in the event of a wildfire[31].

[23] Fiddler, Gary O., Hart, Dennis R., Fiddler, Troy A. McDonald, Philip M. 1989. Thinning decreases mortality and increases growth of ponderosa pine in northeastern California. Res. Paper PSW-194. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S., Department of Agriculture. 7.p.
[24] USDA Forest Service, 1995 (see footnote 1), pages 4-77 and 4-81.
[25] USDA Forest Service, 1995 (see footnote 1), pages 4-76 and 4-80.
[26] USDA Forest Service, 1995 (see footnote 1), pages 4-75 and 4-79.
[27] USDA Forest Service, 1995 (see footnote 1), page 4-18.
[28] USDA Forest Service 1999, (see footnote 13) Chapter 4, page 4-1.
[29] USDA Forest Service 1999, (see footnote 13) Chapter 4, page 4-2.
[30] USDA Forest Service 2003 (see footnote 2) pages 3-54-56.
[31] USDA Forest Service 2003, (see footnote 2) page 56.

Stand composition is shifting from pine, to pine mixed with incense cedar and white fir[32]. Incense cedar and white fir are prolific throughout the understory and mid-story of many stands. This shift in species composition increases the risk of loss due to wildfire. Historically, periodic wildfires limited the species composition of dry sites to mainly pine. Cedar and fir are more susceptible to fire-caused mortality than pine due to their branch characteristics and bark qualities[33]. Pines that are normally fire-resistant are now at risk of being killed by fire that could be transferred into their crowns by the cedar and fir trees.

Brush in the understory of conifer stands is becoming decadent due to age and overstory shading. Dead and dying brush creates additional fuel loading in the stand understory and could also help carry a fire into the tree crowns in dry or windy conditions. Historically, periodic surface fire would consume existing brush, stimulate sprouting and seed germination, and limit heavy accumulations of brush.

Actions Needed

- Reduce ladder fuels that threaten the large, mature overstory trees in a wildfire event by thinning and removing mid-story and understory trees.
- Shift stand species composition from pine mixed with cedar and fir to stands predominately composed of pine. Pines can be selected for retention during forest thinning to reduce stocking.
- Decrease concentrations of surface fuels where they are in excess of those needed to meet Forest Plan standards and guidelines[34]. Surface fuels can be piled and burned during conditions when there is low fire hazard. Sensitive areas or areas where excess fuels are limited can be hand piled. Large, continuous areas of fuels or areas with decadent brush can be piled with a tractor mounted brush rake.
- Reintroduce fire through low-intensity prescribed burning after ladder fuels are removed. This would reduce the accumulation of natural fuels since the last wildfire event and promote pine regeneration. Burning would also promote the establishment of bitterbrush[35].

Maintain Aspen and Meadows

Desired Conditions

Riparian areas are managed to maintain and restore the species composition and structural diversity of plant communities[36]. Plant communities within project riparian areas include aspen and meadows.

[32] U.S. Department of Agriculture, Forest Service. 2003. Porcupine Watershed Analysis. Unpublished report on file at Shasta-Trinity National Forest, Redding, CA. page 5-5.
[33] U.S. Department of Agriculture, Forest Service. 2006. Fire Effects Information System (online). Available: http://www.fs.fed.us/database/feis. Rocky Mountain Research Station, Fire Sciences Laboratory.
[34] USDA Forest Service 1995 (see footnote 1), page 4-67, Appendix G 12.
[35] U.S. Department of Agriculture, Forest Service 2006. Fire Effects Information System (online). Available: http://www.fs.fed.us/database/feis. Rocky Mountain Research Station, Fire Sciences Laboratory.
[36] USDA Forest Service 1995 (see footnote 1), page 4-53.

Management of hardwoods is emphasized including aspen as a stand component where they exist[37]. Existing quaking aspen[38] stands are restored and rehabilitated. Management activities provide for the maintenance, restoration or enhancement of a variety of riparian habitat types.

Existing Conditions

The project area has one stand of aspen (approximately 30 acres) that is overmature and in decline. The overstory aspen trees are dying and the stand is regenerating through root sprouts. Conifers occupy much of the stand and are shading the sprouts. Aspen is a shade-intolerant species and regenerates best in full sunlight. Due to competition for light and nutrients, combined with browsing by animals, the sprouts could eventually be lost and the site would convert to conifers. Aspen communities are considered high in biodiversity. When aspen communities change to conifers there is a loss of plant species richness[39].

Conifers are now growing in areas that were once meadows. A comparison of 1944 aerial photos to recent aerial photos shows a loss of meadow habitat to forest cover[40]. Meadows in the Porcupine Watershed declined from 1,185 acres in 1944 to 574 acres in 2003.[41] Roads in the meadows channel water flow, change hydrologic conditions, and invite motorized use.

Actions Needed

- Remove conifers within the aspen stand and follow-up with a low-intensity surface burn. Aspen is a shade intolerant species and grows best in full sunlight. Removing conifers would increase the health and growth of the aspen root sprouts. Burning the aspen stand with a low-intensity surface fire would stimulate sprouting[42].
- Remove conifers growing in meadows. Close roads in meadows to vehicle traffic, decrease soil compaction of the road prism, and revegetate the road surface with native species.

Proposed Action

The proposed action would reduce forest stocking levels and fuels on approximately 4,300 acres. In addition, 30 acres of meadow and 30 acres of aspen would be restored. Meadow restoration would include decommissioning two existing roads. Forest stand treatments would be accomplished primarily through commercial timber harvest of sawtimber (log) and biomass (chip) products. Fuel

[37] USDA Forest Service 1995 (see footnote 1), page 4-78.
[38] USDA Forest Service 2003, (see footnote 32), page 6-6.
[39] Bartos, Dale L. 2000. Landscape Dynamics of Aspen and Conifer Forests; 2000 June 13-15; Grand Junction, CO. Sustaining Aspen in Western Landscapes: Symposium Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. page 5-14.
[40] USDA Forest Service 2003, (see footnote 2), page 4-14.
[41] USDA Forest Service 2003, (see footnote 2) page 4-12.
[42] Shepard, Wayne D. 2001. Manipulations to Regenerate Aspen Ecosystems; 2000 June 13-15; Grand Junction, CO. Sustaining Aspen in Western Landscapes: Symposium Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. page 358-362.

treatments would follow the harvest operation to meet overall treatment objectives. Existing roads would provide access for harvest operations. Most roads are suitable for hauling sawtimber logs and biomass chips with pre-haul maintenance, however some existing roads would require reconstruction and maintenance level I roads, now closed to vehicles would be reopened. Any maintenance level I roads used during the project would be closed to vehicle traffic and vegetation would be reestablished upon completion of harvest activities. The proposed action is described in detail in the Alternatives section of this document.

Decision Framework

After reviewing this environmental assessment and supporting documents and considering all public input on the project, the Forest Supervisor of the Shasta-Trinity National Forest will decide whether to implement the proposed action as described, select another action alternative action that meets the purpose and need, or take no action. The decision will be in accordance with Forest Plan goals, objectives, and desired future conditions. If an action alternative is selected, the decision will specify:

- When proposed activities could begin and whether there are any time restrictions
- How roads in the project area would be managed
- What mitigation and monitoring requirements would take place

Public Involvement and Issues

This project has been listed in the Shasta-Trinity Schedule of Proposed Actions (SOPA) since July 2006. A notice of opportunity to comment was published in the Mount Shasta Herald on April 25, 2007. Letters requesting comment were sent to three individuals who expressed an interest in this project. Three written responses were received. District staff met with members of the Pit River Tribe regarding the project in May 2006 and tribal members attended a project area field trip in October 2006.

Public scoping is integral to the environmental analysis process. Comments in response to scoping are used to determine the range of actions, alternatives, and impacts to be considered in an analysis. Issues are points of discussion, dispute, or debate about the environmental effects of proposed actions. Using the comments from the public, other agencies, and the organization, the IDT and District Ranger identified four significant issues. Appendix F includes a list of scoping respondents, their comments, issue determination, and response to comments[43].

[43]U.S. Department of Agriculture, Forest Service. 2007. Porcupine Vegetation and Road Management Project Issue Management. October 11, 2007. Unpublished, available on file: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit, Mt. Shasta, CA. 70 p.

Issues Identified

1. **Late-successional reserve:** The proposed action includes treatments within the Porcupine LSR. Late-successional reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species. The proposed actions are consistent with Forest Plan direction for LSR management; however, there is concern that any treatments must have clear benefits and be justified. An alternative that includes no treatment within the LSR would provide a clear comparison of treatment effects and provide an option to forego management treatments within the LSR while proceeding with management activities within the project area.
2. **Regenerate mature and overmature stands:** The project area includes matrix lands with areas of commercial wood products emphasis. The purpose of this prescription is to obtain an optimum yield of wood fiber products from productive forest stands. Proposed treatments would thin mature and overmature stands. These stands should be regenerated for optimum yield of wood fiber.
3. **Project level roads analysis process (RAP) recommendations:** A project level RAP was completed in June 2007. The RAP identified opportunities for the long-term management of classified and unclassified roads, including: reduced open road density by decommissioning unneeded unclassified roads, closure of classified roads with intermittent use, and obliteration of unclassified roads; addition of existing unclassified roads to the system with long-term and reoccurring use; and upgrade of roads with heavy traffic. The RAP recommendations should be included project actions.
4. **Limit harvest to trees less than 12 inches DBH:** An alternative to the proposed action should focus on the purpose and need of forest health and fire risk reduction rather than the production of commercial wood products. This alternative should preclude the harvest of trees 12 inches DBH and larger and minimize road construction and reconstruction.

Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Porcupine Vegetation and Road Management Project. It describes alternatives considered in detail and eliminated from detailed study. Reasonable alternatives were explored and objectively evaluated. One alternative was considered but dismissed from detailed study. The end of this chapter presents the alternatives in a table so the alternatives and their impacts can be readily compared.

Alternatives Considered

Alternative 1: Proposed Action

The proposed action would reduce forest stocking levels and fuels on approximately 4,300 acres. In addition, 30 acres of meadow and 30 acres of aspen would be restored. Road management actions

include 102 miles of haul road maintenance and 2 miles of decommissioning roads that impact meadows. The following tables summarize the treatments and road management activities.

Forest stand treatments would be accomplished primarily through commercial harvest. Harvest operations would yield sawtimber (logs) and biomass (chips) products. These products would contribute to Forest Goals for biomass and timber.[44] Trees would be felled, removed, and processed with mechanized equipment. Harvested trees would be transported from the stump to central landing areas adjacent to roads where they would be limbed and processed into logs or chips.

Forest Health and Growth

Standard Thin

Overstocked forest stands would be thinned by removing primarily understory and midstory trees to achieve desired stocking. Some dominant and codominant trees may be removed to attain desired stocking. Excess trees would be removed as sawlogs (trees 10 inches and greater in diameter) and biomass material (trees 4 to 9.9 inches in diameter). Thinning treatments vary depending on the management prescription and objective. Treatment objectives include improve stand health and tree growth, improve resistance to insect mortality, remove ladder fuels, shift species composition, and improve the growth of shrub and forage species.

Table 1. Summary of proposed action stand and fuel treatments (all acres are approximate)

Forest Stand Treatments	Forest Stand Treatment Acres	Fuel Treatment Acres			
		Slashing	Hand Pile & Burn	Machine Pile & Burn	Underburn
Standard Thin	3,370	260	110	30	1,590
Biomass Thin	450	0	20	0	0
Hazard Reduction	260	210	0	210	0
Mature Stand Thin	150	150	0	140	20
Lodgepole Regeneration with Green Tree Retention	40	0	0	40	0
Aspen Release	30	30	0	0	30
Meadow Restoration	30	30	0	0	20
Total Acres	4,330	680	130	420	1,660

Table 2. Summary of proposed action road management actions

Transportation Actions	Miles
Roads Decommissioned	2
Haul Maintenance	103

[44] USDA Forest Service 1995 (see footnote 1), pages 4-4, 4-5.

Biomass Thin

Overstocked forest stands would be thinned from below by removing primarily understory trees to achieve desired stocking. Most trees to be removed would range from 4 to 13 inches in diameter and the harvest would yield primarily biomass material. Some trees larger than 13 inches would be removed to achieve treatment objectives. Treatment objectives include improve stand health and tree growth, improve resistance to insect mortality, and remove ladder fuels.

Hazard Reduction

Stands would be thinned by primarily removing trees 4 to 13 inches in diameter. The objective is to remove ladder fuels in stands with late-successional characteristics and reduce the likelihood of stand-replacing disturbances such as crown fire or high levels of insect-caused mortality that would result in the loss of key late-successional structure.

Mature Stand Thin

Stands would be thinned to desired stocking levels by primarily removing trees in the suppressed and intermediate crown classes. Some dominant and codominant trees may also be removed. Trees 4 inches in diameter and greater would be cut and removed. This treatment is prescribed in stands with a considerable mature tree component. The treatment objective is to remove ladder fuels and reduce competition around existing mature trees.

Lodgepole Regeneration with Green Tree Retention

Overmature lodgepole pine would be regenerated by harvesting most trees 4 inches in diameter and greater. At least 15 percent of the stand would be retained uncut to meet the Forest Plan standard for green tree retention[45]. Natural regeneration following harvest is expected to result in a fully stocked stand of seedlings within 5 years of the harvest. The treatment objectives are to remove diseased overstory lodgepole pine in close proximity to existing, young lodgepole and regenerate a stand of lodgepole.

Reduce Fuels

Forest fuels would be reduced within harvest units by decreasing understory and mid-story stocking. Commercial and biomass timber harvest would use whole-tree yarding, which means the entire tree would be removed, processed at a landing, and made into logs or wood chips. Minor amounts of slash would remain in the forest as a result of harvest activities. Portions of trees not used for logs or chips would be piled and burned at the landing. The following fuel treatments would be in addition to whole-tree yarding. These treatments would contribute to Forest Plan goals for fire and fuels[46].

[45] USDA Forest Service 1995 (see footnote 1), page 4-61.
[46] USDA Forest Service 1995 (see footnote 1), pages 4-4, 4-8

Slashing

Conifer trees less than 4 inches in diameter would be cut, lopped, and scattered. The treatment objective is to complete the thin from below prescription and reduce ladder fuels. Slashing in the aspen stand would complete the removal of conifers.

Hand Pile and Burn

Harvest-generated fuels would be manually piled. Piles would be burned when there is low fire danger. This treatment would reduce concentrations of activity fuels and would result in predicted fire behavior that would be within desired intensities.

Machine Pile and Burn

Harvest generated fuels, natural fuels, brush and heavy accumulations of litter would be piled with a tractor-mounted brush rake. Piles would be burned when there is low fire danger. This treatment would also reduce concentrations of activity fuels and predicted fire behavior would be within desired intensities.

Underburn

Natural and harvest-generated fuels would be broadcast burned in-place with a low-intensity surface fire. This treatment would be applied to forest stands with low fuel loading that have a developing understory of conifer saplings. The low-intensity burn would reduce surface fuels along with the developing ladder fuels of conifer saplings. Underburning would require control lines, where forest litter is cleared down to mineral soil. Control lines would be constructed by hand crews, small crawler tractors, or existing roads would serve as control lines. Burning with a low-intensity surface fire would reduce natural and activity fuels and predicted fire behavior would be within desired intensities.

Maintain Aspen and Meadow

Aspen Release

One aspen stand would be treated by removing conifers followed by underburning. Conifer trees within approximately 150 feet of aspen would be harvested as sawlogs and biomass. The treatment objective in these areas is to restore aspen as the predominate stand species. The aspen stand is currently in decline and removal of the pine followed by burning would provide good growing conditions for aspen root sprouts.

Meadow Restoration

Two meadows would be restored by removing encroaching conifers. Conifers of commercial size would be removed through harvest operations. Trees less than 4 inches in diameter would be cut and slashed. Existing roads would be blocked to normal vehicular traffic by creating a barricade of rocks or through the construction of earth berms. Soil compaction within the road prism would be reduced

by subsoiling[47]. Vegetation on the road surface would be reestablished by seeding with native species.

Alternative 2: No Treatments within the Porcupine LSR

This alternative is responsive to the issue regarding the Porcupine LSR by proposing to forego all treatments within the LSR boundary. Outside the LSR boundary, units and treatments would be the same as Alternative 1 with the exception of previously established fuel breaks along Forest System Roads 41N36 and 41N01[48]. This alternative is also responsive to the issue regarding road management actions identified in the project-level RAP. Road management actions identified in the project level RAP include 2 miles of road would be surfaced with rock; 7 miles of roads currently open to vehicle travel would be closed with barriers and vegetation would be reestablished; 3.2 miles of unneeded system roads would be decommissioned; and 3 miles of unclassified roads needed for long-term management would be added to the system. Tables 3 and 4 (next page) summarize the treatments and road management actions for Alternative 2.

Table 3. Summary of Alternative 2 stand and fuel treatments (all treatment acres are approximate)

Forest Stand Treatments	Forest Stand Treatment Acres	Fuel Treatment Acres			
		Slashing	Hand Pile & Burn	Machine Pile & Burn	Underburn
Standard Thin	3,300	260	110	30	1,560
Biomass Thin	350	0	10	0	0
Hazard Reduction	140	140	0	140	0
Mature Stand Thin	140	140	0	120	20
Lodgepole Regeneration with Green Tree Retention	40	0	0	40	0
Aspen Release	30	30	0	0	30
Meadow Restoration	30	30	0	0	20
Total Acres	4,030	600	120	330	1,630

Table 4. Summary of Alternative 2 road management actions

Road Management Actions	Miles
Roads Decommissioned	3
Additions to System (unclassified to become system)	3
Road Reconstruction	2
Road Closure	7
Haul Maintenance	104

[47] Subsoiling is a method of mechanically decompacting soil. A tractor-pulled wing shaped blade travels 1 to 2 feet below the soil surface, relieving compaction.

[48] Previously established fuel breaks along Forest System Roads 41N36 and 41N01 are excluded from units 43-20, 44-60, 47-104 (approximately 80 acres).

Alternative 3: Modified Proposed Action

This alternative is responsive to the issues regarding the regeneration of over-mature stands within areas of commercial wood products emphasis, and project level RAP recommendations. This alternative also includes stands where additional opportunities to meet the project purpose and need were identified. One stand within areas of commercial wood products emphasis would be treated with a regeneration harvest. The additional opportunities include one additional stand to be treated with a standard thin, and one additional meadow to be restored. Road management actions identified in the project level RAP are included: 2 miles of road would be surfaced with rock; 7 miles of roads open to vehicle travel would be closed with barriers and vegetation would be re-established; 3 miles of unneeded system roads would be decommissioned; and 3 miles of unclassified roads needed for long term management would be added to the system. The following tables summarize the treatments and road management actions:

Table 5. Summary of Alternative 3 stand and fuel treatments (all acres are approximate)

Forest Stand Treatments	Forest Stand Treatment Acres	Fuel Treatment Acres			
		Slashing	Hand Pile & Burn	Machine Pile & Burn	Underburn
Standard Thin	3380	260	110	30	1640
Biomass Thin	450	0	20	0	0
Hazard Reduction	260	210	10	210	0
Mature Stand Thin	130	130	0	130	20
Lodgepole Regeneration with Green Tree Retention	40	0	0	40	0
Ponderosa Pine Regeneration Harvest with Green Tree Retention	20	20	0	0	20
Aspen Release	30	30	0	0	30
Meadow Restoration	50	50	30	o	20
Total Acres	4360	700	170	410	1730

Table 6. Summary of Alternative 3 road management actions

Road Management Actions	Miles
Roads Decommissioned	3
Additions to System (unclassified to become system)	3
Road Reconstruction	2
Road Closure	7
Haul Maintenance	104

Alternative 4: No Action

Proposed management activities would not be implemented under this alternative. This alternative provides a baseline of conditions used to compare the environmental effects of the varying action alternatives.

Design Criteria Common to All Action Alternatives

The Forest Plan identifies requirements that must be met by all projects that implement the plan. The following list defines Forest Plan standards and guidelines, and other management direction relevant to the alternatives.

1. **Late-successional forest:** The *Shasta-Trinity Forest Wide Late Successional Reserve Assessment (1999)* identifies design criteria standards for activities within the reserve. The treatment standards for "Hazard Reduction – Manual and Mechanical Fuel Reduction" apply to units 39-54, 39-55, and 39-61. Treatment standards for "Thinning in early successional pole and mid-successional stands – Development of Late-Successional Habitat" apply to units 39-51, 39-52, 39-53, and 39-60.[49]
2. **Snags:** Retain snags within harvest units at an average of 1.5 snags per acre greater than 15 inches in diameter and 20 feet in height within the matrix land allocation. Retain all snags within the riparian reserve allocation unless they are a defined safety hazard. Retain snags at naturally occurring levels within the Late-Successional Reserve.
3. **Coarse woody debris:** Retain and protect existing coarse woody debris on the ground from disturbance to the greatest extent possible. Maintain an average of 10 tons of unburned down/dead material within the roaded recreation management prescription and 5 tons within the commercial wood products emphasis management prescription[50].
4. **Root disease:** Treat cut stumps 14 inches in diameter with borax within 4 hours of stump creation to prevent the spread of root disease. Application of borax will follow all state and federal rules as they apply to pesticides. Borax will not be applied within 20 feet of running water. Do not subsoil within the drip line of living conifers to minimize tree root damage, unless there are overriding reasons[51].
5. **Water quality and soils:** Implement best management practices (BMPs) and Forest soil quality standards for all project activities. Incorporate BMPs into the design of all proposed harvest units so that treated units meet or make progress toward meeting Forest soil quality standards. These BMPs will be used to prevent or mitigate any project-associated effects related to soil erosion, compaction, and productivity. BMPs are found in Water Quality Management for Forest System Lands in California[52] and listed in Appendix E.

[49] USDA Forest Service 1999, (see footnote 13), Chapter 4
[50] USDA Forest Service 1995 (see footnote 1), pages 4-65, 4-67.
[51] Van Susteren, Peter. 2006. Personal communication regarding subsoiling, McCloud Ranger District, Shasta-Trinity National Forest.
[52] USDA Forest Service. 2000. Water Quality Management for Forest System Lands in California, Best Management Practices. 186 pp.

6. **Meadow and riparian protection:** Timber sale provisions B6.422 Landing and Skid Trail Location, and B6.61 Meadow Protection will apply to all units within or partly within Riparian Reserves. Landings will not be located within existing, intact meadow areas that have not experienced heavy conifer encroachment. Where a landing is needed within a meadow or aspen restoration unit, it will be located on an existing landing or within an area where conifer encroachment is advanced. Landings located in the former area will allow for the complete removal and disposal of conifers and debris including stumps. Landings within meadows will be ripped and reseeded with native grasses to allow for restoration of the meadow.
7. **Operating restrictions:** Region 5 timber sale contract C provision 6.315, Sale Operating Schedule, will be included in the timber sale contract and will apply to the following units where operations will occur within Riparian Reserves: 48-207, 48-208, 48-209, 48-214, 48-215, and 48-227. Prior to entering the harvest units with equipment, the sale administrator will verify ground conditions are dry and operations will not cause resource damage. Harvest operations will be restricted to dry or frozen soil conditions in the following units: 39-61, 48-204, 48-205, 48-206, 48-207, 48-208, 48-209, 48-210, 48-214, 48-227. Unit 48-215 will include a 25 foot equipment exclusion zone on either side of the intermittent stream.
8. **Grazing:** Grazing will be deferred for 2 seasons following underburning.
9. **Road drainage:** All roads displaying signs of runoff concentration will be bladed to provide adequate drainage and minimize runoff concentrations.
10. **Porcupine Lake:** No treatments or harvest activity will take place within 150 feet of Porcupine Lake and no treatments or harvest activities will take place within the dispersed camping area on the Lake's east side.
11. **Noxious weeds:** Reduce the risk of noxious weed introduction and spread in accordance with the Shasta-Trinity National Forest noxious weed management policy with the following preventative measures:
    a. Treat existing populations of listed noxious weeds along haul roads prior to harvest activities. Existing noxious weeds will be treated by manual removal.
    b. Clean all off-road logging and construction equipment prior to entering the project area to remove dirt, plant parts, and material that may carry weed seeds. Include a provision for equipment cleaning in all contracts.
    c. Certify all mulching agents such as hay or straw as weed free.
    d. Certified weed-free seeds and plants will be used for revegetation and erosion control.
    e. If new populations of noxious weeds are found, treatment will be implemented in accordance with priorities set by the Shasta-Trinity National Forest noxious weed program. New invader species will be slated for eradication immediately upon discovery. Other weed infestations will be treated according to district priorities.
    f. Monitor all weed treatments for effectiveness.

g. District botany or range staff will pre-inspect all gravel used in road maintenance and reconstruction to ensure the gravel source is weed free.
h. Landing construction in areas known to have bull thistle and/or common mullein will take place before flower buds appear or after heavy rains so seeds are not spread by the wind.
i. Vehicles or equipment will no be parked in areas where weed populations are known to occur.

12. **Plants:** Threatened or endangered plants are not known or suspected to occur within the project area. Sensitive plant habitat has been surveyed and one occurrence is known adjacent to a treatment unit and will be avoided in all alternatives.
    a. Notify an agency botanist if threatened, endangered, and sensitive (TES) species are discovered prior to or during project implementation so that measures can be taken to maintain population viability and habitat. Measures may include dropping units from activity, modifying the planned activity, or buffers around plant occurrences.
    b. Include provisions for protection of endangered species and settlement for environmental cancellation in all timber sale contracts.
13. **Air quality:** All burning will be consistent with the provisions of the Siskiyou County Air Pollution Control District rules and regulations through the permit process[53]. Require dust abatement where necessary to prevent the loss of road and landing surface material. The smoke management plan will adhere to the air quality regulations and restrictions set forth and approved by the North East Air Alliance.
14. **Heritage resources:** Heritage resource inventories and treatment provisions will be in accordance with *Section 106 of the National Historic Preservation Act* and the Region 5 Heritage Programmatic Agreement. Historic properties are flagged and posted for avoidance. Historic linear features can be crossed at pre-designated breaches. The timber sale contract will include standard provision C6.24 (protection of cultural resources): "if new heritage resources are discovered during project activities, all work in the vicinity will cease until the heritage resource manager examines the resource".
15. **Pile burning and underburning:** All burning will follow the guidelines set forth in a prescribed burn plan developed specifically for this project. Prescribed burn plans will address parameters for weather, air quality, contingency resources, and potential escapes. Roads and natural barriers will be primary fire control lines.
16. **Machine piles:** Machine fuel piling will be accomplished with a brush rake to minimize dirt in piles. Dirt in piles will be avoided to decrease fire smoldering.
17. **Activity fuels along Powder Hill Road (Forest Highway 49):** Hand pile and burn, machine pile and burn, or broadcast burn activity fuels within 50 feet of the Powder Hill road (Forest Highway 49).

[53] A smoke management plan will be submitted to the Siskiyou County Air Pollution Control District with the project burn plan. The county would issue a burn permit upon approval of the smoke management plan.

