United States
Department of
Agriculture

Forest Service
Pacific Southwest
Region

Shasta-Trinity
National Forest

Trinity River
Management Unit

Trinity County
California

July 2007

Revised Draft Environmental Impact Statement

Browns Project

Desired future condition (foreground) and existing condition (background)
along Musser Hill road in the Browns Project area

Browns Project

Revised Draft Environmental Impact Statement

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Abstract: The Revised Draft Environmental Impact Statement (Revised DEIS) considers three alternatives in detail, including a No Action alternative, for the purpose of improving forest health by reducing overcrowded forest stand conditions and the associated fuel ladders. The proposed action would harvest timber from about 790 acres, treat forest fuels within the harvested acreage, construct approximately 5 miles of temporary road, reconstruct approximately 6 miles of road, and decommission approximately 14 miles of road.

Revised Browns Project Summary

The Browns Project is being proposed as part of the Shasta-Trinity National Forest Fuels and Timber Management Program. The activities being proposed in this Revised Draft Environmental Impact Statement (Revised DEIS) involve commercial timber harvesting (within mixed conifer stands) and management of roads (temporary road construction for project access and road closures for watershed restoration). The area affected by the proposal includes the area adjacent to the northern Weaverville community boundary. The activities would occur in the Weaverville 5th field watershed, and are designed to modify existing conditions in the project area toward desired conditions as described in the Shasta-Trinity National Forest Land and Resource Management Plan. These actions are also needed because the Weaverville Wildland-Urban Interface (WUI) occupies approximately 60% of the project area and the National Fire Plan identifies WUIs as priority areas for treatment.

The proposed action considered in the Revised DEIS includes:

- Timber harvest (thinning) on approximately 750 acres
- Timber harvest (group regeneration) on 37 acres
- Fuel reduction treatment on all harvested acreage
- Timber harvest total volume = 8.8 million board feet
- 5 miles of temporary road construction, and approximately 7 miles of road reconstruction
- Road decommissioning on about 6 miles of system roads and 8 miles of non-system roads (includes decommissioning of 5 miles of new temporary road)

Initial public involvement for the Browns Project began in August 2003. The project was listed quarterly from December 2000 to July 2005 (20 quarters) in the Schedule of Proposed Environmental Actions (SOPA), a Shasta-Trinity National Forest publication. The project was again listed in the SOPA in June 2007 because the Forest was preparing this Revised DEIS in response to the project decision being reversed on appeal. A Notice of Intent (NOI) was published in the Federal Register on February 10, 2005, which requested initial public comment on the Browns Project. A second scoping letter was mailed March 10, 2005, to individuals who responded to the first scoping letter; the notice was also published in the newspaper of record on March 10, 2005.

One significant issue was received during initial public involvement and it was regarding road building. Specifically, the Environmental Protection Information Center expressed a concern that road construction and reconstruction may severely impact terrestrial and aquatic systems in the area. Therefore, an additional alternative (Alternative 4) was added for consideration in detailed study – this alternative includes less temporary road construction, road reconstruction only where the planning team recognized an environmental benefit, and less timber harvest.

The May 2006 Final Environmental Impact Statement for the Browns Project (FEIS) was appealed by the Environmental Protection Information Center. On August 30, 2006 Deputy Regional Forester, Beth Pendleton reversed the May 31, 2006 Record of Decision (ROD)for the project with instructions to further clarify in the FEIS how the Browns Project was consistent with forest plan 4-62 "Provide for retention of old-growth fragments in watersheds where little remains (15%-rule)." In March 2007 the Forest issued a ROD to implement road decommissioning as described in Alternative

3 of the May 2006 FEIS. That ROD explained that another decision on the remaining project activities was deferred pending completion of the revision process. The revision process focused on the instructions provided in the Deputy Regional Forester's appeal decision, and included a re-evaluation of environmental effects associated with remaining Browns Project activities (timber harvest, fuels reduction, and road activities) in light of changes to the proposed action. Changes to the proposed action, as it was described in the May 2006 FEIS, have been considered in environmental analysis for this Revised DEIS and are summarized below.

1) The wildlife sections in Chapters 3 and 4 of this Revised DEIS address how the Browns Project is consistent with the 15%-rule, as described in the Shasta-Trinity Land and Resource Management Plan (4-62).
2) The May 2006 FEIS proposed approximately 30 miles of road decommissioning. The March 2007 Browns Project decommissioning ROD implements those road activities described in Alternative 3 of the FEIS that would not be involved in Browns Project timber harvest and fuels reduction activities. These road activities are in the process of being implemented, and thus were considered as future foreseeable actions for environmental analysis in this Revised DEIS. The proposed action now includes decommissioning approximately 6 miles of existing system road after they are used for Project activities. It also includes 5 miles of temporary road construction, and 3 miles of reconstruction; these 8 miles of road will also be decommissioned post-Project. The 3.6 miles of road reconstruction proposed in the May 2006 FEIS remains part of the proposed action.
3) All road construction involved with the project will be temporary. The proposed action includes 5 miles of temporary road construction. All roads for the project will be built, used, and decommissioned within one season. Road construction to unit 5 (34N87) proposed in the 2006 FEIS has been reduced and the proposed action now includes use of a parallel private road. These changes reduce road-related watershed impacts of the project.
4) This Revised DEIS includes a water quality monitoring plan developed by the project hydrologist. Proposed monitoring includes instream locations on East Weaver, Little Browns, and Rush Creeks as well as several upland locations within the Little Browns Creek subwatershed. The purpose of the monitoring is to prevent and measure potential impacts of the Browns Project on water quality and beneficial uses.
5) This Revised DEIS includes additional project design features (outlined in Chapter 2) to protect the scenic quality in the project area as observed from State Highway 3.

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Chapter 1: Purpose of and Need for Action

Introduction

The town of Weaverville, California has been threatened by wildfire on several occasions in recent years. The most serious threat was the 2001 Oregon Fire which burned 1,720 acres, destroyed 33 structures and 29 vehicles, and threatened the local high school in Weaverville. More recently, the 2006 Junction Fire burned 3,207 acres, destroyed two structures, and threatened downtown Weaverville. Other recent wildfires that have threatened local communities in the area include:

- The 1994 Browns Fire which burned approximately 1,768 acres and destroyed two structures 1.5 miles east of Weaverville.
- The 1999 Lowden Fire which burned approximately 2,000 acres and destroyed 23 structures in Lewiston, approximately eight miles east of Weaverville.
- The 2006 Pigeon Fire which burned 35,181 acres and threatened numerous homes near Junction City, approximately seven miles west of Weaverville.

Fuel conditions that supported such intense wildfire events in the past still exist on National Forest lands near Weaverville. Weaverville is listed in the Federal Register for communities at high risk from wildfire (Federal Register, April 17, 2001, page 43390). The Browns Project is located within forested areas with high fuel loading adjacent to the northern Weaverville community. Approximately 60% of the project area is within the Weaverville Wildland-Urban Interface. Isolated scattered homes are located on private lands within the Browns project area. In the absence of natural fire or management activities, ground fuels in the area have accumulated over time, understory vegetation has developed into vertical fuel ladders, and increasing tree densities have created dense crown canopies. This combination of fuel conditions can carry ground fire into the crown canopy resulting in a rapidly spreading crown fire. As a result of these conditions, the Shasta-Trinity National Forest proposes the Browns Project on approximately 790 acres on the north end of Weaverville. Project activities were designed to address increasing fuel loads and overstocked forest conditions.

The location of proposed activities is displayed in project maps included in Chapter 2 of this document. The project area is defined by the boundaries of 6 Sections within which all proposed activities would occur; activities are proposed within Township 34 North, Range 9 West, Sections 20-22, 27-29, and 32-34. The project area is within the Weaverville 5th field watershed[1], containing East Weaver, Little Browns, and Rush Creeks.

Purpose and Need

Frequent low-intensity fires have played an important beneficial role in the natural function of ecosystems. With the suppression of fire over the past hundred years, the role of fire has changed from a natural low-intensity disturbance factor that was critical to maintaining healthy sustainable ecosystems to a significant threat with the potential to destroy large areas of forest. In forested areas

[1] Generally watersheds 40,000 – 250,000 acres in size are referred to as 5th field watersheds

surrounding rural communities the risk of intense wildfire also threatens lives and property. The elimination of frequent low-intensity fire as a beneficial disturbance factor has resulted in unnaturally high tree densities and heavy accumulations of ground fuels. The purpose of the Browns Project is to modify existing fuel and vegetation conditions in the Wildland-Urban Interface surrounding Weaverville and to restore fire regimes within or near their historical range by:

- Reducing ground and ladder fuels to conditions that reduce the potential for rapidly spreading crown fire while still meeting other resource needs.
- Improving forest health, growth and sustainability where overstocked forest conditions exist; where there is inadequate stocking; or where there is substantial tree mortality due to insects and disease.

The need for specific actions was determined by comparing existing conditions in the field with the desired future conditions as described in the *Shasta-Trinity National Forest Land and Resource Management Plan* (LRMP).[2] Desired future conditions applicable to the project area are described in the LRMP at the following locations:

- Forest Goals and Objectives (pages 4-4 to 4-6)
- Forest-wide Standards and Guidelines (pages 4-11 to 4-30)
- Aquatic Conservation Strategy Objectives (page 4-53)
- Management Prescription Standards and Guidelines (pages 4-33 to 4-71)
- Desired Future Condition for Management Area 7 (pages 4-107 to 4-109)

Existing conditions were identified by the interdisciplinary planning team from known information of the project area, extensive field reviews, and computer modeling of wildfire behavior and effects. The planning team identified several situations where the desired conditions described in the LRMP differ from the existing conditions observed in the field. These discrepancies between desired and existing conditions provided the basis for development of the proposed action.

The following section describes the need for specific proposed actions and the existing and desired conditions that determined the need for these actions.

Reduce Ground and Ladder Fuels

Existing Condition

In the absence of fire – or other natural disturbance or management activity – the volume and arrangement of forest fuels develop into conditions that can lead to the loss of entire forest stands in the event of wildfire. Accumulations of ground fuels increase heat intensity and flame lengths during wildfire, increasing the potential to ignite the overhead crown canopy. Understory vegetation and smaller trees serve as fuel ladders which can carry ground fire into the crown canopy. Overstocked forest conditions result in high density crown canopies that, if ignited by ground fuel and understory

[2] USDA Forest Service 1995b

fuel ladders, can result in rapidly spreading crown fire. The project area has been identified for treatment because of existing fuel conditions that could result in extensive, high-intensity wildfire.

A wildfire in the project area is likely to pose a threat to life and property in the nearby community of Weaverville, as well as cause excessive erosion and watershed damage. In the last two decades several wildfires in the vicinity of Weaverville have demonstrated the danger associated with unnatural fuel accumulation within the Wildland-Urban Interface.

Desired Condition

The desired condition is to have a forest where stand understories appear more open with less ingrowth particularly on sites where wildfire plays a key role in stand development[3]. Fuel treatments would replicate fire's natural role in the ecosystem.[4] Desired levels of unburned dead and down material is an average of 10 tons/acre on project area lands (LRMP Prescription III).[5]

Actions Needed

- There is a need to reduce overstory crown density in overstocked forest conditions.
    - The application of thinning treatments over approximately 750 acres will reduce crown density to levels that are likely to reduce the potential for rapidly spreading crown fire. With an emphasis on removing the shorter trees in thinning treatments, the height of the lower level of residual crown canopy will be raised reducing the potential for crown fire.
- There is a need to reduce fuel ladders created by the development of understory vegetation.
    - The inclusion of biomass removal (trees less than 10 inches diameter) over approximately 790 acres will remove understory conifers and reduce the potential for ground fire being carried into the overstory crown canopy.
- There is a need to reduce existing concentrations of woody ground fuels in the project area, and to avoid any additional accumulation of ground fuels resulting from project activities.
    - Whole-tree removal during timber harvest will reduce the amount of additional woody ground fuel resulting from project activities. Fuels treatment of current excessive fuel loading and project-generated fuels over approximately 790 acres will achieve desired fuel loads.
- There is a need to focus fuels reduction activities on areas where there are threats to public safety, structures, or community infrastructure.[6]
    - Fuels reduction activities have been focused within the Wildland-Urban Interface zone and in areas identified as high hazard/risk/value.[7] Fuels reduction activities were also focused on the Highway 3 travel corridor which would be used as an emergency route and a defensible zone during wildfire events.

[3] LRMP, page 4-108
[4] LRMP, page 4-18
[5] LRMP, page 4-65
[6] LRMP, page 4-18 section 8e
[7] Weaverville Watershed Analysis (USDA-FS 2004) pg. 35 and 104

Improve Forest Health/Growth

Existing Condition

All forest stands within the project area were examined in the field by a certified silviculturist to determine current stand attributes including species composition, stand age, site quality, tree density, mortality levels, and the presence of insects and disease.

Overstocked forest conditions were noted within the project area, and the distribution of overstocked stands was a primary consideration for identifying project treatment units. Overstocked conditions occur when tree density exceeds commonly accepted levels for the species, age, and site capacity of the stand. At higher densities tree growth and vigor declines as individual trees compete for limited moisture, nutrients, and light. Climate variations, such as drought, can exacerbate the effects of overstocking. As tree vigor declines the ability to repel insects also declines and stands become susceptible to insect attack.

Desired Condition

The desired condition is to manage forest stand densities at levels to maintain and enhance growth and yield to improve and protect forest health and vigor recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem. Stand understories would appear more open with less ingrowth particularly in stands on sites where wildfire plays a key role in stand development. The stand densities would depend upon stand species, site quality, stand age, and stand objective.[8]

Actions Needed

There is a need to reduce tree densities to levels that restore and maintain forest health and vigor. Thinning treatments over approximately 750 acres will reduce tree densities to levels appropriate for the species, age, and site capacity of the stand.[9] Thinning will improve the resistance of trees to insect attack, improve the ability of forest stands to withstand climate fluctuations such as drought, enhance growth in residual trees, and improve the long-term yield of the stand.

Proposed Action Summary

- Thin approximately 750 acres of overcrowded forest stands.
- Construct, use, and restore landings on approximately 37 acres in areas of currently understocked stands and/or heavy fuels accumulation.
- Apply a combination of fuels treatments to reduce fuel loading and/or fuel continuity. Hand-piling, tractor-piling, broadcast burning, and lop, scatter, and burn techniques will be used on a unit-by-unit basis. Details on specific fuels reduction activities proposed for each unit are in Chapter 2 and Appendix A.

[8] LRMP, page 4-108.
[9] Silvicultural Practices Handbook, R-5 FSH 1/79 Amend. 1, Chapter 33.31

- Reconstruct 3.6 miles of existing road by resurfacing and replacing culverts.
- Construct (5 miles) or reconstruct (3 miles) a total of approximately 8 miles of temporary road that will be decommissioned[10] after use.
- Decommission approximately 6 miles of existing system road after they are used for proposed activities.

[10] Decommissioning is defined by a range of techniques used to close an existing road, making it unavailable for future use. Specific activities proposed for each road segment are displayed in Appendix C.

Chapter 2: Alternatives

This chapter describes and compares the alternatives considered for the Browns Project. It describes both alternatives considered in detail and those eliminated from detailed study. The end of this chapter presents the alternatives in tabular format so that the alternatives and their environmental effects can be compared.

Alternatives Considered

Based on the issues identified through public comment on the proposed action, the Forest Service developed one alternative proposal that achieves the stated purpose and need differently than the proposed action. In addition, the Forest Service is required to analyze the no action alternative (Alternative 1). The action alternatives and the no action alternative are described below.

Alternative 1 (No Action)

No timber harvest, burning, or watershed restoration activities associated with this proposal would be implemented with this alternative.

The no action alternative provides a point of reference from which to evaluate the action alternatives. This alternative would implement no activity at this time, allowing the existing conditions to remain unchanged from a management perspective. The average fuel loading within the project area is estimated to be 15 tons per acre, with low to high fire behavior ratings due to fire hazard and tree mortality.

This alternative does not meet the identified purpose and need for action and disregards recommendations from the Weaverville WA, the Cohesive Strategy (USDA Forest Service 2000), and the Shasta-Trinity National Forest LRMP.

Alternative 3 (Proposed Action)

Refer to the following section *Design Criteria Common to All Action Alternatives* for specific information regarding both action alternatives. Appendix A lists the units, acreages, and prescriptions proposed in this alternative. Alternative 3 proposes management activities to meet the identified purpose and need, including actions to meet recommendations from the WA (Opportunity #6.1 to reduce hazardous fuel, Opportunity #1.2 to use commercial timber sales to meet desired fuels and vegetation conditions, and Opportunity 1.3 to improve the road transportation system). A primary objective of Alternative 3 is to limit the needed fuels reduction and forest health activities to the extent that there would be no significant long-term (longer than 5 years) increase in cumulative watershed effects (CWEs) resulting from the project. In addition, the project proposal is designed to avoid adverse effects to slope stability, riparian reserves, soils, and wildlife habitat while still contributing to meeting the identified purpose and need.

This alternative proposes to thin mature conifer stands of all existing diameter classes to levels expected to improve forest health, and maintain and enhance growth and yield of conifer species.