18. **Roads:** Close or block traffic on Maintenance Level I (intermittent service level) roads upon completion of harvest activities[54].
19. **Skid trails, temporary roads, and landings:** Re-use previously created skid trails, yarding corridors, temporary roads and landings if possible to avoid new ground disturbance. Limit skid trail spacing to 50 feet and minimize equipment use off these trails to 3 passes. Subsoil main skid trails, yarding corridors, temporary roads and landings to a depth of 18 inches or more. Subsoiling will occur after pile burning on landings. .
20. **Mechanized equipment:** Limit mechanized harvest equipment to slopes less than 35 percent.
21. **Visual Quality:** Locate landings out of sight of Powder Hill Road (Forest Highway 49) wherever possible. Cut trees to be removed within 200 feet of Powder Hill Road and visible to travelers with a stump height no greater than 6 inches.
22. **Wildlife Habitat:** Harvest and fuel reduction operations within all or portions of the units shown in Table 7 will not take place within the indicated dates to provide wildlife protection during a critical period.
23. **Public Safety:** Place warning signs along the Powder Hill Road (Forest Highway 49) and Forest Highway 3 when hauling is in progress to make the public aware of logging trucks. Place signs along the Powder Hill Road and Forest Highway 3 when burning is in progress to alert the public of possible smoke and fire in the area.

Table 7. Stands affected by limited operating periods (LOP) for the protection of a modeled northern spotted owl territory and a known northern goshawk territory

Unit	LOP[55]	Species driving LOP
39-53	1 February – 31 August	Northern spotted owl, northern goshawk
39-51	1 February – 31 August	Northern spotted owl, northern goshawk
39-52	1 February – 31 August	Northern spotted owl, northern goshawk
39-56	1 February – 15 August	Northern spotted owl
39-54	1 February – 31 August	Northern spotted owl, northern goshawk
39-55	1 February – 15 August	Northern spotted owl
39-60	1 February – 15 August	Northern spotted owl
39-63	1 February – 15 August	Northern spotted owl
39-61	1 February – 15 August	Northern spotted owl

[54] USDA Forest Service 1995 (see footnote 1), Appendix K.
[55] Northern spotted owl LOP is 1 February – 15 August within 1.3 miles of territories. Northern goshawk LOP is 15 February – 31 August within 0.25 miles of a nest. Therefore, where the two LOP areas overlap, there is a longer LOP to take in both individual LOPs. In this project area, the locations of each habitat feature driving the LOP are adjacent, near the boundary of the project area.

Monitoring

1. **Aspen:** The aspen stand will be monitored following conifer removal and underburning. Aspen regeneration with excessive browse damage will be fenced to minimize damage. Fences will be maintained until regenerating aspen stems are of sufficient size to avoid browse damage. Fences will be removed when they are no longer needed.
2. **BMPs and soil productivity:** BMP implementation, effectiveness and soil productivity will be monitored during the project and post-project by the District soil scientist.
3. **Reforestation:** The District silviculturist will monitor regeneration harvest units to verify that minimum stocking standards are achieved within 5 years of final harvest.

Alternatives Considered but Eliminated from Detailed Study

Alternative 5: Limit harvest to trees less than 12 inches DBH

An alternative that precludes the harvest of trees 12 inches DBH and larger was not considered in detail because it would not reasonably meet the project purpose and need. A 12-inch upper diameter limit would not be effective in accomplishing treatment objectives for the following reasons:

- High stocking levels include overstory trees and stocking could not be reduced to desired levels by limiting harvest to trees less than 12 inches DBH.
- Disease-infected lodgepole pine overstory trees would continue to infect adjacent young lodgepole pine.
- The species composition of mixed stands (white fir, incense cedar, ponderosa pine) on dry, fire- maintained sites would not shift back to pine.
- Aspen would remain overtopped and suppressed by large-diameter conifers.

The production of commercial wood products from project area stands is consistent with Forest Plan direction. The majority of the project area (93 percent) is in the Matrix land allocation. Forest Plan desired conditions for the Matrix allocation include "a sustained level of forest products from suitable Matrix lands as a by product of ecosystem management is expected to provide approximately 159 million board feet per decade in wood products."[56] Based on this information, this alternative was eliminated from detailed study.

Comparison of Alternatives

Table 8 compares the effects of the alternatives in summary form. The alternatives are compared by significant issue, project purpose and need, and resource effects. The environmental consequences section of this document forms the scientific and analytical basis for this comparison and describes effects in detail.

[56] USDA Forest Service 1995 (see footnote 1), page 4-76.

Table 8. Comparison of alternatives

Project Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forest Health and Growth				
Reduced stand density within Commercial Wood Products Emphasis areas; stands stocked below 230 SDI	3,080 acres	3,020 acres	2,990 acres	0 acres
Reduced stand density within Wildlife Habitat Management areas: stands stocked below 230 SDI	650 acres	650 acres	650 acres	0 acres
Reduced stand density within Roaded Recreation areas	250 acres	250 acres	330 acres	0 acres
Reduced stand density within Riparian Reserve areas	10 acres	10 acres	10 acres	0 acres
Regenerate mature and overmature forests stands	40 acres	40 acres	60 acres	0 acres
Shift species composition to back to pine	3,420 acres	3,110 acres	3,340 acres	0 acres
Promote development of Late Successional Habitat through thinning: Porcupine Late Successional Reserve, Modoc Scenic Byway	240 acres	0 acres	240 acres	0 acres
Fuel Loading				
Ladder fuels reduced through thinning of mid and understory trees	4,230 acres	3,930 acres	4,220 acres	0 acres
Surface fuels reduced through piling and burning.	570 acres	450 acres	580 acres	0 acres
Surface fuels reduced through prescribed burning	1,660 acres	1,630 acres	1,730 acres	0 acres
Late-successional forest with reduced fuel loading	340 acres	270 acres	340 acres	0 acres
Late-successional forest with reduced chance of stand replacing crown fire	340 acres	270 acres	340 acres	0 acres
Maintain Aspen and Meadow				
Aspen released	30 acres	30 acres	30 acres	0 acres
Meadow restored	30 acres	30 acres	50 acres	0 acres
Transportation Management				
Roads closed	0 miles	7 miles	7 miles	0 miles
Road decommissioned	2 miles	3 miles	3 miles	0 miles
Roads upgraded	0 miles	2 miles	2 miles	0 miles
Wildlife				
Impact on the Northern Spotted Owl	NLAA*	NLAA*	NLAA*	No impact
Impact on the Northern Goshawk	MIIH*	MIIH*	MIIH*	No impact
Impact on the Pacific Fisher	No impact	No impact	No impact	No impact
Economic				
Harvest volume	51,200 CCF	48,300 CCF	54,000 CCF	0 CCF
Present Net Value	$2,356,600	$2,223,000	$2,283,200	$0
Jobs Supported	780	720	810	0

*NLAA=Not likely to adversely affect individuals or their habitat
MIIH=May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species.

Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Table 8.

Effects Relative to the Purpose and Need

Forest Health and Growth

Alternative 1

Direct and Indirect Effect

Forest Stocking Levels

Alternative 1 would treat approximately 3,900 acres of overstocked, mid-seral and mature mixed-conifer and ponderosa pine stands with thinning prescriptions designed to achieve the desired conditions (for a description of the various forest stand treatments see Forest Health and Growth on page 12). The thinning prescriptions would retain densities recommended for ponderosa pine and drier mixed-conifer stands - approximately 100-140 square feet of basal area (average 120 square feet) and approximately 16- to 20-foot spacing in biomass areas. Table 9 illustrates the corresponding stand density indices (SDI) for an average post-treatment basal area of 120 square feet for the average overstory stand diameters representative of mid-seral and mature treatment units. All SDI values are below the 230 SDI value recommended for resistance to bark beetle attacks.

Table 9. Stand density indices

Post-treatment Average Basal Area/Acre	Average Stand Diameter	Post Treatment SDI Value
120 sq ft/acre	10 inches	220
120 sq ft/acre	14 inches	192
120 sq ft/acre	18 inches	174
120 sq ft/acre	22 inches	161
120 sq ft/acre	26 inches	150

Alternative 1 would also treat approximately 340 acres of overstocked, multi-storied mixed-conifer stands with late-successional characteristics. Thinning prescriptions in these stands are designed to maintain late-successional forest, structurally diverse characteristics, and reduce stand density to reduce the likelihood of stand-replacing disturbances such as crown fire or high levels of insect-caused mortality that would result in the loss of key late-successional structure. These

prescriptions would thin the middle and understory layers resulting in a total residual density of approximately 140-180 square feet of basal area (average 160 square feet).

After treatment, all thinned stands (4,230 acres) would meet the project purpose and need for healthier growing conditions by reducing inter-tree competition for resources. An exhaustive body of research shows how thinning helps reduce the incidence of pest damage to a stand.[57] Less competition increases the health and vigor of the remaining trees resulting in a reduction of risk to bark beetle attack. The growth rates would be greater for the residual trees and less mortality would lead to lower dead fuel levels. The thinned stands would be more open, similar to historic conditions at densities shown to be sustainable with increased resilience to bark beetle attacks. Stocking levels in the mid-seral stands are expected to remain between 230 and 300 SDI for 20 years after treatment. These estimates are based on expected growth rates for this project area, which were generated from Forest Vegetation Simulation modeling runs based on inventory plot data from the project area, Region 5 Growth Studies within the project area, and appropriate yield tables.[58]

Studies indicate that thinning to 100-140 square feet per acre reduced tree mortality 86 to 95 percent, and growth increased 338 to 638 percent as compared to unthinned stands. At this level of thinning, expected mortality would be 1-3 trees per acre over 10 years.[59] A 30-year study in central Oregon also demonstrated that basal area and volume growth of the 20 largest diameter trees per acre decreased with increasing growing stock levels due to competition from smaller trees.[60] Thinning directly reduces the host resource base (excess trees) that supports beetle populations. It also reduces competition among the leave trees for water and nutrients, which improves the trees' resilience to future bark beetle attacks.

The lodgepole pine regeneration with green tree retention treatment (40 acres) would regenerate diseased and overmature overstory lodgepole pine by harvesting most trees within the units 4 inches in diameter and greater. At least 15 percent of the stand would be retained uncut to

[57] Cochran, P.H. and James W. Barrett. 1995. Growth and mortality of ponderosa pine poles thinned to various densities in the Blue Mountains of Oregon. Res. Pap. PNW-RP-483. Portland OR:U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.
Oliver, William W. 1995. Is self-thinning in ponderosa pine ruled by Dendroctonus bark beetles? In: Lane G. Eskew, ed. Forest Health Through Silviculture-Proceedings of the 1995 National Silviculture Workshop. Gen. Tech. Rpt.RM-GTR-267. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 213-218.
Sartwell, Charles and R.E. Stevens. 1975. Mountain pine beetle in ponderosa pine- prospects for silvicultural control in second growth stands. J. of Forestry. March 1975; 136-140
[58] Dunning, D., and L.H. Reineke. 1933. Preliminary Yield Tables for Second-Growth Stands in the California Pine Region. USDA, Washington D.C. Technical Bulletin 354 23 p.
[59] Fiddler, Gary O., Hart, Dennis R., Fiddler, Troy A., McDonald, Phillip M. 1989. Thinning decreases mortality and increases growth of ponderosa pine in northeastern California. Res. Paper PSW-194. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture. 7 p. page 5.
[60] Cochran, P.H and James W Barrett. 1999. Growth of Ponderosa Pine Thinned to Different Stocking Levels in Central Oregon: 30 Year Results. Res. Paper PNW-RP-508. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 36 p. pages 20, 23

meet the Forest Plan standard for green tree retention.[61] Priority for retention includes leaving healthy, vigorous ponderosa pine followed by young, healthy and vigorous white fir and lodgepole. Natural regeneration following harvest is expected to result in a fully stocked stand of mostly lodgepole pine seedlings within 5 years of the harvest. Post-treatment stocking exams will occur during this 5-year period to ensure minimum stocking requirements are met and to determine if remedial treatments are needed.

Species Composition

Alternative 1 thinning prescriptions would result in a shift in the species composition on dry sites that were historically pine by favoring the retention of fire-resistant pine and removing incense cedar and white fir during thinning. This would ensure the following:

- Thinning units that are currently dominated by ponderosa pine (820 acres) would remain pine dominated.
- Thinning units that are on dry mixed -conifer sites with a heavy ponderosa pine component (420 acres) would become pine dominated.
- Thinning units that are on moist mixed-conifer sites with a low percentage of ponderosa pine (3,000 acres) would remain white fir-dominated with an overall increase in the percentage of ponderosa pine trees per acre.

Development of Late-successional Habitat

Thinning prescriptions for the mature pine stands along the Modoc Scenic Byway and within the Porcupine LSR (80 acres) are designed to maintain late-successional forest, structurally diverse characteristics and reduce stand density within the mid and understory layers. This would reduce the risk to insect outbreaks and reduce the likelihood of a large-scale disturbance by lowering the potential for a crown fire and the potential for increased fuel levels that would be created from insect- and stress-related mortality.[62] An additional 90 acres of stands with similar structure adjacent to the LSR boundary would be managed under the same prescription to maintain late-successional characteristics.

Alternative 1 would also treat approximately 150 acres of overstocked, mid-seral mixed-conifer stands within the LSR. Implementation of the thinning prescriptions for these stands would reduce stocking levels to accelerate growth and achieve desired tree size characteristics in a quicker timeframe[63]. An additional 160 acres of stands with similar structure adjacent to the LSR boundary would be managed under the same prescription with similar objectives.

[61] USDA Forest Service 1995 (see footnote 1). page 4-61.
[62] USDA Forest Service 1999 (see footnote 13). page 4-23.
[63] USDA Forest Service 1999 (see footnote 13). page 4-22.

Shrub Development

Thinning prescriptions in the Wildlife Habitat Management areas (650 acres) would achieve stocking levels that allow for the growth of shrubs and forage for early and mid-seral-stage dependent species.

Tractor Yarding and Fuel Treatments

All merchantable harvested material would be whole-tree tractor yarded from the unit. Fuel treatments proposed for Alternative 1 include slashing, hand pile and burn, machine pile and burn, underburn. Slashing would further reduce understory stocking and reduce inter-tree competition. All piling and/or low-intensity burning treatments would also reduce understory stocking and reduce inter-tree competition as well as stimulate understory vegetation (shrubs, forbs, grasses). Some damage to the residual trees would be expected with the felling, tractor yarding and piling operations. Damage would be minimized through sale administration and proper harvest methods.

Road Maintenance and Decommissioning

Road maintenance activities would have no effect on the health and growth of forest stands. Road decommissioning within forest stands would return approximately 2 acres to forest production.

Sporax Application

Sporax ($Na_2B_4O_710H_2O$, sodium tetraborate decahydrate) is used as a registered pesticide (fungicide) for forestry to prevent the spread of annosus root disease.[64] As such, Sporax is applied to freshly cut stump surfaces at a rate of approximately one pound per 50 square feet of stump surface. For this project, it is estimated that about 1 pound of Sporax per acre would be applied in thinning prescription stands and about 1-2 pounds of Sporax in regeneration harvest stands.[65] Sporax would be applied to cut stumps 14 inches in diameter and greater on approximately 4,300 acres of treatment units.[66]

Cumulative Effects (Forest Health and Growth)

The forest health and growth cumulative effects analysis considered past, present, and reasonably foreseeable projects within the Porcupine project area boundary. This area was selected because activities outside the area do no notably influence the presence of disease, insect infestations, or

[64] Wilbur-Ellis, undated. Sporax, a borax fungicide for control of annosus root disease. Label published by Wilbur-Ellis Co., Fresno California. Accessed on-line at http://www.cdms.net/ldat/ld1NU004.pdf on September 1, 2005.
[65] Based on an estimate of square feet of basal area removal and local experience with Sporax application in stands with similar prescriptions.
[66] Schmitt, Craig L., John R. Parmeter, and John T. Kliejunas. 2000. Annosus Root Disease of Western Conifers. Forest Insect and Disease Leaflet 172. U.S. Department of Agriculture, Forest Service. page 8.

tree growth within the area. The analysis includes activities 10 years into the future because stands in the McCloud flats are usually entered for timber harvest at 10-20 year intervals.

Timber harvest in the last 10 years within the cumulative effects analysis area has consisted of approximately 5,100 acres of commercial thinning, which is approximately 10 percent of the area. Approximately 3,500 acres of the thinning was in plantations and the remaining 1,600 acres was thinning from below in natural stands. The majority of the thinning in the natural stands (1,350 acres) was in ponderosa pine-dominated stands with an emphasis on improving forest growth and reducing risk of bark beetle attack. The remaining 250 acres emphasized improving forest growth while maintaining 45-50 percent canopy cover for wildlife objectives.

The 3,500 acres of plantation thinning and 1,350 acres of thinning in natural stands have a beneficial effect of reducing risk to bark beetle infestation and improving forest growth. It is estimated this beneficial effect will last approximately 20 years. The 250 acres of thinning for wildlife objectives have a beneficial effect of improving forest growth, but still remain above recommended stocking levels for reducing risk of beetle attack. These stands remain susceptible to drought and insect-related mortality.

Alternative 1 treatments would contribute an additional 4,270 acres toward improving forest health and growth with regards to stand susceptibility to insect infestation and drought-related mortality.

Alternative 2 (Forest Health and Growth)

Direct and Indirect Effects

Alternative 2 would forego all treatments within the LSR boundary (230 acres) and within the previously established fuelbreaks that are in units 43-20, 44-60, and 47-104 (80 acres). Outside of these areas, the units and treatments would be the same as Alternative 1. The following is a summary of Alternative 2 treatment acres that are different from Alternative 1.

Forest Stocking Levels

- Thin overstocked, mid-seral, mixed-conifer and ponderosa pine stands: 3,670 acres.
- Thin overstocked, multi-storied, mixed-conifer stands with late-successional characteristics: 270 acres
- Total thinning: 3,930 acres

Species Composition

- Thin moist mixed-conifer sites with a low percentage of ponderosa pine: 2,690 acres.

Development of Late-successional Habitat

- Thin mature stands along the Modoc Scenic Byway and within the Porcupine LSR: 0 acres.
- Thin overstocked, mid-seral mixed conifer stands within the Porcupine LSR: 0 acres.

The risk to insect outbreaks or the likelihood of a large-scale disturbance would not be reduced within the overstocked, multi-storied mixed-conifer stands with late-successional characteristics or mature pine stands within the LSR.[67]

Growth would continue to slow due to inter-tree competition within overstocked, mid-seral mixed-conifer stands within the LSR resulting in a longer time frame to achieve desired tree size characteristics.[68] Mortality in these unthinned stands could potentially be 20 trees per acre, per decade, compared to thinned stands, with 1-3 trees per acre, per decade expected mortality.[69]

Road Maintenance and Decommissioning

Road closure would allow growth of forest vegetation on approximately 11 acres. Road decommissioning within forest stands would return approximately 5 acres to forest production.

Sporax Application

Apply Sporax to cut stumps 14 inches in diameter and greater – approximately 4,000 acres.

Cumulative Effects

The cumulative effects would be the same as Alternative 1 except this alternative would contribute approximately 310 acres less toward improving forest health and growth with regard to stand susceptibility to insect infestation and drought-related mortality.

Alternative 3 (Forest Health and Growth)

Direct and Indirect Effects

Alternative 3 would forego treatments within the previously established fuelbreaks that are in units 43-20, 44-60, and 47-104 (80 acres), treat one of the Alternative 1 standard thin units with a regeneration harvest, treat an additional unit with a standard thin and one additional meadow would be restored. Outside of these areas, the units and treatments would be the same as Alternative 1. The following is a summary of Alternative 3 treatment acres that are different from Alternative 1.

Forest Stocking Levels

- Thin overstocked, mid-seral, mixed-conifer and ponderosa pine stands: 3,880 acres.
- Total thinning: 4,220 acres
- Regeneration harvest of a mature ponderosa pine stand: 20 acres.

The regeneration harvest of a mature ponderosa pine stand would regenerate ponderosa pine by harvesting most trees within the unit larger than 4 inches in diameter and greater. At least 15 percent of the stand would be retained uncut to meet the Forest Plan standard for green tree

[67] USDA Forest Service 1999 (see footnote 13). Chapter 4, page 4-23.
[68] USDA Forest Service 1999 (see footnote 13). Chapter 4, page 4-22.
[69] Fiddler, et al 1989 (see footnote 59).

retention[70]. Priority for retention includes healthy, young, healthy and vigorous ponderosa pine. Natural regeneration following harvest is expected to result in a fully stocked stand of mostly ponderosa pine seedlings within 5 years of the harvest.

Species Composition

- Thin ponderosa pine dominated sites: 880 acres.
- Thin moist mixed-conifer sites with a low percentage of ponderosa pine: 2,920 acres.

Sporax Application

- Apply Sporax to cut stumps 14 inches in diameter and greater – approximately 4,350 acres.

Road Closure and Decommissioning

Road closure would allow growth of forest vegetation on approximately 11 acres once the roads are closed. Road decommissioning within forest stands would return approximately 5 acres to forest production.

Cumulative Effects

The cumulative effects would be the same as Alternative 1 except this alternative would contribute approximately 2 acres more toward improving forest health and growth with regard to stand susceptibility to insect infestation and drought related mortality.

Alternative 4 (Forest Health and Growth)

Direct and Indirect Effects

Forest Stocking Levels

Numerous areas within each stand would continue to exceed recommended stocking levels for the site. Current stocking levels in the mid-seral areas range from 160 to 280 square feet of basal area with corresponding stand density indices from 240 to 470. Current stocking levels in the multi-storied, mixed-conifer stands with a late-successional component range from 180 to 340 square feet of basal area per acre. These are included in the 4,240 acres of overstocked stands identified with biomass thinning, standard thinning, hazard reduction thinning, and mature stand thinning areas on the Alternative 1 map. These levels are 7 percent to 213 percent above the recommended level of 150 square feet per acre and are above the 230 recommended SDI level. Without treatment, stocking densities in these stands would continue to increase over time resulting in loss of diameter growth and increased competition between individual trees for moisture and nutrients. As both basal area per acre and associated SDI indices continue to rise above the recommended levels for resistance to insects and disease, mortality will occur at higher rates than in thinned stands. One study under similar conditions found that mortality rates were approximately 6 to 20 times higher in overstocked stands compared to thinned stands (tree

[70] USDA Forest Service 1995 (see footnote 1). page 4-61.

mortality of 20 trees per acre over 10 years for the unthinned control plot versus 1-3 trees per acre over 10 years for stands thinned to 100-140 square feet of basal area).[71]

Species Composition

Conditions would continue to favor shade-tolerant species (white fir, incense cedar) at the expense of shade-intolerant ponderosa pine resulting in a further reduction in the overall percentage of ponderosa pine within the overstocked stands. This trend would be especially prevalent on the dry mixed-conifer sites with a heavy ponderosa pine component and on moist mixed-conifer sites with a low percentage of ponderosa pine.

Development of Late-successional Habitat

The risk to insect outbreaks or the likelihood of a large-scale disturbance would not be reduced within the overstocked, multi-storied mixed-conifer stands with late-successional characteristics or the mature pine stands within and adjacent to the LSR.[72]

Growth will continue to slow due to inter-tree competition within overstocked, mid-seral mixed-conifer stands within and adjacent to the LSR resulting in a longer time frame to achieve desired tree size characteristics.[73]

Shrub Development

Stocking levels within Wildlife Habitat Management areas would continue to increase resulting in fewer opportunities for shrub and forage development.

Sporax

There would be no cut stumps; therefore, Sporax would not be applied.

Fuel Treatments

There would be no fuel treatments that reduce understory stocking, reduce inter-tree competition, or stimulate understory vegetation (shrubs, forbs, grass). There would be no cutting treatments; therefore, there would be no activity fuels in need of treatment. Natural fuels would not be reduced, and would continue to accumulate.

Road Maintenance and Decommissioning

Road maintenance would continue at current levels. No road decommissioning would occur. Vegetation development (ingrowth and mortality) within current road rights-of-way would continue on the current course.

[71] Fiddler and others 1989 (see footnote 59).
[72] USDA Forest Service 1999 (see footnote 13). page 4-23.
[73] USDA Forest Service 1999 (see footnote 13). page 4-22.

Cumulative Effects

The cumulative effects of timber harvest over the last 10 years within the cumulative effects bounded area would be the same as Alternative 1. Alternative 4 would not contribute to improving forest health and growth with regard to stand susceptibility to insect infestation and drought related mortality.

Reduce Fuels

Alternative 1

Direct and Indirect Effects

Fire Behavior and Fuels

Reducing the surface fuels, ladder fuels and crown density in the project area would directly change the fuel profile and fuel models representing the proposed treatment areas. Fire modeling results show a significant decrease in fire behavior as compared with the existing condition. Figure 2 and Table 10 compare the existing and Alternative 1 post-treatment fuel models. All treated units would have reduced flame lengths trending downward resulting in less fire intensity, torching, and severe crown fire. The most notable change is a 61 percent reduction in fuel model 10 across treated stands. The overall fire hazard is reduced from moderate-high to low-moderate hazard. Treatments would result in predicted fire behavior that is not likely to destroy forest stands.

Activity-generated slash and pockets of natural slash and brush concentrations would be reduced through proposed treatments over 2,200 acres or 50 percent of the proposed treatment areas. The desired level of 5 to 10 tons per acre addressed in the forest plan for Matrix Lands (Roaded Recreation and Commercial Wood Products areas) is not expected to be exceeded. Fuel loading is expected to gradually increase again after treatment has occurred as a result of growth and decay.

Science-based literature[74] indicates the most appropriate fuel treatment strategy is often thinning (removing ladder fuels and decreasing crown density) followed by prescribed fire, piling and burning fuels, and mechanical treatments. These treatments would provide maximum protection from severe fires in the future.

[74] Peterson, David L.; Johnson, Morris C.; Agee, James K.; Jain, Theresa B.; McKenzie, Donald; Reinhardt, Elizabeth D. 2005. *Forest structure and fire hazard in dry forests of the Western United States.* Gen. Tech. Rep. PNW-GTR-628. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 30 p; Graham, Russell T.; McCaffrey, Sarah; Jain, Theresa B. (tech. eds.) 2004. Science basis for changing forest structure to modify wildfire behavior and severity. Gen. Tech. Rep. RMRS-GTR-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 43 p

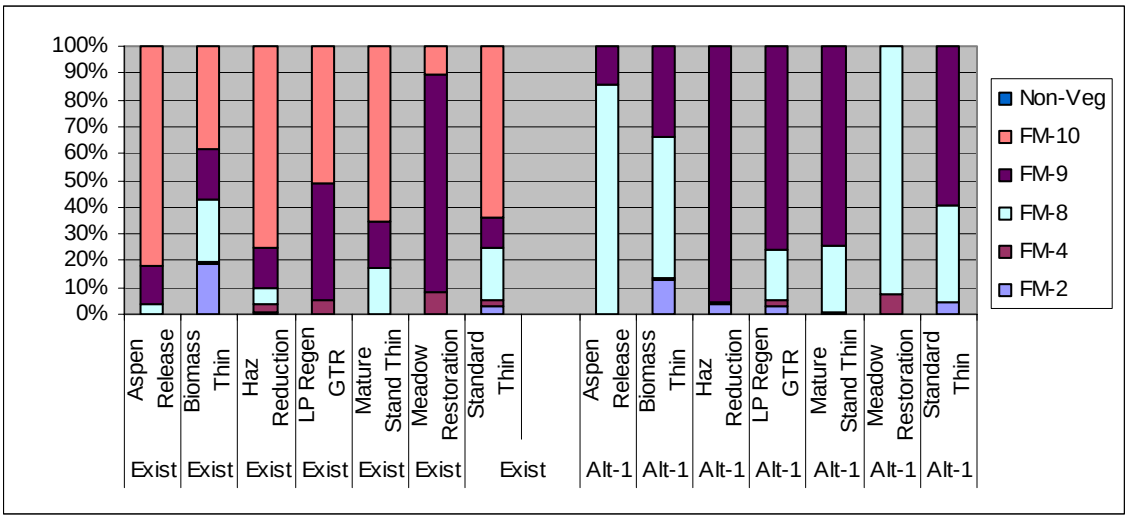

Figure 2. Existing fuel models compared with fuel models resulting from the implementation of Alternative 1 proposed treatments

Table 10. Alternative 1 predicted fire behavior and hazard rating

Fuel Models	Flame Length (feet)	Fire Type	Hazard Rating	Treatment Area Existing Fuel Models Acres/Percent		Alternative 1 Fuel Models Acres/Percent	
FM-2	9.3	Surface	Moderate	180	4%	210	5%
FM-4	27.2	Torching	High	110	3%	30	1%
FM-8	1.5	Surface	Low	820	19%	1,540	35%
FM-9	4.1	Surface	Low-Moderate	57-	13%	2,550	59%
FM-10	7.0	Crown	Moderate-High	2,660	61%	0	0%

Thinning of overstocked small-diameter understory stands would reduce the ladder fuels allowing fire to remain in the surface fuels, and reducing the potential for crown-dominated fire. Suppression operations would continue to occur, however, the proposed action would keep the fuels profile at a level that reduces fireline intensity allowing suppression resources to more safely use direct suppression tactics. [75] This is especially true with the reduction of fuel model 10. Firefighters would have greater success keeping fires smaller after proposed treatment activities have been applied thus minimizing fire size and resource damage.

Proposed activities help make the area more suited for future low-intensity prescribed fire applications; therefore, progress is made towards initiating the restoration of ecological processes and allowing more opportunities to help trend the area towards a more natural fire regime. Proposed treatment areas are dispersed throughout the project analysis area helping to break up fuel continuity and reducing the likelihood of wildfires gaining momentum over the landscape.

[75] Rothermel, Richard C. 1983. *How to predict the spread and intensity of forest and range fires*, Gen Tech Rep. INT-143, USDA, FS, Intermountain Range and Experiment Station, Ogden, UT, 161 p; USDA Forest Plan 1995 (see footnote 1) pages 4-44, 4-75, 4-79

This alternative achieves the desired condition, purpose and need, and responds to the National Fire Plan goals of reducing hazardous fuels to modify current fire behavior that would improve wildfire suppression operations and safety.

Effects on the Late Successional Reserve (LSR)

Proposed treatments are expected to reduce ladder and crown fuels and change the fuel model profile in the LSR stands from model 10 to mostly models 8 and 9. This reduces flame lengths and crown fire risk allowing firefighters greater success in protecting the LSR.

Cumulative Effects

The cumulative effects area was determined to be the Project boundary because collective activities within this area can modify fire behavior. Although the effects outside this boundary could notably influence fire behavior, the spatial magnitude (size) of this boundary was determined quite adequate from a fire management perspective.

The cumulative effects area has been intensively used and/or logged dating back to the late 1800s and early 1900s.[76] Activities have continued since that time. Past activities include a variety of prescriptions associated with several projects such as commercial thinning, precommercial thinning, regeneration cutting, salvage and thinning, biomass removal, site preparation, and planting. A variety of treatment methods have included mechanical whole-tree removal, mechanical piling, hand piling, pile burning, and prescribed underburning.

The Forest Service Activity Tracking System (FACTS) and GIS were used to sort all past, present, and reasonably foreseeable activities recognized as having potential cumulative effects that could further modify fuels and fire behavior within the analysis area. The *Porcupine Watershed Assessment* accounts for the changes in the fuel model profile associated with activities affecting fire behavior and hazard up to about 2003.

Activities considered relevant based on data since 2003 are: Chippy underburning (1,350 acres); Red Hill thinning (3,450 acres), Baby Powder thinning (190 acres), Davis thinning and chipping (32 acres). These activities would reduce surface, ladder and crown fuels that would change fire models primarily from fuel model 10 to fuel models 8 and 9. Alternatives combined with the past, present and foreseeable activities would contribute to the overall reduction of ladder and crown fuels, therefore reducing fire intensity and severe crown fire on the landscape.

Alternative 2 (Reduce Fuels)

Direct and Indirect Effects

Fire Behavior and Fuels

The effects on the fuels profile, loading and fire behavior on treated stands outside the LSR boundary are similar to what is described in Alternative 1 (see Table 10).

[76] USDA Forest Service 2003 (see footnote 2) pages 4-1, 4-4

Effects on Late-successional Reserve

Under this alternative, surface fuels, ladder fuels and stand density would remain the same within the LSR. Because no treatments are planned in the LSR, no change in the fuel model profile within the LSR would occur. The fuel model profile would remain mostly a fuel model 10 (see Table 11). As described above, this model can develop high fireline intensity with severe crown fire in these stands. By not treating these stands, they become vulnerable to stand-replacing wildfire.

Cumulative Effects

The overall direct and indirect effects of Alternative 2 are similar to Alternative 1, with a slight decrease (300 acres) in overall reduction of fuels and corresponding change in representative fuel models. The cumulative effects of Alternative 3 would be very similar to those discussed under Alternative 1.

Alternative 3 (Reduce Fuels)

Direct and Indirect Effects

Fire Behavior and Fuels

The effects on the fuels profile, loading and fire behavior on treated stands are similar to Alternatives 1 and 2, with slight differences in the percent of area converted to fuel models 8 and 9 (less area would be converted to fuel model 9 and more would be converted to fuel model 8; see Table 11).

Effects on Late-successional Reserve

The effects of treatments within the LSR proposed in Alternative 3 are the same as those effects described in Alternative 1.

Cumulative Effects

The overall direct and indirect effects of Alternative 3 are similar to Alternative 1, with a slight increase in overall reduction of fuels and corresponding change in representative fuel models. The cumulative effects of Alternative 3 would be very similar to those discussed under Alternative 1.

Table 11. Post-treatment fuel models, fire behavior, and hazard rating

Fuel Model	Fireline Intensity Flame Length (feet)	Fire Type	Hazard Rating	Alt 1 Acres/%		Alt 2 Acres/%		Alt 3 Acres/%		Alt 4 Acres/%	
FM-2	9.3	Surface	Moderate	210	5%	210	5%	220	5%	180	4%
FM-4	27.2	Torching	High	30	1%	30	1%	30	1%	110	3%
FM-8	1.5	Surface	Low	1,540	35%	1530	38%	1,720	39%	820	19%
FM-9	4.1	Surface	Low/Moderate	2,550	59%	2250	56%	2,380	55%	570	13%
FM-10	7.0	Crown	Moderate/High	0	0%	0	0%	0	0%	2,660	61%

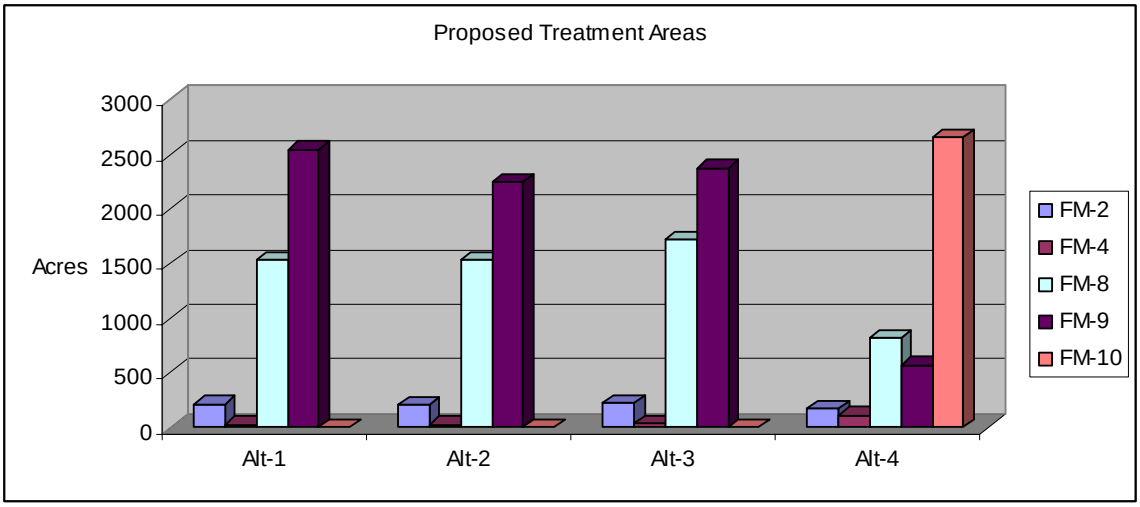

Figure 3. Post-treatment fuel models

Alternative 4 (Reduce Fuels)

Direct and Indirect Effects

Fire Behavior and Fuels

The behavior effects of the no action alternative are considered the same as the existing condition and summarized in Table 10. The treatment areas are highly susceptible to high fire intensity torching and active crown fire under 90th percentile weather conditions.

Surface, ladder, and crown fuels would accumulate in the absence of fire or treatment. With no modification of forest structure and fuels, fire behavior under normal, summer conditions would persist as described under the existing condition, threatening resources within the project area. These conditions could produce extreme fire behavior and stand-replacing fires.

Fires that escape initial attack, usually those burning under severe fire weather conditions (90^{th} percentile, high severity fire weather) are likely to become large and damaging crown fires. Fire behavior characteristics are expected to be similar to those described under the existing condition. Direct suppression tactics would not be effective.

In the absence of any kind of human-caused or natural disturbance, indirect effects would occur from the natural progression of forest growth and change. The result would be increased surface and ladder fuels that affect flame length, reduced canopy base heights that affect torching of trees, and increased crown density that make crown fire probable.[77] Fire risk in the project analysis area would likely increase and contribute to severe wildfires that could destroy important resources and habitat.

No progress would be made towards initiating the restoration of ecological processes that include the natural fire regimes, moderate to low intensity, frequent interval (1-25 years)

[77] Peterson et al. 2005, Graham et al. 2004 (see footnote 74)

regime.[78] Stands would continue to shift in species composition from pine to cedar and fir increasing the risk of loss due to wildfire because cedar and fir are more susceptible to fire caused mortality than pine due to their branch characteristics and bark qualities.[79]

The no action alternative would be consistent with the Forest Plan direction and other regulatory direction outlined in this document. However, it would not contribute to the desired condition, purpose and need, or respond to the National Fire Plan goals of reducing hazardous fuels to modify current fire behavior that would improve suppression operations. The ability of firefighters to safely and effectively suppress wildland fire would become more difficult as fire behavior characteristics intensify.

Effects on Late-successional Reserve

Surface fuels, ladder fuels and stand density would remain unchanged within the LSR. No change in the fuel model profile within the LSR would occur. The fuel model profile would remain mostly a fuel model 10 (see Table 11). As described above, this model can develop high fireline intensity with severe crown fire in these stands. Forest stands would be vulnerable to stand-replacing wildfires.

Cumulative Effects

Activities considered relevant based on data since 2003 are: Chippy underburning (1,350 acres); Red Hill thinning (3,450 acres), Baby Powder thinning (190 acres), and Davis thinning and chipping (30 acres). These activities reduced surface, ladder and crown fuels and changed fire models primarily from fuel model 10 to fuel models 8 and 9. Alternative 4 does not alter the fuels profile in a way that minimizes fire behavior detrimental effects; therefore, there would be no additional direct effects in regard to forest fuels or fire behavior. Considerable area would remain in fuel model 10 with a corresponding risk for stand-replacing wildfire. Figure 4 (next page) compares the post-treatment project area fuel models for all alternatives.

Maintain Aspen and Meadows

Alternatives 1, 2, and 3

Direct and Indirect Effects

Aspen

One remnant aspen stand (30 acres) would be treated by removing conifers followed by underburning in order to restore aspen as the predominate species within the stand. Conifer trees within approximately 150 feet of aspen would be harvested as sawlogs and biomass. Removal of the conifers followed by burning would provide good growing conditions for aspen root sprouts.

[78] USDA Forest Service 2003 (see footnote 2) page 3-52
[79] USDA Forest Service 2006. Fire Effects Information System (online). Available: http://www.fs.fed.us/database/feis. Rocky Mountain Research Station, Fire Sciences Laboratory.

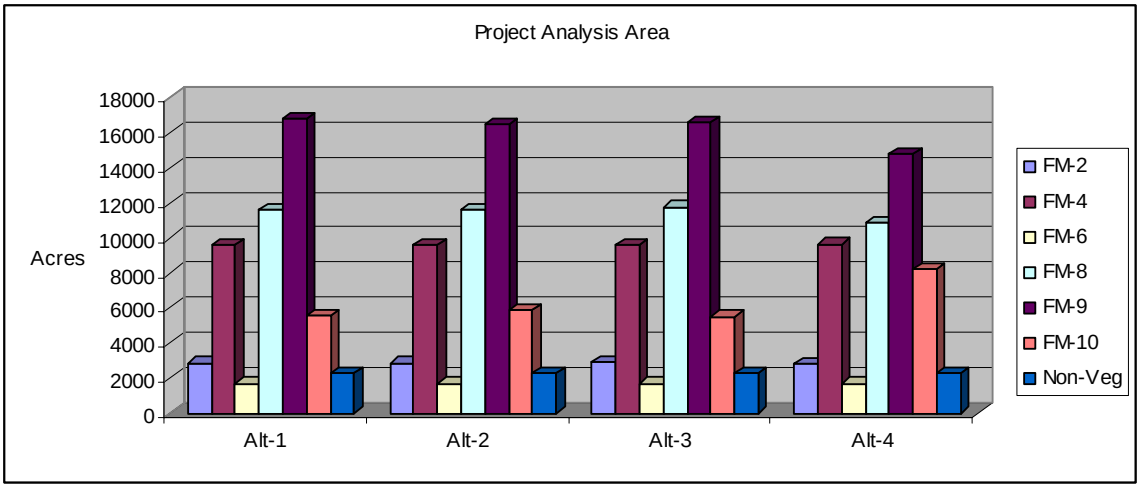

Figure 4. Comparison of all alternative fuel models within the project analysis area

Post-treatment stocking exams would occur within a 5-year period to ensure minimum stocking requirements are met and to determine if remedial treatments or mitigation such as fencing is needed. This treatment would achieve the Forest Plan goal of emphasizing management of hardwoods including aspen where they exist.[80]

Meadows

Alternatives 1 and 2 would restore two meadows (30 acres) by the removal of conifer ingrowth; Alternative 3 would restore 3 meadows (50 acres). Conifers of commercial size would be removed through harvest operations. Trees less than 4 inches in diameter would be cut and slashed. In addition, existing roads within the meadows would be decommissioned by blocking the road to normal vehicular traffic followed by subsoiling to decrease soil compaction, and reseeding with native species. Road decommissioning would reduce water channeled in roadbeds. This treatment would achieve the Forest Plan goal of managing riparian areas to maintain and restore the species composition and structural diversity of plant communities[81] including meadows.

Cumulative Effects

The area considered for cumulative effects is the 5th-level Porcupine watershed. This is the aerial extent that forest vegetation diversity is analyzed. Treatments within the last 10 years and all reasonably foreseeable treatments are included in this analysis.[82]

Aspen

Aspen is limited within the 5th-level Porcupine watershed; it only occurs as a component of other vegetation types. Recent timber harvest has released approximately 5 acres of aspen within the

[80] USDA Forest Service 1995 (see footnote 1). page 4-14
[81] USDA Forest Service 1995 (see footnote 1). page 4-53.
[82] Past, planned and future activities within the 5th level Porcupine watershed area listed in Appendix D.

watershed and an additional 170 acres are planned. The direct effects of proposed activities to release approximately 30 acres of aspen combined with recent and planned aspen release would contribute to maintaining aspen within the watershed.

Meadows

Meadows are limited within the 5th-level Porcupine watershed; less than one percent of the watershed vegetation type is meadow (approximately 570 acres). Recent planned treatments will restore 125 acres of meadow. The direct effects of proposed meadow restoration (30-50 acres) and other recent planned treatments would contribute to maintaining 27 to 31 percent of the meadows within the watershed.

Alternative 4 (Maintain Aspen and Meadows)

Direct and Indirect Effects

Aspen

Conditions that favor aspen vigor and sprouting would continue to deteriorate as conifer density increases. These conditions could eventually result in complete loss of the aspen clones within the stand.

Meadows

Conifer ingrowth would continue within the historical meadow complex resulting in a loss of species and structural diversity within the meadow plant community.

Cumulative Effects

Aspen

Aspen is limited within the 5th-level Porcupine watershed; it only occurs as a component of other vegetation types. Recent timber harvest has released approximately 5 acres of aspen within the watershed and an additional 170 acres are planned. However, aspen would continue to decrease as clones are lost due to browse and conifer competition.

Meadows

Meadows are limited within the 5th-level Porcupine watershed; less than one percent of the watershed vegetation type is meadow. Recent planned treatments will restore and maintain 125 acres of meadow, 22 percent of the watershed meadow habitat, however meadow habitat will continue to transition to forest as conifers establish and grow.

Effects Relative to 10 Significant Factors

The following is a summary of the project analysis for significance, as defined by NEPA (40CFR 1508.27). “Significantly” as used in NEPA requires consideration of both context and intensity of the expected project effects.

Context means that the significance of an action must be analyzed in several contexts (i.e. local, regional, worldwide), and over short and long time frames. For site-specific actions, significance usually depends upon the effects in the local rather than in the world as a whole. This project is limited in scope and duration. The action alternatives include timber harvest and fuel treatments on approximately 4,000 acres of the 150,000 acre Porcupine 5th Order Watershed. The project would be implemented over a three to five year time period. The project will provide wood products and employment to the northern California and Southern Oregon region.

Intensity refers to the severity of the expected project impacts. The following factors were considered to evaluate intensity.

Beneficial and Adverse Impacts (CFR 1508.27(b)(1))

Both beneficial and adverse impacts have been considered in the evaluation of the environmental consequences of the proposed action and alternative actions. Beneficial effects have not been used to offset or compensate for potential adverse effects. Singularly and collectively, the resources affected by the proposed activities in all alternatives are not expected to experience significant impacts. The adverse impacts associated with the project include localized soil disturbance, a short-term increase (5-10 years) in noxious weeds (see the *Invasive Plants* and *Soils* sections) and a short-term reduction in the quality of about 375 acres of Northern Spotted Owl foraging habitat (see *Threatened and Endangered Species* section). The beneficial effects of the action alternatives are improved forest health, reduced fuels, development of late-successional habitat, and improved vegetation diversity (see *Forest Health, Reduce Fuels, Aspen and Meadow* sections). Improved forest health and reduced fuels decrease the risk of stand loss due to forest insects or wildfire. The beneficial and adverse impacts of the alternatives are discussed in this chapter.

Public Health and Safety (CFR 1508.27(b)(2)

The proposed action will not pose a threat to public health and safety. Temporary closures and warning signs will restrict public access during project activities.

The use of borax (Sporax©) to prevent colonization of fresh conifer stumps by *Fomes annosus* does not present a significant risk to humans or wildlife species under most conditions of normal use, even under the highest application rate.[83] The agent of toxicological concern in Sporax - i.e., boron – occurs naturally. The use of Sporax in Forest Service programs will not substantially contribute to boron exposures in humans. In addition, the use of Sporax in Forest Service programs will not typically or substantially contribute to concentrations of boron in water or soil.[84]

[83] U.S. Department of Agriculture, Forest Service. 2006. Human Health and Ecological Risk Assessment for Borax (Sporax©) Final Report. Arlington, VA: U.S. Department of Agriculture, Forest Service, Forest Health Protection. 135 p.
[84] USDA Forest Service 2006 (see footnote 83).

Unique Characteristics of the Area (CFR 1508.27(b)(3))

The following have been identified as "unique characteristics of the geographic area":

- Historic and cultural sites
- Habitat for the northern spotted owl and northern goshawk
- Geological and volcanic features

The proposed action and alternative actions do not significantly affect the unique characteristics of the geographic area. The project has been designed to avoid, protect, or enhance these features. Thinning and fuel treatments reduce the risk of these features being impacted by catastrophic wildfire.

Caves, lava tubes, and other volcanic features of interest are located within the project area, however, these features are not in close proximity to treatment units or road management activities so there would be no impacts.

Degree of Controversy (CFR 1508.27(b)(4))

There is no indication that the effects of the proposed action or action alternatives on the quality of the human environment are likely to be highly controversial. Proposed silvicultural treatments, harvest methods, and road management actions are routine activities that are consistent with the Forest Plan.

Uncertain, Unique, or Unknown Risks (CFR 1508.27(b)(5))

Proposed silviculture treatments and harvest methods are routine activities that have been conducted in the area over the past 60 years and, therefore, do not have highly uncertain effects on the human environment or involve unique or unknown risks.

Setting a Precedent for Future Actions (CFR 1508.27(b)(6))

The proposed action and action alternatives consist of routine activities that are consistent with management direction in the Forest Plan. Implementation of the actions would not establish a precedent for future actions.

Cumulative Impacts (CFR 1508.27(b)(7))

According to the Council on Environmental Quality (NEPA) regulations "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7).

The relevant boundaries and projects assessed for cumulative effects vary by resource. Each resource cumulative effect area can be different and possibly larger or smaller. Relevant cumulative effects are discussed for each resource in this chapter. Each cumulative effects analysis for each environmental component or resource area is guided by and consistent with the Council on Environmental Quality letter "Guidance on the Consideration of Past Actions in

Cumulative Effects Analysis" of June 24, 2005. A listing of relevant related past, present and future management activities in the Porcupine 5th-level watershed is provided in Appendix D.

Heritage Resources (CFR 1508.27(b)(3) and (b)(8))

A heritage resources analysis (Archaeological Reconnaissance Report ARR #R200605140007) has been completed. The assessment area has been surveyed for cultural and historical resources. Treatment units have been designed to avoid sites containing these resources. Site locations would be provided to Forest Service project implementation and contract administration staffs to ensure sites are protected. Project activities would not be permitted within site boundaries except as allowed by the District or Forest Archaeologist in consultation with the State Historic Preservation Officer (SHPO).

Archaeological sites, or buried cultural materials not evident on the surface may be discovered during project operations. If this occurs, all work must cease immediately and the appropriate unit archaeologist consulted before project activities resume.

The timber sale contract would include standard provision B6.24 - Protection Measures Needed for Plants, Animals, Cultural Resources, and Caves; and special provision C6.24# - Site Specific Special Protection Measures.

Threatened and Endangered Species (CFR 1508.27(b)(9))

At present, no plants on the Shasta-Trinity National Forest are listed federally as threatened or endangered; therefore, there would be no effects to those species. The northern spotted owl is the only federally listed wildlife species with habitat in or near the project area. Biological assessments for threatened and endangered plants and animals have been completed for this project.[85, 86]

Northern Spotted Owl

The Northern spotted owl is a threatened species. Northern spotted owl habitat preference was identified within the Federal Register. Critical habitat was proposed within the Federal Register on May 6, 1991 (56 FR 20816-21016) and a Final Rule was published (USDI 1992) on January 15, 1992 (57 FR 1796-1838). The Federal Register Final Rule designated portions of the Shasta-McCloud McCloud Management Unit in the Shasta/McCloud Area of Concern for the northern spotted owl. The project area is on the far eastern edge of the northern spotted owl range and outside of the designated critical habitat area.

[85] Hill, S. 2008. Biological Assessment and Biological Evaluation for the Porcupine Vegetation and Road Management Project, Shasta-McCloud Management Unit, Shasta-Trinity National Forest. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 51 pp.

[86] Baker, B. 2008. Biological Evaluation/Assessment for Sensitive Plant Species, Porcupine Vegetation and Road Management Project, Shasta-Trinity National Forest, Shasta-McCloud Management Unit. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 20 pp.

Alternatives 1, 2, and 3

Direct and Indirect Effects

The action alternatives could increase the potential for northern spotted owls to be impacted by West-Nile Virus through stand thinning activities and the responding increase of tall grasses. However, the extent and duration of these potential impacts are unknown because the change of suitable habitat for mosquitoes is not reliably predictable or measurable at this time due to variations in weather, among other factors.

Barred owls may pose a greater threat to northern spotted owls than previously thought.[87] Habitat interactions are not well known; however, barred owls are now thought to use late-successional forest, not solely younger forests. In addition, barred owls may have a broader base to their diet, may reduce northern spotted owl survey detectability, and may occupy former northern spotted owl sites and thus displace historic northern spotted owl activity centers.[88] Simplifying the stand structure by reducing the understory and canopy closure could make more habitat available for barred owls at the expense of northern spotted owls. However, no barred owls have been located in or near the project boundary. Given the current absence of barred owls in the project area and the goal of providing long-term, sustainable northern spotted owl habitat, this risk is believed to be minor.

Road closures would not impact northern spotted owls because the proposed closures do not coincide with any existing or capable northern spotted owl habitat. Chip sealing (road maintenance) along the Powder Hill Road near the Porcupine LSR could affect northern spotted owls from Six Shooter Butte if the owls are present and maintenance activities occur from February through August. This would be a disturbance effect, but would be difficult to differentiate from the normal vehicle traffic already present.

Direct and Indirect Effects Specific to Alternatives 1 and 3

Proposed treatments in spotted owl habitat under these alternatives would concentrate on removal of understory and subdominant trees. About 380 acres of northern spotted owl foraging habitat and about 410 acres of capable habitat could be affected with implementation of either of these alternatives (see Table 12 below). Treatment prescriptions within these identified areas include biomass thin, hazard reduction thin, mature stand thin, and standard thin. These areas would likely continue to provide suitable foraging habitat in both the short- and long-term, but the quality could be diminished due to initial treatment impacts such as decreased total canopy closure, decreased understory composition, and reduced structural complexity.