Stand attributes such as snags and hardwoods will be maintained for wildlife habitat needs. Trees targeted for removal would be the least vigorous individuals in the suppressed and intermediate crown positions. Whole-tree yarding will reduce activity fuels and leave the resultant timber stands in an improved fire resilient condition. All pre-dominant and dominant trees will be retained. Trees in the co-dominant crown position would be removed where stand densities are excessive and removal is expected to contribute to the development of late-successional conditions. Stand densities outside of riparian reserves would be thinned to a density that would sustain timber stand growth for approximately 30 years (no re-entry for harvest is anticipated for 30 years or more). Within riparian reserves, stand densities would be maintained at higher levels to retain a greater amount of crown cover (at least 60% where it exists). Additionally, the project hydrologist designated Equipment Exclusion Zones (EEZ) for near stream areas in project units (within 100 feet of high water for fish-bearing streams). Project activities within EEZ provide for retention of 85% or greater overstory canopy closure where it exists, as described in hydrology recommendations for streamside management zones (located in the project record).

Several pre-designated landing areas (each no larger than 2.5 acres in size) would be harvested to accommodate the space needed for decking/piling the material generated from whole-tree yarding within the thinning units. These areas are located where cable harvesting effects to the residual stands are expected to be greatest (immediately below the expected yarder setup). Most of the land affected by pre-designated landings currently have heavy ground fuel loadings and/or understocked forest stands.

Project design criteria and road decommissioning activities that contribute to decreasing potential for watershed impacts are included in both action alternatives. A total of about 14 miles of road decommissioning would be accomplished after timber and fuels activities are implemented; this includes approximately 8 miles of temporary road. Refer to Appendix C for a complete list and map of the proposed road decommissioning, including future foreseeable road decommissioning within the Weaverville 5th field watershed (Weaverville Watershed).

Alternative 4 (No New Roads Alternative)

Refer to the following section *Design Criteria Common to All Action Alternatives* for specific information regarding this alternative. Appendix A lists the units, acreages, and prescriptions proposed in this alternative. This alternative has less temporary road construction and therefore further minimizes potential for adverse watershed effects; this alternative was developed in response to a scoping comment request to consider an alternative that does not build any roads. Due to the reduction in proposed temporary roads, some timber harvest areas identified in Alternative 3 are not included in Alternative 4. Specifically, roads needed to access units 3E, 3F, 3G, 3H, 5A, 5B, 5C, 5D, 5E, 5F, 5G, 5H, 9A, 9B, 9C, 9D, and 9E would not be constructed and these units would not be harvested. No permanent roads would be constructed (some temporary roads **within** units accessible by the existing road system would be constructed for log hauling and decommissioned after fuels treatments).

Design Criteria Common to All Action Alternatives

Key components of Alternatives 3 and 4, including design features and mitigation measures, are identified in the following section. Refer to Appendix A for additional unit-specific information on the proposed action (Alternative 3) and Alternative 4.

Key Components of Alternatives 3 and 4

A. The timber management proposals include reducing the trees per acre of mature mixed conifer timber stands from approximately 300 trees per acre (individual trees from 4- to 40-inches diameter at breast height, DBH) to 40-70 trees per acre (individual trees remaining would be 16- to 40-inches DBH). This is an intermediate harvest – thinning from below. The most vigorous pre-dominant, dominant, and co-dominant trees would be left after stocking objectives are met. In addition, small (approximately two-acre) patches of regeneration harvest would occur at pre-designated landings in selected locations within harvest units. After harvest and successful planting site preparation, the landings would be planted with conifers. See Table 2-1 for a summary of the key timber management components of Alternatives 3 and 4. Refer to Appendix A for unit-specific timber management activities.

Table 2-1. Key Timber Management Components of Alternatives 3 and 4.

Timber Stand Activity	Alt. 3	Alt. 4
Intermediate Harvest (thin from below) (acres)	744	543
Tractor yarding (mechanical) (acres)	582	459
Cable yarding (acres)	172	84
Regeneration Harvest (total of two-acre pre-designated landings) (acres)	37	25
Tractor yarding (acres)	26	23
Cable yarding (acres)	11	2
Total timber volume proposed for harvest in millions of board feet (mmbf)	8.8	6.3

B. A combination of fuels treatments would be applied on a unit-by-unit basis to reduce fuel loading and/or fuel continuity. A more detailed description of the proposed fuels treatments is included in Appendix A. Specific burn plans would be developed (and approved by the Forest Supervisor) prior to initiating any burning to minimize the potential for adverse affects to personnel involved in burning, to the public, and to the forest resources. Burn plans might include a combination of hand line construction, prescribed fire prescriptions, firing/ignition procedures, smoke management and air quality requirements, holding procedures, signing, traffic controls, and an escape fire contingency plan. See Table 2-2 for a summary of the key fuel treatment components of Alternatives 3 and 4.

Table 2-2. Key Fuel Treatment Components for Alternatives 3 and 4.

Treatment of Activity Fuels	Alt. 3	Alt. 4
Whole Tree Yard (acres)	790	568
Lop and Scatter (acres)	674	467
Tractor Pile/Burn (acres)	26	21
Roadside Pile/Burn (acres)	81	76
Burn Concentrations (acres)	674	467
Broadcast Burn (acres)	13	4
Dozer Line Construction (chains)	878	700
Hand Line Construction (chains)	586	290

C. Archaeologists have conducted archaeological surveys and identified historic properties within the Browns project area. Identified historic properties will be avoided from management activities.

D. No herbicides or other types of pesticide would be used for any proposed treatments or connected actions.

E. Regarding wildlife and wildlife habitat:
- Retain existing large (greater than 19-inches DBH) snags and downed logs within thinning units. Snags felled for safety reasons would be left on site.
- Limited operating periods would be implemented to avoid direct adverse effects to the Northern spotted owl. From February 1 through July 10, all noise- and smoke-generating activities will be prohibited **within ¼-mile** of suitable nesting/roosting habitat. In addition, all vegetation removal/cutting/burning will be prohibited through September 15 **within** suitable nesting/roosting habitat. These limited operating periods may be lifted if surveys using currently accepted protocols indicate specific areas are not occupied by breeding owls or with the mutual agreement between the U.S. Fish and Wildlife Service and the Forest Service that a site-specific action would not likely affect owls.
- Maintain an average of five tons of downed logs per acre with a preference to have four to six downed logs per acre at the largest available diameter.
- Retain all hardwoods that have a reasonable chance of surviving and thriving after stand treatments.

F. Approximately 5 miles of temporary roads would be constructed in the area during the implementation of fuels treatment and timber management proposed in Alternative 3. An additional 3 miles of unclassified road would be used for the project then decommissioned. These roads are located in areas suited to access land management activities and would remain open only during the season of project implementation then decommissioned prior to the wet season. A total of about 6 miles of existing system roads would also be decommissioned as part of Alternatives 3 and 4. Table 2-3 summarizes project road actions. More information about proposed and future foreseeable road decommissioning is in Appendix C.

Table 2-3. Road Actions Proposed by Alternative.

Affected Transportation System (Roads)	Alt. 1	Alt. 3	Alt. 4
Temporary Road Construction			
34N47	Non-existing	Constructed, then decommissioned	Non-existing
34N47A	Non-existing	Constructed, then decommissioned	Non-existing
34N87	Non-existing	Constructed, then restricted use	Non-existing
34N87A	Non-existing	Constructed, then decommissioned	Non-existing
34N88	Non-existing	Constructed, then decommissioned	Non-existing
Total Miles of New Temporary Road	**0**	**5 miles**	**0**
Reconstruction			
34N52Y (0.5 mi.)	No change	Reconstructed, then decommissioned	Same as Alt. 3
34N52YA (0.1 mi.)	No change	Reconstructed and surfaced	Same as Alt. 3
34N95 (*1.9 mile, to northwest corner of Unit 16*)	No change	Reconstructed and surfaced	Same as Alt. 3
34N77 (1.1 mi.)	No change	Reconstructed and surfaced	No change
Total Miles of Reconstruction	**0**	**3.6 miles**	**2.5 miles**
Summary of Road Decommissioning			
Total miles of *temporary* roads constructed, then decommissioned	0	5 miles	0
Total miles of *existing* roads that would be decommissioned after use (includes 3 miles of unclassified roads used temporarily)	0	9 miles	7 miles
Total Miles of Decommissioned Roads	**0**	**14 miles**	**7 miles**

G. Regarding project designs to protect Sensitive and endemic plants:

- Include Contract Provision C/Ct6.25# in all timber sale contracts for this proposed project. This provision extends protection to any plants listed on the Regional Forester's Sensitive Species List and provides for halting operations in the vicinity of newly discovered populations after completion of the Biological Evaluation or EIS.
- Include Contract Provision C6.36 in all timber sale contracts to reduce the possibility of introducing new noxious weeds into the project area. This provision requires all purchasers to clean off-road equipment prior to entrance into the project area.
- Flag Sensitive plant populations in Unit 15A and exclude this site from all treatment activities other than fuel concentration burning.
- Flag two populations of Canada thistle along Rush Creek Road and exclude all project activities within these population sites.

- Flag two populations of scotchbroom along Rush Creek Road and exclude all project activities within these population sites. Scotchbroom tops will be removed prior to flowering in the year project activities are to occur to minimize the possibility of spreading seed during project activities.

H. Regarding project designs to protect and enhance riparian reserves:

- Riparian reserves of intermittent and ephemeral streams that display annual scour have a minimum 150-foot riparian reserve buffer. There is one inner gorge greater than 150 feet from the defined channel of intermittent or ephemeral streams in Unit 13 that would require a riparian reserve buffer greater than 150 feet in width.
- Riparian reserves of fish bearing streams that display annual scour would have a 300-foot riparian reserve. There are no inner gorges or flood plains in the project area greater than 300 feet from the defined channel of fish bearing streams.
- Thinning would occur in riparian reserves (but not within the inner gorge, or within 50 feet from the defined channel *of a fish-bearing stream* if no inner gorge exists) for the purpose of enhancing riparian reserve timber stand health and treating hazardous fuels. Thinning and fuels treatment would not reduce crown cover to less than 60% where it currently exists within riparian reserves.
- Thinning within Equipment Exclusion Zones (EEZ) in riparian reserves will maintain 85% or greater canopy closure where it exists, as described in riparian marking prescriptions in the project record.
- A wet weather limited operating period would be in effect from October 15 to May 15. Activities may occur in dry conditions during this period with approval of the Timber Sale Contract Administrator.
- Hazard trees 16-inches DBH or greater within riparian reserves would be dropped and retained on site.

I. Regarding management of the soil resource:

- Dedicate no more that 15% of a harvest unit to primary skid trails and landings.
- Minimize soil erosion by water-barring all skid trails, mulching with straw or fine slash (achieve 75%+ cover) the last 50 feet of all skid trails where they enter landings or roads.
- Rip (with winged subsoil to 18 inches deep), all temporary roads, landings, and identifiable skid trails to break up compaction in units 3, 16, and 17, about 131 acres (see C6.606,C6.607, C6.608).
- Reuse existing primary skid trails and landings whenever possible.
- Construct landings to adequately drain with crowned landings and directed drainage with catchment structures (rock armoring and/or silt fences with straw bales may be used as necessary). All new landing fill slopes and road fill slopes (>100 sq. ft) would be mulched initially, and the mulch would be maintained throughout the life of the project.

- Retain existing down coarse woody debris (CWD) whenever possible while not exceeding fuel management objectives.
- Mechanical skidding equipment is restricted to slash covered primary skid trails where slopes are >35%.
- Ground-based mechanical equipment will only operate on fine-textured soils (non-rocky) when the soils are dry down to 8 inches from June to the end of September. No wet weather logging on soils with severe compaction hazard.
- Fuel reduction activities retain 30-50% of the existing duff mat.
- Post-treatment total soil cover between 50 and 70% with at least 50% cover as fine slash (<3 inch material).

J. Regarding protection of water quality:

Standard Pacific Southwest Region Forest Service timber sale harvest management requirements and mitigation measures are required for all harvest activities. The following mitigation measures are required and are in addition to Best Management Practices (BMPs) listed in the erosion control plan (Appendix B). BMP implementation for the project includes monitoring as described in the Browns Project Instream and Upland Monitoring Plan and summarized in Appendix B.

- No ignition or intensive burning within designated riparian areas.
- Keep prescribed fire as cool as possible while attaining desired burn conditions.
- Allow hand cutting and piling where feasible to arrange fuel load in riparian areas.
- All streamside management zones shall be flagged and/or signed within proposed treatment units. Identify riparian reserves as “Protect Stream Course” on sale area map.
- Remove harvest activity fuels within the high water mark of each affected stream course.
- Follow streamside management zone objectives (as defined in BMP Handbook) for each protected stream course (BMP 1-8).
- No mechanical entry or harvesting would occur within inner-gorge areas (designated by sale preparation personnel and approved by the project hydrologist or fishery biologist).
- Designate/approve riparian reserve crossings. Skid trail grade shall not exceed 35% and shall be located so as to minimize ground and vegetative disturbance. Rehabilitate skid trail disturbed mineral soil within 50 feet (slope distance) of defined channel limits with available organic material, resulting in minimum 50-70% ground cover post-treatment.
- Limit the operating period of heavy machinery activity. To avoid compaction, rutting, gullying, and the resulting long-term damage to the productivity of the soil resource, as well as to achieve clean tractor piles, tractor piling activities would be accomplished with grapple-type equipment and be limited to the dry periods of the year. Tractor operation would be suspended by the Timber Sale Contract Administrator when soil conditions become too wet, and there is a potential for soil compaction and soil hydrologic function to occur. (BMPs 1-10, 5-2, 5-6, 1-13.)

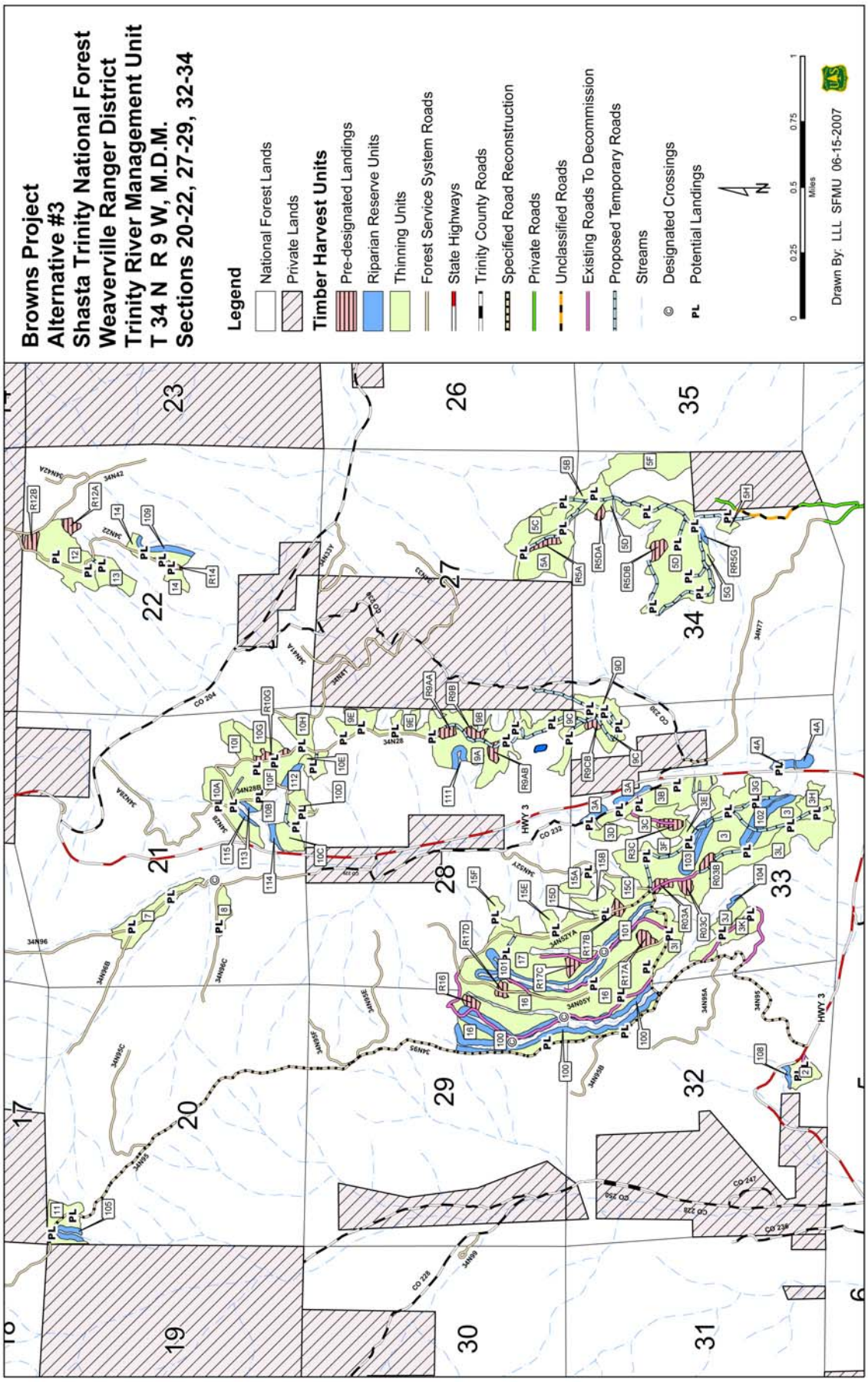
- Dedicate no more than 15% of the unit to primary skid roads, trails, and landings. The objective is to design a skidding pattern that best fits the terrain and limits the effect on the soil. Pre-designated skid trails, felling to the lead, and end lining are methods that can be used to achieve this. Skid trails should be outsloped and not located in swales, where waterbarring is not possible or requires deep cuts. (BMPs 1-10, 1-12, 1-13, 1-16.)
- Decommission temporary roads constructed by the project and identified existing roads after use. Road decommissioning entails removing culverts, ripping and outsloping road surface, and installing large water-bars (a.k.a. tank-trapping). Other activities may occur depending on site conditions. The goal is to control surface runoff, erosion, and mass failure, and to make the road unavailable for future use. The condition of these roads would be monitored long-term as part of BMP effectiveness monitoring.
- If timber hauling is performed outside the normal operating season, the placement of aggregate base course may be required to provide a stable running surface and prevent rutting and erosion. Snow berms would be removed or drains installed to avoid channelization of melt water to minimize potential for damage to the road and to protect water quality. If the road surface is damaged, lost surface material would be replaced, and damaged structures repaired. (BMPs 2-23, 2-24 and 2-25)
- Purchaser-utilized roads rutted or otherwise damaged by purchaser operations would be spot-rocked or otherwise suitably repaired. Drainage structures would be protected or repaired as necessary. The road surface would be outsloped, if possible, during maintenance operations. Due to the chance of rilling and gullying of the roadbed, road surfaces in areas crossing serpentinitic soils should be rocked to prevent roadbed deformation (rutting) during wet conditions.
- Closed roads would have an earthen berm or gate.