In existing suitable foraging habitat, silvicultural prescriptions would retain a minimum of 40 percent canopy closure, maintain the largest trees on site, and maintain at least the minimum snag

[87] U.S. Department of the Interior Fish and Wildlife Service. 2007. 2007 Draft Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*): Merged options 1 and 2. USDI Fish and Wildlife Service. Portland, Oregon. 173 pages.
[88] Ibid.

and down wood requirements according to the Forest Plan and allocation objectives in mid-successional stands. In late-successional stands, prescriptions would be the same, but would retain 60 percent canopy closure. Silvicultural treatment projections predict an initial decrease in canopy closure, followed by increases in canopy closure, average diameter, as well as snag and down wood size classes throughout a 10-decade term (see the vegetation report for more details.) The treatments proposed in these alternatives are expected to maintain all or improve several characteristics of northern spotted owl habitat while reducing the risk of stand-replacing events to these habitats.

Because all foraging habitats that are proposed for treatments are expected to remain foraging habitat following treatments, there would be no loss of foraging habitat in the short or long term. There would only be temporary disruptions to the habitat while the activities were occurring. Ground vegetation and shrubs would be expected to return within one decade in areas where machinery and/or fire removed them during implementation. Reductions in ground vegetation cover and shrubs could impact prey availability, so there would be a short- to mid-term reduction in foraging habitat quality in parts of the treated stands. These effects would be localized and may not adversely affect all of the treated stands. About 42 percent of existing foraging habitat would be affected, which would leave more than half of available foraging habitat not impacted. In capable habitat where the number of trees per acre is high and tree diameter has peaked, thinning would lead to increased diameter of residual trees, and this would be a habitat improvement for that attribute.

The Modoc habitat zone on the far eastern edge of the Shasta-Trinity National Forest is best considered as strictly having the potential for foraging and dispersal habitat with limited nesting and roosting capacity. Risk reduction through silvicultural and fuels treatments would likely enhance the long-term availability of foraging and dispersal habitat. Short- to mid-term (0- to 20-year) reductions in suitability (quality) in some stands would likely be offset by long-term (30- to 100-year) gains in reduced risk of stand-replacing insect and disease outbreaks.[89]

The existing single stand of nesting and roosting habitat within the project area would remain as it is and is not being considered for any activities. Treatment objectives in adjacent stands are expected to increase the quality of the stands and over time are expected to increase the amount of nesting and roosting habitat adjacent to that existing nesting and roosting stand. That is, the expectation of the treatments within the mid- and late-successional stands near the existing nesting and roosting stand would eventually produce a larger stand with potential nesting and roosting structural characteristics. This larger stand of nesting and roosting habitat could then be maintained for a longer period of time.

Because a northern spotted owl has been located within the project area (only once), no habitat at that location would be treated, all other responses have been located outside the project

[89] McCusker, N. 2008. Porcupine Vegetation and Road Management Project Silviculture Report. Unpublished report on file at Shasta-Trinity National Forest, Mt. Shasta, CA. 24 pages.

boundary, and a breeding season limited operating period would be in effect, direct effects to known northern spotted owls are discountable.

Direct and Indirect Effects Specific to Alternative 2

The effects to northern spotted owl habitats are expected to be the same as under Alternatives 1 and 3, except that less existing foraging and capable habitat would be treated. The areas being excluded from treatment are all within the Porcupine LSR. About 290 acres of foraging habitat and about 330 acres of capable habitat outside the Porcupine LSR would be treated under Alternative 2 (see Table 12 below). Effects to the northern spotted owl habitat outside the LSR boundary would remain the same as in Alternatives 1 and 3. In the Porcupine LSR, dense stands could continue to be at risk for insect and disease outbreaks and at risk for stand-replacing fire.[90] Large scale losses of habitat due to these factors would remove habitat from suitable status for 30-40 years. So long as none of these events occur, existing habitat status could remain the same. Although canopy closure may increase to meet minimum nesting and roosting quality, lack of water and large-diameter trees could continue to limit nesting and roosting habitat quality. These stands could continue to hold foraging status.

Table 12. Summary of potential treatments within northern spotted owl habitats and the resulting acres that would provide habitats following treatments compared to the existing

Habitat Description	Existing Acres	Alt. 1 Acres Treated	Alt. 2 Acres Treated	Alt. 3 Acres Treated	Alt. 4 Acres Treated	Acres Providing Habitat Following Proposed Treatment
Nesting/Roosting	13.5	0	0	0	0	13.5 (100%)
Foraging	890	380 (42%)	290 (33%)	380 (42%)	0	890 (100%)
Capable	1,230	410 (34%)	330 (26%)	410 (34%)	0	1,230 (100%)

Cumulative Effects

The cumulative effects area for northern spotted owl consists of all lands within 1.3 miles of the project area, which is the provincial radius for the northern spotted owl survey protocol. Adding the modified baseline northern spotted owl habitat acres to existing habitat outside the project boundary may give an accurate reflection of available northern spotted owl habitat. Whereas some designated capable habitat inside the boundary was deemed unsuitable as a result of its status as a plantation, isolation/fragmentation, and lack of suitable mixed-conifer stands nearby, the plantations along the west side of the Porcupine project boundary can be considered capable, at a minimum, because of their close relation in distance and proximity to other suitable habitat. Therefore, it is reasonable to assess the capable stands as being truly capable to one day become suitable northern spotted owl habitat on the west side of the project area. Table 13 lists how much habitat is available within the cumulative effects boundary.

[90] McCusker 2008 (see footnote 18).

Table 13. Nesting, roosting, foraging, and capable acres of Northern spotted owl habitat within the 1.3-mile cumulative effects boundary of the project

Forest	Nesting/Roosting	Foraging	Capable
Shasta-Trinity	40 acres	2970 acres	3,450 acres
Modoc	0 acres	380 acres	2,260 acres
Total	40 acres	3350 acres	6,090 acres

Suitable habitat was modeled for those portions of the Modoc National Forest in the same manner as on the Shasta-Trinity NF where onsite visits determined the final suitability of habitat. The area lacks water sources, large-diameter trees, complex canopies, and suitable canopy closure, and as a result, most of the Modoc NF stands could not be habitat, even though the CalVeg GIS data indicates strata codes of suitable structure. Therefore, the modeled habitat on the Modoc NF near the Project is about 380 acres of foraging habitat and about 2,260 acres of capable habitat. It should be noted that the current, and in particular the capable habitat is a conservative figure due to the aforementioned reasons.

Within the cumulative effects area there are two additional, small stands of nesting and roosting habitat totaling about 30 acres. They were treated by the Powder Project with jackpot fuel burning, therefore maintained their habitat status as nesting and roosting. No owls responded to surveys for the Powder Project. Also, as a result of these treatments, the stands are in a condition to provide long-term owl habitat.

In 2006 and 2007, surveys detected a northern spotted owl adjacent to the project area on Six Shooter Butte. In the summer of 2007, a researcher captured two owls on Six Shooter Butte; one male and one female.[91] The male had been banded in 1999 and the female was banded on site. There was no sign of breeding. A modeled home range near Six Shooter Butte, based on response locations, is outside the project area boundary for the most part, yet it is plausible that owls could use portions of the Porcupine project area. Direct effects to the known owls in that modeled home range are unlikely because 1) owls have been located within the project area only once, and 2) vegetation treatments would occur outside the breeding season in those stands that could be a part of that home range.

Potential short-term, disturbance effects to northern spotted owls could result from treatment activities taking place near owls or in northern spotted owl habitat. Disturbance to northern spotted owls near Six Shooter Butte from February through August are discountable due to a limited operating period buffer for a nearby northern goshawk territory. Therefore, the action alternatives would not contribute to any disturbance during that period.

Northern spotted owl use of the project area is limited to one known observation, but it is suspected that owls may use more of the area. Foraging habitat is available near Six Shooter Butte and within the project area boundary. Should owls use existing habitat south and east of Six

[91] Derby, D., Wildlife Biologist, Shasta-Trinity National Forest. 2007. Personal communication.

Shooter Butte, inside the project boundary, some habitat could be impacted. However, most of the contiguous habitat in the modeled home range lies on Six Shooter Butte, and to the northwest lies an adjacent, large continuous block of foraging habitat (nearly 1,600 acres). There have been other projects on and near Six Shooter Butte that have included thinning and small clearcuts totaling about 260 acres. These stands are currently classified as capable habitat.

The Forest activities database lists many timber sales, salvage sales, plantation management activities, thinning, and other vegetation management in the project area. The northern spotted owl habitat that has been affected from these activities is summarized in Table 14. Not all northern spotted owl habitat has been adversely affected. For example, although about two-thirds of the available nesting and roosting area has been affected, the management activities consisted of pile burning to reduce excess fuel accumulations, and thereby maintained or improved habitat, at least for that attribute. Likewise, thinning in foraging habitat (especially in mixed-conifer stands) to a minimum 40 percent canopy closure maintained minimum canopy closure guidelines and reduced insect/disease and fire risk in those stands. Recent projects that treated stands in northern spotted owl habitat include Bear Mountain, Davis, and Powder, all near the south and west edge of the Porcupine Project. These projects are nearly complete. Maintaining minimum 40 percent canopy closure guidelines in these projects should have maintained northern spotted owl foraging habitat status. Parts of treated stands may not be used immediately after treatments because ground vegetation and shrubs may require up to 10 years to return and provide quality prey species habitat. However, there should be sufficient quantity and quality of vegetation remaining post-treatment. Thus, the amount of foraging habitat should remain the same in those projects and in the cumulative effects area. There were no spotted owl responses to survey for these projects.

Table 14. Acres affected by past projects in the cumulative effects area

Northern Spotted Owl Baseline Habitat in the Cumulative Effects Area		Northern Spotted Owl Habitat Affected by Other Activities in the Cumulative Effects Area
Foraging habitat	3350 acres	2120 acres (63%)
Nesting/roosting habitat	40 acres	30 acres (67%)
Capable habitat	6090 acres	1380 acres (23%)
Total	9430 acres	3520 acres (37%)

Thinning treatments in capable habitat could increase residual tree size beyond that which could occur naturally in very dense stands, thus moving capable habitat closer to developing into foraging habitat of a better quality than could be found in those dense stands.

No activities data was available for the Modoc National Forest, but most of the adjacent areas of the Modoc NF near the project are moderately sparse stands of fir or mixed conifer occurring in lava flows. Examination on the ground and using aerial imagery (NAIP) shows very little vegetation alteration and those areas where past activities have occurred are on Six Shooter Butte.

Table 15 summarizes contributions the Porcupine Project could make to the existing cumulative effect acres.

Table 15. Porcupine project contributions to cumulative effects (acres and percent)

Project Additions to the Cumulative Effects Acres				Cumulative Acres of Northern Spotted Owl Habitat Affected		
Alternative	Foraging Habitat	Nesting/Roosting Habitat	Capable Habitat	Foraging Habitat	Nesting/Roosting Habitat	Capable Habitat
1	360	0	400	2,480 (74%)	30 (67%)	1,780 (29%)
2	280	0	320	2,400 (72%)	30 (67%)	1,700 (28%)
3	360	0	400	2,480 (74%)	30 (67%)	1,780 (29%)
4	0	0	0	2,120 (63%)	30 (76%)	1,380

Alternative 4 (Northern Spotted Owl)

Direct and Indirect Effects

No treatments would occur in any northern spotted owl habitat (see Table 12) and existing and capable habitat would continue to be at a higher risk for insect/disease infestations and stand-replacing wildfire. Under better climactic and soil conditions, existing northern spotted owl habitat classified as foraging would remain as such until which time it transformed into nesting/roosting habitat or is set back to capable due to an uncharacteristic stand-replacing wildfire or insect/disease infestation. However, due to the extremely dry climate, poor growing conditions within much of the project area, lack of riparian areas and corridors, and overall low habitat quality on this edge of the owls' range, habitat is unlikely to achieve good quality nesting and roosting characteristics before stands become susceptible to insects, disease, and fire. Risks for stand-replacing events are currently moderate to high and would increase over time due to greater stand densities and fuel build-up[92]. Should stand-replacing events occur, much of the northern spotted owl habitat would become early-seral stage with small tree size and large openings and thus unsuitable for owls. Alternately, given the persisting shrub condition resulting from the 1950 and 1959 fires in the east edge of the project area, there is a worst-case scenario that a severe wildfire could eliminate existing and capable habitat altogether for a long time. Large-scale losses of northern spotted owl habitat such as this could make this area even more marginal than existing conditions.

Cumulative Effects

Although there could be an increasing risk of forest habitat loss from insects, disease, and fire due to the no-action alternative, there is no means to accurately predict when such an event could

[92] Ibid; McCusker 2008.

occur and how much it could affect northern spotted owls and their habitat at this time. Therefore, there could be no cumulative effects from Alternative 4.

Determinations for Northern Spotted Owl

Alternatives 1, 2, and 3

The biological assessment[93] determination concludes: *"full implementation of any alternative 1, 2, or 3 may affect, but is not likely to adversely affect the northern spotted owl"; "full implementation of Alternatives 1, 2, or 3 would have no effect on northern spotted owl critical habitat."*

Alternative 4

The biological assessment[94] determination concludes: *"this alternative would have no effect on northern spotted owls or their critical habitat."*

Consistency with Federal, State, or Local Laws or Requirements (CFR 1508.27(b)(10)

The proposed action is consistent with all Federal, Sate and local laws or requirements imposed for protection of the environment. The proposed action and alternatives are consistent wit the Shasta-Trinity National Forest Land and Resource Management Plan and the Lassen National Forest Land and Resource Management Plan. The proposed action and alternatives were specifically developed to comply with the following laws and regulations:

- The Endangered Species Act
- Clean Water Act (including Best Management Practices and Aquatic Conservation Strategy Objectives)
- Clean Air Act (including Siskiyou County Air Pollution Board Regulations)
- National Historic Preservation Act (including the Region 5 Heritage Programmatic Agreement)
- National Forest Management Act
- National Environmental Policy Act

Effects on Other Resources

Sensitive Wildlife Species

The biological evaluation[95] completed for this project considered 24 Regional Forester's Sensitive Species. The project area is within the range or contains habitat for five species: northern goshawk *(Accipter gentillis)*, Pallid Bat *(Antoqous pallidus)*, Townsend's big-eared bat

[93] Hill 2008 (see footnote 85) page 29-30.
[94] Hill 2008 (see footnote 85) page 29-30.
[95] Hill 2008. (see footnote 85)

(Corynorhinus townsendii), American marten *(Martes americana)*, and Shasta hesperian snail *(Vespericola shasta)*. Project effects on the Shasta hesperian snail are discussed in the *Survey-and-manage Fauna* section of this document.

Northern Goshawk

One known northern goshawk territory exists on the north end of the project area, including portions of the Modoc National Forest. This pair was known to exist prior to 2006, but the first documentation of nesting was in 2006. Two nesting areas (primary and secondary), each a minimum of 125 acres, were modeled using the best available habitat near the known nest location. The nesting territory has been monitored by the Shasta-McCloud Management Unit since that time. In 2006 this pair fledged two young goshawks. Between the 2006 fledging and 2007 nesting seasons, the 2006 nest blew down; the goshawks used an alternate nest less than 50 meters away which was located by the Shasta-McCloud Management Unit wildlife crew. Part of their territory is in the Porcupine LSR and part of it lies to the west, on Six Shooter Butte.

Alternatives 1 and 3

Direct and Indirect Effects

Direct impacts to the known pair of goshawks are unlikely because a limited operating period (LOP) (see Table 7) would be in place during the goshawk-breeding season, which means no activity would occur in the goshawk primary or alternate nest territory or within one-half mile during that period. Therefore, direct impacts to adults and young are unlikely in that area. No treatments are proposed for the actual nest stand, but there are treatments proposed for several stands surrounding the nest stand. These treatments would maintain a minimum of 40 percent canopy closure and would not be implemented during any nesting period.

Disturbance impacts near the goshawk nest site are unlikely due to the LOP, as well. Goshawks could experience some disturbance if foraging near locations where treatment activities are taking place; however, the goshawk could, and probably would, avoid activity areas due to noise or smoke.

About 3,350 acres of suitable habitat for northern goshawks could be impacted, of which about 130 acres are within the LSR. The proposed treatments in mid- and late-successional dense stands would result in decreased canopy closure (maintaining a minimum of 40 percent canopy closure), understory vegetation, and down wood. In these, stands this could be short-term (about ten years) as the post-treatment stand projections show larger diameter overstory trees, minor increases in canopy density, and increases in down wood over a ten-decade term. Treatments are expected to increase the diameter-at-breast-height and the crown diameter of the residual trees, which could increase long-term nest site availability. Canopy closure is not expected to increase to its current levels in some of the treated stands even in the long-term, but is expected to be maintained above 40 percent throughout the next 100 years. In pine-dominated stands, canopy closure would be thinned to about 40 percent for silvicultural reasons and this would still remain

foraging habitat. Although goshawks are not present in all suitable habitat in the project area, long-term maintenance of suitable habitat would ensure future dispersal and foraging habitat for goshawks.

Alternative 2 (Goshawk)

Direct and Indirect Effects

This alternative is expected to have similar direct and indirect impacts to goshawks and their habitat as Alternatives 1 and 3. This alternative would not treat any stands in the Porcupine LSR and therefore would not treat any stands near the modeled goshawk territory. Under this alternative, it is unlikely there would be any disturbance to known northern goshawks. This alternative would thin stands in about 3,140 acres of northern goshawk habitat outside the Porcupine LSR. Habitat impacts would remain the same as in Alternatives 1 and 3.

Alternatives 1, 2, and 3 (Goshawk)

Cumulative Effects

The area analyzed for cumulative effects includes all lands within 1.3 miles of the project boundary. This distance is at least equivalent to the radius of a typical northern goshawk home range in this region. There are about 24,000 acres of goshawk habitat (primarily foraging) in this area.

Past projects have impacted about 11,330 acres of northern goshawk habitat in the cumulative effects analysis area through timber and salvage sales, plantation management, and thinning operations. Three current projects could impact northern goshawks: Bear Mountain, Davis, and Powder. During these projects, goshawks would likely forage elsewhere to avoid disturbance. The treated stands are all expected to remain viable as goshawk foraging habitat as they were managed to retain late-successional habitat where it occurred. These activities, like those proposed for the Porcupine Project, are expected to reduce the risk from stand-replacement events such as insects, disease, and fire. Table 16 and Table 17 display impacts to northern goshawk habitat in the project area and cumulative impacts areas.

The Porcupine Project may add cumulatively to the amount of impacted habitat across the cumulative impacts area. The status of goshawk habitat is unlikely to change in the long term because existing habitat should remain suitable habitat. Ongoing projects in goshawk habitat involve thinning treatments in mixed-conifer stands where canopy closure is maintained at or above 40 percent.

Table 16. Acres and percent of Northern goshawk habitat impacted by each alternative

Goshawk Habitat in Project Boundary	Goshawk Habitat Impacted by Alternative			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
11,940	3,350 (28%)	3,140 (26%)	3,310 (28%)	0 (0%)

Table 17. Acres and percent of Northern goshawk habitat impacted in the cumulative impacts area

Goshawk Habitat in the Cumulative Impacts Boundary	Goshawk Habitat Impacted by Other Actions in the Cumulative Impacts Boundary	Cumulative Acres of Impacted Northern Goshawk Habitat			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4
24,000	11,330 (47%)	14,680 (61%)	14,470 (60.3%)	14,640 (61%)	11,330 (47%)

Alternative 4 (Goshawk)

Direct and Indirect Effects

This alternative would not actively change any goshawk habitat. Because goshawk-nesting habitat is related to late-successional habitat in LSRs and on Matrix lands, there could be continued and increasing long-term risk of habitat loss due to forest insects, disease, and fire resulting from overstocked stands. The amount of goshawk nesting and foraging habitat would remain the same as the existing condition until which time insects, disease or an uncharacteristic wildfire substantially change all or portions of the existing habitat.

Cumulative Effects

Although there could be an increasing risk of forest habitat loss from insects, disease, and fire due to the no-action alternative, there is no means to accurately predict when such an event could occur and how much it could impact northern goshawks and their habitat at this time. Therefore, there could be no cumulative impacts from Alternative 4.

Determinations for Goshawk

Alternatives 1, 2, and 3

The biological evaluation[96] determination concludes: *"all action alternatives (1, 2, and 3) may impact individuals, but is not likely to result in a trend towards federal listing or loss of viability for the northern goshawk."*

Alternative 4

The biological evaluation[97] determination concludes *"Alternative 4 would have no impact on northern goshawks or their habitat."*

[96] Hill 2008 (see footnote 85) page 35.
[97] Hill 2008 (see footnote 85) page 35.

Pallid Bat

The pallid bat is associated primarily with dry environments. Foraging may be concentrated in riparian areas where available, for invertebrates,[98] but foraging sites are typically arid and only occasionally will pallid bats use conifer woodlands.[99] Roost sites include rock crevices, buildings, under bridges, caves/mines, and less often in trees.[100] Preferred hibernacula consist of caves.[101] Foraging distances are unknown, but travel distances between day and night roosts were estimated to be less than 2 miles.[102]

Alternatives 1, 2, and 3

Direct and Indirect Effects

Habitat requirements for pallid bats are vague with the exception of roosting and hibernacula. Therefore, because foraging habitat is not well defined, foraging activities occur after dark, and proposed treatments would not substantially affect preferred prey species abundance or distribution, this impact analysis will concentrate on day and night roost areas in addition to likely hibernacula.

The action alternatives could affect up to 530 acres of forested lands of the identified 14,900 acres of forested portion of the modeled pallid bat habitat, that contains snags potentially used for day or night roosts. Table 18 displays the pallid bat habitat in the project area and area impacted by alternative. Although snags would be retained at or above Forest Plan levels, it is likely that some existing snags would not survive all proposed activities. Therefore, individual roosting bats could be directly or indirectly impacted by the activities on these acres. Long-term roosts and hibernacula would not be directly impacted by any proposed activities other than short-term disturbances from noise within these activity areas. The known caves in the area would not have any activities associated with any of the action alternatives and therefore, would be well protected.

Table 18. Acres and percent of pallid bat habitat in the Porcupine project boundary by alternative

Pallid Bat Habitat in the Project Boundary	Forested Portion of Pallid Bat Habitat in the Project Boundary	Pallid Bat Habitat Impacted by Alternative						
		Alt. 1		Alt. 2		Alt. 3		Alt. 4
26,160	14,900 (57%)	560 (2%)	510 forested acres (3%)	490 acres (2%)	450 forested acres (3%)	580 acres (2%)	530 forested acres (4%)	0 acres (0%)

[98] NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life[web application]. Version 6.2. Arlington, Virginia. NatureServe. November 14, 2007 Available http://www.natureserve.org/explorer.
[99] Hermanson, J. W. and T. J. O'Shea 1983. "Antrozous pallidus." Mammalian Species **213**: 1-8.
[100] Ibid; NatureServe 2007.
[101] NatureServe 2007.
[102] Hermanson and O'Shea. 1983.

Cumulative Effects

The area considered in the cumulative effects analysis is the project area boundary. This area was chosen because foraging bats can travel large distances, about 30 miles, and the most important feature of pallid bat habitat is their day and night roosts and hibernacula. Their roosts and hibernacula are immovable objects and would not likely be impacted by activities occurring outside of the project area and foraging abundance and quality are not likely to be substantially changed with vegetation management activities.

Multiple historic projects have occurred that likely resulted in changes to the abundance and distribution of snags that are available for roosting habitat. It is unlikely that permanent roosts and hibernacula have been impacted negatively by management activities with the exception of temporary disturbances (i.e., noise). The protection (gating) of caves has resulted in beneficial impacts to high quality hibernacula and potential roost sites. Many historic projects were not restricted by specific standards and guidelines for snag and leave tree retention. All ongoing, proposed, and future foreseeable projects are restricted to leaving minimum amounts of snags and green trees for future snags. As such, there could be ample snags in the future to meet pallid bat needs. Open habitats tend to persist from the large fires in the 1950s and are stable.

In combination with all historic, ongoing, and foreseeable projects, proposed Alternatives 1, 2, and 3 could have minor, incremental, negative cumulative impacts to pallid bats or their habitat. It is not believed that these cumulative impacts would be substantial because all permanent roosts and hibernacula habitat in addition to the retention of snags and green tree replacements throughout all proposed activity areas would maintain sufficient habitat availability for any pallid bats that may be utilizing portions of the project area.

Alternative 4 (Pallid Bat)

Direct and Indirect Effects

There would be no direct or measurable indirect impacts as a result of implementing Alternative 4, as no activities would occur. Open habitats dominate the Project boundary and the Porcupine watershed and are under no threats. This habitat type is stable and therefore could provide pallid bat habitat for the long term.

Cumulative Effects

Because this alternative does not expect any impacts, there could be no cumulative impacts to pallid bats or their habitat.

Determinations for Pallid Bat

Alternatives 1, 2, and 3

The biological evaluation[103] determination concludes: *"Alternatives 1, 2, and 3 may impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species for the pallid bat."*

Alternative 4

The biological evaluation[104] determination concludes: *"alternative 4 would have no impact on pallid bats or their habitat."*

Townsend's Big-eared Bat

Townsend's big-eared bat is a generalist in its habitat preferences. Townsend's big-eared bat roost sites include caves, tunnels, trees, buildings and other man-made structures where they prefer total darkness.[105] Townsend's big-eared bats are particularly sensitive to disturbance.[106] It forages in a wide variety of habitats, preferring riparian areas where available, but also utilizing shrub and forested areas where moths are the primary prey.[107]

Alternatives 1, 2, and 3 (Townsend's Big-eared Bat)

Direct and Indirect Effects

Direct impacts such as injury and death, are unlikely to occur as a result of these alternatives. Likely roost sites (protected buildings, caves, tunnels, and large snags) would be retained onsite to meet wildlife habitat and snag and woody debris guidelines.

Disturbance and foraging habitat changes are the most likely indirect impacts. Disturbance at primary roost sites is unlikely to occur because these sites could not be impacted due to protection buffers and these sites are not in treatment areas. Individual and small groups of bats may roost in snags and could be disturbed during thinning and burning operations; however, these disturbances would be of short duration and would not impact a substantial part of the bat population as a whole.

There could be impacts to foraging habitat in the forested areas as a result of thinning. However, forest structure overall would be maintained through retention of dominant trees, tree species, canopy density, and snags. Primary foraging habitat is in shrub-dominated areas and along forest edges, so treatments would not measurably impact overall foraging habitat.

[103] Hill 2008 (see footnote 85) page 38.
[104] Hill 2008 (see footnote 85) page 35.
[105] Pierson, E. D. and W. E. Rainey. 1998. Distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii*) in California. California Department of Fish and Game. Sacramento, California; NatureServe 2007.
[106] Pierson and Rainey 1998; NatureServe 2007.
[107] NatureServe 2007.

Cumulative Effects

A reasonable cumulative effects area includes lands within 15 miles of the project. This distance is used because Townsend's big-eared bats have been recorded to travel up to this distance to forage in central Oregon, forested lava flows.[108]

Other projects that have occurred within the cumulative effects area are unlikely to have negatively impacted western Townsend's big-eared bats or their habitat. Other projects have occurred in timbered stands that are not typical big-eared bat habitat. Deer hunting and firewood cutting are the primary non-commercial activities occurring in the area and are unlikely to impact big-eared bats because those activities take place in more forested areas. The Modoc Scenic Byway, the western boundary of the project area, crosses some suitable big-eared bat habitat and has heavy recreational travel during the summer, but it is unlikely to adversely impact big-eared bats due to the small impact area.

Fires may have altered some stands and may have varying impacts on roost trees, either destroying them or creating them. Fire may also alter foraging habitat, particularly if open, brush-dominated areas burn. No fires of a magnitude that could adversely impact big-eared bat habitat have recently occurred.

Alternative 4 (Townsend's Big-eared Bat)

Direct and Indirect Effects

There would be no direct impacts as a result of the no action alternative as no activities would occur. Indirect impacts of the no action alternative would be limited to minor losses of forest edge foraging habitat and the loss of some roosting snags in the event of a stand-replacing fire. A loss of forest edge habitat and some snags could impact some individual bats, but would be unlikely to adversely impact the population because most of the bats do not roost in the forest, and bats forage primarily in the brush-dominated areas. A large fire that would consume extensive foraging areas could adversely impact western Townsend's big-eared bats, but the sparsely-vegetated forested stands and brush in most of the project area are unlikely to sustain a large fire and would thus be unlikely to occur. Changes in habitat resulting from insects, disease, and fire are unpredictable, and the amount of habitat that could be impacted is unpredictable as well. Therefore, there would be no measurable impact as a result of implementing this alternative.

Cumulative Effects

Since there would be no direct or indirect impacts from implementing this alternative, there would be no cumulative impacts.

[108] NatureServe 2007.

Determinations for Townsend's Big-eared Bat

Alternatives 1, 2, and 3

The biological evaluation[109] determination concludes *"Alternatives 1, 2, and 3 may impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species."*

Alternative 4

The biological evaluation[110] determination concludes *"Alternative 4 would not impact Townsend's big-eared bats."*

American Marten

The American marten is a medium-sized member of the weasel family, slightly smaller than the fisher. The mountainous forests of the Rocky Mountains, Sierra Nevada, and Coast Ranges covers the distribution[111] of the marten in the western U.S. General habitat preferences in the lower forty-eight United States are conifer forests that offer a dense canopy, down woody debris, and broadly riparian or mesic habitat.[112]

Alternatives 1, 2, and 3 (American Marten)

Direct and Indirect Effects

Direct impacts that could kill or injure martens are unlikely because martens are mobile. Given the probable absence of martens in the project area, this impact is even more unlikely because project area habitat is marginal. Average home ranges are usually less than 2,470 acres but are larger in the project area and vicinity because the climate is dry, riparian habitat is generally absent, and stands of mature trees are naturally fragmented. These conditions all contribute to marginal habitat.

The area of impacted marten habitat varies with each alternative and is displayed in Table 19. About 3,280 acres of marten habitat could be impacted by Alternative 1, about 3,080 acres under Alternative 2, and about 3,210 acre under Alternative 3. In general, treatment actions that could impact marten habitat could include reductions in canopy closure, down wood, snags and understory vegetation. Canopy closure retention for other late-successional species would maintain minimum 40 percent canopy closure for martens in impacted stands. Reductions in down wood accumulations and snags may impact the marten the most as it depends on this feature for prey and shelter. Likewise, reductions in canopy density could increase predation on martens. By meeting standards and guidelines for woody debris and snag retention, these

[109] Hill 2008 (see footnote 85) page 40.
[110] Hill 2008 (see footnote 85) page 340.
[111] NatureServe 2007.
[112] Powell, R., S. W. Buskirk, et al. 2003. Fisher and Marten (*Martes pennanti* and *Martes americana*). Wild Mammals of North America - Biology, Management, and Conservation. G. Feldhamer, B. Thompson and J. Chapman. Baltimore, Maryland and London, England, Johns Hopkins University Press**:** Chapter 29, Ruggiero, Aubry, et al.

alternatives would maintain habitat as suitable, even if marginal. Within 10 years shrub and ground cover should return to pre-treatment levels and therefore would provide foraging habitat quality similar to existing conditions.

Over the long-term, up to 100 years post-treatment, thinned stands could be expected to have suitable foraging habitat with larger diameter trees with larger crowns, more and larger snags and down wood, greater canopy closure, and some understory diversity. Furthermore, treatments are expected to maintain habitat for marten for the long-term by reducing insect, disease, and fire threats. However, habitat for marten would continue to be poor due to lack of true riparian areas and dense corridors between suitably-structured, mature mixed conifer stands.

Smoke from fuels treatments could cause martens to avoid the areas where burning is occurring or move away from smoky areas. This impact would be of short duration and is unlikely to adversely impact martens.

Table 19. Acres and percent of American marten habitat in the porcupine project area and impacts to marten habitat by alternative

Marten Habitat in Project Area	Marten Habitat Impacted by Alternative			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
13,540	3,280 (24%)	3,080 (23%)	3,210 (24%)	0 (0%)

Cumulative Effects

A reasonable cumulative effects area includes those areas of suitable habitat within 2 miles of the project boundary. This distance is roughly the diameter of a circular, 2,470-acre home range. Modeled marten habitat in the cumulative effects area covers about 35,660 acres of forested areas like those modeled inside the project boundary. Given the lack of riparian habitat, most of this could be considered foraging habitat. Like the habitat in the project area, the habitat in the remaining cumulative effects area is naturally fragmented.

Alternatives 1, 2, and 3

Past projects have impacted about 14,780 acres of marten habitat in the cumulative impacts boundary through timber and salvage sales, plantation management, and thinning operations. Three ongoing projects could impact marten: Bear Mountain, Davis, and Powder. During these projects, marten would likely forage elsewhere to avoid disturbance. The treated stands are all expected to remain viable as marten foraging habitat in the long term as they were managed to retain late-successional habitat where it occurred. These activities, like those proposed for the Porcupine Project, are expected to reduce the risk from stand-replacement events such as insects, disease, and fire. Table 20 displays impacts to marten habitat in the cumulative impacts area.

The Porcupine Project could add cumulatively to those total acres of marten habitat impacted by activities. The Project could maintain habitat for marten throughout most of the stands under

the proposed treatments. Therefore, habitat in the cumulative impacts area should be expected to remain stable.

Table 20. Acres and percent of American marten habitat in the cumulative effects analysis area

Marten Habitat within the Cumulative Impacts Boundary	Marten Habitat Impacted by Other Actions in the Cumulative Impacts Area	Cumulative Acres of Marten Habitat Impacted by Alternative			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4
35,660 Acres	14,780 (41%)	17,830 (50%)	17,630 (49%)	17,760 (50%)	14,780 (41%)

Alternative 4 (American Marten)

Direct and Indirect Effects

There would be no direct impacts as a result of the no action alternative as no activities would occur. Marten habitat, though probably not occupied, would continue to increase in area, based on increasing density of stands, canopy density, down wood, and snags. Martin habitat is probably not occupied because it is marginal habitat due to the dry climate, lack of riparian habitat, and naturally fragmented stands of mature trees. There would still be a lack of riparian vegetation. The stands of trees would be considered suitable habitat, but would remain susceptible to stand-replacing insect, disease, and fire events, and would in general be outside the normal range of variability. Over time, the stand-replacement risks would increase. These potential indirect impacts to marten are not quantifiable. There would be no change to the natural fragmentation of marten habitat.

Cumulative Effects

Since there would be no direct impacts to marten as a result of implementing this alternative, and because there would be no measurable indirect impacts at this time, there would be no cumulative impacts to marten.

Determinations (American Marten)

Alternatives 1, 2, and 3

The biological evaluation[113] determination concludes *"Alternatives 1, 2, and 3 may impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species."*

Alternative 4

The biological evaluation[114] determination concludes *"Alternative 4 would have no impact on marten."*

[113] Hill 2008 (see footnote 85) page 47.
[114] Hill 2008 (see footnote 85) page 47.

Sensitive Plant Species

Alternatives 1, 2, and 3 (Sensitive Plant Species)

Direct, Indirect and Cumulative Effects

Units were field surveyed for rare plants. No sensitive vascular plant, bryophyte or fungi species are located near any areas proposed for treatments. The action alternatives are not expected to directly affect sensitive plant species.

Restoration of disturbance in the ecosystem, particularly from prescribed fire, is a step in the direction of mimicking disturbances and increasing biodiversity. The loss of habitat or gain in habitat is very difficult to quantify and is discussed in general terms. Sensitive species that have suffered from management that caused reductions in biodiversity may benefit in the long term if habitat increases. The reduction in habitat such as meadows has occurred due to fire suppression, grazing, timber type conversions, and mono-specific plantations. The actions proposed in the action alternatives are designed to move the existing condition as described in the Porcupine Watershed Analysis to one that better reflects historic conditions of higher biodiversity and natural disturbance. Sensitive species could be positively affected by improving and increasing available habitat.

Proposed road closure and meadow restoration in the Hambone area would improve habitat for the long-haired star-tulip (*Calochortus longebarbatus var. longebarbatus*) and Columbia yellow cress (*Rorippa columbiae*). The road closure should provide for long-term reductions in human-caused disturbances to the meadow systems that have habitat for the long-haired star-tulip and are in proximity to a known occurrence (outside the project area). One occurrence of *Calochortus longebarbatus var. longebarbatus* was located outside and adjacent to the project area. A meadow within the vicinity is proposed for road decommissioning and removal of conifers in Alternatives 1, 2, and 3. This would provide long-term reduction in human-caused disturbance to the meadow systems that have habitat for *Calochortus longebarbatus var. longebarbatus*.

Alternative 4 (Sensitive Plant Species)

Direct, Indirect and Cumulative Effects

There would be no direct effects to sensitive plants within the project area due to the no action alternative, however, the indirect effects of the status quo would continue. Sensitive species have suffered from management that caused reductions in biodiversity this would continue. Reductions in habitat such as meadows that has occurred due to fire suppression and aforestation would continue. Continued use of a road through meadow habitat and associated dispersed camping would continue to negatively affect habitat for sensitive plant species.

Determination for Sensitive Plants

The biological evaluation[115] determination concludes: "*the Porcupine Vegetation and Road Management Project will not negatively affect Region 5 sensitive plant species or their viability and may have positive effects where habitats are improved*".

Management Indicator Assemblages[116]

Management indicator species assemblages for the Shasta-Trinity National Forest are identified in the Forest Plan.[117] The wildlife management indicator assemblages analyzed for the project were selected from this list. Management indicator assemblages whose habitat would either be directly or indirectly affected by this project are carried forward in the Project Level Management Indicator Species Assemblages Report.

The following management indicator species assemblages were not considered:

Aquatic, Chaparral and Cliffs, Caves, Talus and Rock Outcroppings: These assemblages are not found within the project implementation area. This is a flat area with deep, but highly porous soils that do not support open water or the moisture necessary for riparian zones. There are no mapped rock outcroppings in the proposed implementation area and the chaparral is limited by lack of surface moisture allowing trees to reliably out-compete chaparral species in this harsh environment. The proposed project would not directly or indirectly affect the habitat for these assemblages and would, therefore, have no impact on forest-level habitat or populations trends. Therefore, these assemblages will not be further discussed in this report.

The following management indicator species assemblage habitat associations were selected for analysis:

- Multihabitat
- Snag and Down Log
- Late Seral
- Openings and Early Seral.
- Hardwood
- Riparian

Although riparian zones are present, the ephemeral nature of water in this area restricts the riparian (as measured by the influence of water) influence on the vegetation and species

[115] Baker, Blaze. 2008. Biological Evaluation/Assessment for Sensitive Plant Species, Porcupine Vegetation and Road Management Project, Shasta-Trinity National Forest, Shasta-McCloud Management Unit. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 20 pp.
[116] Summarized from: Hill, S. 2008. Project Level Management Indicator Assemblages Report, Porcupine Vegetation and Road Management Project, Shasta-Trinity National Forest, Shasta-McCloud Management Unit. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 39 pp.
[117] USDA Forest Service 1995 (see footnote 1), page 3-24.

components. No riparian obligate species were selected because of this highly limited nature of the riparian zone (they are highly unlikely to occur here), but we have chosen to measure and analyze the riparian zone as assemblage 'habitat' to provide for a more complete analysis.

The assemblage representative species include:

- Mule deer (multi-habitat, openings and early seral)
- Red-breasted nuthatch (snag and down log, late seral)
- White-breasted nuthatch (hardwood)

These species were selected for the following reasons: each species has been documented near the project area, each species has been observed at least once annually east of McCloud or at the ranger station, each species is regularly found within the habitat for the assigned assemblage.

Past, present, and reasonably foreseeable activities within 2 miles of the project boundary were considered in the cumulative effects analysis for all assemblages with the exception of riparian. The riparian assemblage considered cumulative effects within the project boundary. Past activities include those within the last 10 years.

Mule Deer (open and early seral, multi-habitat assemblages)

Alternative 1

Direct and Indirect Effects

In general, thinning projects would affect canopy cover and stand density in treated stands. There would be reductions to hiding and thermal cover for about 10 years until understory vegetation returns in parts of the treated stands. The whole project area would not be treated, so there would remain about 80 percent of the existing thermal and hiding cover. Better habitat for bitterbrush and other forage would be created where late-seral stands, in particular pine, would be thinned to allow more light and nutrients for bitterbrush.

All multi-habitat assemblage areas would remain the same as the existing condition. There would be a shift of about 60 acres from cover habitat to open, forage habitat under Alternative 1, but this would not substantially alter the forage to cover ratio within the project area.

Thinning in the already open and early-seral stands would maintain existing conditions and create better conditions for bitterbrush and other forage that require less dense canopy closure. Hardwood trees, in particular oaks where they occur, would be left in a stand and would provide forage and security for deer.

Restoration of aspen and meadows would reduce canopy closure in deer habitat because existing conifers would be removed, but the proposed treatments would impact less than one percent of deer habitat in the project boundary. Even though there would be a temporary reduction of existing cover habitat in the proposed aspen restoration stand, the long-term benefits to deer include up to about 10 years of hardwood browse, until the aspen grow out of reach, and cover habitat at all stages.

Road closures would add 4 to 8 acres of deer habitat, but the total percentage would be inconsequential. A reduction in the road access to the meadows would benefit deer because human access would be reduced in the immediate vicinity, thus potentially reducing impacts from hunting or disturbance.

Cumulative Effects

According to the Forest vegetation database, there are about 33,700 acres of foraging habitat and about 42,300 acres of hiding and thermal cover in the cumulative impacts area. Within the last 10 years, the Forest Service has thinned or is in the process of thinning approximately 20,500 acres, regenerated 100 acres, and salvaged and sanitation cut 1,400 acres of forestland within the boundary. Also, there have been 5 acres of aspen regeneration and 30 acres of meadow restoration.

In general, the thinning has opened stands, creating greater amounts of forage habitats and slightly decreasing cover value. The area encompassed by most of these projects also corresponds to northern spotted owl foraging habitat, and as such has minimum canopy closure retention guidelines of 40 percent. Thus, most of these projects would retain existing assemblage classes following treatment, with the exception of sanitation, salvage, and regeneration cuts. Ten years after completion, these other projects would have sufficient understory vegetation to provide hiding cover in thinned stands and forage in other timbered stand treatments (regeneration, sanitation, and salvage). Long Grade, Chippy, and Hopper project areas should soon provide cover and better forage habitat for mule deer as these projects were completed in 2003 or earlier.

Implementation of Alternative 1, when combined with past and currently proposed actions, would shift approximately 30 acres of habitat previously identified as cover into forage habitat types. The shift of cover into a forage type habitat is unlikely to alter deer use of the area for the following reasons: neither cover nor forage quantity are limiting factors in this area; forage quality is likely to improve in quantity; deer use this area primarily during the growing season where thermal cover is not as important and total forage is more diverse.

Regeneration, salvage, sanitation, and aspen and meadow restoration would have reduced cover habitat by about 1,650 acres and converted that area into forage habitat. Cumulatively, Alternative 1 would further reduce the amount of cover habitat by less than one percent. Loss of forage habitat is not expected to be more than 1 percent cumulatively as most forage habitat is in thin pine and mixed-conifer stands and in brushy areas not typically suited for timber production and activity. The forage-to-cover ration would remain within the accepted range for mule deer. Multi-habitat acreage would not change overall.

Alternative 2 (open and early seral, multi-habitat assemblages)

Direct and Indirect Effects

Alternative 2 proposes to change the same number of acres of hiding and thermal cover to open and early-seral stage vegetation as Alternative 1. The direct and indirect impacts under

Alternative 2 are identical to Alternative 1. The same areas would be disturbed in essentially the same way and within the same timeframe. Cover habitat in the Porcupine LSR would likely not change at all, and the transformation of cover to forage habitat in thinned stands outside the LSR would be the same as in Alternative 1. Multi-habitat would not change from the existing 4,030 acres under Alternative 2.

Cumulative Effects

The cumulative effects of Alternative 2 would be the same as Alternative 1.

Alternative 3 (open and early seral, multi-habitat assemblages)

Direct and Indirect Effects

Alternative 3 would change about 90 acres of hiding and thermal cover to open and early-seral stage vegetation. The direct and indirect impacts would be the same as Alternative 1 and have only a slight increase in the total impacted habitat. Only two additional small stands would be impacted. Multi-habitat would not change from the existing 4,360 acres under Alternative 3.

Cumulative Effects

The cumulative effects of Alternative 3 would be the same as Alternative 1.

Alternative 4 (open and early seral, multi-habitat assemblages)

Direct and Indirect Effects

Under Alternative 4, no direct effects would occur. Because fire and forest insect and disease outbreaks are not predictable in their timing and scope, there would be no direct impacts resulting from them. However, it is reasonable to discuss the threat posed from these events and how they could impact deer and their habitat. Forest succession is reasonable and somewhat predictable to discuss.

Stands that provide cover would become increasingly dense and would continue to provide excellent cover habitat so long as there are no losses from fire and insects or disease. Given fuel conditions in many stands, the risk of a stand-replacing fire event increases every year. Current fire regimes are outside the normal range of variability[118]. Likewise, dense stocking in timbered stands can create conditions for insect and disease outbreaks, which have already occurred in some stands near the project. Although such events are unpredictable and not measurable, they are very likely to occur given the existing high fuel loading, stand density, understory density, and dry climate.

The impacts of not thinning these dense stands are that fire, insect, and disease risk could increase. Stand-replacing fire could eliminate hiding and thermal cover for deer, thus eliminating a major habitat component in the project area. Similarly, large insect and disease outbreaks could

[118] USDA Forest Service, 2003 (see footnote 2)

limit the effectiveness of timber to provide cover. Each of these scenarios could increase forage sources.

Not taking any action in this area could result in the following impacts:

- Cover could increase in density, and this could benefit deer. However, since this area has abundant cover, this impact is easily dismissed as inconsequential. If the ratio of cover to forage is skewed heavily towards cover, habitat quality could decrease.
- Forage in shrub/chaparral could be stable, but bitterbrush forage in open pine stands could decrease as pine stand canopy closes and shades out bitterbrush.
- An increase in total cover is reasonable to expect as timbered stands increase in density and area. This situation is not expected to last in the long term because drought conditions, high stocking in timbered stands, and heavy fuel accumulations would lead to insect and disease infestations and/or fire.

Cumulative Effects

Because there would be no measurable or substantial insect and disease or fire impact from the no action alternative, there would be no cumulative impacts. It is generally understood that the risk that these events could occur increases annually.

By implementing the no action alternative, the existing condition would persist in the short term and open and early-seral stage habitat would decrease in the long term. Cumulatively, the amount of cover habitat would increase over time in relation to the amount in the cumulative impacts area and the amount of forage, or open, early-seral stage habitat, would decrease. There would be no change in the quality of cover habitat; the quality of the forage habitat would decrease.

Multi-habitat across the cumulative impacts area would not change. Ratios of forage-to-cover habitat would stay about the same (1:1.3) in the short term, but cover habitat would increase in proportion in the long term.

Over the last 10 years, less than 2 percent of the hiding and thermal cover habitat in the cumulative impacts area has been lost. The Porcupine Project would not substantially change this amount under each action alternative. Thinning has been the predominant activity and has resulted in maintenance of moderate canopy closure and thus maintenance of existing hiding and thermal cover.

Habitat Status and Trend at the Forest Scale (open and early seral, multi-habitat assemblages)

The open and early-seral stage assemblages on the Forest are decreasing relative to the larger land base. Although new openings and early stage habitat is created through natural disturbances such as wildfire or pest infestations and through management actions such as timber harvest, the large amount of class 2 openings and early seral assemblage stands on the Forest are currently growing more wood and transitioning into class 3 late-seral stands faster than they are being lost. There is an overall net loss of openings and early-seral stage assemblage type on the Forest. Some of this

represents the increasing density of forest stands that were historically maintained more open by frequent ground fires. Table 21 displays the net shifts in late-seral and early-seral habitat assemblages across the Forest.

Table 21. Net shifts in late-seral and early-seral habitat assemblages[119]

Assemblage	Amount of Assemblage Type Habitat in 1991	Change in Acres due to wildfire and harvest since 1991	Forest Growth – Shift from Early Seral to late-seral Assemblage Habitat Types	Net Shift in Habitat from Early Seral to late Seral Assemblages
Late-seral	776,346	-58,717	254,434	195,717
Openings and Early Seral	908,693	73,563	-254,434	-180,871

Population Status and Trend at the Forest Scale (open and early seral, multi-habitat assemblages)

Current data from the State indicates that mule deer population has been decreasing since the early 1960s.[120] County harvest reports through 2006 report decreasing numbers.[121] The State of California attributes most of this decline to reductions in early seral habitat accompanying less timber harvest and increasingly more effective fire suppression throughout this period.[122]

Relationship of Project-Level Impacts to Forest-Scale Habitat and Population Trends for the Species (open and early seral, multi-habitat assemblages)

All three action alternatives would shift less than 60 acres of late-seral assemblage habitat into openings and early-seral assemblage habitat. This represents less than 1 percent increase in the available openings and early-seral stage habitat on the forest. This represents a very minor net gain in forage habitat for the mule deer, but is so small as to be insignificant at the Forest scale. Due to the decrease in harvest rates over the last 20 years and the increasing age and density of younger forests on the Shasta-Trinity National Forest, the proportion of openings and early-seral-stage habitat appears to be decreasing. However, the proposed project would not significantly impact that larger trend.

Thinning in the proposed late-seral stands would maintain the stands as late seral. Thinning in open and dense pine stands would promote forage availability. Since there would not be a large shift in acreage to open and early-seral stage vegetation, the change would be inconsequential and would not have a measurable impact to deer populations.

[119] U.S. Department of Agriculture, Forest Service 2007. Shasta-Trinity National Forest Wildlife Management Indicator Assemblage Habitat Monitoring Report. Shasta-Trinity National Forest. Redding, California. 36 pages. Table 19.
[120] California Department of Fish and Game. 2007. Long-term trends in California's Deer Population. Sacramento, California. < http://www.dfg.ca.gov/wildlife/hunting/deer/population.html>.
[121] Ibid.
[122] Ibid.

In summary, because there would be no shift in multi-habitat and no significant change in late- or early-early seral/open habitat, impacts to the mule deer population are not quantifiable. Across the Forest, there may be less open and early-seral vegetation, but the ratio of that seral stage with late-seral cover habitat in the project area is satisfactory. Deer populations would continue to be limited by a lack of water and low vegetative productivity in the area. The action alternatives would not substantially alter or contribute to existing habitat on the Forest or to the deer population.

White-breasted Nuthatch (hardwood assemblage)

Alternatives 1, 2, and 3

Direct and Indirect Effects

The action alternatives propose to increase hardwood habitat through aspen restoration. The alternatives would restore about 30 acres of aspen by removal of overstory pines and burning. This would add 30 acres of hardwood habitat to the project area in the long-term where none currently exists, according to the Forest vegetation database.

Incidental hardwoods found in conifer stands would be retained under Forest Plan standards and guidelines. It is not expected that these measures would appreciably increase the total area of hardwood habitat and therefore would not appreciably increase the quantity or quality of nuthatch habitat.

Restoration of this one aspen stand would increase the vegetation diversity in the project area because no stands of hardwood currently exist. There are scattered oaks and aspen, but these are typically minor components in conifer stands.

Cumulative Effects

About 5 acres of aspen restoration has occurred within the area considered for cumulative impacts. Cumulatively, this project would increase that amount by 30 acres, yet would still add less than one percent to the total hardwood habitat Forest-wide. However, hardwoods are very important for many species and 30 acres of aspen restoration represents a substantial increase in the cumulative impacts area.

For the cumulative impacts area, the proposed project would substantially increase the amount of hardwood habitat as this one stand would represent about 85 percent of the mapped hardwood habitat. Forestwide, the change would be inconsequential in area. Localized importance would be substantial, however, as the white-breasted nuthatch and other wildlife species (deer, elk, other migratory birds, and grouse, for example) are known to utilize aspen.

Alternative 4 (hardwood assemblage)

Direct and Indirect Effects

Alternative 4 would not directly impact hardwood assemblage types or the white-breasted nuthatch. Aspen is only found on about 30 acres within the analysis area, is primarily in the form

of weak sprouts, and is suppressed by conifers. Barring treatment, conifers will continue to suppress existing aspen. It is reasonable to expect that aspen could disappear from the site as canopy closure increases and disturbance does not occur. This potential hardwood habitat could be lost.

Cumulative Effects

The no action alternative would not add to the few acres of existing aspen in the cumulative impacts area. There would be even less hardwood assemblage vegetation in the analysis area.

The no action alternative would maintain the existing condition, which is less than 1 percent of the cumulative impacts area as mapped hardwood stands. Barring wildfire or insect and disease infestation in the stands overtopping the existing aspen, no aspen regeneration would naturally occur.

Summary of Habitat Status and Trend at the Forest Scale (hardwood assemblage)

Hardwood habitat occurs both as a separate forest type and as a component in many forest types on the Forest. Although the Forest lost 15,755 acres of hardwood habitat due primarily to wildfire, an undeterminable amount of hardwood habitat has also grown in or been established in the same amount of time.[123] Current best management practices and Forest Plan Standards and Guidelines favors the protection and enhancement of hardwood habitat components, retaining it and releasing oaks, aspen and other common hardwoods from competition. Harvest in these areas is likely to favor hardwoods by retaining them in the thinned stand or selecting them as leave trees in green tree retention units. Hardwoods can respond well to wild and prescribed fire.

Population Status and Trend at the Forest Scale (hardwood assemblage)

The Breeding Bird Survey (BBS) provides the most comprehensive and long-term data available on population trends.[124] Based on this data, the white-breasted nuthatch is increasing in three of the four geographic analysis areas near the project area from 1966-2006. The Sierra Nevada geographic area, well south of the project area, shows a decline. The Pitt-Klamath area, in which the project occurs, and the California Foothills have the highest credibility rating, as does the state as a whole. The remaining geographic categories have a moderate credibility rating.