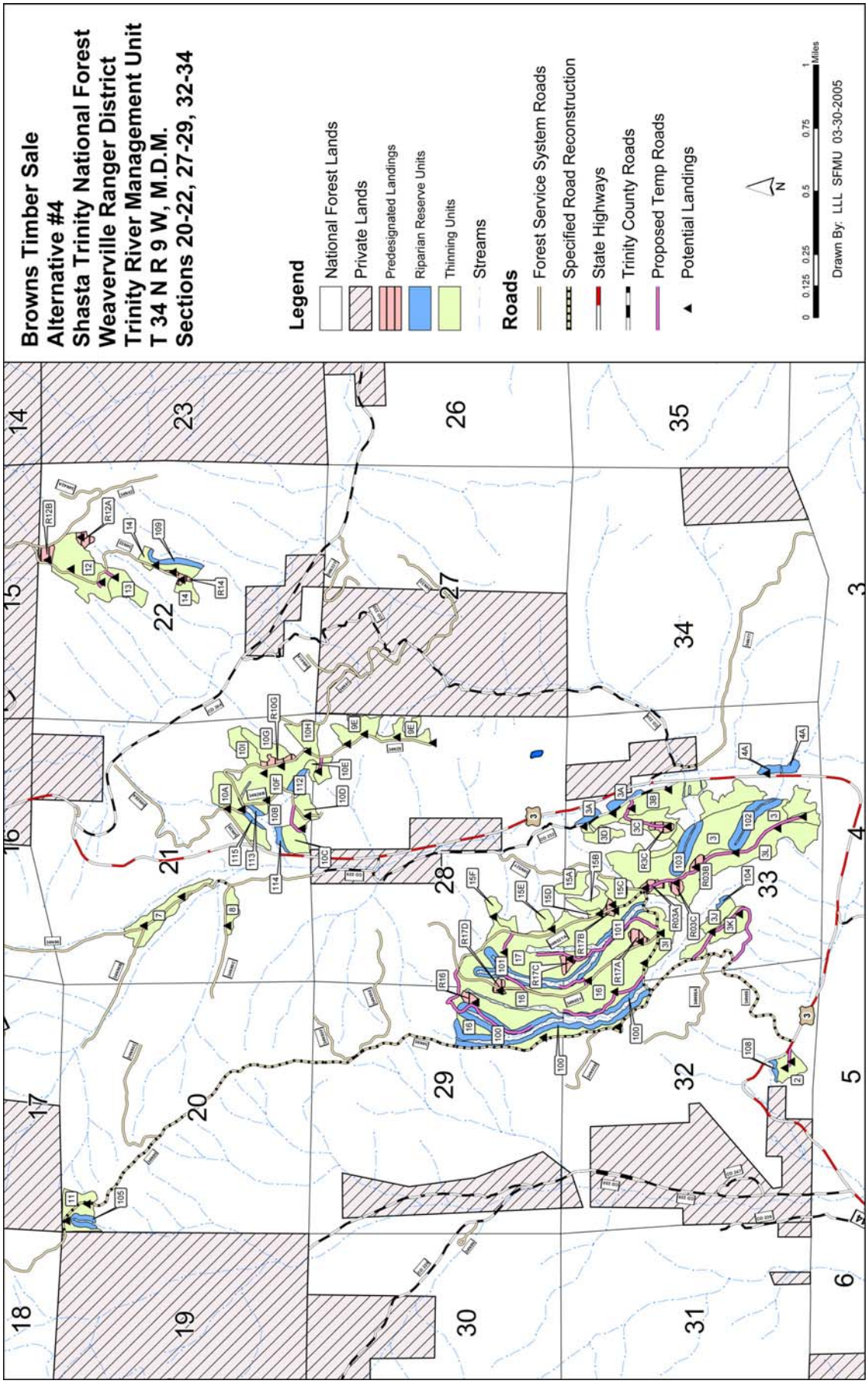
K. Regarding project designs to protect water quality from adverse effects due to mass wasting:
- There are several large dormant rotational landslides located within the southeast portion of Unit 3 with deeply incised gullies. The southeast portion of Unit 3 has been reviewed by a hydrologist and geologist to assure appropriate stream width protection zone widths.
- The northwestern portion of Unit 9 and the eastern portion of Unit 15 have been reviewed by a geologist to assure appropriate area exclusion widths have been provided prior to project implementation.
- The roadside management zone between Unit 9 and China Gulch has an equipment exclusion area; only trees smaller than 8-inches in diameter would be removed under the Fuels Management prescription. In addition, no trees within 20-feet of a landslide scarp would be taken. This area has been reviewed by a geologist to assure appropriate area exclusion widths have been provided prior to project implementation.

L. Regarding protection of visual quality along Highway 3:[11]

[11] Identified as a sensitive travel corridor, LRMP 4-27 and 4-28

- Locate all landings where they will not be seen from Hwy 3. Utilize only 1 landing in the back of unit 2 for units 108 and 2, away from the highway and the Weaverville Basin trail. Locate the proposed landing in unit 3B near the historical marker out of sight of Hwy 3. Utilize the existing truck pull-out on Hwy 3 for the unit 4A landing. Keep the existing pull-out footprint and clean up all logging debris, slash and cull logs immediately upon harvest completion.
- Identify at least 100-foot visual corridors on the edge of units 2, 3B, 108, 4A, 3B, 3G, 10C, 114, and 10A in areas that can be seen from Hwy 3. The corridor may be wider than 100 feet, if it enhances other resource management objectives. Within this corridor implement the following mitigations:
  A. Employ a prescription that retains at least 60% canopy closure with random tree spacing. Retain small groupings of young conifers and deciduous vegetation. Mark the backsides of the trees away from Hwy 3. Leave only low stumps, less than 6" high within the visual corridor.
  B. Achieve a 'clean forest floor' look adjacent to the highway by removing, chipping and/or masticating slash. Hand pile slash outside of the 100' visual corridor. Utilize hand lines instead of dozer lines for fuels management in areas seen from Hwy 3.


Browns Project
Alternative #3
Shasta Trinity National Forest
Weaverville Ranger District
Trinity River Management Unit
T 34 N R 9 W, M.D.M.
Sections 20-22, 27-29, 32-34
Legend
National Forest Lands
Private Lands
Timber Harvest Units
Pre-designated Landings
Riparian Reserve Units
Thinning Units
Forest Service System Roads
State Highways
Trinity County Roads
Specified Road Reconstruction
Private Roads
Unclassified Roads
Existing Roads To Decommission
Proposed Temporary Roads
Streams
Designated Crossings
Potential Landings
N
0
0.25
0.5
0.75
1
Miles
Drawn By: LLL SFMU 06-15-2007


Browns Timber Sale
Alternative #4
Shasta Trinity National Forest
Weaverville Ranger District
Trinity River Management Unit
T 34 N R 9 W, M.D.M.
Sections 20-22, 27-29, 32-34
Legend
National Forest Lands
Private Lands
Predesignated Landings
Riparian Reserve Units
Thinning Units
Streams
Roads
Forest Service System Roads
Specified Road Reconstruction
State Highways
Trinity County Roads
Proposed Temp Roads
Potential Landings
N
0 0.125 0.25 0.5 0.75 1 Miles
Drawn By: LLL SFMU 03-30-2005

Alternatives Considered, but Eliminated from Detailed Study

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the proposal, duplicative of the alternatives considered in detail, or determined to have potential to cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Alternative 2 (Timber Harvest Emphasis)

This alternative was considered during the first scoping period (in 2003). Alternative 2 focused on management activities to meet the identified project purpose, including actions and recommendations from the Weaverville WA (USDA Forest Service 2004). The emphasis of this alternative was to maximize the acreage of commercial timber stand harvesting and associated fuels treatments within in strategically located areas. However, the other identified need to limit potential watershed effects to within the established threshold of concern (TOC) would not have been met within a reasonable time period (TOC in a project watershed would have been exceeded for more than five years, even with implementation of all opportunities for reductions in watershed impacts). See Appendix G for a completed discussion of TOC and watershed effects analysis. Therefore, this alternative was eliminated from detailed study.

Alternative 5 (19-Inch Diameter Harvest Limit)

In response to public comments received, an alternative limiting harvest to trees less than 19-inches DBH and avoiding any road construction was considered. The proposed action (Alternative 3) would harvest trees of all diameter classes; less than 10% of the trees to be harvested are 19-inches or greater DBH. By leaving trees above a 19-inch DBH limit, the site-specific stand attributes to meet the purpose and need for the Browns Project would be missed; specifically, the benefit to forest health resulting from thinning the overcrowded conifer stands would not be achieved. Trees greater than 19-inch DBH are competing with other larger trees for essential resources (sunlight and water) and inter-tree competition would continue. Weak trees under competition stress would be prone to increased mortality, forming fuel loadings that are contrary to the purpose and need statement. Retaining all 19-inch DBH trees on site would not meet the purpose and need for the Browns Project which is reducing hazardous fuels and improving forest health. Therefore, Alternative 5 was eliminated from detailed study.

Comparison of Alternatives

Table 2-4 provides a brief summary of the alternatives and their environmental effects in comparative format.

Table 2-4. Comparison of Effects and Outputs between Alternatives 1, 3, and 4.

	Alternative 1 (No Action)	Alternative 3	Alternative 4
Botany			
Effect on sensitive plant and fungi species	No Effects	May affect individuals	May affect individuals
Effect on noxious weeds	No Effects	Some adverse effects	Some adverse effects
Cumulative Watershed Effects (includes completion of foreseeable road decommissioning)			
% ERA for Rush Creek (TOC 16%)	13.0	13.0	12.9
% ERA for E. Weaver Cr. (TOC 16%)	9.8	9.6	9.6
% ERA for Little Browns Cr. (TOC 16%)	14.8	12.5	11.4
Economic Effects			
Value of timber harvested (in $)	0	3,577,200	2,560,950
Present net value of timber management (in $)	0	1,177,100	935,750
Road decommissioning costs (in $)	0	115,500	115,500
Fire and Fuels Effects (in treated areas)			
Fire behavior	No Change	Reduced	Reduced
Fire severity	No Change	Less Severity	Less Severity
Fisheries			
Effects to Listed and MIS Fish	No direct effect	Adverse effect due to short-term sediment increase	Adverse effect due to short-term sediment increase
Effects to fish habitat & riparian reserves	No direct effect	Short-term sediment effect; long-term improvement	Short-term sediment effect; long-term improvement
Geology			
Effect to land stability	No change	No effect. Unstable areas avoided in project design	No effect. Unstable areas avoided in project design
Heritage Resources			
Effects to heritage sites	No effect	No effect	No effect
Soils			
Erosion (erosion hazard)	Low (2-4)	Moderate (7-12)	Moderate (5-8)
Compaction (acres compacted)	300 acres (0 acres treated)	100 acres (200 acres treated)	200 acres (100 acres treated)
Fertility (tons per acre of slash and duff)	6-12	3-4	5-6

	Alternative 1 (No Action)	Alternative 3	Alternative 4
Roads			
Total miles decommissioning of existing roads	0	9 miles	7 miles
Total miles of temporary road construction (*decommissioned after use)*	0	5 miles	3 miles
Timber			
Average timber stand density (square foot of basal area per acre)	120-340	80-140	80-140
Acreage affected by managing stand density (thinning)	0	744	543
Acreage of regeneration harvest	0	37	25
Timber volume (mmbf)	0	8.8	6.3
Wildlife			
Effects on Old-Growth Habitat	No effect	Temporary downgrade; long-term increase in habitat quality	Temporary downgrade; long-term increase in habitat quality
Threatened, Endangered, and sensitive (TE&S) species	No effect	Chance of temporary displacement of spotted owls; long-term beneficial effect	Chance of temporary displacement of spotted owls; long-term beneficial effect

Chapter 3: Affected Environment

This chapter describes aspects of the environment likely to be affected by the proposed action and alternatives. These descriptions form the scientific basis for the comparison of effects in Chapter 2. The resources are listed alphabetically.

Botany

Existing Conditions Relative to Sensitive Plants, Fungi, and Survey and Manage Plants

The proposed project area contains a mixture of chaparral, mixed conifer/hardwood, conifer, riparian, and oak woodland habitats. Regardless of the alternative, most of the conifer and mixed conifer/hardwood habitat lies on the eastern half of the project area and large blocks of chaparral and oak woodlands are in the western half. All Sensitive species habitat is found within conifer or mixed conifer/hardwood habitats.

Suitable habitat is present within the project area for branched collybia, *Cudonia monticola*, Brownie lady's-slipper, mountain lady's-slipper, copper moss, olive phaeocollybia, Canyon Creek stonecrop, and English Peak greenbriar. Populations of Brownie lady's-slipper, mountain lady's-slipper, Canyon Creek stonecrop, and English Peak greenbriar were found in the general project area during field surveys, but only one population each of Brownie lady's-slipper and mountain lady's-slipper are contained within any treatment units.

Field surveys for all Survey and Manage plant species were conducted concurrent with Sensitive plant surveys. Four populations of Brownie lady's-slipper and 18 populations of mountain lady's-slipper were found within the project area during field surveys. All populations are excluded from any treatments and no impacts will occur to either. Because of lack of individuals and project prescriptions, the Browns Project complies with the 2001 Survey and Manage Record of Decision (USDA and USDI, 2001).

Noxious Weeds

The project area was inventoried for the presence of noxious weeds in conjunction with Sensitive plant surveys. There were no weed species of concern found within the proposed project area. Isolated populations of Klamath weed (*Hypericum perforatum*), bull thistle (*Cirsium vulgare*), are present, but no populations were dense enough to warrant concern. Yellow starthistle (*Centaurea solstitialis*) is a wide ranging roadside and opening weed that is present throughout the west side of the Shasta-Trinity National Forest. Two populations of Canada thistle (*Cirsium arvense*) were found along Rush Creek Road, but no more than two plants were found at either population. There are two populations of scotchbroom, also located along Rush Creek Road. The largest population contains 31 plants.

Economics

Trinity County receives a portion of the Forest's receipts collected on National Forest Timber Sales. The local community is affected both directly and indirectly by timber sales and associated management activities on National Forest lands, mostly in terms of employment opportunities. One method of determining the economic efficiency of a project proposal is the calculation of its present net value (PNV). A PNV is equal to the discounted sum of benefits minus the discounted sum of the costs for the same period of time. A PNV with a positive value indicates that returns associated with a project exceed the project's costs. A PNV with a negative value indicates that project costs exceed returns. The objective of the Browns Project is to have a positive PNV. However, the resource values associated with project benefits are not always measured in monetary terms (such as the value of increase fire protection for the Weaverville community), requiring resource managers to consider qualitative costs and benefits along with the quantitative values measured by PNV.

Executive Order No.12898 requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Trinity County is considered the affected area of the Browns Project.

Statistics from the 2000 census show that for Trinity County, 0.4% are Black or African American; 4.8% are American Indian and Native Alaskan; 0.5% are Asian; 0.1% are Native Hawaiian and Other Pacific Islander; 0.9% are persons reporting some other race; 4.4% are persons reporting two or more races; 86.6% are white, not reporting Hispanic/Latino origin; and 4.0% are Hispanic or Latino origin. The poverty level was 18.7 % in 1999.

Fire and Fuels

About 60% of the Browns project area falls within the Wildland-Urban Interface. Weaverville is the nearest town to the project area, and it is listed in the Federal Register for communities at high risk from wildfire (Federal Register, April 17, 2001, page 43390).

Fire hazard reflects fire behavior potential and its magnitude of effects as a function of fuel conditions (USDA Forest Service, 2004). A map was created to display this across the Browns analysis area in which 88 percent is considered high fire hazard (See Fire and Fuels Specialist Report in Appendix F). Current surface fuel loadings are in excess of desired conditions (Fuel Model 8); which can result in extreme fire behavior and high fire-severity effects.

Fire regimes in the project area, as described by the Cohesive Strategy (USDA Forest Service, 2000), fall within Groups I and II (Table 3-1). Both groups describe many of the lower elevational zones across the United States, which have been affected by the presence of human intervention and are the furthest away from historical levels. These areas are at greatest risk to loss of highly valued resources, commodity interests, and human health and safety (USDA Forest Service, 2000). Conifer stands within the project area are considered to be in Fire Regime Group I.

Table 3-1. The Five Historic Natural Fire Regime Groups (USDA Forest Service 2000).

Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0-35 years	Low severity
II	0-35 years	Stand replacement severity
III	35-100+ years	Mixed severity
IV	35-100+ years	Stand replacement severity
V	>200 years	Stand replacement severity

Fuel loadings range from about 1 to 33 tons per acre (Table 3-1a), with an average of about 15 tons per acre. This information was used to determine fuel models.