Relationship of Project-Level Impacts to Forest-Scale Habitat and Population Trends for the Species (hardwood assemblage)

The proposed project would restore aspen by removal of conifers that overtop the remnant aspen trees and sprouts, followed by prescribed fire. It would be decades before the aspen stand would provide nesting habitat, but it would provide foraging habitat within 10 years. Although restoring this stand would greatly increase the amount of aspen in the project area, it would not create a

[123] USDA Forest Service 2007. Shasta-Trinity National Forest Wildlife Management Indicator Assemblage Habitat Monitoring Report. Shasta-Trinity National Forest. Redding, California. 36 pages.
[124] Sauer, J. R., J. E. Hines, and J. Fallon. 2006. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 6.2.2006. USGS Patuxent Wildlife Research Center. Laurel, MD.

substantial increase in aspen on the Forest. Nuthatch habitat in hardwoods would continue to be provided by small, unmapped stands of oaks and larger oaks that incidentally occur as part of other vegetation types. Restoring this 30-acre aspen stand would not have a measurable impact on the white-breasted nuthatch population or Forestwide trends.

Red-breasted Nuthatch (snag and down log, late-seral assemblages)

Alternative 1 (snag and down log, late-seral assemblages)

Direct and Indirect Effects

Alternative 1 proposes to thin about 3,400 acres, about 28 percent, of late-seral and snag and down log habitat assemblages in the project boundary. These areas would remain late seral and snag and down log assemblage types following treatment. Also proposed are 20 acres of late-seral and snag and down log assemblage conversion to hardwood (aspen restoration) and about 5 acres of late-seral and snag and down log assemblage conversion to grasslands (meadow restoration). The aspen and meadow restorations would be type conversions and are each less than 1 percent of the existing late-seral and snag and down log assemblage types.

Direct impacts in the stands proposed for thinning include reduced canopy closure, increased average tree size, and a decrease in the quantity of snags and down logs in stands that exceed the Forest Plan minimum. In the Porcupine LSR, there would be no substantial reduction in the snag and down log assemblage because these features must be retained at naturally occurring levels. It is likely that some snags and down logs would be removed during thinning operations for safety, but this is the exception. Future recruitment of snags and down logs would result in fewer numbers, but individuals would be larger, and therefore of higher quality. Thinned stands would retain approximately 40 percent canopy closure to meet habitat requirements of other wildlife species and residual tree size would be greater than the existing condition, therefore there would be no change in the assemblage type.

Indirect impacts to habitat include a reduced risk for insect/disease and stand-replacing wildfire because stand density would be reduced, allowing for more water and nutrients for residual trees. In the long term, residual trees would grow larger, and canopy closure would increase.

Cumulative Effects

According to the Forest vegetation database, there are about 42,300 acres of late-seral and snag and down log assemblage habitat in the cumulative effects area. Within the last 10 years, the Forest Service has thinned or is in the process of thinning approximately 20,500 acres, regenerated 100 acres, and salvaged and sanitation cut 1,400 acres of forestland within the boundary.

In general, thinning in late-seral and snag and down log assemblage habitat has retained these assemblages' status due to other species' habitat requirements. Thinning may temporarily make

habitat unsuitable to red-breasted nuthatches due to disturbance and reductions in forage habitat, but does retain the major habitat characteristics of each assemblage type.

Alternative 1 may further change about 60 acres from the late-seral and snag and down log assemblage habitat types to early-seral habitat types. This would be added to the regeneration, sanitation, and salvage treatments. The cumulative area that would be changed is about 1,570 acres, about a four percent reduction in the amount of late-seral and snag and down log assemblage types for the last 10 years. There are no other projects currently planned.

Although the proposed project would reduce the number and density of snags found in the cumulative impacts area, snag and down log levels would remain relatively high over the same area. Nesting and foraging habitat are unlikely to be adversely impacted.

Alternative 2 (snag and down log, late-seral assemblages)

Direct and Indirect Effects

Alternative 2 would impact about 3,300 acres of late-seral and snag and down log assemblage habitats. No activities would occur in the Porcupine LSR under this alternative. The direct and indirect impacts to red-breasted nuthatch habitat would be similar to Alternative 1, with lower percentages of each assemblage type being impacted. About 27 percent of the available late-seral and snag and down log assemblages in the project boundary would be impacted, but would retain their status. The same percentage and type of assemblage habitat converted to hardwoods and grasslands would apply.

Cumulative Effects

The cumulative impacts would be the same as in Alternative 1.

Alternative 3 (snag and down log, late-seral assemblages)

Direct and Indirect Effects

Alternative 3 would impact about 3,400 acres of late-seral and snag and down log assemblage habitats. The direct and indirect impacts to red-breasted nuthatch habitat would be the same as Alternative 1, with slightly higher percentages of each assemblage type being impacted. About 29 percent of the available late-seral and snag and down log assemblages within the project boundary would be impacted, but would retain its status. About 90 acres of each the late-seral and snag and down log assemblage types would change to open and early-seral assemblage habitat. The aspen and meadow restorations would be type conversions and are each less than one percent of the existing late-seral and snag and down log assemblage types.

Cumulative Effects

The cumulative impacts would be the same as in Alternative 1.

Alternative 4 (snag and down log, late-seral assemblages)

Direct and Indirect Effects

Alternative 4, the no action alternative, would have no direct impacts to red-breasted nuthatch habitat as no activities would occur. Indirect impacts would occur through successional changes.

The existing conditions for the timbered stands in this project are denser and have a higher fuel load than historic conditions. Historically, the stands in this area were pine-dominated, with fir occurring on north and east slopes and at higher elevations.[125] More frequent fire kept down wood quantities low and lowered understory shrub and tree density.[126] Historically, this area was likely marginal red-breasted nuthatch habitat except in the higher elevation fir zones.

With fire suppression and selective logging of the dominant overstory pine trees, the residual trees grew in to become the dominant trees seen today, namely a heavy fir and incense cedar component to pine stands. The climate is drier now, as well, and there are more trees demanding a decreasing water source and the available nutrients. These dense stands are at a higher risk of an insect and disease infestation that would kill many more trees than would naturally occur under more open stand conditions. This risk would increase with each season.

The dense stands with a heavy fir and cedar component when combined with a lack of fire, either natural or prescribed, has also allowed above normal fuel accumulations in these stands. With each season, the amount of fuel on the ground and in the canopy layers increases. The risk of severe, stand-replacing fire increases each season.

The timing of severe disease and insect infestations and wildfire are impossible to predict and their potential severity is not quantifiable. However, there is an increasing risk.

Increasing density and a high number of potential future snags would provide habitat for the red-breasted nuthatch for the long term. However, the increasing risk due to infestations and fire implies that large portions of habitat in this area could be lost should they occur. Not treating these stands would maintain the higher risk and potential for losses of late-seral and snag and down log assemblages.

Cumulative Effects

This alternative would not thin any stands to reduce the risk for insect and disease infestation or fire. There would be no change to existing late-seral and snag and down log assemblage habitat in the cumulative impacts area. It is unlikely that this alternative would adversely impact red-breasted nuthatches and their habitat at this time. In the long term, potential losses in habitat resulting from the insects, disease, or fire would adversely impact red-breasted nuthatch habitat. Alternative 4 would not adversely impact the red-breasted nuthatch habitat at this time, but the potential risk for future, large-scale habitat loss increases each season.

[125] USDA Forest Service, 2003 (see footnote 2).
[126] Ibid.

Habitat Status and Trend at the Forest Scale (snag and down log, late-seral assemblages)

Snags and down logs are a natural and necessary component of almost all forest types. Natural, background densities of snag and down logs vary with forest type and seral stage. Late-seral and snag and down log assemblage changes Forestwide from 1991 to 2005[127] were due to timber harvest and wildfire. Table 22 displays Forestwide net shifts to late seral and snag and down log assemblages habitat. Although timber harvest would maintain minimum levels of snag densities, wildfire has highly variable results. Most fires, whether 'hot' or 'cool' would leave ample amounts of snags on the landscape. However, since 1991, 254,434 acres of younger, early seral forest has grown into the late-seral assemblage category.[128] This acreage of late-seral assemblage habitat also can be applied to the snag and down log assemblage category, and as such, both categories would show a net gain in area Forestwide.

Table 22. Net shifts to late-seral and snag and down log assemblages habitat.[129]

Assemblage	Amount of Assemblage Type Habitat in 1991 (in Acres)	Change in Acres Due to Wildfire and Harvest, 1991 Through 2005 (in Acres)	Forest Growth – Shift from Early-seral to Late-seral Assemblage Habitat Types	Net Shift in Habitat from Early-seral to Late-seral Assemblages
Late-seral	776,346	-58,717	254,434	195,717
Snags and Down Log	1,012,460	-79,318	254,434	175,116

Note: Snag and down log assemblage change assumes that change due to succession from early- to late-successional means those maturing stands now provide snag and down log habitat where they did not previously.

Population Status and Trend at the Forest Scale (snag and down log, late-seral assemblages)

The Breeding Bird Survey (BBS) results for the red-breasted nuthatch shows a species with statistically insignificant decrease in one nearby strata (Sierra Nevada); statistically insignificant increases in the local strata (Pitt-Klamath Plateau), in one nearby strata (California Foothills) and at a larger scale (California); statistically significant increases in one nearby strata (South Pacific Rainforests); and a statistically significant increase survey wide (which should cover the entire North American range of the species). With the exception of the California Foothills strata, all of these scales retain the highest credibility given in BBS data.

[127] USDA Forest Service, 2007 (see footnote 123).
[128] Ibid.
[129] U.S. Department of Agriculture, Forest Service 2007. Shasta-Trinity National Forest Wildlife Management Indicator Assemblage Habitat Monitoring Report. Shasta-Trinity National Forest. Redding, California. 36 pages.

Relationship of Project-Level Impacts to Forest-Scale Habitat and Population Trends for the Species (snag and down log, late-seral assemblages)

Because the direct and indirect impacts to habitat are unlikely to change large-scale areas to different assemblage types, the impacts alone would not affect the population trend of the red-breasted nuthatch, and assuming all other habitat factors being equal, the current population trend would continue. Expected numbers of red-breasted nuthatches would remain the same in the project area.

To summarize, the red-breasted nuthatch as a representative of the late-seral and snag and down log management indicator assemblages would show very little to no observable effects from the project. The project area has abundant late-successional forest and snag numbers are higher than Forest Plan minimums[130] and likely will continue into the long-term. Proposed treatments would reduce threats to late-seral and snag and down log habitat while maintaining the features that classify it as such. Canopy closure, average tree size, and snag and down log requirements would be retained. In general, this project would not alter existing trends for red-breasted nuthatch populations.

Riparian Assemblage

Habitat

Riparian habitat is classified in the Forest Plan vegetation database as riparian reserves, and in the project consists of 250-foot buffers on each side of ephemeral and intermittent streams. There are about 320 acres of riparian reserves in the project boundary.

The riparian habitat in this boundary is not typical of most riparian areas in that there is no mapped hardwood and deciduous shrub cover associated with it. Remnant aspen trees exist, but no aspen stands. Grass is the major component and reflects the ephemeral and intermittent nature of water in the riparian zone of influence. Channels are undefined or poorly defined. Most of the annual precipitation comes in the form of snow; 90 percent of the annual precipitation arrives from October through April.[131] Wet meadows that form the riparian areas are typically dry by early summer.[132]

Given that the water in these riparian areas is not permanent and would not provide permanent year-round habitat for any of the riparian management indicator assemblage species, none were chosen to augment the discussion of this assemblage. If species were to occur, their presence would be extraordinary.[133]

Alternatives 1, 2, and 3

Direct and Indirect Effects

[130] McCusker 2008 (see footnote 89).
[131] USDA Forest Service, 2003 (see footnote 2).
[132] Ibid.
[133] Ibid.

Alternatives 1 and 2 would impact about 50 acres of riparian assemblage habitat, and Alternative 3 would impact about 80 acres of riparian assemblage habitat. This represents 17 percent of the total available in the project boundary for Alternatives 1 and 2, and about 24 percent for Alternative 3.

Proposed treatments for all three alternatives include about 30 acres of aspen release and 20 acres of standard thinning on three stands (48-206, 48-209, 48-215) that intersect the riparian zone. Treatments for the aspen release include removal of overstory conifers and applying fire to residual material to initiate growth of the remnant aspen. Thinning treatments would be applied for wildlife management to open up the overstory to promote bitterbrush growth. Thinning units in the riparian assemblage habitat are portions of stands that overlap the mapped boundary of the riparian zone. In addition, Alternatives 1 and 2 would restore about 30 acres of meadow; Alternative 3, about 50 acres. These treatments include removal of encroaching conifers and thereby open up the former meadows to more historic conditions.

All action alternatives would maintain existing riparian assemblage habitat. The habitat would not be made any more suitable to riparian assemblage species, however, because there would be no change to factors influencing precipitation or its retention (storage) on the landscape. Impacts would be classified under other assemblage habitat types (hardwoods and open and early-seral habitat). These treatment units and goals happen to intersect the riparian zones. There would be no change to the riparian assemblage habitat or species even though restoration activities would occur there. The changes would be to hardwood or forest openings habitat types, as discussed in the above mule deer and white-breasted nuthatch sections.

Cumulative Effects

The cumulative impacts area is the project boundary because there are no existing assemblage species and the assemblage habitat is not perennial. Because there would be no direct or indirect impacts to the riparian assemblage habitat, there would be no cumulative impacts.

Alternative 4 (Riparian Assemblage)

Direct and Indirect Effects

Alternative 4 is unlikely to impact the riparian habitat assemblage. Because there are no riparian management indicator assemblage species present, cover vegetation would have no influence on them. Even if the riparian area were allowed to grow in under no treatment, the lack of perennial water would preclude occupation by those species.

Under the no action alternative, it is probable that conifers would continue to encroach upon the open meadows and over time, the openings would disappear. However, this would not change the intermittent nature of water flow across the landscape. The riparian habitat would continue to be classified as such; the dominant or overstory vegetation types would change. Therefore, despite the vegetation changes that would occur under this alternative, there would be no impact to the riparian assemblage.

Cumulative Impacts

Because there would be no direct and indirect impacts to this assemblage type, there would be no cumulative impacts.

Migratory Birds

Alternatives 1, 2 and 3

Direct and Indirect Impacts

Direct impacts include possible death and physical injury of some birds due to project implementation. Potential sources of these impacts include thinning and burning operations and associated activities that would alter the physical habitat. The season of implementation has the greatest influence on direct impacts; no neotropical migratory birds would be directly impacted if treatments occurred outside the breeding season. Indirect impacts include changes to foraging, nesting, dispersal, hiding or cover, and migration habitats.

In general, thinning treatments in mixed-conifer and pine stands would move those stands to a more historic condition of fewer, larger trees, less dense canopy closure, and a higher percentage of pine as dominant trees. Mixed-conifer and white fir vegetation types would be impacted the most as they constitute about 77 percent of the proposed treatment areas. Residual canopy closure would remain approximately 40 percent or higher in these stands. It is reasonable to expect some understory regrowth in the form of shrubs and small trees by the end of the first decade post-treatment and certainly in the long-term.

In the short-term, fir-dominated stands would have a more open canopy, fewer understory trees and shrubs, and the residual tree size would increase. Initially, there would be fewer nesting and foraging opportunities for some birds that utilize the understory; others would find better or easier opportunities. Some birds could benefit from the more open canopy conditions while others would find this habitat unsuitable. For most of the species, the impacts would not be sufficient to make a difference in their use of the forest stands.

Thinning in ponderosa pine stands and plantations would reduce canopy closure to about 40 percent or higher, and would maintain bitterbrush at minimum standards for deer habitat. Bitterbrush would continue to provide nesting and foraging habitat for many migratory birds including those that utilize shrub, chaparral, and forests. Thinning would promote mid-successional stand characteristics for the dominant trees.

Lodgepole treated to initiate regeneration would be early-seral stage post-treatment and not serve as habitat for most migratory birds for at least 10 years, with the exception of birds that forage and nest in forest openings and early-seral stage vegetation.

Shrub habitat would decrease in many forested stands, except where bitterbrush is retained in ponderosa pine stands. Therefore, in the short term, there would be negative impacts to shrub-related species. Overall in the project boundary, however, the amount of shrub habitat would not

substantially change from the existing conditions. Over the long term, the understory shrubs would return.

Restoration activities in the meadows and aspen stand could provide a specific habitat type that does not currently exist. Meadow restoration would have quick results and there could be increased meadow habitat (30 acres under Alternatives 1 and 2, 50 acres under Alternative 3) by the first year post-treatment. Allowing for frequent fire, by human or natural means, this meadow habitat could persist indefinitely. Aspen restoration is unlikely to have a beneficial impact during the first decade post-treatment. After this time, however, the aspen stand would mature and could provide more habitat for more species of birds. It is unlikely that this meadow and hardwood restoration would impact a population of migratory birds because the scale is small in the context of the larger landscape and the lack of availability of similar, nearby habitat. However, it could be a benefit to some individuals.

There would be no changes to species utilizing riparian habitat or cliff/rocky/barren habitat. No treatments would occur in cliff/rocky/barren habitat.

Due to the importance of late-successional habitat throughout the region, managing for this type of stand, where available, is desired and requires some maintenance. In this dry environment, this habitat type may be difficult to maintain in an ideal condition; however, it may be possible to maintain habitat in a moderate, but sustainable condition. Thinning treatments would lower the risk of stand-replacing events, thus increasing the probability that these stands would continue to provide mature forest habitat for the mentioned species for the long-term.

Forest standards and guidelines for green tree retention, snag and down wood retention, and project design features for these and canopy closure would maintain coarse-scale existing habitat and strata codes for the treated stands. There would be short-term adverse impacts from initial reductions in some of these characteristics, but in the long term these characteristics would continue to provide existing amounts of habitat in most treated stands while reducing forest health and fire risks. Potential bird representation would remain the same after treatment with the exception of the restoration and regeneration sites because most of the stands would retain existing vegetation classification (strata code).

Cumulative Impacts

A reasonable cumulative effects boundary is a two-mile boundary surrounding the project area. This distance would encompass home ranges of the largest and widest-ranging neotropical migratory birds. As stated previously habitat for neotropical migratory birds is limited by a lack of riparian and old growth forest types in the watershed.

The Forest activities database has records of Forest actions dating back into the mid-1900s. There have been about 20 actions that have manipulated the existing vegetation within and immediately surrounding the project boundary. Since the 1970s, the Forest has attempted restoration of historical timber types in the Porcupine watershed.[134] Treatments have primarily

[134] Ibid.

been thinning, with the primary exception of salvage sales resulting from disease or insects. Non-timber vegetation types have not been appreciably impacted as changes to these types are either incidental to management of forested types or inclusion of open types resulted from slight mapping errors.

In general, riparian protection measures are implemented on all lands regardless of ownership. The amount of riparian habitat in this cumulative impacts area is very small, less than 1 percent, and, as stated above, is poor quality at best. This project would not remove any riparian acres from providing long-term habitat, but would remove encroaching conifers to reestablish riparian and meadow habitat.

There are about 35,600 acres of forested vegetation types in the cumulative impacts area. Past activities have concentrated on pine-dominated and mixed-conifer stands and have impacted about 14,000 acres of these forest types. Snags and down wood have been retained at existing levels or at higher, standards and guidelines levels. Thus, habitat for snag-dependent birds has been maintained. Implementation of any of the action alternatives would retain this habitat feature, as well. Thinning in forested stands has, in general, retained the broad forest type and strata code for stands while attempting to restore natural vegetation types. For example, mixed-conifer stands have remained mixed conifer and historically dominant trees, pines, have been retained in an effort to move stands back to conditions that more closely reflect historical conditions.

Alternative 4 (Migratory Birds)

Direct and Indirect Impacts

Under Alternative 4, no birds would be injured or killed as a result of any activities because no land management activities are proposed.

Indirect impacts to migratory birds are habitat-related and discussed below. Predicting stochastic events is obviously problematic and not quantifiable at this time, however, stand succession and increased risk from potential insect, disease and fire events will be discussed.

Extensive shrub habitat (such as mountain mahogany, manzanita, and bitterbrush; about 7,000 acres) would remain relatively stable barring any large, landscape-scale fires. Bitterbrush found in open pine stands would decrease in number and vigor as timbered stands would likely increase in stem density and canopy closure, thus shading out bitterbrush. Loss of understory shrubs in this habitat type would transform the stands to single layer pine of little value to migratory birds or other wildlife.

Forested habitat would become increasingly dense and thus prone to insect and diseases infestation, and there would be increasing amounts of woody fuel accumulations. Increasing density would not necessarily be detrimental to many forest-dependent species. In the long-term, there would not be a difference in bird species habitat between the action and no action alternatives. In many stands, increasing canopy density would correspond to high numbers of trees per acre, as opposed to fewer, larger trees with large crowns typical of the historic

conditions. In the long term, there would be more snags and down logs, but these would be smaller than would be possible under treatment scenarios in the long term.

Should there be insect or disease outbreaks resulting from the increased forest density, cavity nesters, woodpeckers, and forest flycatchers would benefit with more dead and dying trees and the potential insect abundance that would occur. Fewer mature, healthy overstory trees without a complex canopy would reduce habitat quality for large raptors and migratory birds that utilize dense forest canopy.

Natural forest openings have become smaller and this trend would continue without meadow restoration through thinning and burning. Migratory bird species that prefer open habitats and grasses would lose even more habitat as forests encroach on these openings.

Riparian habitat, for the reasons previously mentioned, does not provide the quality habitat it would under perennially wet conditions. A general lack of water in the project area, even in riparian areas, would limit the effectiveness of these areas in providing migratory bird habitat. Even under continued forest encroachment, these riparian areas would not improve habitat quality in the riparian vegetation sense (there would not be growth of deciduous woody vegetation) and would further reduce the natural grass and forest openings character of these riparian areas. Wildfire possibility would increase with increasing tree density, and wildfire would be beneficial in that it would promote grasses, the dominant ground cover in these riparian zones.

Cumulative Impacts

Alternative 4 would have no cumulative impacts from forest insect/disease outbreaks or fire because these features would have no measurable direct or indirect impacts. Forest succession cumulative impacts exist.

In the cumulative impacts area, there would be an increase in late-successional forest types and a corresponding decrease in open and early-seral forest types, which are already lower than desired. Increases in late-successional habitat would benefit those birds associated with dense canopies at the expense of those that utilize more open stands and that were historically found in the area. Forested stands would be at risk to insects, disease and, fire in the long-term.

Losses in understory brush, like bitterbrush, under pine stands would result from no action in dense pine stands with a bitterbrush component. Gnatcatchers, some flycatchers, sparrows, and goldfinches would be negatively impacted. In the cumulative impacts area, thinning treatments in pine-dominated stands left better conditions for understory shrub development. No action would not improve the amount of this habitat type.

Aspen regeneration and meadow restoration has occurred on very few acres. There would be no addition to hardwood and meadow habitat in the cumulative impacts area under this alternative.

Invasive Plants

Alternatives 1, 2, and 3

Direct and Indirect Effects

The effects from the action alternatives on non-native invasive species (NNIS) plants, including noxious weeds, are expected to be relatively similar because they all have the same weed prevention design criteria as well as the same favorable environmental effects such as road closure. The overall acres treated are similar between action alternatives.

A weed risk assessment was used for determining the risk of introducing or spreading noxious weeds associated with this project.[135] The risk of weed spread or introduction is best defined as risk because with an increase in treatment area the more likely project-related activities could affect weed distribution. The proposed action alternatives have a moderate risk (risk rating 25) of undesirable plant establishment or spread in the project area. The moderate risk is based solely on the ability of some species, such as bull thistle, to spread by wind into the areas disturbed during project implementation. It is expected that equipment used for the project would be weed-free, any added materials (mulches or seed) would be weed-free, and the project is in a relatively weed-free state.

There are few weeds in the project area except along roads. State listed noxious and non-native European and Eurasian invasive plant species are both present (bull thistle, spotted knapweed, wooley mullein). Project design criteria and guidelines for noxious weed management are expected to prevent new weeds from entering into the area and as well as leaving the area on equipment to invade new areas. However, these criteria may not prevent occurrences of weeds spreading on site due to the high numbers of weeds along roads.

Ground-disturbing activities and the proposed road decommissioning would increase bare soil and weed risk. Reductions of canopy cover and bare soil areas resulting from burning increase the risk of weed invasion. The movement of weeds into these disturbed areas could affect native ecosystems. If wooly mullein or bull thistle become established in disturbed areas it is expected that they would be replaced by native vegetation in the next 5 to 10 years. Areas where spotted knapweed becomes established or intensifies could experience a longer-term loss of biodiversity until canopy closure reduces its presence. Spotted knapweed occurrences would be targeted for eradication by hand treatment prior to project implementation as part of regular District weed control.

[135] Baker, Blaze. 2008. Non-native Invasive Plant Species/Noxious Weed Report for the Porcupine Vegetation and Road Management Project, Shasta-Trinity National Forest, Shasta-McCloud Management Unit. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 16 pp.

Cumulative Effects

Cumulative effects were analyzed qualitatively using the effects of this project and other past, present, and reasonably foreseeable activities in the area that may have impacts on NNIS populations in the project area.

Cumulative effects on rare plants and native ecosystems can be caused by weeds. A moderate risk of weed increase is posed by the project action alternatives. If weeds become established and are left untreated, they can displace rare or native plants and the animals that depend on them. Over the long term, the weeds that are most likely to invade the project area (e.g. bull thistle, spotted knapweed, and wooly mullein) are generally not so aggressive in these ecosystems to cause permanent degradation. This is in part due to the main focus of the project to thin forest stands which would leave an overstory of trees that would close the canopy in a few years and within one season, provide a mulch layer over disturbed soils. The longest-term risk is where landings and burn piles were created as bull thistle and wooly mullein have a high affinity for establishing in those types of disturbed sites.

As a result of the short duration of disturbance, the extensive measures to minimize spread, and existing and foreseeable control actions such as prevention and avoidance, the overall risk of NNIS spread would be moderate in the short tem with long-term reductions in risk due to low current levels of infestations, low range use, and low overall recreation use.

Alternative 4 (Invasive Plants)

Direct and Indirect Effects

NNIS would continue to increase at current rates via animals, wind, and humans, however, the rate would not increase or decrease as a result of the no action alternative. This alternative would not directly or indirectly increase or decrease the spread of NNIS plants in the project area or surrounding area.

Cumulative Effects

Alternative 4 would not cause negative cumulative effects from NNIS plants because direct and indirect effects are not anticipated.

Survey-and-manage Fauna

Alternatives 1, 2, and 3

Direct and Indirect Effects

Six survey-and-manage snail species require surveys prior to management activities. Habitat for five of these species does not occur within the project area because there are no limestone outcrops in the watershed (four species) or it does not occur in the county (one species). There is marginal habitat potential for one species. Protocol surveys were conducted for this snail in 2006 and 2007 and none were found.