Table 3-1a. Minimum and maximum fuel distributions by size class and fuel class for the Browns analysis area.

Size Class (Inches)	Fuel Class	Minimum (tons/acre) Timber	Maximum (tons/acre) Timber
0 - .24	1 hr	0.3	1.0
.25 - .9	10 hr	1.0	3.2
1 - 2.9	100 hr	0.4	7.9
3+	1000 hr	0.0	27.1
TOTAL		1.70	33.20

Fuel models within the Browns analysis area were chosen based on sampled fuel loads, a fuel model map (See Appendix F), and knowledge of past fire behavior for this area (Oregon Fire 2001). Since sample plots show a range of fuel loadings, the map was used to help identify their locations and associated fuel models.

Fuel model 9 best represents current expected fire behavior and is found in approximately half of the Browns analysis area; and in more than half of the proposed treatment units (Table 3-2). Fuel model 10 represents small scattered pockets of heavier surface fuels, which would result in worse case fire behavior (Table 3-2). Fuel model 8 exists on a substantial portion of the area and represents the desired condition due to its low flame length, rate of spread, and fireline intensity (Table 3-2). Fuel model 6 represents a small component of brush and plantations scattered throughout the analysis area; and is found adjacent to several proposed treatment units (Table 3-2).

Table 3-2. Estimated acres and percentages of fuel models found within the Browns analysis area, and proposed treatment units (Alternatives 3 and 4 combined).

Fuel Model	Description	Browns Analysis Area (acres)	(%)	Proposed Treatment Units (acres)	(%)
8	Closed Timber Litter	4707	33	264	33
9	Closed Timber Litter	6167	44	469	59
10	Closed Timber Litter	486	3	39	5
6	Brush	2274	16	0	0

Calculations include approximately 3084 acres of private land within the Browns analysis area.

Fire behavior within the Browns analysis area was determined using Behave Plus (version 2.0.2). Outputs are based on fuel models, and 90th percentile weather data. One limitation of the program is it represents static conditions; assuming weather, topography, and fuels are constant. In addition, it does not predict crown fire behavior; however, this phenomenon is likely to occur under certain weather and vegetative conditions. For example, the Oregon Fire (2001) is a real time model of what fire in this fuel type can produce under 90th percentile weather. This fire burned through similar fuels and during strong west winds, which resulted in surface and crown fire. The chance for crown fire does exist; which might occur irregularly across the landscape as changes occur in fuels, weather, and topography.

Fire severity (the terms “fire severity” and “tree mortality” are used synonymously here) is the degree to which a site has been altered or disrupted by fire; a product of fire intensity and residence time (NWCG 1996). Larger fuels (>3-inches) result in a higher energy release over a longer period of time. This increases fire severity and reduces rates of fireline construction (Agee et al. 2000). Changes to fuels are related to potential fire behavior at any given site and have resulted in reduced severity effects (Finney 2003).

Probability of mortality is the likelihood that a tree will be killed by fire. This is based on bark thickness and percent crown volume scorched. First Order Fire Effects Model (FOFEM, version 5.0) was used to determine percent mortality in Douglas-fir trees. Other tree species exist within the analysis area, such as pine, cedar, and oak; however, the dominant species (Douglas-fir) was used in modeling tree mortality. Inputs to the model were flame length, species, dbh, tree height, trees per acre, and crown ratio.

There are several limitations to FOFEM; one of which is that the model assumes a continuous fire. Since post-treatment fuels continuity would be discontinuous, a wildfire would burn only portions where fuels were concentrated. Another limitation to FOFEM is that it does not consider ladder fuels, which allow fire to move up into the tree canopy, burning the crowns of larger trees. Generally, a large tree (e.g., greater than 16 inches in diameter) is more susceptible to fire due to its thick bark and high crown base[12]. However, a fire burning in the canopy usually results in a total loss of foliage, which causes high mortality. Due to this limitation, FOFEM was not used to predict

[12] This further varies by species.

mortality rates for current conditions (Alternative 1- Direct Effects). Instead, mortality expected to occur from Alternative 1 (Browns analysis area) was compared to mortality that resulted from the Oregon fire (2001). This fire burned through similar vegetation, topography, fuels, and weather, in which standing vegetation suffered high mortality (Wideman 2002).

Fisheries

In general, streams of the Weaverville Watershed begin in the Trinity Alps Wilderness and are in excellent condition in the upper areas of the watershed. Large amounts of water are withdrawn from East Weaver Creek by the Weaverville Community Service District and from Rush Creek at the Rush Creek Estates area. High water temperature and low flow are limiting factors to fish, especially during the mid-summer and fall.

Anadromous fishes found in the Weaverville Watershed include Fall-run Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), Winter-run Steelhead (*O. mykiss*), and Pacific Lamprey (*Lampetra tridentata*). The coho salmon is part of the Southern Oregon Northern California Coast (SONCC) Evolutionary Significant Unit and listed as threatened under the Endangered Species Act (ESA). Essential Fish Habitat (EFH) for coho salmon and Chinook salmon in the action area is identical to coho critical habitat. Winter-run steelhead is a Forest Service Sensitive and Management Indicator Species (MIS) throughout the Shasta-Trinity National Forest. Adult fishes are found in the Weaverville Watershed during their spawning migrations. Chinook are found infrequently due to low stream flows that prevent migration during the fall. Coho salmon run later in the year can usually ascend streams in the watershed by late November or early December. Steelhead and lamprey ascend streams in the watershed during early spring and are limited by natural waterfalls, dams, and culverts. Juvenile fish of all species may be found at any time in the watershed, with juvenile steelhead being most abundant.

Fish habitat surveys have been performed periodically since the early 1980s for most streams (1963 for Rush Creek) in the analysis area. Many surveys note poor habitat conditions and, from 1986 to 1992, most streams had habitat improvement structures installed. In confined channels such as Little Browns Creek, some well-constructed structures still persist and provide complex habitats. In streams with less confinement and high bedload transport, the structures were less successful.

Water quality is generally high in streams of the Weaverville Watershed. Surveyed streams have had dissolved oxygen levels from 11 to 12 parts per million (ppm), pH from 7 to 7.5, and temperatures around 60° F.

Project Level MIS Fish

Management Indicator Species fish that were chosen in the Shasta-Trinity National Forest Land and Resource Management Plan (USDA Forest Service, 1995b) represent several fish assemblages (Table 3-3).

Table 3-3. Shasta Trinity National Forest Management Indicator Species fishes.

Fish Assemblage	Group MIS Representative
Anadromous Commercial/Recreational Sportfish	Spring-Run Chinook (South Fork Trinity River only) Winter-Run Steelhead
Anadromous Threatened, Endangered & Sensitive Sportfish	Spring-run (summer) Steelhead (South Fork Trinity River only)
Inland Coldwater Sportfish	Rainbow Trout
Inland Warmwater Sportfish	Largemouth Bass

Inland coldwater sportfish are only addressed in watersheds where longstanding natural barriers or dams have blocked migration of anadromous fishes and inland warmwater sportfish are addressed in only in warmwater lakes. The Browns Project is not located above any longstanding natural barrier to fish migration and there are no warmwater lakes within the Weaverville Watershed, therefore inland coldwater and warmwater sportfish are not affected by the project and are not addressed. Several other MIS representatives are addressed only in the South Fork Trinity River (Spring-run Chinook and Spring-run steelhead) (USDA 1995b). The Browns Project is not located within the South Fork Trinity River Watershed; therefore, Spring-run Chinook and Spring-run steelhead are not addressed. The Browns Project is located within an anadromous fish watershed; tributary to the Trinity River upstream of the South Fork Trinity River, therefore winter-run steelhead is the appropriate MIS fish representative for this project.

Abundance and Distribution of Anadromous Fishes

Rush Creek: Anadromous fishes have access to approximately 9.5 miles of stream habitat before steep bedrock falls block passage. There is SONCC coho salmon critical habitat throughout the project area (See Fish BA in Appendix E). Chinook are only found during years of early fall rain that creates suitable migration conditions. Low fall flows generally prevent anadromous fishes from using Rush Creek until late November. Spawning surveys for salmon and steelhead have been conducted on sections of Rush Creek intermittently since 1964. Counts have varied widely according to year and survey effort, but have ranged from zero to one Chinook, zero to 32 coho, and five to 439 steelhead.

The very first fish habitat surveys in Rush Creek noted excessive bedload and recommended that measures be taken to improve habitat. During the 1980s, a coordinated resource management planning group was formed of state and federal agencies to address habitat needs in Rush Creek. The group recommended placing instream structures and 32 structures were build in 1988 and 1989. Surveys in 2002 and 2004 showed that only 40% of the structures remain and less than 20% are still functioning. A 2002 stream condition inventory found that most of the large woody debris was less than one foot in diameter, pools averaged only 1.6 feet deep, and 68% of the stream banks were unstable.

Little Browns Creek: Little Browns Creek has approximately 0.9 miles of habitat accessible to anadromous fishes on NFS lands. Culverts on County Road 232 present a complete barrier to

migrating fishes. Little Browns Creek contains critical habitat for coho salmon as displayed in Appendix E maps. Juvenile steelhead and Coho salmon have been observed in the analysis area; however, spawning has not been documented.

Highway 3, County Roads 230, 232 and 807, and Forest Service road U34N77A closely parallel Little Browns Creek within the analysis area. Little Browns Creek has been channelized and its habitat greatly simplified. Large woody debris is lacking, pools are shallow, and the stream banks are vulnerable to erosion (2003 stream condition inventory). Six habitat improvement structures were installed in 1992; several of the structures still exist and provide valuable habitat.

East Weaver Creek: East Weaver Creek has approximately 0.5 miles of habitat accessible to anadromous fishes on NFS lands. The diversion dam for the Weaverville Community Service District blocks migration 0.25 miles above the East Weaver Campground. There is SONCC coho salmon critical habitat throughout the project area Juvenile coho salmon and steelhead have been observed near East Weaver Campground but adult spawning has not been observed. Stream condition inventory surveys performed in 2002 found that most large woody debris was of small diameter (< 1 foot), pools are shallow (average 1.1 feet), and 83% of stream banks are unstable.

Forest Productivity

The existing vegetative condition of the areas considered (for timber harvest in the proposed action) includes about 900 acres of even-aged, 90-year-old conifer stands with species distributions of about 80% Douglas-fir, 10% ponderosa pine, 8% incense cedar, and incidental amounts (about 2%) of sugar pine. Remnant trees aged 110 to 300 years are scattered throughout the project area. Stand densities average about 280 square feet of basal area per acre with crown closures of 70 - 100%. Inter-tree competition for sun, water, and nutrients has resulted in decreased in tree diameter growth (from approximately four rings per inch in the 1980s to 14 rings per inch currently) and decreased live crown ratios (from approximately 60% in the 1980s to 30% currently).

The desired future condition of the timber resource as identified in the LRMP for the project area is an even-aged forest where ingrowth and understory vegetation treatments are used to enhance timber stand growth and yield. The management objectives for the proposed project are to maintain timber stand vigor/growth by removing excess trees in stand understories and managing stand densities (LRMP, page 4-108). The LRMP emphasizes vegetation management activities to meet recreation, visual, and wildlife objectives while maintaining healthy and vigorous ecosystems (LRMP, page 4-64). Stands in the project area are approaching, or beyond, the desired carrying capacity as measured by the density of trees. The live crown ratio, an indicator of tree vigor, is decreasing and averages about 30-40% (considered minimum to maintain adequate tree growth and vigor). The high density of understory trees in the suppressed and intermediate crown positions are expected to result in tree mortality within these positions, increasing the fuels available during a wildland fire.

Forest stand densities in the project area are to be managed to enhance growth and yield to improve and protect forest health (LRMP, page 4-108). The existing stand densities vary from site to site within the project area. Existing conditions observed through stand examinations indicate that the

selected stands are experiencing inhibited individual tree growth due to inter-tree competition, mortality in many trees that occur in the intermediate and suppressed crown positions, and substantial fuel loads and fuel ladders. These conditions are expected to increase the probability of high timber stand mortality should a wildfire occur. Pockets of mortality from endemic levels of insect or disease activity are apparent in portions of the proposed harvest areas – a condition that is exacerbated by the dense tree stocking and results in stress in individual trees from root competition for available water.

Heritage Resources

The Browns Project lies within territory identified as that of the Wintu People. Previous archaeological investigations have occurred within the proposed Browns project area. These investigations were conducted for the following Archaeological Reconnaissance Reports (ARR): ARR #05-14-431, Moors Land Exchange; ARR #05-14-472, Rush Timber Sale; ARR #05-14-516, Trinity High Land Exchange; ARR #05-14-516/1, Old Weaver Town Dump/Utility; ARR #05-14-563, Frase II Land Exchange; ARR #05-14-563; Baxter Timber Sale; ARR #05-14-567/1A, Rush Creek Fish Project; ARR #05-14-567/1B, Baxter TS addition; ARR #05-14-568, Lower Clear Timber Sale; ARR #05-14-569, East Weaver Timber Sale; ARR #05-14-569/1, La Grange Bike Race, ARR #05-14-569/2, East Branch CR. Fir Management; ARR #05-14-569/3, Weaver Basin Trail; ARR #05-14-569/3B, East Weaver; ARR #05-14-569/4 Deer Brush Burn; ARR #05-14-629, West Weaver Timber Sale; ARR #05-14-786, West Weaver Reservoir; ARR # 05-14-786/1, Moon Lee Ditch Project; ARR #05-14-804, Mule Timber Sale; ARR #05-14-851/1, Red Rock/Garden Gulch Land Exchange; ARR #05-14-921, Bear Basin Trail, and ARR #05-14-569/4, Oregon Fire Recovery. Nine historic sites considered eligible to the National Register of Historic Places are located within or adjacent to the proposed project area. These historic properties are:

- #05-14-56-010 Dolly Road & Sweepstakes Ditch
- #05-14-56-377 Com-A Rush Ck Mining Complex
- #05-14-56-379 Com-C Rush Ck Mining Complex
- #05-14-56-387 La Grange Mud Tunnel
- #05-14-56-385 La Grange Ditch System
- #05-14-56-388 La Grange Siphon #2
- #05-14-56-399 La Grange-Musser Hill Ditch
- #05-14-56-512 Chinese Cabin Site
- #05-14-56-535 Old La Grange Trail

These previously recorded sites were evaluated for inclusion to the National Register of Historic Places and were determined “Eligible.” Therefore, these sites will be protected utilizing standard protection measures stipulated in the Region 5 Programmatic Agreement. These sites will be identified as controlled areas on project maps and they will also be flagged and avoided (no disturbance will be allowed in these areas).

Land Stability

Bedrock Geology

The project area lies both within the Weaverville Formation, located within the southeast portion of the project area, and the Salmon Hornblende Schist. These formations are in fault contact along a northeast-southwest fault, which trends across the approximate middle of the project area. Additionally, there are granite outcrops in the Weaver Bally Mountain and Rush Creek areas.

The Weaverville Formation is composed of Oligocene sediments such as sandstone, shale, and coarse stream conglomerate. This formation is relatively more prone to landsliding than the Salmon Hornblende Schist especially where it is composed of coarse stream conglomerate.

The Salmon Hornblende Schist is a mixed rock unit composed of amphibolite-rich rocks.

Geomorphology

Both glacial and mass wasting process have played a part in shaping the geomorphology of the area. Glacially shaped landscapes are evident in the extreme upper reaches of the East Weaver Creek Watershed, although these fall *outside* the project area. These areas are composed of glacial cirques and moraines.

Mass wasting features include deep-seated dormant rotational landslides and shallow stream headwall basins. Deep-seated dormant landslide terrain dominates northeast-facing slopes while headwall basins dominate the southwest-facing slopes. This characteristic is due to higher moisture conditions within northeast-facing landscapes that have allowed the development of deep soils and mass wasting features. Although ancient and dormant mass wasting features occur throughout the project area, their occurrence is somewhat less frequent in the Musser Hill area.

The major project area creek systems of East Weaver, Browns, and Rush form the major transporters of rock debris and sediments produced through these mentioned geomorphic processes. Debris flow deposits presently occupy all of these creeks.

Mass Wasting Features

Due to the nature just described of the rocks within this area, mass wasting has played a dominant role in shaping the geomorphology. In several instances, the processes that contribute to mass wasting are presently active, in most however they are dormant. The map contained within the project file in the Geology Report depicts the major active and dormant slides within the project area.

By far the greatest occurrences of mass wasting features within the project area are dormant rotational/translational slides. Movement of a coherent mass over a discrete, broadly concave failure surface characterizes this type of slide. Most slides have occurred in association with wet zones such as inner gorges or road construction especially within the Weaverville formation.

Inter-nested rotational landslides occur in proximity to perennial and ephemeral drainages. These areas are somewhat stable if ground slopes remain under thirty percent, less within the Weaverville

formation. At greater slope gradients, these slides should be considered potentially unstable. Such slides commonly creep gradually, but where undercut by a road or drainage will slide out rapidly.

Valley inner gorges are defined as those slopes adjacent to channel margins having gradients in excess of 65%. The valley inner gorge is formed through mass wasting triggered by channel downcutting, oversteepening, and undercutting. Valley inner gorges occur throughout the project area and are almost always associated with some landsliding activity.

Associated with inner gorges are rock debris flows, which can be found throughout the project area especially along Sidney, Munger, Five Cent, and Garden Gulches and Weaver, Browns, and Rush Creeks. These, together with inner gorges, are active mass wasting features.

Scenery

The project area is typified by highly forested repetitive ridges of similar but rising elevations towards the east. Ridge tops are often quite narrow and canyons are deep in most places. The Browns project area is typical of the Klamath-Siskiyou Character Type. The forest is comprised of mixed conifer stands with variable understory and some hardwood species.

The Shasta-Trinity National Forest LRMP established Visual Quality Objectives (VQO) based upon estimates of public concern for scenic quality, the quality of the landscape, and distance of the landscape from viewing areas[13]. Existing scenery ranges from management activities being unnoticed (Retention VQO) to being evident but subordinate to the natural landscape (Partial Retention VQO) as seen from Highway 3 and County Road 204 (Rush Creek Rd.). Existing scenery in the project area is influenced by prior vegetation management activities and roads.

The project area occurs within the LRMP Management Area (MA) 7, Weaverville / Lewiston. The LRMP identifies that timber management activities, in support of wildlife and visual objectives and the production of high quality water for domestic use, are the predominant management opportunities in this MA.[14] The project area is also within Prescription III, Roaded Recreation which has a landscape character goal that is designed to meet recreation, visual and ecosystem management objectives. Timber harvest openings will be dispersed throughout the project area and average 5 acres or less.[15] Hwy 3 and County Rd. 204 (Rush Creek Rd.) are part of the Trinity Heritage Scenic Byway**,** designated by the Forest Service.

The LRMP identifies that views from Hwy 3 must meet a minimum of Retention in the foreground, Partial Retention in the middleground and Modification in the background. County Road 204 must meet a minimum of Partial Retention in the foreground and Modification in the middle and background. Areas unseen from these vantage points are not considered in the project scenery analysis. Views from other roads and vistas are not required to meet VQOs per the LRMP, however other views may be affected.

[13] LRMP, pages 3-22 and 4-27
[14] LRMP, page 4-107
[15] LRMP, page 4-65

There are many local residences in the area of Hwy 3 and County Rd. 204. Several residences may have views of the project area from their homes. They may also use the area for wood cutting and recreational activities. Hwy 3 is traveled by many visitors to get to Trinity Lake within the Whiskeytown-Shasta-Trinity National Recreation Area. The quantity of people that live, travel and recreate in this area make scenery a valuable resource.

The desired landscape character is a forest with a healthy ecosystem that primarily looks natural from sensitive viewpoints. Areas adjacent to Hwy 3 and County Road 204 (Rush Creek Road) would have a multi-faceted forest structure including randomly spaced mature conifers, hardwoods and clumps of vegetative understory. Forest stands range from tree seedling to mature forests, while maintaining some structural diversity.[16]

Research has found that large mature trees are an important part of scenic beauty and should be retained in forest thinning projects. Forests with more open structure that allow visual access through the understory are considered more scenic than forests with extremely dense understory vegetation. Partial clearing of up to 50% of trees in a dispersed pattern may be visually acceptable in moderately sensitive areas, especially if large trees are preserved. Downed wood from timber harvesting and tree thinning is considered unattractive and has negative impact on scenic beauty. Removing dead wood or chipping on site can greatly increase scenic ratings for tree thinning projects[17].

Soils

Soil development was slow in the upper reaches of the project area due to steep slopes and unstable geological formations. In the lower reaches, soil development was moderate to moderately slow due to more stable nonmarine terrace formations. In the upper reaches, the area is susceptible to debris slides and many dormant landslides exist in the area. In the lower reaches, the area is susceptible to rotational slumping. Soils in the lower reaches were in the past placer mined removing vegetation that over time caused erosion and stripping of topsoil. Steep slopes, erosion, and landslides have contributed to current soil conditions of moderately developed soils that are shallow (less than 20 inches) to deep (40 to 60 inches) with a shallow topsoil layer.

Current soil conditions for the Weaver and Rush Creek watersheds are indicative of landscapes with heavy past use. Soils in the headwaters are mostly Granitics, while on the hillslopes there are nonmarine terrace deposits. Granitic soils are very susceptible to erosion and past use (shallow topsoil layers vs. similar soils in less impacted areas that have moderately deep topsoil layers) indicates that erosion has been elevated. Currently these areas are stabilized and erosion is at normal rates for granitics (little observable erosion based on field visits). The nonmarine terrace deposits have had elevated erosion due to past placer miming and stripping (shallow topsoil layers for these soils). These areas have been logged in the past thus causing more erosion and compaction. Currently these areas have good cover and erosion is at normal levels. In the nonmarine sediment deposits, legacy

[16] LRMP, page 4-108
[17] Social Science to Improve Fuels Management: A Synthesis of Research on Aesthetics and Fuels Management, Robert L. Ryan, U.S. FS. North Central Research Station

compaction is also present due to logging. Legacy compaction on Musser Hill exceeds soil quality standards on 25 to 50 percent of the landscape.

If extensive, high-intensity fire were to occur in the Weaverville Watershed, severe erosion would occur on the granitic soils and the fine textured nonmarine sediments. Crown fire would remove soil cover and cause organic matter destruction especially in the topsoil of the granitics. These factors would cause rill and gully erosion in the granitics and sheet and rill erosion in the nonmarine sediments.

Water Quality

Streams draining the Browns project area are within the Upper-Middle Trinity River basin and directly contribute water and sediment to Rush, Little Browns, and East Weaver Creeks. The designated beneficial uses for the Trinity River and tributaries within the project area are established in the Water Quality Control Plan for the North Coast Region and are listed in the Hydrologist Report in Appendix G.

The streams draining the project area are classified as water quality impaired due to excess sediment (EPA 2001). These waters are meeting water quality objectives for water temperature, pH, oil and grease, toxicity, and chemical constituents. The limiting water quality objectives are turbidity and sediment. Historic mining, timber harvest, road use, and urban development are sources of excess sediment within the project area.

The Shasta-Trinity National Forest Cumulative Watershed Effects (CWE) analysis process is used to characterize and quantify the past, present, and future condition of the water quality and quantity of the Browns project area. The Equivalent Roaded Area (ERA) model is used to characterize and analyze the past, present, and future watershed condition. This CWE analysis compares the Threshold of Concern (TOC), identified in the LRMP, to the existing ERA and reports the Watershed Condition Class (WCC). The model results are compared to the measured stream stability and water quality data. For at-risk watersheds, a sediment budget is developed to predict the consequences of the proposed action. The CWE process evaluates the potential impacts of land management activities on the balance between rainfall-runoff, erosion, and stream channel response. For a detailed description of CWE methods, refer to the Hydrologist Report in Appendix G and supporting references.

The LRMP established TOC for each 5th Field Hydrologic Unit Code (HUC) watersheds and defines the WCC (USDA Forest Service, 1995b). The 7th and 8th Field HUC watersheds within a 5th Field HUC watershed are given the same TOC as the 5th Field. As the ERA increases, the watershed condition degrades, and the WCC increases.

The following is a list of the WCC categories (See Hydrologist Report for definitions):

- I: ERA less than 40% TOC
- II: ERA between 40 and 80% TOC
- III: ERA greater than 80% TOC

The WCC is derived from the water quality cumulative effects model and is rated from WCC-I to WCC III.

- **Watershed Condition Class I**: Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominantly functional in terms of supporting beneficial uses.
- **Watershed Condition Class II**: Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the watershed may exhibit an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses.
- **Watershed Condition Class III**: Watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. A majority of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, riparian, and aquatic systems do not support beneficial uses.

Watersheds that are at risk of adverse CWE (i.e., high WCC) are identified and investigated further, using a sediment budget, to determine which actions need to be taken to mitigate ground disturbance. Mitigation requirements are developed from this analysis. If implemented, these mitigations are likely to improve the long-term channel stability and improve WCC.

The Browns Project analysis area includes four 7th Field HUC watersheds. Within the 7th Field watersheds are 11 - 8th Field HUC watersheds (Table 3-4). Plate 3-1 shows the streams, 8th Field HUC watersheds, and existing WCC.

Table 3-4. Seventh Field HUC Watersheds for the Browns Project.

7th Field HUC	**7th Field HUC Watershed Name**	**Drainage Area** (acres)	**Activities Analyzed**
18010211060101 & 02	Rush Creek	14,388	Mining, roads, and timber
18010211060401	E Weaver Creek	8,892	Mining, roads, timber, and urban
18010211060403	L Browns Creek	4,989	Mining, roads, timber, and urban

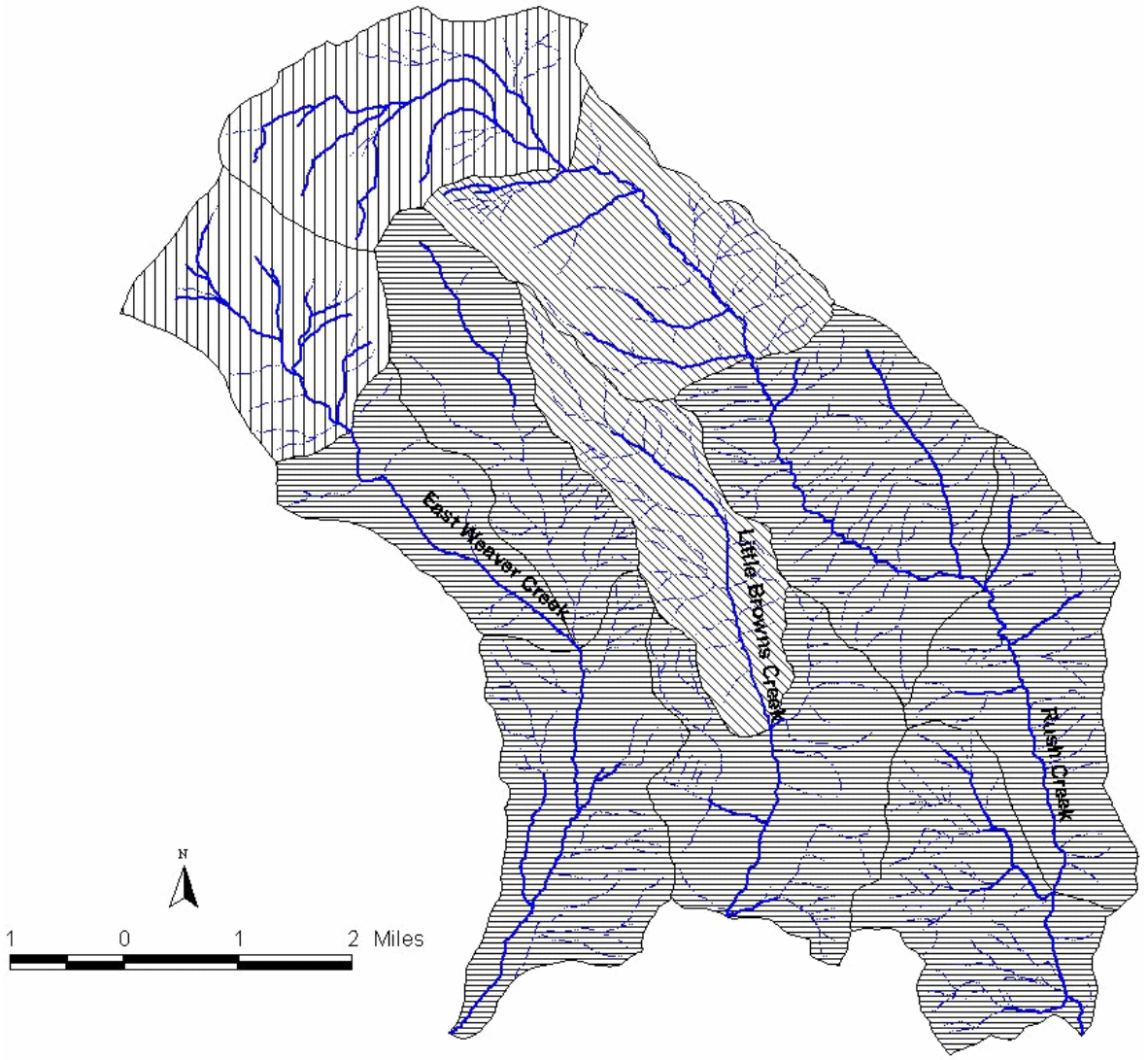


Plate 3-1. Map illustrating the Browns Project Area 7th and 8th Field HUC watersheds and the existing Watershed Condition Class. Vertical lines = WCC I, diagonal lines = WCC II, and horizontal lines = WCC III.

The CWE analysis uses corporate and project specific data and information to characterize the past, present, and future watershed condition within and downstream of the project area. The following is a list of the core data sources used to analyze the Browns Project (See Hydrologist Report and Appendices for the core data):

- Watersheds (5th, 7th, and 8th Field HUC watersheds)
- Streams [perennial fish bearing (Class 1), perennial non-fish bearing (Class II), intermittent, and ephemeral (Class III)]
- Wetlands (springs, meadows, and ponds)
- Region 5 geologic map
- Shasta-Trinity National Forest geomorphic map
- Shasta-Trinity National Forest soils map

- Stream condition inventories
- Active mass wasting feature inventories
- Road condition inventories
- Water quality monitoring data
- Road layer (includes Forest Service and private classified and unclassified roads and trails)
- Forest Service harvest history layer
- Fire history layer
- Private land harvest history layer

The first significant land use within the Browns project area was placer and strip gold mining. Starting in 1848, large areas of land were dedicated to mining and most of the project area, including wilderness areas, were explored and mined for gold and other minerals (O'Brien, 1965). The impacts of gold mining are still imprinted on the landscape and stream channel network. The project area has several mining ditches and ponds that are still hydrologically connected to the stream network. Impacts from strip mining are common as well. Typically, headwater stream channels were hydraulically excavated leaving a void that resembles a landslide scar. Larger streams, like Weaver Creek, were placer mined. Entrenched channels and adjacent gravel piles are still present.

Since the peak of gold mining, lands within the project area have mainly been used for public and private timber harvest and urban development. About 310 miles of roads and trails have been built for access to towns, recreational areas, mining claims, power lines, and timber lands. About 13 miles of Highway 299 and 3 dissect the project area and parallel Weaver and Little Browns Creeks, respectively. About seven miles of County Road 204 parallels Rush Creek as well. There are about 109 miles of private road, and about 99 miles of Forest Service road. For the CWE road data, see Hydrologist Report Appendix B. Most of these roads are sources of sediment, and constrict and divert stream channels. There are several known fish barriers within the project area on public and private lands. The Trinity County Planning Department completed a fish passage survey and found several full barriers on Little Browns and Weaver Creeks.

Timber has been harvested within the project area since the 1800s. Timber harvest outputs peaked in the 1990s (Figure 3-1). Plate 3-2 illustrates the timber harvest history since the 1940s on public and private lands. Since 1940, about 12,818 acres of private land and about 864 acres of public land have been timber harvested, which is 37 percent of the analysis area. This does not include cutting of small areas that were not tracked by the Forest Service or private. Erosion from past timber harvest is limited to areas that became unstable after vegetation removal. Most of the erosion from past timber harvest is limited to areas that became unstable after vegetation removal.

Weaverville is the main town within the project area and is developed around the confluence of West and East Weaver Creek. There are several homes spread throughout the project area, with associated roads mainly in Rush and Little Browns Creeks. Streams draining the town of Weaverville have been heavily modified by urban development and act as canals. Erosion from roads and development sites are sources of sediment and other pollutants.

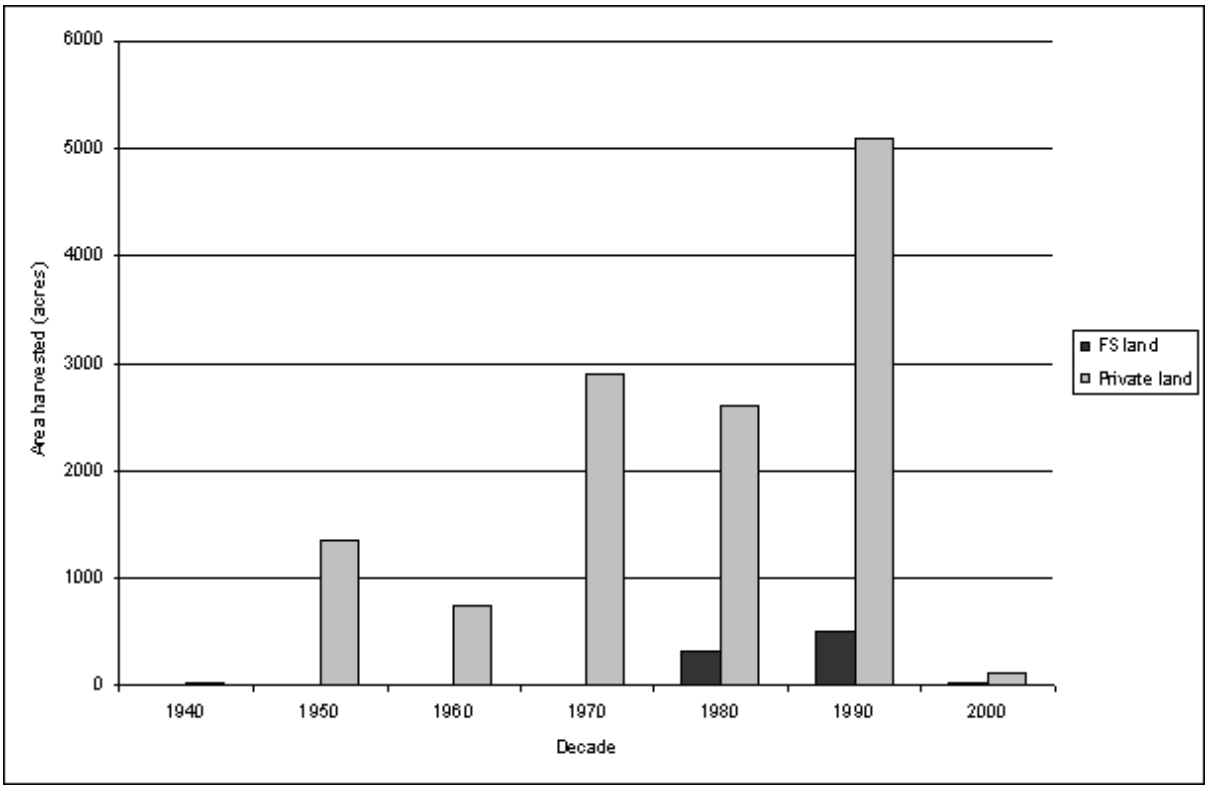


Figure 3-1. Bar chart showing timber harvest history by decade and land ownership (FS=Forest Service).