Direct impacts to snails are unlikely because these snails have not been found in their suitable, though marginal habitat and proposed activities would remain outside the riparian zone. The exception to this would be meadow restoration activities, however, these snails are not likely to be present in the dry meadows proposed for restoration.

Indirect impacts could occur due to habitat changes. Proposed treatments include about 10 acres of meadow restoration, 80 acres of thinning, and 30 acres of aspen release in survey and manage habitat. These impacts could be beneficial in the long term because the meadow and riparian systems could be restored to historic, open conditions typical of their ephemeral nature. Road closures in the meadow would further enhance long-term stability of meadows by maintaining local surface hydrology and preventing channeling of run-off water by rutted roads. Thinning and removal of some trees could reduce the risk of intense, stand-replacing fire in these habitat types.

Given the poor habitat and absence of snails, direct impacts are unlikely and indirect impacts are likely to be beneficial to existing habitat, even though the existing habitat is marginal.

Cumulative Effects

A reasonable cumulative impacts area includes those surveyed riparian areas inside the project boundary because these animals are limited in their movement to permanently wet areas.

Many projects have occurred in the cumulative impacts boundary, but not in riparian areas. Grazing and roaded recreation have been the primary recent activities in these zones. Grazing no longer occurs and roads associated with the meadows near the riparian areas could provide the most likely source of direct or indirect impacts. Fire exclusion has likely changed the meadows the most.

The action alternatives are unlikely to contribute cumulatively to any impacts from other activities. The poor habitat and no presence of these snails suggest that these snails may not have been present in the riparian areas in the past. While restoration of the meadows may contribute to better riparian habitats in the watershed, the type of meadow is not suitable for these snails. There could still be no permanently wet riparian areas.

Alternative 4 (Survey-and-manage Fauna)

Direct and Indirect Effects

The no action alternative would not directly impact terrestrial snails because no management activities would occur. Indirect impacts to habitat include further forest encroachment to riparian areas and potential snail habitat. These riparian areas are ephemeral in nature, and are covered in grasses. Further encroachment by trees could eliminate the existing riparian habitat, even further reducing the marginal habitat for these snails.

Cumulative Effects

Because there would be no direct impacts to snails and no measurable indirect impacts at this time, there would be no cumulative effects.

Survey-and-Manage Flora

Alternatives 1, 2, 3, and 4

Direct and Indirect Effects

There are no occurrences of survey-and-manage plants, bryophytes, fungi, or lichen within proposed treatment units.[136] There would be no direct effects from the alternatives because they are not located within any proposed treatment units. Project activities (alternatives 1, 2 and 3) could indirectly affect potential habitat through the introduction of noxious weeds that could compete with native plants (see *Invasive Weeds* section). Equipment could bring seed into the project area and soil-disturbing activities could create conditions favorable for weed establishment. Noxious weeds are not a problem at the present time. As a result of the short duration of the disturbance, the extensive measures to minimize spread, control actions such as prevention and avoidance, the risk of weed spread and establishment is moderate and short term.

Cumulative Effects

Cumulative effects are not anticipated because there are no direct effects and the indirect effects from weed risk to the species are expected to be of short duration.

Vegetation Diversity

Alternatives 1, 2 and 3

Direct and Indirect Effects

Direct and indirect effects discussions are limited to the project area and will focus on changes in vegetation types, seral stages, and late-successional forest.

Vegetation Type and Seral Stage

Thinning would not change the vegetation type or seral stage diversity. The thinned mid-seral stands would develop into late-successional forest in 10 to 70 years. The thinned late-successional forest would remain late-successional forest (see Table 23).

Table 23. Amount of thinned stands and effect on successional stage

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres of thinned mid-seral stands to develop into late-successional forest*	3,900	3,670	3,880	0
Acres of thinned late-successional stands maintained	340	270	340	0

* in 10 to 70 years

[136] Baker, Blaze. 2008. Supplemental Botanical Report, Porcupine Vegetation and Road Management Project, Shasta-Trinity National Forest, Shasta-McCloud Management Unit. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit. Mt. Shasta, CA. 13 pp.

Regeneration harvest of a mature, medium tree – closed lodgepole pine stand would have no effect on the vegetation type and would result in about 40 acres for Alternatives 1, 2 and 3 reverting to the grass/forb seral stage. Regeneration harvest of a mature, medium tree – closed ponderosa pine stand in Alternative 3 would have no effect on the vegetation type and would result in about 20 acres reverting to the grass/forb seral stage.

Aspen release in a medium tree – closed lodgepole pine stand would result in a 30-acre reduction in the lodgepole pine vegetation type and a 30-acre increase in the hardwood type for Alternatives 1, 2 and 3. There would also be a 30-acre reduction in the closed-canopy, medium-tree seral stage and a 30-acre increase in the grass/forb seral stage for Alternatives 1, 2 and 3. Meadow restoration in medium tree – open ponderosa pine stands would result in about 30 acres in Alternatives 1 and 2, and 50 acres in Alternative 3, reverting to the meadow vegetation type and the grass/forb seral stage. Table 24 lists acreage changes in vegetation type and seral stage for alternatives 1, 2 and 3.

For Alternatives 1, 2 and 3, the Porcupine watershed would remain below the minimum desired acreage of 5 percent in the grass/shrub, large tree – open, and large tree – closed seral stages (Table 25).

Table 24. Alternatives 1, 2 and 3 direct and indirect effects – vegetation diversity

		Alt. 1 Net Change (Acres)	Alt. 2 Net Change (Acres)	Alt. 3 Net Change (Acres)
Vegetation Type:	Lodgepole Pine	- 30	- 30	- 30
	Ponderosa Pine	- 30	- 30	- 50
	Meadow	+ 30	+ 30	+ 50
	Hardwood	+ 30	+ 30	+ 50
Seral Stage:	1 - Grass Forb	+ 90	+ 90	+ 130
	3a - Medium Tree - Open	- 30	- 30	- 50
	3b, 3,c - Medium Tree - Closed	- 60	- 60	- 80
	4b, 4c - Late-successional Forest	0	0	0

Table 25. Post-treatment seral stage diversity, Porcupine watershed

Seral Stage	Current % of Watershed	Post-Treatment % of Watershed		
		Alt 1	Alt 2	Alt 3
Non-forested (lava, rock, etc.)	5.6	5.6	5.6	5.6
1 - Grass/forb	2.7	2.8	2.8	2.8
2 - Shrub/seedling/sapling	13.8	13.8	13.8	13.8
3a - Medium tree, <40% canopy closure	23.7	23.7	23.7	23.7
3b/3c - Medium tree, >40% canopy closure	49.8	49.7	49.7	49.7
4a - Large tree , <40% canopy closure	1.1	1.1	1.1	1.1
4b/4c/4c Older - Large tree, >40% canopy closure	3.3	3.3	3.3	3.3
Total:	100.0	100.0	100.0	100.0

Late-successional Forest

The area of capable land occupied by forest types that meet the criteria of late-successional forest would remain at approximately 34 percent of the Porcupine watershed.[137] Thirty-four percent exceeds the 15 percent threshold established for Matrix Lands.[138]

Mature Forest

Regeneration harvest vegetation management treatments would reduce the mature forest type by 70 acres under Alternatives 1 and 2 and 90 acres under Alternative 3. Thinning vegetation management treatments under Alternatives 1, 2 and 3 would have no effect on the mature forest type in the short term (10 years and less). Implementation of the thinning treatments would retain the majority of the dominant and codominant trees within the stand and remove the smaller diameter trees from the understory. This would increase the average stand diameter and concentrate site growth potential on the residual trees maintaining mature late-successional forest characteristics. In the long term (10 years and longer), this would accelerate development of late-successional forest on the thinned acres.

Old-Growth Forest

Vegetation management activities proposed under Alternatives 1, 2 or 3 would not reduce this forest type. Thinning vegetation management treatments under Alternatives 1, 2 and 3 would have no effect on the old-growth forest type in the short term (10 years and less). Implementation of the thinning treatments would retain the majority of the dominant and codominant trees within the stand and remove the smaller diameter trees from the understory. This would increase the average stand diameter and concentrate site growth potential on the residual trees maintaining mature late-successional forest characteristics. In the long term (10 years and longer), this would accelerate development of late-successional forest on the thinned acres.

Cumulative Effects

Cumulative effects for vegetation diversity are bounded by the Porcupine 5th-level watershed. This boundary is based on Forest Plan direction for assessing the existing percent of late-successional forests and effects of the proposed actions on those successional stages.

Within the last decade, approximately 1,800 acres of regeneration harvest and salvage/sanitation have occurred in the Porcupine watershed on National Forest lands. This included 1,000 acres of regeneration or sanitation of lodgepole, 100 acres of knobcone pine conversion, and 700 acres of salvage of insect and fire mortality. These silvicultural treatments had no effect on vegetation type other than the knobcone pine conversion, which resulted in a type change from knobcone to ponderosa pine. The regeneration harvest and the knobcone pine conversion treatments changed those acres back to the grass/forb seral stage and are expected to remain in that stage for approximately 10 years before transitioning to the shrub, seedling, sapling

[137] USDA Forest Service 2003 (see footnote 2), Table 3-16.
[138] USDA Forest Service 1995 (see footnote 1), p. 4-63.

stage. The salvage units have some residual mid- and late-successional stage trees and groups of trees with a much lower canopy closure. The treatments listed above have not affected the amount of late-successional forests within the Porcupine watershed. Most of the stands treated were mature, mid-seral at the time of harvest. However, the salvage harvest did potentially remove some dead, late-successional trees.

There has also been approximately 31,000 acres of commercial thinning in the Porcupine watershed within the last 10 years. Commercial thinning had no effect on vegetation type or seral stage and has not changed the amount of late-successional forest in the short term (10 years and less). Thinning would increase the percent of late-successional forest in the long term as mid-successional (3b and 3c) stands that were thinned grow into the late-successional (4b and 4c) stage. Approximately 22,700 acres of the commercial thinning occurred in natural stands. These areas will develop into the late-successional stage in the next 10 to 70 years. The remaining 8,300 acres of thinning occurred in mid-successional plantations. It is estimated that these plantations will develop into late-successional forest within 50 to 80 years. Development of these stands assumes no stand-replacing loss from fire, insects, or disease. Future forest management projects planned in the Porcupine watershed would remove about 300 acres of mid and late successional forest for meadow restoration and aspen release.

Commercial thinning that has occurred in the last decade and the proposed commercial thinning under Alternatives 1, 2 and 3 combined will have treated approximately 25 percent of the forest lands in the Porcupine watershed. Implementation of the thinning treatments retains the majority of the dominant and codominant trees within the stand and removes the smaller diameter trees from the understory. This would increase the average stand diameter and concentrate site growth potential to the residual trees maintaining mature late-successional forest characteristics. In the long term (10 years and longer), this would accelerate development of late-successional forest on the thinned acres within the Porcupine watershed.

Alternative 4 (Vegetation Diversity)

Direct and Indirect Effects

In the absence of major insect and fire disturbance, current successional trends would continue. There would be no short-term changes in vegetation type, seral stage, or late-successional forest. The Porcupine watershed would remain below the minimum desired acreage of 5 percent in the grass/shrub, large tree – open, and large tree – closed seral stages.

Late-successional Forest

The area of capable land occupied by forest types that meet the criteria of late-successional forest within the Porcupine watershed, now at approximately 34 percent, would increase as stands mature.

Mature Forest

In the absence of future natural disturbance such as wildfire or insect attack, the amount of mature late-successional forest in the watershed would continue to increase over the next decade. Large acreages of younger 60- to 80-year-old conifer stands are expected to progress naturally into late-successional forest.[139]

Old-Growth Forest

In the absence of future natural disturbance such as wildfire or insect attack, the amount of old-growth late-successional forest in the watershed will continue to increase slightly over the next decade. Additional ingrowth is expected from current mature late-successional forest. As a result, a continuing gradual increase of old-growth late-successional forest is expected in the future.

Cumulative Effects

Cumulative effects from past projects are the same as for Alternatives 1, 2, and 3. Commercial thinning from past projects treated approximately 22 percent of the watershed. There would be no direct effects from Alternative 4. In the absence of major insect and fire disturbance, current successional trends would continue.

Visual Quality

The foreground along the Powder Hill Road (43N49) is to be managed primarily to meet the adopted visual quality objective (VQO) of Partial Retention. Approximately one mile of the Powder Hill Road, along the north border of the project area is part of the Modoc Volcanic Scenic Byway. The analysis considers the impacts of the proposed action and alternatives on the visual quality along this road.

Alternative 1

Direct and Indirect Effects

Treatment units would meet a VQO of Partial Retention within 1 to 2 years after completion of thinning and fuel treatments. Management activities may be noticed but the area would look natural.

Thinning along the Powder Hill Road (43N49) would enhance visual quality by removing understory and mid-story vegetation to enhance mature, large-diameter trees, particularly pine. Thinning would also provide more visual depth into the forest by allowing travelers to view the interior of the stands, and see mature, large-diameter trees. Vegetation on the forest floor would also respond to thinning and within 1-2 years with increased grass and shrub growth. Grass and shrub growth on the forest floor would conceal low cut stumps and residual logging slash, providing a natural appearance.

[139] USDA Forest Service, 2003 (see footnote 2).

The underburning fuel treatment proposed for unit 48-220 would meet Partial Retention within 1 to 2 years after treatment. The lower portion of tree poles and other vegetation would be black or brown, however within 1 to 2 years grass and forbs would be reestablished.

Soil disturbance and/or brush piles would be apparent in units planned for machine or hand-piling. Within 1 to 2 years, the piles would be gone, grasses and forbs would be reestablished, ground disturbance would no longer be noticeable, and the units would meet a VQO of partial retention. Proposed treatments would reduce the chance of loss of large-diameter overstory trees to insect attack and wildfire. Thinning would also promote the growth of large-diameter trees.

Cumulative Effects

The area assessed for cumulative effects is the foreground along Powder Hill Road within or adjacent to the project area. The timeframe for the analysis includes projects within the last 10 years and foreseeable projects.

Recent vegetation treatments adjacent to the Powder Hill Road (190 acres of the Baby Powder Sale) are similar to those planned in the Porcupine Project; thinning and fuel treatments to maintain and enhance large-diameter overstory trees and decrease the risk of stand loss due to insects and wildfire. These treatments enhance the mature stand character of forest stands within the visual zone along the Powder Hill Road. They also reduce the risk of loss of mature stands to insects and wildfire and help to ensure the perpetuation of scenic mature pine and mixed forest stands.

Alternative 2 (Visual Quality)

Direct and Indirect Effects

The direct and indirect effects of Alternative 2 would be similar to Alternative 1 with the exception of stands within the LSR. Within the LSR, the effects would be similar to the no action alternative (Alternative 4).

Cumulative Effects

The cumulative effects of Alternative 2 are similar to those disclosed for Alternative 1.

Alternative 3 (Visual Quality)

Direct and Indirect Effects

The direct effects of Alternative 3 would be similar to Alternative1, however one additional unit (31-227) along Powder Hill Road would be treated. The treatments in this stand would be the same as the stand immediately across the road. This would improve the natural view because the stand on both sides of the road would appear the same.

Cumulative Effects

The cumulative effects of Alternative 3 are similar to those disclosed for Alternative 1.

Alternative 4 (Visual Quality)

Direct and Indirect Effects

No treatments would take place under the no action alternative so there would be no corresponding direct effects. The visual quality of untreated stands would remain in the existing condition. Understory vegetation would continue to develop and obscure views of large diameter, mature pine and fir. The mature overstory component important for scenic quality would remain at risk of loss due to insects or wildfire.

Cumulative Effects

Recent vegetation treatments adjacent to the Powder Hill Road maintain and enhance large-diameter overstory trees and decrease the risk of stand loss due to insects and wildfire. These treatments enhance the mature stand character of forest stands within the visual zone along the Powder Hill Road. They also reduce the risk of loss of mature stands to insects and wildfire and help to ensure the perpetuation of scenic mature pine and mixed forest stands. However, with the no action alternative, stands would remain untreated, understory vegetation would continue to develop and obscure the mature overstory component important for scenic quality, and the mature overstory component would remain at risk of loss due to insects or wildfire.

Air Quality

Alternatives 1, 2 and 3

Direct and Indirect Effects

Logging operations would produce some dust, primarily from tractor skidding of logs and log hauling over native surface roads. Dust from hauling would be minimized through dust abatement by water application or an acceptable alternative. Logging operations generally occur over several years and localized dust from skidding and hauling dissipates rapidly.

Proposed pile burning and under burning in Alternatives 1, 2, and 3 would produce smoke and ash from partially burned plant matter. This burning of organic matter would produce emission of particulates suspended in the atmosphere from one to several days. Slash pile burning would produce an estimated 13 to 14 tons of particulate matter (PM_{10})[140] and underburning would produce an estimated 153 to 159 tons of particulate matter (PM_{10})[141]. Burning would only occur on “burn days” designated by the Siskiyou County Air Pollution District. All burning would follow the approved Northeast Air Alliance Smoke Management Plan. It is unlikely that the 24-hour State or Federal Standard for PM_{10} or$MP_{2.5}$ would be exceeded as the only time it has been exceeded in the past 5 years is when a large wildfire burns over considerable time. Burning would also be done under an approved burn plan that will

[140] U.S. Department of Agriculture, Forest Service. 1995. Air Quality Conformity Handbook for Land Managers. Pacific Southwest Region. Tables 6-8-1995
[141] USDA Forest Service 1995, (see footnote 140). Tables 6-8-1995

schedule burning when wind conditions dissipate smoke rapidly and direct it away from populated and other sensitive (Class II Airsheds) areas. The Mt. Shasta Wilderness is a Class II Airshed located approximately 18 miles west of the project area.

Smoke emissions can be reduced by burning less fuel, and fuel available for burning can be reduce by utilizing small-diameter material. Alternatives 1, 2 and 3 include the harvest and removal of biomass.[142] Biomass harvest would reduce the fuel available for smoke emissions. Dirt-free piles also reduce smoke emissions and project design features include piling slash to minimize the inclusion of dirt.[143]

Cumulative Effects

The area considered for cumulative effects in regard to air quality is the 5th-level Porcupine Watershed (approximately 150,000 acres). The timeframe for analysis includes past planned and future activities on National Forest and private lands that would be implemented over the same time period as this project. The project vicinity is primarily forested federal and private lands with no substantial emission sources other than dust from logging operations and smoke from slash pile burning and broadcast burning. The project is located away from populated areas where emissions are generally higher due to industries and smoke from private residences.

Project burning activities are expected to occur over a period of 4 to 6 years and burning over any given time period would be limited to allow smoke to dissipate and any residual combustion (smoldering) to be completed, and air quality would be maintained within standards. Present and past planned timber harvest, associated pile burning, and broadcast burns are expected to be completed before burning associated with this project commences and there are no foreseen future projects that would be implemented over the same time period so there would only be the direct effects of smoke and dust from this project. Because the smoke and dust from other projects will have dispersed and dissipated before burning associated with this project commences there would be no cumulative impacts on air quality.

Alternatives 4 (Air Quality)

Direct and Indirect Effects

No treatments would take place under the no action alternative so there would be no corresponding direct effects on air quality. No activities would take place to reduce fuel loading within the project area and these fuels would remain available for consumption in a wildfire and consumption in a wildfire would create smoke.

Cumulative Effects

There would be no direct effects on air quality due to the no action alternative to add to cumulative effects; however, the indirect effects of no action would result in a continued

[142] Biomass harvest includes the removal of stems 4-10 inches DBH.
[143] DeBano, Leonard F., Daniel G. Neary, and Peter F. Ffolliott. 1998. Fire's Effects on Ecosystems. New York: John Wiley & Sons, Inc. pp. 256-257.

accumulation of dead and live fuels available for consumption in a wildfire, and the generation of smoke.

Soil Resources

Soil quality standards[144] from the Shasta Trinity Land and Resource Management Plan were used to evaluate the impacts to long-term soil productivity from the Porcupine Project. Historical timber harvest history from the intense logging during the 1920s and more recent logging in the 1960s and 1970s left residual effects from old railroad grades, roads and log yarding. This historical logging is evident with compaction along old yarding routes. Despite this evidence, the area maintains a high level of productivity in terms of plant growth. Also, field work found that soil quality standards are met for all other thresholds. The impacts of the proposed activities have low risk given the site characteristics of low slope, adequate drainage and high productive capacity. Furthermore, the focus of this project is thinning, which preserves forest canopy for moderating moisture and providing continued forest litter for soil conditioning. In this context, the main impacts to soils are from adverse cumulative effects from additional compaction that would occur with mechanical harvest methods. To address these issues and minimize adverse cumulative effects, the project plans to use old routes to the extent possible and rehabilitate major skid routes and landings. Alternatives 2 and 3 address roads more effectively based on the roads analysis; the planned road actions would benefit the soil resource by closing 7 miles and decommissioning 3 miles. System road impacts are not considered since these are dedicated uses for management and not intended for forest/soil productivity.

Alternatives 1, 2, and 3 (Soil Resources)

Direct and Indirect Effects

All action alternatives would have roughly the same impact on soils. The action alternatives may vary slightly, with a slight decrease of 5 percent acreage with Alternative 2 and slight increase of 1 percent with Alternative 3, but the overall effects are the same with regards to silvicultural treatments. Alternative 3 does have a change of 20 acres of ponderosa pine treatment moved from thinning to regeneration harvest, which would likely increase soil impacts from compaction.

The main indicators typically used for soil resource impacts include erosion, compaction, and soil organic matter content.[145] Detrimental effects involving one or multiple indicators indicate impairment of soil production potential when a threshold is passed, typically 15 percent of the area in a detrimental condition.

Soil erosion is not a factor in the project because of adequate infiltration of the soils, dominantly low slope for most of the project area and good soil groundcover that increases infiltration and reduces overland flow. The low erosion hazard in all units of every alternative makes the possibility of a loss of production due to erosion very unlikely, regardless of potential

[144] USDA Forest Service. 1995. (see footnote 1)
[145] USDA Forest Service. 1995 (see footnote 1)

disturbance or acreage. As a result, there is not a single alternative that is more likely than the others to cause (or prevent) a greater loss of productivity due to erosion.

Soil Compaction

Surveys revealed that most of the existing disturbance found within the project area was associated with compaction, almost exclusively a result of old skid trails and landings.[146] Landings are about ½ acre or less in size, and skid trails can be up to several hundred feet in length. Based on these observations, the soils have a risk for compaction. All alternatives have a risk for soil compaction given the use of mechanical ground-based harvest operations. The risk is fairly equal for all alternatives given the negligible difference in treatment area.

Soil compacts from heavy ground pressures commonly associated with mechanical harvest methods, most commonly ground-based tractor systems. Feller-bunchers and rubber-tired skidders are planned for the harvesting. Feller-bunchers have lower ground pressures than the skidders, though turning and repeated travel results in compaction along with soil displacement. These systems are thought to be lighter on soil though results depend on the restriction of travel. In Montana[147], monitoring results found tighter skid trail spacing of 50 feet had overall less detrimental disturbance than traditional requirements of 100 to 150 feet. The traditional requirement causes much more off-trail travel than the smaller trail spacing and this was reflected in higher incidence of detrimental disturbance. Using tighter skid trail spacing may also allow the feller-buncher operators to reach in without traveling to every tree.

Compacted soils lose air space and do not transmit water as effectively and therefore growing potential can be reduced in some soils such as clay swales. A certain amount of resiliency is associated with soils where seasonal influences such as freeze-thaw can release slight compaction levels, but some severely compacted surfaces may take roughly 30 years to recuperate.[148] Despite perhaps 80 years since the last harvest entry, some compaction persists in the project area. Blading away of topsoil creates longer lasting adverse conditions, reducing nutrients, impeding drainage, and providing less air for root and microbial respiration. This is the case with some of the old railroad beds and some skid trails.

Soil standards provide guidance to limit adverse compaction, in terms of soil porosity, to less than 10 percent of total porosity found under natural conditions[149]. This standard is intended to indicate a threshold at which productivity may be affected, though current science indicates this may not be an appropriate blanket threshold for all soils. Even severe compaction on soils may

[146] Fryxell, J., and A. Jackson. 2006. TEAMS Soil Survey and Methodology and Field Notes for the Porcupine Project on the Shasta-Trinity National Forest. Unpublished report on file at Shasta-Trinity National Forest. Mt. Shasta, CA. 21 p.
[147] Archer, V., and M. Vander Meer. 2007. Lolo NF Monitoring: Deborgia Timber Sales. Internal In-service Report. Region 1, Lolo NF, Lolo NF Supervisors Office. Missoula, MT. 12p.
[148] Geist, J. Michael, John W. Hazard, and Kenneth W Seidel. 1989. Assessing Physical Conditions of Some Pacific Northwest Volcanic Ash Soils After Forest Harvest. Soil Sci. Soc. Am. J. 53:946-950
[149]USDA Forest Service. 1995a. (see footnote 10)

not have adverse effects on tree growth, as reported for sandy loam sites[150]. These soils are extremely to excessively well drained, and thus compaction can increase water-holding capacity, perhaps important in a water-limited Mediterranean climate. Loam-textured soils tend to have very well balanced drainage and water holding capacity for growth; therefore, limiting drainage from compaction would not improve growing conditions on these soils where they exist.

The proposed action has 4,330 acres planned for mechanical treatment, but no adverse effects on production are anticipated as a result of compaction caused by the proposed action. Although treatment activities have the potential to cause compaction, the proposed action is expected to have a neutral effect on compaction in areas with no detrimental disturbance because BMPs would require limits on new disturbance and reclamation measures would mechanically relieve new compaction in areas that could be expected at detrimental levels. As a general guideline, per Timber Harvest BMP 1-10, the areal extent of skid trails and landings shall not exceed 15 percent of a given treatment unit in even-aged stands and no more than 20 percent in uneven-aged stands. Using the recommended 50-foot spacing between skid trails could exceed these guidelines (up to 20 to 30 percent total extent per unit) in terms of areal disturbance on a unit-by-unit basis. However, studies have indicated that only a portion of this areal extent is typically considered detrimental[151] and detrimental compaction resulting from management activities would be treated. After proposed treatments are implemented, all new and reused landings and skid trails within 200 feet of landings would be subsoiled to a depth of 12-18 inches. These BMPs also translate to a potentially positive effect on overall compaction, in alleviating legacy as well as new detrimental compaction.