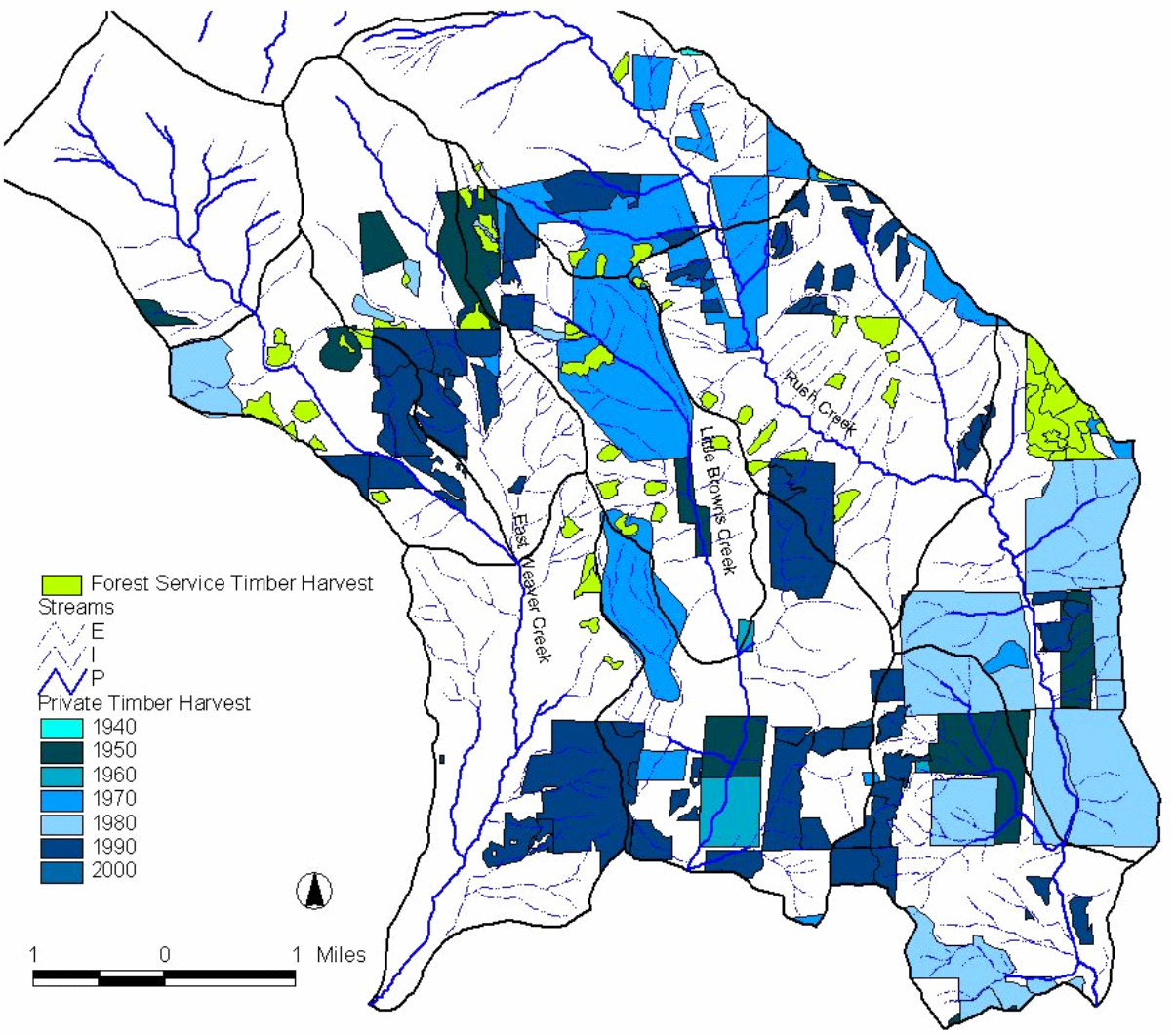


Plate 3-2. Map illustrating the timber harvest history by land ownership.

The existing watershed condition is derived using the ERA model and field data. For the Browns project area, the Rush and Little Browns 7th Field HUC watersheds are in WCC III. East Weaver is in WCC II; however, one of the 8th Field HUC watersheds (i.e., 1801021106040102) is in WCC III. Table 3-5 lists the existing condition ERA, and Plate 3-1 shows the WCC for each 8th Field HUC watershed.

Table 3-5. The Existing Watershed Condition Class for the Browns Project Area.

8th Field HUC	6th Field HUC Watershed Name	Drainage Area (acres)	Forest Plan TOC (%)	Existing ERA (%)	WCC (existing)
1801021106010101	Rush Creek	2860	16	0.5	I
1801021106010102	Rush Creek	2997	16	9.3	II
1801021106010201	Rush Creek	3470	16	13.3	III
1801021106010202	Rush Creek	2676	16	24.0	III
1801021106010203	Rush Creek	2384	16	19.7	III
7th Field Watershed	***Rush Creek***	***14,388***	***16***	***13.0***	***III***
1801021106040101	E Weaver Creek	2148	16	0.7	I
1801021106040102	E Weaver Creek	1567	16	17.1	III
1801021106040103	E Weaver Creek	2291	16	10.1	II
1801021106040105	E Weaver Creek	2886	16	13.7	III
7th Field Watershed	***E Weaver Creek***	***8892***	***16***	***10.3***	***II***
1801021106040301	L Browns Creek	2151	16	14.5	III
1801021106040302	L Browns Creek	2838	16	17.2	III
7th Field Watershed	***L Browns Creek***	***4989***	***16***	***15.7***	***III***

Wildlife

Potential effects to old-growth habitat are the main wildlife concern associated with the Browns Project. Based upon field reviews and habitat mapping of the terrestrial habitats associated with the nine wildlife assemblages listed in the LRMP (pages 3-24 and 3-25), only late-successional habitat-that includes old-growth as a subset-would be measurably affected by either of the action alternatives. The limited amount of old-growth habitat in the Weaverville Watershed is a concern. There is a distinction between old-growth and overall late-successional habitat (see below). Late-successional includes both mature stands *and* old-growth. The concern with the Browns Project is potential impacts to the old-growth subset of late-successional, not the mature forest stand subset. **NOTE:** The terms "late seral" or "late seral stage" used in the LRMP are synonymous with the term **late-successional** in the context of this document. Late-successional is the term used in this document as well as in the NWFP and most other supporting documents.

Habitat Definitions

- ***Late-Successional Forest*** - Forest seral stages that include both old-growth and mature age classes that are defined below:

  Old-Growth **– A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous snags; and heavy accumulations of wood, including large logs on the ground. Old-**

growth stands provide relatively high quality habitat for species such as the northern spotted owl.

Mature Stand **– A mappable (>10 acres) stand of trees for which the annual rate of growth has peaked; generally greater than 80 years old but not yet old-growth. Mature stands generally contain trees with a smaller average diameter, less age class variation, and less structural complexity than old-growth stands of the same forest type**. **Mature stands, especially those with less than moderate canopy closure, do not necessarily provide habitat for species such as the northern spotted owl.**

Federal Forest Land – **Federal land that is now, or is capable of becoming, at least 10 percent stocked with forest trees (i.e., conifers) and that has not been developed for nontimber use. This acreage is the base (denominator) used to calculate the 15% S&G (see below).**

"Provide for Retention of Old-Growth Fragments Where Little Remains" Standard and Guideline (15% S&G)

The 15% S&G is addressed not because of concerns about whether the Browns Project would meet the S&G (Table 3-6), but rather because this is the principal S&G that provides for protection of old-growth habitat outside of the large areas set aside to provide habitat for old-growth associated species (Late-Successional Reserves, NWFP ROD page C-44 and LRMP page 4-62). The threshold of concern with this S&G is the retention of late-successional habitat over at least 15% of federal forest land within a 5th field watershed. The first paragraph of the S&G describes the importance of old-growth habitat in providing for biological and structural diversity across the landscape and goes on to state that it is prudent to retain what little remains of this age class within landscapes where it is currently very limited. The second paragraph of the S&G makes it clear that late-successional (including both mature and old-growth) constitute the numerator in calculating the percentage of federal forest land (i.e., the denominator) meeting this S&G within a 5th field watershed. For the Browns Project, this S&G is met through retention of greater than 15% late-successional forest in the Weaverville Watershed (Table 3-6).

The third paragraph of the 15% S&G (NWFP ROD page C-45 and reiterated on page 4-71 of the LRMP) states that within Adaptive Management Areas, less than 15 percent of fifth field watershed in late-successional forest should be considered as a threshold of analysis rather than a strict standard and guideline, and that the role of remaining stands of late-successional forests must be fully considered in watershed analysis before they can be modified".[18] The project area is within the Hayfork Adaptive Management Area[19]. The role of remaining stands of late-successional forests were fully considered in the Weaverville Watershed Analysis that incorporated the analysis and recommendations related to the 15% S&G found in Appendix D, part 1 (the Wildlife Biological Assessment, pages D-22 through D-28).

[18] LRMP, page 4-71
[19] LRMP, pages 4-69 and 4-107

Table 3-6. Current conditions related to the 15% S&G in the Weaverville 5th Field Watershed. This watershed encompasses the project area and the NWFP ROD establishes the 5th field watershed as the analysis area for the 15% S&G. This S&G applies to federal forest land only (see definition above).

Total Acres	Federal Forest Land (FFL)	Total Late-Successional (percent of FFL)	Old-Growth Subset Only (percent of FFL)
54,000	20,533 acres	15,418 acres (75 percent)	2,300 acres (11 percent)

The Northern Spotted Owl as the Late-Successional (Late Seral Stage) Management Indicator Species (MIS)

NOTE: Again, the terms "late seral" or "late seral stage" used in the LRMP are synonymous with the term **late-successional** in the context of this document. Late-successional is the term used in this document as well as in the NWFP and most other supporting documents.

The Northern spotted owl (*Strix occidentalis caurina*) was selected as the Browns Project MIS primarily for species associated with late-successional forest habitat (called the late seral stage assemblage in the LRMP, page 3-25) and also for the associated snag & down log and hardwood assemblages. On the Shasta-Trinity National Forest, the Northern spotted owl is strongly associated with late-successional-especially old-growth-conifer forest habitat that includes snags/logs and hardwoods as essential components (Thomas et al. 1990, USDI 1990). Owls use snags for nesting sites and both snags and logs provide habitat for owl prey species. Hardwoods provide structural diversity and lower (cooler) roosting sites important to owls for thermoregulation in the heat of the summer. A well-recognized relationship exists between effects to habitat and owl populations. The loss or adverse modification of suitable habitat was a primary reason for the spotted owl being listed as threatened under the Endangered Species Act (Act) of 1973, as amended (USDI 1990). As such, existing habitat conditions and anticipated effects to habitat related to the spotted owl "indicate" similar conditions and effects for other species associated with late-successional habitat such as the Forest Service Sensitive Pacific fisher, American marten, and northern goshawk as well as a number of migratory bird species (see Appendix G of the LRMP EIS). Appendix H of this EIS includes a more detailed discussion of wildlife MIS related to the Browns Project.

Within each of the three areas analyzed specific to the owl (see below), old-growth is more limited than dense or moderately dense mature forest habitat (Table 3-6). Old-growth stands provide "high quality" owl nesting/roosting habitat even though owls may use densely to moderately canopied mature stands to a lesser extent as "moderate quality" nesting/roosting and foraging habitat respectively. Sparsely canopied late-successional forest does not typically provide suitable habitat for species in the late seral assemblage. Therefore while the focus is old-growth habitat, densely to moderately canopied mature forest habitat is also discussed in relation to the MIS spotted owl. Attachment 1 at the end of Appendix D (the Wildlife Biological Assessment), provides a more detailed discussion of habitat definitions.

The Weaverville Watershed is used to examine how the project is consistent with the 15% S&G, and the amount of mature forest habitat (with at least a moderately dense canopy) is measured at three additional spatial scales specific to the Northern spotted owl:

- The 16,266-acre **spotted owl Action Area** is the **primary area** analyzed for this project-level MIS analysis. It was established by a 1.3 mile buffer around all areas proposed for treatment (i.e., proposed harvest units, roads and landings). This 16,266-acre area was deemed appropriate for the following reason: Based on available radio-telemetry data (Thomas et al. 1990), the U.S. Fish and Wildlife Service (FWS) estimated the median annual home range size for the Northern spotted owl in California. Because the actual configuration of a home range is rarely known, the estimated home range of a Northern spotted owl pair in California is represented by a 1.3-mile circle (3,340 acres) centered upon an owl activity center (e.g., nest site). Territorial owls would likely utilize suitable habitat within their home range to some extent within any given year. Therefore, any effects to habitat, both positive and negative, due to the Browns Project would likely affect any current or potential owl activity centers in the area. That is to say, habitat affected by the Browns Project would indirectly affect any owls nesting in the owl Action Area.
- Two additional smaller areas-within the Action Area-analyzed include the individual **home range** (see above) and **territory** ("core area") associated with one known owl activity center (state ID# TR150) that would experience effects to existing habitat due to the Browns Project. The FWS uses a 0.7-mile radius circle to delineate the area most heavily used (territory or "core area") by owls during the nesting season. These areas assisted the FWS during project consultation related to possible impacts to individual owl pairs.

Table 3-7. Existing spotted owl nesting/roosting (NR) and foraging (F) habitat (acres) within the spotted owl Action Area and within the home range and territory of the one known owl activity center (state ID# TR150) that would experience effects to existing habitat. Old growth (high quality NR) is displayed separately to focus on the old-growth concern apart from overall owl habitat.

Area	Old-Growth (high quality NR habitat acreage)	Dense Mature Stands (moderate quality NR habitat acreage)	Mod. Dense Mature Stands (foraging habitat acreage)	Total NRF Habitat (acreage)
Spotted Owl Action Area	814	2,136	527	3,477
Home Range	245	1,138	288	1,716
Territory	138	315	18	471

Other TE&S Species

The Biological Assessment for the Browns Project (Wildlife BA in Appendix D) and the Biological Evaluation (Wildlife BE) completed for this project provide habitat conditions and known occurrences for federally-listed and Forest Service Sensitive species respectively. Again, only effects to old-growth habitat is a concern and habitat conditions for the MIS spotted owl indicate similar

habitat conditions for other species within the late seral assemblage such as the Forest Service Sensitive Pacific fisher, American marten, and northern goshawk.

Survey and Manage (S&M) Wildlife Species

S&M wildlife species are not known or expected to occur in or near any of the areas proposed for treatment in the two action alternatives. In the years 2000 and 2001, surveys completed in the project area and vicinity following the *Survey Protocol for Terrestrial Mollusk Species from the Northwest Forest Plan Draft Version 2.0* (Furnish et al. 1997) revealed no S&M species requiring special management consideration or protection as per the *Record of Decision and Standards and Guidelines for Amendments to Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidelines* (2001) and subsequent Annual Species Reviews (June 14, 2002; March 14, 2003 and December 12, 2003). The project area lies outside the known or expected ranges the Shasta salamander as well as S&M freshwater mollusk species (Frest and Johannes 1999).

Chapter 4: Environmental Consequences

This chapter describes the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or alternative. The resources are listed alphabetically.

Direct and Indirect Effects Relative to Resources Affected_____

The interdisciplinary planning team determined the resources to consider from project area objectives identified in the LRMP and from public scoping. The methodology used to describe the effects relative to the resources considered is described within each resource analysis and is bounded in time and space.

Air Quality - Direct and Indirect Effects

Alternative 1 would have no direct effect on air quality because no project-related activities would occur. However, should a future wildfire occur in the project area, the indirect effect of **Alternative 1** may result in adverse air quality effects that would exceed the thresholds of air quality set by the California Air Quality Control Board by amounts greater than would be experienced under the treated stands resulting from **Alternatives 3** and **4**.

The project: Smoke would be visible for approximately two weeks. The project would be within the standards of the Clean Air Act.

Alternatives 3 and **4** would have a short duration of smoke produced by burning slash and other activity fuels around the community of Weaverville. Burning would occur on permissable burn days and under an approved permit (in compliance with air quality thresholds set by California State Regulations) issued by the North Coast Unified Air Quality Management District (Eureka, California). In addition, smoke management information such as projected tonnage to be burned, type of burning, and smoke contingency actions would be documented in a Burn Plan[20]. There would be approximately ten days of burning, in which smoke would be present; and this would occur over an estimated two month period.

Botany – Direct and Indirect Effects

Sensitive Plant and Fungi Species

A Biological Evaluation for Sensitive plant species has been prepared to evaluate the alternatives in sufficient detail to determine if the effects of implementation would result in a trend toward Federal listing of any Sensitive plant or fungi species, as designated by the June 10, 1998, Region 5 sensitive plant list. There are no Forest Plan Endemic species of concern within the project area (Plant BE, page 21).

[20] Refer to the Shasta-Trinity Burn Plan (version 5) format. A project specific burn plan would be created before implementing prescribed fire; and would be signed by the District Ranger and the Forest Supervisor.

Direct and Indirect Effects to Sensitive Plant and Fungi Species

There would be no indirect impacts on Sensitive plants or fungi resulting from implementation of **Alternative 1**, the No Action alternative. The single, overlapping populations of mountain and Brownie's lady's-slipper near Unit 15A would retain the current overstory shade and duff layer that is present to provide shade, moisture and organic matter nutrients. Thirty other Sensitive plant populations found outside of treatment units but within the greater project area would also remain unaffected. All Sensitive species that occur in or around (but outside of) treatment units benefit from shade and moderate-to-high amounts of forest floor organic matter. This type of habitat would continue to improve and accumulate under the **No Action alternative**.

Not implementing the proposed action could increase the possibility of the project area experiencing high-intensity wildfire, which could result in adverse impacts to 31 of 32 documented Sensitive species populations. Canyon Creek stonecrop would likely remain unaffected even in high intensity wildfire because of it's location on a large, exposed rock outcrop. The **No Action alternative** would maintain current tree and shrub density levels which have higher fuel loadings and higher fire hazard. Fire risk remains the same regardless of the alternative because of the proximity of the project area to frequently traveled roads and the inherent level of lightening activity for that zone. Indirect impacts of higher-intensity wildfire in habitat for Sensitive species include loss of above ground plant parts, soil sterilization and temperatures high enough to kill underground reproductive tissues, death of soil microorganisms essential to growth and reproduction of these species, and loss of soil and it's nutrients through erosion. These are the same impacts that could occur in any wildfire; high intensity wildfire is expected to increase the degree of these impacts on plant species.

Four Sensitive species are known to occur within the project area, although not necessarily within proposed treatment units. All are species that have evolved in a fire-dependent ecosystem (Sawyer and Thornburgh, 1977) so they are likely to survive or respond positively to low or moderate-intensity wildfire. High-intensity wildfires were not typical in the Klamath Mountains of California historically and many native plant species are not resilient to impacts of high-intensity wildfire. There is a higher chance of death of native species individuals or populations from lethal soil temperatures that can kill underground reproductive structures. Indirectly, severe modifications in the forest canopy could be great enough to eliminate necessary habitat characteristics, such as shade, necessary for native and rare plant species to survive after high-intensity wildfire has occurred.

The Browns project area falls within an identified high risk Urban Wildland Interface Community-at-Risk but is also identified as being within a low-to-moderate wildfire risk area based on risk factors such as lightening starts, presence of roads or developments, and recreation use patterns. In the absence of high-intensity wildfire within the project area in the future, there would be no direct or indirect effects; therefore no cumulative effects, from **Alternative 1**, the No Action Alternative, would occur.

Alternatives 3 and 4

Because there are no populations of any Sensitive plant species within any treatment units, there would be no direct or indirect impacts. In the absence of direct or indirect impacts, there would be no cumulative impacts.

Reducing the potential for high-intensity wildfire would reduce the potential for more severe adverse impacts to 31 of 32 Sensitive plant populations known from within the general project area (Canyon Ck. Stonecrop would not be affected by high-intensity wildfire). The potential for complete loss of canopy (shading), soil sterilization, death of underground reproductive tissues, death of soil microorganisms, and erosional loss of topsoil would all be lessened.

No surveys were performed for the branched collybia, *Cudonia monticola*, olive phaeocollybia, and orange-peel fungus fungi, but there is suitable habitat for all three species present within units containing mid-seral or late-seral conifer or mixed conifer/hardwood forest types. These are primarily the units receiving timber and associated post-activity fuels treatments, where species-specific host trees are found as well as adequate amounts of leaf litter and organic debris in the understory. Because of the lack of field surveys and presence of suitable habitat, occupancy by these four species must be assumed. Little or no scientific research has been completed on impacts from management species to the four Sensitive fungi, but impacts are thought to be similar to those for common forest fungi. Results of research studies on impacts to these species are available to varying degree and those will be cited where applicable.

Habitat requirements for fungi at their most basic level include organic matter from which nutrients are extracted and a host tree for exchange of nutrients (Castellano et al., 1999). Water or moisture is almost always necessary to speed decomposition and to sustain plant biomass that will ultimately provide organic matter. Highest quality habitat in general includes abundant organic matter in the form of litter, duff, and down logs, associated host trees, and shade to provide cool, moist conditions that will facilitate decomposition of organic matter. Disruption of the belowground fungal network from host tree or duff layer removal would disrupt nutrient exchange, and moisture is essential to fungal organisms for survival. Underground fungal networks may go into dormancy when moisture is lacking, but expansion of the mycelium is unlikely to occur and the population will eventually die if dry conditions are sustained over long periods.

Specific habitat requirements for the four species are (Castellano et al., 1999) (Castellano et al., 2003):

Olive phaeocollybia requires an oak or pine host tree

Branched collybia (mycoparasite) requires the presence of another fungi species, this is provided in organic debris

Cudonia monticola (saprophyte and decomposer) requires decaying coarse, woody debris

Orange-peel fungus (saprophyte and decomposer) requires decaying litter

Assuming occupancy in the absence of surveys within suitable habitat, direct impacts may occur to fungi. The only direct impact would be disruption of mycelial networks where machinery used in

thinning, road construction, and machine piling churns up soil. Fungi typically fruit only when soil is cool and/or wet. Soil protection and Best Management Practices prohibit treatment activities while soil is wet to prevent compaction. Fungi would not be present above ground during any periods that treatments are occurring lessening direct impacts from soil churning.

Thinning From Below

Indirect impacts proposed in the Browns Project are more relevant to fungi than are direct impacts. Removal of some forest canopy may disrupt host tree connections for olive phaeocollybia. The greater the number of trees removed, the more adverse the impact. Increased sunlight to the forest floor would dry out the soil and organic layer more quickly, reducing available moisture necessary for fungi growth and reproduction and slowing organic matter decomposition rates.

The proposed action would not reduce canopy cover below 50% on average in any treatment units. By thinning from below, this would retain the largest trees to provide shade for ground-floor moisture retention that would contribute to organic matter accumulation, which provides a substrate for branched collybia and orange-peel fungus and a source of fungal species biomass for reinoculation of disturbed soils in the project area. Retention of the largest trees would insure retention of an adequate number of host trees for olive phaeocollybia.

There is no information available on the amount of time branched collybia, olive phaeocollybia, and orange-peel fungus require to recover from minor, moderate or heavy impacts. Retention of habitat elements such as organic matter, shade, and host trees would insure that at least a minimum of each of these elements is available after treatments for potential populations of the three species to recover.

Group Selection Harvest at Pre-designated Landings

Twelve to twenty (depending on the alternative) group regeneration cuts are planned throughout the project area to provide landings for timber removal. Each pre-designated landing is 2.4 acres or smaller in size. Total acreage of regeneration cuts is 25 acres (**Alt. 4**) to 37 acres (**Alt. 3**). Removal of all trees in these units would have the greatest impact on the four fungi species. Complete overstory removal would alter shade patterns to the forest floor, greatly increasing sunlight, drying out forest floor litter and organic matter beyond what is acceptable for many fungi species (Byrd et al, 2000). Fungal biomass, needed for re-inoculation after treatments, will be dramatically reduced (Baath, 1980). All suitable host trees would be taken from each treated unit. In the absence of necessary moisture, woody matter decomposition slows greatly, reducing the available carbon source for fungi to extract nutrients from. With the loss of habitat components, many fungi that occupy late-seral forests, including the four Sensitive fungi species, drop out of the forest community and are not available for future forest recruitment until appropriate habitat components return (Hagerman et al., 1999). Units that are less than 2 acres have been shown to be small enough to allow timely re-inoculation from neighboring inoculant sources (Durall et al., 1999). Branched collybia, *Cudonia monticola*, olive phaeocollybia, and orange-peel fungi are all thought to require late-seral forest components. However, the alternatives considered would only have the potential to affect up to 37

acres out of the Weaverville watershed of over 53,000 acres - affecting potential populations within pre-designated landings because most or all late-seral habitat components would be removed.

Harvesting and Fuel Treatment Methods

Tractors would be used to remove timber on 608 acres (**Alt. 3**) or 482 acres (**Alt. 4**) out of a total of 791 acres (**Alt. 3**) or 568 acres (**Alt. 4**). Only 26 acres (**Alt. 3**) or 21 acres (**Alt. 4**) would cause heavy disturbance by being invasive into the soil, with the remainder of the disturbance in thinning units restricted to hauling logs. This is less than 5% of the total treatment acres. Tractors can cause much greater soil disturbance than other harvesting methods because they are more invasive into the soil and have greater potential to cause soil compaction. Constant soil moisture is essential to fungal organisms for reproduction and expansion. Entry into the soil will break up the belowground fungal network resulting in disruption of nutrient exchange and acceleration of soil drying. Underground fungal networks may go into dormancy when moisture is lacking, but expansion of the mycelium is unlikely to occur and the population will eventually die if dry conditions are sustained over long periods. Soil compaction caused by repeated tractor passes restricts the movement of water and oxygen through the soil, reducing availability of those necessary components for fungi growth and survival (Amaranthus et al., 1996). There will be a increase in acres of disturbance to organic layers; however, the net results of **Alternatives 3** and **4** are a decrease in compaction due to the mitigating measures included in project design (see direct and indirect discussion in the Soils section of this document).

Cable systems would be used to remove timber on 183 acres (**Alt. 3**) or 86 acres out of a total of 791 acres (**Alt. 3**) or 568 acres (**Alt. 4**). Cable systems are much less invasive into the soil and damage is mostly restricted to surface soil gouging from dragging logs to decks. Adverse soil compaction and disruption of underground fungal networks will not occur as a result of this type of yarding.

Post-Activity Fuels Treatments

Lop and scatter treatments would have no impacts on Sensitive fungi species because they aren't invasive into the soil and they do not remove canopy or soil cover. Roadside piling and burning by hand is not invasive into the soil, but pile burning would cause temporary soil heating which may result in death of any fungi in the top couple of inches of the soil. Handpiles are typically no bigger than 4'x4'x4', resulting in a fast burning pile that does not cause lethal soil temperatures at greater than a couple of inches.

Broadcast burning and burning concentrations may consume areas of organic matter which is the food source for the four Sensitive fungi, but especially for branched collybia, *Cudonia monticola*, and orange-peel fungus. All three of these species require decaying organic matter for nutrients, water, or a host species. Burning would occur in either small areas (concentrations) or in a mosaic pattern (broadcast), leaving adequate islands of unburned material within close proximity for reinoculation of any of the 4 species.

Dozer line construction would result in 13 acres (**Alt. 3**) or 11 acres (**Alt. 4**) of heavy soil disturbance around tractor units. The goal of this activity is to remove as much vegetation as possible and remove all organic matter down to mineral soil. While the loss of organic matter will remove a nutrient and water-retention source for fungi, the line would be restricted to 10 feet wide. Reintroduction of fungi from inoculant sources outside tractor units and the dozer line should occur easily.

Handline construction also works toward the goal of removing vegetation and organic matter, but the line is less than 3 feet wide. While this activity is invasive into the soil, it disturbs very little area and reintroduction of weeds and vegetation can happen quickly. Less than 5 acres total under either alternative would be disturbed.

Road Construction and Decommissioning

Decommissioning of roads and reconstruction of existing roads would have no impacts on the 4 Sensitive fungi. There is no suitable habitat for most fungi on roadbeds because compacted soils have no soil porosity or organic matter to act as a food source.

New road construction and temporary road construction would occur in areas that have not been previously disturbed, although proposed road segments may move in and out of plant communities that would provide suitable habitat for fungi. Up to 5 miles or 8.5 acres of temporary road would be created under **Alt. 3**. Up to 3 miles or 5.3 acres of temporary road would be created under **Alt. 4**. These alternatives would potentially affect only up to 8.5 acres out of the Weaverville Watershed of over 53,000 acres – affecting suitable habitat for fungi because of heavy soil compaction (Amarathus et al, 1996).

All temporary road construction would be decommissioned by ripping after project activities are completed. This would work toward counteracting soil compaction by increasing soil porosity and creating spaces for deposition of organic matter that will hold moisture in the soil. Although it would likely take over ten years for habitat conditions to recover enough to host fungi species, this process would take hundreds of years without decommissioning treatments.

Survey and Manage Species

The proposed project area contains a mixture of chaparral, mixed conifer/hardwood, conifer, riparian, and oak woodland habitats. Most of the conifer and mixed conifer/hardwood habitat lies on the eastern half of the project area, and large blocks of chaparral and oak woodlands are in the western half. All Sensitive species habitat is found within conifer or mixed conifer/hardwood habitats. Suitable habitat for mountain lady's-slipper, Brownie lady's-slipper, and *Leptogium cyanescens* (lichen with no common name) is present within treatment units in the project area.

In the absence of any treatments there would be no direct or indirect effects from **Alternative 1**. Therefore, there would be no cumulative effects to any Survey and Manage plant species.

Four populations of Brownie lady's-slipper and 18 populations of mountain lady's-slipper were found within the project area during field surveys. Project design in **Alternatives 3** and **4** has

excluded all populations of Survey and Manage species from any treatments; therefore, no impacts would occur to either.

Field surveys were not performed for *Leptogium cyanescens*. This species is thought to be found on hardwood trees in riparian zones. Project prescriptions that retain at least 50% of canopy cover in riparian zones would provide adequate protection for this lichen. Thinning prescriptions in riparian reserve units of the Browns Project will maintain at least 60% crown cover where it exists. Because there would be no direct or indirect impacts to the three species, there would be no cumulative impacts.

Because of lack of individuals, **All Alternatives** considered in the Browns Project are in compliance with the 2001 Survey and Manage ROD.

Noxious Weeds

Alternative 1

Implementation of the No Action alternative would result in a continuation of current weed habitat conditions. Within forest stands, suitable habitat for weeds would diminish as canopy cover increases and litter and duff layers accumulate. Where stand densities are high and the chance of high intensity wildfire is greater, total canopy loss could create suitable habitat for noxious weeds. Where forest stand densities are not overstocked, implementation of **Alternative 1** would result in working toward reduction of suitable habitat for noxious weeds as disturbance is minimized, canopies close and litter and duff layers accumulate and suppress weed germination and establishment.

Alternatives 3 and 4

Direct and Indirect Effects

The Canada thistle and scotchbroom populations identified within the project area would be flagged. The Canada thistle population on Rush Ck. Road is not within any treatment areas, so no disturbance is expected. The scotchbroom plants would be lopped prior to any treatments, where they are in activity units, to avoid disturbing these plants. The proposed action would not disturb these populations and therefore would not contribute to their spread.

Soil disturbance creates spaces of bare soil that provide suitable habitat for competitive noxious weeds to germinate and become established. Noxious weeds have developed growth characteristics that enable them to germinate and grow faster than natives, which allows them to occupy sites before natives can become established. Most native plant species are not able to compete with weeds and would eventually drop out of plant communities. Noxious weeds displace native plant communities, resulting in losses of wildlife habitat and forage, and losses of scenic and recreation values.

Soil disturbance would occur as a result of yarding, landing use, machine piling and pile burning, but heavy disturbance will occur only with tractor piling treatments on 26 acres (**Alt. 3**) or 21 acres (**Alt. 4**). In areas where tractors are used for yarding, but are not invasive into the soil, soil compaction would decrease soil porosity and create poorer conditions for native seed germination.

While soil is disturbed during and immediately after project activities, seeds of weeds in the surrounding area may blow in and become established, especially if weeds are nearby. Equipment cleaning before initiation of project activities would minimize introduction of weeds. Spreading native grass seed followed by mulching after treatments would help reduce chance introductions from vehicles and surrounding areas after treatments.

Economic Effects – Direct and Indirect Effects

The environmental consequences of implementing the alternatives considered on economic effects have been evaluated. Table 4-1 shows the result of the short-term economic analysis for all alternatives.

Table 4-1. Short-term Economic Analysis for Alternatives 1, 3, and 4 (estimates, in dollars).

Timber Management Economic Consequences	Alt. 1	Alt. 3	Alt. 4
Value of timber harvested	0	3,577,200	2,560,950
Yarding costs	0	1,067,000	765,500
Fuels treatment costs	0	282,000	199,000
Road costs	0	417,100	208,700
Reforestation costs	0	26,800	17,300
Other administrative costs, including overhead costs	0	607,200	434,700
Present net value (using a 4% discount rate)	0	+1,177,100	+ 935,750

The values and costs shown on Table 4-1 are estimates intended to capture the economic value of implementing the "timber sale-related" portion of the alternatives considered. The present net value has been calculated using the estimated selling value of the timber as the revenue value of resource outputs and using the associated activity costs (yarding, fuels treatment, roads, and reforestation) and administrative costs (harvest administration, sale preparation, analysis and documentation, and other resource support) as discounted financial costs. Itemized revenues and costs are included on pages 8 and 9 of the Timber/Economics Evaluation included in the project file. Alternative 1 would have no financial revenue generated. No financial costs would be invested, and no opportunities to achieve management objectives would occur.

Alternatives 3 and **4** would result in a timber sale (or sales) removing merchantable timber from the area. The value of the timber would pay for the fuels treatments, which are intended to help develop low relative risk fire class conditions within the project area – the primary purpose of the project. The values of community protection, resource protection, and firefighter safety are not reflected in the present net value analysis. **Alternative 3** is expected to offer the greatest present net value using the current timber values from the Western Wood Products Association index. Table 4-2 shows other project proposal economic consequences.

Table 4-2. Other Project Proposal Economic Consequences (estimates, in dollars).