While subsoiling is not expected to be entirely effective in alleviating compaction in all places treated, when applied properly it should be effective in most places treated, and adequate to meet the intent of the soil standards.[152] Proper application depends upon equipment used (true winged subsoiler, not a modified rock ripper), proper soil moisture when treated to provide good soil tilth, and done in conjunction with effective erosion control measures. Other effects of subsoiling, such as damaging living roots and exacerbating root disease, have not been shown to be significant factors in considering overall effects and benefits.[153]

Most soil cover is removed during subsoiling to prevent unwanted mixing of coarse organics into the soil. Soil cover should recover quickly from conifer needle cast and vegetative growth. If post-project monitoring indicates a long-term lack of soil cover, additional measures would take place to ameliorate the soil surface with slash or other cover such as woodchip mulch. The cover would aid in recovery in promoting cooler soil temperatures and provide microsites for soil

[150] Gomez, A., RF Powers, MJ Singer, WR Horwath. 2002. Soil Compaction Effects on Growth of Young Ponderosa Pine Following Litter Removal in California's Sierra Nevada. Soil Sci. Soc. Am. J. 66: 1339
[151] Young, David (Zone Soil Scientist). 2008. Personal communication regarding unpublished work from PSW research.
[152] Young, David. 2008. Personal communication. (see footnote 151)
[153] Young, David. 2008. Unpublished PSW Ponderosa Study in project vicinity. Shasta-Trinity National Forest, Redding, CA.

microbe activity as found under dead wood. The soil microbes and larger fauna such as ants and beetles, in turn, increase the soil functional attributes such as gas exchange and nutrient availability.

Soil Organic Matter

Organic matter should be maintained in amounts sufficient to prevent significant short- or long-term nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions.[154] Proposed mechanical and fire-related treatments in each proposed alternative would decrease organic cover along skidding routes. Levels of organic matter groundcover would be impacted from coarse slash removal, especially with the machine piling treatments common to all action alternatives. These treatments would maintain ground cover over the minimum 50 percent coverage listed in the soil standards, though woody residues in the 1- to 3-inch category could be reduced. The intent of the cover standard is to reduce the potential for erosion, which as already mentioned is low regardless. Prescribed burning would have a net positive impact with patchy losses to groundcover, and fine and coarse wood, but with net increases in nutrient availability. Organic matter losses would be short term as litter returns from the shrub, grass, and forest overstory.

As discussed above, no adverse effects related to organic or vegetative cover are expected. The retention of a forest canopy would continue to supplement soils with leaf litter. The majority of proposed units (68 percent) meet coarse woody debris standards. Retention of coarse wood to at least 5 logs/acre is desirable per Forest Plan direction and would moderate site conditions for mycorrhizal microsites and added moisture[155]. Units without desirable levels of coarse wood are being silviculturally managed to grow larger trees, so eventually these units should come into standard as well through natural recruitment of snags. Coarse wood does not necessarily increase soil fertility substantially since the material is more resistant to decay with high carbon-to-nitrogen ratios[156]. However, coarse wood can increase soil moisture and moderate temperature flux by providing microsites for increased biologic activity.[157] [158] These coarse wood microsites can improve soil recovery and supplement soil function. Retaining existing coarse wood levels and allowing for recruitment through the natural addition of snags and or standing trees would facilitate these benefits.

[154] USDA Forest Service. 1995. (see footnote 1)
[155] Graham et al. 1994.
[156] Laiho, R. and C.E. Prescott. 1999. The contribution of coarse woody debris to carbon, nitrogen, and phosphorus cycles in three Rocky Mountain coniferous forests. Can J. For. Res. 29: 1592-1603
[157] Graham, R.T., A.E. Harvey, M.F. Jurgenson, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Res. Pap. INT-RP-477. USDA Forest Service, Intermountain Research Station. 13p.
[158] Pyle, C. and M.M. Brown. 2002. The effects of microsite (logs versus ground surface) on the presence of forest floor biota in a second-growth hardwood forest. USDA Forest Service, Gen. Tech. Rep. PSW-GTR-181

Soil Buffering Capacity/Soil Environmental Health

Soil reaction class, buffering or exchange capacities, or microorganism populations would be maintained for continued soil productivity. The planned treatments could alter existing condition of soils by changing the relative proportions of soil nutrients and biotic populations through mechanical or fire-related means, though soil organic matter would be conserved. Maintaining adequate soil organic matter implies that soil buffering capacity would remain at functional levels, especially since organic matter in the form of humus has 10 fold the cation exchange capacity as mineral clay complexes in soil.[159] All action alternatives have low severity prescribed burning planned that would decrease cover, though increase soil buffering capacity with a shift to more viable substrate for microbial use. Additional positive effects are from charcoal that buffers inhibitive terpines from conifer litter and can facilitate higher levels of plant available nutrients.[160]

The risk for adverse impacts to soils from Borax stump treatment is low since treatments would not elevate Boron levels outside of natural background concentrations. Also, treatments would be localized to stumps[161]. Boron, the active ingredient in Sporax, is a micronutrient that is reported as a range as low as 15 parts per million[162] to 300 ppm. The assessment is based on an application rate of 1 to 5 pounds per acre of Borax to cut stumps; reported Forest Service rates were around 2 pounds per acre. Soil monitoring results of Borax stump treatments suggest that Borax treatments would not reach toxic levels in nearby soils since Sporax treatments led to 0.1 to 2 ppm Boron levels in soil. In contrast, phytotoxic levels for plants range from 5 to 20 ppm for agricultural crop species.

Cumulative Effects

The area considered for cumulative effects are the proposed treatment units. For all action alternatives, the main risk from the proposed project is compaction in addition to compaction to that already existing from historic logging. The site was heavily logged during the early 1900s and thus many railroad grades were built across the area. The low-sloped area made it ideal to build roads and yard logs. Also, the relatively high production made timber extraction favorable. Additional logging was done in the 1960s and 1970s within second growth stands. Proposed action units laid out for access by present road system sometimes incorporates within them previous systems of railroad beds, and associated skidding trails and haul routes.

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[159] Brady, Nyle C., and Ray R. Weil. 1999. The Nature and Properties of Soils. Prentice Hall. Upper Saddle River, NJ.

[160] DeLuca, T.H., M.D. Mackenzie, M.J. Gundale, and W.E. Holdben. 2006. Wildfire-Produced Charcoal Directly Influences Nitrogen Cycling in Ponderosa Pine Forests. Soil Science Society of America. 70: 448-453

[161] U. S. Department of Agriculture, Forest Service 2006. Human Health and Ecological Risk Assessment for Borax (Sporax) Final Report. Prepared by Syracuse Environmental Research Associates, Inc. Forest Health Protection, USDA Forest Service, Arlington, VA. 136p.

[162] Borax Pesticide Fact Sheet. 1995. Prepared for USDA Forest Service by Information Ventures, Inc. Available: http://infoventures.com/e-hlth/pestcide/borax.html [2007].

The area has a high level of productivity and recovery potential if soils are left intact. However, scraped and displaced topsoil as found along roads and major skidding routes will continue to have a lower growth potential. Given this lowered condition occupies a minor unit area, and soil displacement is short distance (5-10 feet), affects upon tree growth across the site is probably minor. Ten years into long term soil productivity studies by Powers et al.[163] has yielded mixed results when looking at individual tree and stand growth response, depending largely on soil texture; sandy loam sites did not show productivity declines from severe compaction at ten years. In general, studies linking site index, a silviculture measure of site productivity, have also been mixed.

The indications are that the site has a very high growth potential based on the field observations. Timber harvest in the past has left an imprint of myriad of skid trails, old roads and non-distinct old routes that are difficult to distinguish from contemporary log haul routes or old railroad era steam donkey logging. The site potential together with other soil indicators being met, leads us to conclude that the area has a very high resiliency to soil disturbance, and there are not indications that site productivity from past entries has been adversely affected.

To address the cumulative effects, a conservative approach is taken to maintain existing levels of disturbance. Reclamation would focus on major trails and landings, especially in units with high amounts of old harvest routes. Less-traveled trails are excluded since they are not expected to have detrimental levels of compaction, and subsoiling can have positive and potentially negative effects. Where compaction is extreme, subsoiling should be an effective practice to relieve most of the compaction. Where only low to moderate compaction exists, leaving soils intact is more desirable. While subsoiling can increase soil porosity, this effect can diminish with time as soil settles into a compact state, and deep tilling with dozer tines can mix soils with infertile subsurface rock. Recommended subsoiling would be 12-18 inches deep and only occur on high traffic skid trails and on landings, where the great majority of detrimental compaction occurs. The net effect is that the proposed action would not introduce any meaningful degree of new compaction.

Relevant past, present and foreseeable (see Appendix D) activities that have occurred, are ongoing, or will occur within the treatment boundaries of each action alternative, have been considered for this cumulative effects analysis.[164] Treatment areas in the action alternative are likely to continue meeting or make progress toward meeting soil quality standards. Although some effects may occur, detrimental effects are not anticipated. Therefore, adverse cumulative effects as a result of past, present and foreseeable activities in combination with the alternatives are not expected. Beneficial effects may occur resulting from reduced compaction, improved hydrologic function, and closure of roads, but the relation of these effects to past, present, and

[163]Powers, R.F., D.A. Scott, F.G. Sanchez, R.A. Voldseth, D. Page Dumroese, J.D. Elioff, and D.M. Stone. 2005. the North American long-term soil productivity experiment: findings from the first decade of research. Forest Ecology and Management. 220: 31-50.
[164]Archer, Vince. 2007. Soils Report, Porcupine Vegetation and Road Management Project. Table 3.

future actions can not be quantified at this time because the extent of those benefits are not known.

Alternative 4 (Soil Resources)

Direct and Indirect Effects

Under the no action alternative, there would not be any creation of new soil compaction. The existing condition of soils would persist with the slow steady relief of compaction from natural processes. No new adverse effects would likely result from this action but productive potential in the short term may not be as high under this alternative as compared to the action alternatives because historic compaction would not be alleviated. Hydrologic function, such as soil drainage, would be maintained at existing rates. Old landings and old skid roads would not be reclaimed with decompaction.

The no action alternative also provides for soil organic matter through maintenance of existing cover. Existing levels of coarse wood would not be removed. No treatment may increase the risk of high-intensity wildfire and the loss of soil organic matter and cover. It is speculated that intensive harvests can be preferable to wildfire in terms of soil nutrient balance.[165] Not treating the project area could therefore result in unknown effects on productivity in the future.

Cumulative Effects

The area considered for cumulative effects are the proposed treatment units. No new adverse effects are expected to occur as a result of this action. Soils would likely maintain their high productivity although historic compaction would not be alleviated. Hydrologic function, such as soil drainage, would be maintained at existing rates and the no action alternative would also provide for soil organic matter through maintenance of existing cover. Existing levels of coarse wood would not be removed. No treatment may increase the risk of high-intensity wildfire and it is thought that intensive harvests can be preferable to wildfire in terms of soil nutrient balance, but not treating the project area would result in unknown effects on productivity in the future because the occurrence, intensity, and severity of wildfire is speculative. Because the no action alternative would not result in known direct or indirect effects to soils, no cumulative impacts are expected as a result of this alternative.

Hydrology

The potential environmental consequences to water resources are evaluated within the context of water quality and riparian and aquatic habitats. Because surface runoff is almost entirely non-existent within the project area the extent of potential impacts is limited to the areas where

[165] Wells, C.G and J.R. Jorgensen. 1979. Effects of Intensive Harvesting on Nutrient Supply and Sustained Productivity. USDA Symposium Proceedings, 212-230. p 225-226

activities are proposed within Riparian Reserves. The Riparian Reserve acreage affected for each alternative is shown in Table 26.

Table 26. Riparian reserve area within treatment units

Activity Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Aspen and Meadow Restoration	60 acres	60 acres	80 acres	0 acres

The scarcity of water resources and hydrologic features limits the extent to which management activities under any of the alternatives can influence Riparian Reserves. Riparian Reserves occupy 0.6 percent (320 acres) of the project area (50,260 acres – Alternative 1). The actual area of Riparian Reserves that would be treated under the proposed action (Alternative 1) is 60 acres. This is equivalent to 17 percent of the total Riparian Reserve acreage in the project area and only 0.1 percent of the total project area.

The following section describes the potential direct, indirect and cumulative effects to water resources that could result from implementation of the proposed action or alternatives. The area assessed for cumulative effects is the project area. The Equivalent Roaded Area (ERA) model was not used to assess cumulative effects to water resources in the Porcupine assessment area due to the limited hydrology. The ERA methodology is based on a rainfall-runoff driven model that identifies the potential for land-use activities to affect peak flows and water quality. Because the project area is almost completely devoid of a stream network there is no potential for management activities to have runoff-induced cumulative effects to aquatic and riparian resources.

Alternatives 1 and 2 (Hydrology)

Direct and Indirect Effects

Ground disturbing activities associated with timber harvest, road decommissioning, underburning and meadow restoration would occur within Riparian Reserves. Disturbance and impacts would be minimized using designated skid trails and restrictions on harvest activities during wet periods. Trampled vegetation would result from mechanical tree harvest and skidding. Soil compaction is expected on designated skid trails. Disturbance to intermittent stream channels at designated equipment crossings is expected, however, no operations would be permitted during wet periods when water is present in the stream course. Localized increases in turbidity at temporary crossings are likely if above normal annual precipitation occurs. The duration of elevated turbidity levels would be limited to the first winter following ground disturbance.

Alternatives 1 and 2 would not adversely affect water quality, riparian and aquatic habitats located within and outside of the proposed treatment units provided that mitigation measures and follow-up measures such as fencing are utilized to protect aspen stands based on monitoring results. There is no potential for the proposed action or alternatives to impact fish-bearing

streams. There are no fish-bearing streams within or immediately outside of the proposed treatment units and no perennial or intermittent flow connections (channels) exist between stream channels in the project area and downstream fisheries on Bear Creek and the Fall River.

Alternatives 1 and 2 would have no persisting detrimental impacts to water quality or aquatic/riparian resources. With the exception of short-term localized impacts due to ground-disturbing activities in Riparian Reserves, the overall effects of Alternative 1 would restore meadow and aspen habitats. This alternative would have a positive or neutral effect on each of the nine Aquatic Conservation Strategy Objectives.[166] Short-term impacts would be mitigated by project design features. There is no potential for project activities to affect water quality in downstream reaches including perennial fish bearing streams due to the lack of surface flow connectivity.

Alternative 3 (Hydrology)

Direct and Indirect Effects

The direct effects of Alternative 3 are similar to Alternative 1, however, a greater area of meadow habitat would be disturbed during harvest activities. Ground-disturbing activities would occur on 77 acres of Riparian Reserves.

Alternatives 1, 2, and 3 (Hydrology)

Cumulative Effects

In order for the actions proposed to have a cumulative effect on water quality and riparian habitats there must be multiple or additive effects to these resources. In this case, no projects have occurred and no future projects are planned that would affect water quality or aquatic and riparian habitats within the units identified. There are also no grazing allotments or recreation site developments located within the Riparian Reserves where vegetation management activities are proposed. It is also noted that the effects of the proposed management activities, while not cumulative, would be positive and would result in a net increase in meadow habitat and aspen stands in the assessment area. The lack of stream connectivity to areas outside the project area limit the cumulative effects to the project area.

Alternative 4 (Hydrology)

Direct and Indirect Effects

There would be no treatments to restore aspen stands or meadows and no associated direct or indirect effects. Aspen would continue to decline. Meadow habitat would continue to change to a conifer stand. Roads would continue to impact meadows.

Cumulative Effects

Because there would be no direct or indirect effects, there would be no cumulative effects

[166] The assessment regarding the nine Aquatic Conservation Strategy Objectives is in Appendix D.

Transportation

Alternatives 1, 2 and 3

Direct and Indirect Effects

Harvest unit access, and log and chip hauling would utilize the existing road network and short, temporary roads. Road maintenance on haul roads would be performed prior to and during harvest activities. Maintenance activities include clearing of brush and small trees within the road right-of-way, surface blading to provide a smooth road surface, chip sealing existing surfaced roads, water drainage and dust abatement. Table 27 displays the miles of road that would be maintained for each alternative.

Alternatives 2 and 3 include approximately 2 miles of road reconstruction. The reconstruction would surface Forest System Road 41N23 with a cinder surface. The cinders would come from and existing cinder pit within the project area (SE ¼ of Section 14, T41N, R3E). No expansion of the pit is anticipated for removal of the needed cinders.

All temporary roads used in conjunction with harvest activities would be barricaded, revegetated and closed to vehicle use following harvest activities, however Alternatives 2 and 3 would close an additional 7 miles of Forest System roads. These roads could be reopened in the future to allow access for timber management.

Table 27. Transportation activities (miles)

Management Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Roads closed	0	7	7	0
Roads decommissioned	2	3	3	0
Roads added to system	0	3	3	0
Roads upgraded (reconstruction)	0	2	2	0
Haul maintenance	103	104	104	0
Temporary roads associated with landings[167]	4	3.5	4	0
Area in landings and skid trails within 200' of landings[168]	100 acres	90 acres	100 acres	0 acres

All action alternatives include road decommissioning. Roads to be decommissioned would be removed from the Forest transportation system and returned to forest or meadow lands. Alternative 1 includes approximately 2 miles of road decommissioning, and Alternatives 2 and 3 include 3 miles of road decommissioning. Alternatives 2 and 3 would add 3 miles of existing, unclassified roads, to the Forest transportation System. These roads have a long-term need for management access.

[167] Temporary road estimates are based on one landing for each 30 acres of harvest area, approximately ½ of landings would need a temporary road, and 200-300 feet of road for each landing.
[168] Landing area estimates are based on one ½ acre landing for each 30 acres of harvest, and 4 main skid trails within 200 feet of the landing.

Cumulative Effects

The area assessed for cumulative effects is the Porcupine project area. This area was selected for cumulative effects because, in terms of timber harvest access, roads provide limited access beyond approximately ½ mile. The timeframe for the analysis begins with settlement of the area in the late 1800s and extends approximately 10 years into the future.

The existing network of classified and unclassified roads is a result of over 100 years of timber and range management. Initial harvest utilized railroads to haul the logs to local mills. Once the logs were removed, the ties and rails were removed but the relatively flat, level grades remained. These grades often turned into the roads used for log truck access as the logging industry changed from railroad transportation to trucks. The project area has approximately 155 miles of Forest System Roads and 40 miles of unclassified roads. These roads have provided access for timber harvest, fire suppression, and recreation.

A project level RAP has been completed and includes recommendations to decommission an additional 3 miles of road, close an additional 15 miles of classified road, and obliterate 3 miles of unclassified road.[169] Road activities included in the action alternatives combined with foreseeable road management would result in a decreased network of open and closed Forest System Roads and return additional land to forest or meadow.

Alternative 4 (Transportation)

Direct and Indirect Effects

There would be no direct effects because no road management activities would take place. The existing system of classified and unclassified roads would remain as is. Maintenance activities would continue, however trees and shrubs would continue to grow on and adjacent to the roads, eventually limiting most vehicle traffic.

Cumulative Effects

There would be no cumulative effects for Alternative 4 because there would be no direct effects and no measurable indirect effects.

Financial Considerations

Financial efficiency analysis required at Gate 2 (project analysis, design and decision notice) (FSH 2409.18). The financial efficiency analysis of the proposed timber harvest, vegetation management, and transportation management activities is disclosed in this section. A comparison of the effects between the alternatives in regard to the following measures is also disclosed: harvest volume, estimated jobs supported and estimated 25 Percent Fund payment to county

[169] Poehlmann, Dennis; Derby, Debbie; Huhtala, Jeff; Vardanega, Mark; Navarre, Annette. 2007. Roads Analysis for the Porcupine Vegetation and Road Management Project. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Shasta-McCloud Management Unit, Shasta-Trinity National Forest, Mount Shasta, CA. 7 p.

government. Although the values estimated are not absolute, they do provide a relative comparison of the alternatives and their associated economic values. Details regarding the methodology for analysis and assumptions are available in the project file.

Alternatives 1, 2, 3 and 4

Direct and Indirect Effects

Harvest Volume

Harvest volume originating on the Shasta-McCloud Management Unit usually supplies mills and plants to surrounding counties: Siskiyou and Shasta in California; and Jackson, Josephine, and Klamath in Oregon. Table 28 displays estimated harvest volume for the project by alternative.

Table 28. Harvest volume by alternative*

Species and Product	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Pine Sawtimber	18,000 CCF	17,900 CCF	19,100 CCF	0 CCF
White Fir Sawtimber	15,600 CCF	15,000 CCF	16,100 CCF	0 CCF
Chips (all species)	18,600 CCF	15,400 CCF	18,800 CCF	0 CCF
Total Volume	51,200 CCF	48,300 CCF	54,000 CCF	0 CCF

* Source: Porcupine Project Road and Vegetation Management Project Silvicultural Report, 2008.

Financial and Economic Present Net Value

Financial PNV examines revenue and cost implications from the perspective of the Forest Service. It could also be said that this is the perspective of the taxpayer. Only revenues and costs that are recorded in financial records are included in this analysis.

When considering quantitative issues, financial PNV analysis offers a consistent measure in dollars for comparison of alternatives. This type of analysis does not account for non-market benefits, opportunity costs, individual values, or other values, benefits and costs that are not easily quantifiable. This is not to imply that such values are not significant or important, but to recognize that non-market values are difficult to represent with appropriate dollar figures. The values that are not included in this part of the analysis are often at the center of disagreements and interests people have in forest resource projects. Therefore, financial PNV should not be viewed as a complete answer, but one tool decision makers use to gain information about resources, alternatives, and trade-offs between costs and benefits.

Economic PNV examines a broader definition of benefits by considering the value of national forest uses that are not captured in the marketplace. In this analysis, payment to counties under the 25 Percent Fund is the primary addition over a financial analysis. Some outcomes, such as biological diversity, visual amenities, and some social impacts have no monetary values or costs that have been established by USDA or the Forest Service. While some research studies have explored the development of such values, this analysis has considered these items in a non-monetary fashion in the other resource reports for this project.

Net public benefit is an important concept in the current regulations for carrying forest management activities (benefits minus all the associated Forest Service inputs and negative effects (costs) whether they can be quantitatively valued or not). Thus, net public benefits, conceptually are the sum of this economic analysis plus the net value of non-priced outputs and costs. It is not the result of economic analysis alone. Many relevant factors cannot be quantified or expressed in monetary terms. The agency endeavors to maximize net public benefit through public participation in the planning process. Seeking public input, designing alternatives and mitigation measures to achieve the desired future condition while minimizing adverse effects and analyzing effects relative to the issues and concerns raised is the agency's primary mechanism for achieving the maximum net public benefit. This economic analysis is but one element of that process and must be considered together with the analysis of other resources as detailed throughout this chapter. The concept is the basis upon which the deciding official selects an alternative for implementation.

PNV is defined as the value of discounted benefits (or revenues) minus discounted costs. A PNV analysis includes all outputs to which monetary values are assigned. In deriving PNV figures, costs are subtracted from benefits to yield a net value. "Future values" (i.e., benefits received in the future) are discounted using an appropriate discount rate to obtain a "present value". The PNV of a given alternative is the discounted sum of all benefits minus the sum of all costs associated with the alternative. PNV estimates attempt to condense a large amount of information into a singe value. This value must be used with caution.

Table 29 displays the financial PNV for the proposed action and alternatives. All dollars are in constant dollars with no allowance for inflation. A four percent discount rate was used over a period of 7 years (2008-2015), the estimated time required for full implementation of the project. Present net values assume the county will receive 25 Percent Fund payments.

Table 29. Financial and economic present net value

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
USFS Financial Present Net Value*	1,226,400	1,117,100	1,100,100	0
County Financial Present Net Value*	1,130,200	1,105,900	1,183,100	0
Economic Present Net Value	2,356,600	2,223,000	2,283,200	0

* Present net values assume a county 25% fund payment

Payments to Counties

Counties receive payments in lieu of taxes (PILT) to replace tax revenue lost due to the public nature of lands administered by federal agencies.[170] The amount is based on the amount of acreage administered by certain federal agencies, population, a schedule of payments, the Consumer Price Index, other federal payments made in the prior year, and the level of funding

[170] 1976 Payments in Lieu of Taxes Act

allocated by Congress. These payments would not be affected by changes in revenue as a result of implementation of the proposed action or alternatives (Table 30).

In addition to PILT payments, counties receive a portion of the revenue generated on National Forest System lands. Historically, counties have received 25 Percent Fund payments. These payments returned 25 percent of all revenues generated from forest activities, with the exception of certain mineral programs, and were paid based on the number of National Forest System lands within each county. These funds are used for the upkeep and maintenance of public schools and roads. However, in 2000 Congress enacted the Secure Rural Schools and Community Self-Determination Act (SRSCS). This act was designed to stabilize annual payments to states and counties for the next six years beginning in 2001. The new formula for computing annual payments is based on averaging a state's three highest payments between 1986 and 1999 to arrive at a compensation allotment or "full payment amount". SRSCS authorization ended on September 30, 2006. The last payment under this authorization was made in December of 2006. Public Law (PL) 110-28, the Iraq Accountability Appropriations Act of 2007 contained a provision that provided for payments under the SRSCS Act of 2000 for 2007 and payments continued through September 30, 2007. The future of payments under SRSCS are uncertain, however, should they continue, they would not be impacted by implementation of the proposed action.

The California Timber Yield Tax program sets the harvest value of timber and collects an in lieu tax when it's harvested. The revenue from this program is allocated to the counties where the timber was harvested. The Yield Tax rate for 2007 is 2.9 percent of the assessed timber value.

Table 30. Timber sale revenue and projected payments to Siskiyou County

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Timber Sale Revenue	4,520,800	4,423,459	4,732,302	0
Payments to County – 25% Fund*	1,130,207	1,105,865	1,183,076	0
California Timber Yield Tax**	131,104	128,280	137,237	0

* 25% Fund Payments would not occur if SRSCS payments continue.
** calculated at 2007 rate of 2.9%

Jobs

Estimated jobs attributed to the harvest and processing of the timber are displayed in Table 31. The jobs would be supported over a period of about 3 to 7 years when harvest operations and subsequent post-sale activities take place. The estimated jobs are based on regional averages[171].

[171] Forestry, Forest Industry and Forest Products Consumption in California, Pub. 8070, 2003, University of California, Division of Agriculture and Natural Resource.

Table 31. Estimated jobs supported*

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Number of Jobs	782	724	810	0

*direct and indirect for lumber and wood products industry only

Cumulative Effects

The harvest volume of the action alternatives would support the Forest's annual timber offering. The average annual timber volume offered for sale by the Shasta-Trinity National Forest since the beginning of the Forest Plan (1995) is about 55.6 MMBF (million board feet), or about 68 percent of the ASQ. The Forest offered 70.0 MMBF in 2004, 34.9 MMBF in 2005, and 43.1 MMBF in 2006.[172] The volume associated with the action alternatives would contribute 37 to 41 percent of the average annual timber volume offered for sale and represents 29-32 percent of the 82.5 MMBF to be offered for sale in 2008.

The harvest volume, associated revenues, jobs supported by the proposed action and action alternatives would contribute to overall harvest levels consistent with recent years. As long as the harvest level continues at or around its current level, area economic conditions are not expected to change substantially from current conditions.

[172] U.S. Department of Agriculture, Forest Service. 2004, 2005, 2006. Shasta-Trinity National Forest Monitoring and Evaluation Report(s). Shasta-Trinity National Forest. Redding, CA.

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