Other Project Proposal Economic Consequences	Alt. 1	Alt. 3	Alt. 4
Road Decommissioning costs	0	$115,500	$115,500

The costs shown on Table 4-2 are estimates based on similar project work done in the Weaverville area. Road decommissioning costs will be incurred to improve the cumulative watershed effects within the project area. The decommissioning projects would benefit from funding generated from the project area timber sale(s). However, funding may also come from appropriated dollars for community protection, watershed restoration, and/or non-Forest Service sources (e.g. water quality grants).

Alternative 1 would result in no additional costs or benefits in water quality improvements within the project area. **Alternatives 3** and **4** would be the most expensive, but would result in the most watershed improvements.

Based upon the Present Net Value shown in Table 4-1 and the road decommissioning costs shown in Table 4-2, timber sale revenue values are expected to exceed costs. The cost associated with achieving fuels work with less temporary road construction (Alt 4) is displayed in Table 4-1.

There are positive economic effects associated with the Browns Project. Timber sales will provide a business opportunity for the local sawmill. The Present Net Value of the Browns Project is positive and therefore no disproportionately high adverse effect would be created to any minority population. Tribal consultation was part of the planning process. No issues were brought forward. The fisheries biologist concludes that there will be no effect on the Tribes sustainable fishing rights. No disadvantaged groups have indicated an interest in the Browns Project during the “scoping” or “Notice of Intent” public involvement process regarding environmental justice. No impact is expected from any of the alternatives considered regarding environmental justice.

Fire and Fuels Management – Direct and Indirect Effects

The factors used to evaluate the effectiveness of proposed treatments are fire behavior (flame length, fireline intensity, and rate of spread) and fire severity (percent mortality). The result of this evaluation is as follows:

Fire Behavior

Table 4-3. A comparison of alternatives for estimated direct effects to surface-fire behavior by fuel model within the Browns Project treatment units using 90th percentile weather.

Project Alternatives	Fuel Model	Fuel Structure	Area (acres)	Area Affected (%)	Flame Length (ft)	Rate of Spread (ch/hr)	Fireline Intensity (btu/ft/sec)
Alt. 1	8	Timber	264	33	1.6	3.6	16
	9	Timber	469	59	4.4	15.7	140
	10	Timber	39	5	8.0	17	528
Alt. 3	8	Timber	791	100	1.6	3.6	16
Alt. 4	8	Timber	568	100	1.6	3.6	16

Desired condition is described by fuel model 8, which consists of approximately 8-10 tons of dead and down fuels per acre. Fire behavior represented by this fuel model is qualitatively described as low.

Direct effects from **Alternative 1** would result in no change in fire behavior within the Browns treatment units, with fire behavior dependent upon the existing condition as quantified in Table 4-3 by fuel model. ***Fuel model 8*** has the lowest flame length, rate of spread, and fireline intensity. Direct attack by firefighters would be feasible without mechanical and aerial support, such as dozers and air tankers. Fuel model 8 is considered the desired condition because it produces fire behavior conducive to successful suppression and fire fighter safety. This fuel model is equivalent to approximately 8-10 tons/acre, which complies with desired conditions from the LRMP; and it is currently located in approximately 33 percent of treatment units.

Fuel models 9 and 10 have higher fire behavior results than fuel model 8, which would require mechanical and aerial equipment for fire suppression. Generally, flame lengths greater than four feet produce radiant heat too hot for fire fighters to work near. Indirect fireline must be constructed a distance from the fire, which increases the amount of acres burned, and reduces fireline construction rates. Approximately 64 percent of the treatment units are currently characterized by this type of fire behavior. Furthermore, fuel models 9 and 10 pose the greatest threat of crown fire. The Oregon Fire (2001), which threatened the town of Weaverville, is one example of what can occur in this fuel model and forest structure. This fire burned through similar fuels during strong west winds, which resulted in surface and crown fire.

The indirect effects of **Alternative 1** would be a likely increase in fire behavior due to vegetation growth in 20-30 years (Table 4-3a). One study suggests that in this forest type normal fuel accumulations (excluding areas of bug kill and windthrow) are approximately 0.6 tons/acre/year (Skaggs 1996). At this rate, fuel models 8 and 9 would increase to the next highest level; however, fuel models 6 and 10 would remain fixed since they are already at their highest position within this classification system (Table 4-3a). Extreme fire behavior would result within more than half of the analysis area, which creates unsafe conditions for firefighters and the public. Indirect attack would need to occur since fireline intensity would be too hot for firefighters to work near. This increases the

amount of acres burned and reduces fireline construction rates, thus making containment more difficult.

Table 4-3a. Estimated fuel model increase in 20-30 years; and resulting fire behavior within the Browns analysis area[21] (14,069 acres).

Browns Analysis Area	Fuel Structure	Fuel Model (2005)	Fuel Model (2025)	Area Affected (acres)	Area Affected (%)	Flame Length (ft)	Rate of Spread (ch/hr)	Fireline Intensity (btu/ft/sec)
	Brush	6	6	2274	16	8.3	53.5	563
	Timber	8*	9	4707	33	4.4	15.7	140
	Timber	9	10	6653	47	7.6	15.8	460
	Timber	10						

* Desired condition

Direct effects from **Alternatives 3** and **4** would be a low rate of spread, flame length, and fireline intensity if a wildfire occurred in proposed units (Table 4-3, Fuel model 8). This provides safer conditions for firefighters, and can increase the effectiveness of fire suppression by slowing fire growth and limiting spotting[22]. The difference is **Alternative 3** would treat about 790 acres and **Alternative 4** would treat about 570 acres. **Alternative 3** would treat more acres of fuel model 10 (39 acres), than **Alternative 4** (17 acres); therefore having a greater benefit because fuel model 10 results in extreme fire behavior (spotting and crowning), which creates unsafe conditions for firefighters and the public.

Alternatives 3 and **4** would modify canopy, ladder, and surface fuels by thinning suppressed and intermediate trees, reducing trees per acre, raising crown base heights, and removing surface fuels within proposed treatment units. The project would reduce the likelihood of crown fire. In pre-designated landings proposed regeneration harvest and landing rehabilitation is expected to result in fire behavior most appropriately represented by fuel model 8 for 1-5 years post-project. Scientific literature supports that fuels treatments can reduce crown fire in forested stands (See Appendix F, Fire and Fuels Specialist Report). One example of successful fuels treatments from the Blacks Mountain Experimental Forest suggests that past thinning treatments had reduced potential crown fire to a surface fire.[23] Another example (Hayman Fire 2002) showed that on gentle slopes, and during less extreme fire weather, crown fires diminished to surface fires in stands with low stem densities and low surface fuels.

[21] The remaining 435 (4%) acres are comprised of grass, water, or are barren, and were not considered in this analysis.
[22] Finney, Mark A. 2003. *Calculation of fire spread rates across random landscapes*. International Journal of Widland Fire, 2003, 12, 167-174.
[23] Petersen, 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*. PNW-GTR-628. February 2005. USDA Forest Service, Pacific North West Research Station.

Alternatives 3 and **4** would use prescribed fire to burn tractor and roadside piles, to burn concentrations, and to broadcast burn. Burning would be done to reduce activity fuels[24] and natural fuel accumulations. This would occur during the winter, spring, and fall so that fire behavior would be manageable to firefighters due to wet weather conditions. In addition, this would occur under an approved burn plan[25].

The indirect effects of thinning in **Alternatives 3** and **4** would be growth of grass, brush, and small diameter trees in the understory. However, the remaining co-dominant and dominant trees would eventually shade out new growth; therefore this altered microclimate is estimated to last approximately 3-5 years. Within pre-designated landing units from 6-20 years post-project, surface fuels including small trees, grass and brush may move fire behavior toward fuel model 6 which requires indirect attack; increases the amount of acres burned; and reduces fireline construction rates. Approximately 20 years post-project trees will likely have grown tall enough to shade out understory vegetation and fire behavior in pre-designated landing units would move toward fuel model 8.

The indirect effects of **Alternatives 3** and **4** is that surface fire behavior is predicted to increase within thinning treatment units in approximately 20-30 years. This is due to natural fuels accumulations; however, these effects are still lower that what would occur from **Alternative 1**. Despite this increase, the probability of crown fire would remain low since small diameter trees would be reduced as a result of the project. Scientific literature suggests that fuels and vegetative treatments can reduce extreme fire behavior (crowning and spotting) within forested stands (Agee and Skinner, 2005; Graham et al., 2004; Martinson and Omi, 2003; Graham et al., 1999).

Fire Severity Direct Effects

Table 4-3b. Probability of mortality by alternative within the Browns analysis area using FOFEM, version 5.0.

Douglas-fir	**Diameter** (inches)	**Mortality**
Alternative 1 (Current conditions)	NA	High
Alternatives 3, 4 Proposed treatments (2' flame length) (Fuel Model 8) (Adjusted[26])	16-22	5%
	24+	3%

Trees 2-14 inches in diameter were not modeled in FOFEM for Alternatives 3 and 4 because these trees would be removed through proposed treatments. High Mortality is 67-100% of all vegetation being killed by fire.

[24] Fuels generated from harvesting operations.
[25] Refer to the Shasta-Trinity Burn Plan guidelines for requirements on safety, smoke, weather, etc.
[26] One limitation to the FOFEM model is that is assumes a continuous fire. Since post-treatment fuels continuity would be discontinuous, wildfire would only burn in concentrated areas. Mortality rates predicted by FOFEM were then adjusted by multiplying them to the estimated proportion of area burned (Reinhardt 2004), which is approximately 50 percent.

Alternative 1 would result in high mortality rates. The First Order Fire Effects Model (FOFEM) was not used to predict mortality for this alternative because fire professionals on the STNF determined that the model did not accurately predict tree mortality in the larger trees (16 inches-diameter and greater). This is because FOFEM does not consider ladder fuels, such as brush and small diameter trees, which allows fire to move up into the crowns of larger trees, thus causing higher mortality.

Alternatives 3 and **4** would result in low (much less than 33%) tree mortality rates for trees 16 inches-diameter and greater (Table 4-3b). FOFEM was used to predict mortality because fire professionals on the Forest determined that the model resulted in reliable outputs. Both alternatives would thin out suppressed and intermediate trees (2-14 inches); therefore, leaving larger trees (16-40 inches dbh) that can better tolerate fire. In addition, if a fire were to move through the stand after proposed treatments, there would be no ladder fuels allowing fire to move into and between crowns of larger trees. **Alternative 3** would treat more acres than **Alternative 4**, thus reducing tree mortality rates over a greater area. Surface fuel reduction activities would limit fireline intensity and lower potential fire severity effects (tree mortality) (Agee et. al. 2000).

Fire Severity Indirect Effects

Table 4-3c. Probability of mortality by alternative for Douglas-fir within the Browns analysis area in 20 to 30 years.

Douglas-fir	Diameter (inches)	Average Mortality (percent)
Alternative 1 (8' flame length) (Fuel Model 10) 20-30 years	2-8	100
	10-14	98
	16-22	84
	24 +	33
Alternatives 3, 4 (5' flame length) (Fuel Model 9) 20-30 years	2-8	80
	10-14	35
	16-22	8
	24 +	5

Low- 0-33%, Moderate- 34-66%, High- 67-100%

The indirect effects from **Alternative 1** on tree mortality rates are displayed in Table 4-3c. The model predicts that only trees that are 24 inches dbh and greater would fall into the low category. Therefore, the majority of trees would suffer moderate to high mortality. This is because natural fuel accumulations would add about 12 tons per acre to the current fuel model by the end of 20 years. Consequently, this raises fireline intensity, which increases mortality rates. Scorch heights would reach higher up the trunk damaging tree crowns, and fire intensity would be greater at the boles damaging the cambium layer. FOFEM was used to predict indirect mortality rates because fire professionals on the Forest determined that the model resulted in reliable outputs.

The indirect effects from **Alternatives 3** and **4** on tree mortality rates are expected to range from low to high in 20-30 years (Table 4-3c). However, unlike **Alternative 1**, the majority of trees would

fall in the low to moderate category, allowing more trees to survive a wildfire. The difference between alternatives is the amount of acres treated (**Alternative 3** treats more acres than **Alternative 4**), yet both would thin out suppressed and intermediate trees; therefore, leaving larger trees (16-40 inches dbh) that can better tolerate fire.

Fire and Fuels Management – Summary of Direct and Indirect Effects

Alternative 1 implements no action in the Browns analysis area. The current fuel profile and vegetative structure would sustain a surface and possibly crown fire if it were to occur during 90th percentile weather. Flame lengths would be greater than four feet high- a condition that hinders firefighters from safely suppressing wildfire. As a result, fire induced mortality to conifers would be moderate to high. In addition, fire behavior and mortality rates are likely to increase from current conditions in approximately 20 to 30 years. **Alternative 1** would decrease firefighter and public safety since approximately 63 percent of the Browns analysis area would be conducive to high flame lengths, rapid spread rates, increased fireline intensities, and the potential for crown fire. Suppression tactics would require indirect attack; thus increasing the total area burned; and reducing fireline construction rates. In 20 to 30 years hazardous fuel conditions are predicted to increase; as well as affect more area.

Alternatives 3 and **4** would reduce surface fuels and standing vegetation in project units to desired conditions. However, **Alternative 3** would treat approximately 223 acres more than **Alternative 4**. If a fire occurred under 90th percentile weather, flame length, rate of spread, and fireline intensity would be low, thus increasing firefighter safety and increasing fireline construction rates. However, after 20 years has passed, fire behavior in thinning units is expected to increase from post treatment conditions. **Alternatives 3** and **4** would result in low mortality rates since the remaining trees would be larger, more fire tolerant, in addition to less trees per acre.

Indirect effects of **Alternatives 3** and **4** include the growth of small trees, brush and grass in the understory of pre-designated landings, which could increase the chance of fire ignition and fire behavior in these areas 6-20 years post-project. Fire behavior in these areas during this time period would be comparable to fuel model 6, which creates unsafe conditions for firefighters and the public, requires indirect attack, increases the amount of acres burned, and reduces fireline construction rates. About 20 years post-project it is estimated that stands would result in a fuel model 8 since trees would be tall enough to overshadow brush and grasses, reducing understory vegetation. Needles and branches would fall to the ground, due to self pruning, which is likely to create fuel model 8 conditions. Eventually as stands in these areas continue to grow, and natural disturbances as well as fuel accumulations occur, a fuel model 9 or 10 may again result (greater than 30 years post-project).

Fisheries – Direct and Indirect Effects

Threatened Fish and Management Indicator Species (MIS) Fish

The alternatives have been evaluated for their expected effects on SONCC coho salmon and designated critical habitat. The SONCC coho salmon Evolutionarily Significant Unit is listed as

threatened under the ESA. A detailed fisheries BA has been prepared to review the project proposals in sufficient detail to determine if the actions are likely to adversely affect the threatened species or its designated critical habitat or Essential Fish Habitat. The Fish BA (Appendix E) has been prepared in accordance with legal requirements set forth under Section 7 of the ESA (19 United States Code (USC) 1536 (c)), and follows the standards established in Forest Service Manual direction (FSM 2672.42). A fisheries MIS report has also been prepared, and is summarized in this section. The MIS report discloses the comprehensive effects assessment and trends analysis for fisheries MIS.

Direct Effects on Threatened Fish and MIS Fish

Alternative 1 would have no direct effects on threatened Fish and MIS Fish since no activities would occur. **Alternatives 3** and **4** would result in no direct effects to fish. There are no aspects of the project that would occur in streams where fish are present.

Indirect Effects on Threatened Fish and MIS Fish

Alternative 1 may allow indirect effects to threatened fish to occur due to the increasing risk of wildfire within the watershed. Severe damage to riparian and fish habitat has occurred due to recent large fires within or near the Weaverville Watershed (Browns Fire, 1994; Lewiston Fire, 2000; Oregon Fire, 2001). The Browns project area is currently in fuels Conditions Class 3 (USDA Forest Service, 2004), where the risk of losing key ecosystem components as a result of wildfire is high.

The indirect effects of **Alternatives 3** and **4** to threatened and MIS fish are addressed together because they are identical in scale, duration, and intensity. Short-term increases in turbidity during precipitation events post-project would result from erosion due to ground disturbance from yarding, fuels treatment, and road decommissioning. Some sedimentation may occur in pools of Little Browns Creek for a distance of about ½-mile below the area where roads are decommissioned on the flood plain. This sedimentation may negatively affect the emergence of anadromous fish fry from gravels and result in reduced pool quality for rearing juvenile fish. The greatest effect would occur following the first rains after the project is completed and effects may linger up to three years until sediments are flushed from the stream. Long-term benefits would result as decommissioned roads become re-vegetated and the watersheds' hydrograph assumes a more normal pattern. Lowering the risk of severe fire events which are known to cause watershed damage is a long term positive effect of the project.

Fish Habitat and Riparian Reserves

The project Fisheries Report and the Fish BA include analyses to evaluate expected effects to fish habitat and riparian reserves, as well as project compliance with Aquatic Conservation Strategy Objectives (Shasta-Trinity LRMP, page 4-53). The results of those analyses are summarized below:

Direct Effects to Fish Habitat and Riparian Reserves

Alternative 1 would have no direct effects on riparian reserves or fish habitat since no activities would occur. Thinning the timber stands in riparian reserves as proposed in **Alternatives 3** and **4**

would result in a reduction of tree numbers in overstocked stands in 78 acres of riparian reserves. No direct effects would occur to fish habitat since there are no aspects of the project that would occur in streams where fish are present.

Indirect Effects to Fish Habitat and Riparian Reserves

Alternative 1 may allow indirect effects to riparian reserves and fish habitat to occur due to the increasing risk of fire within the watershed. The Browns project area is currently in fuels Conditions Class 3 (USDA Forest Service, 2004) where the risk of losing key ecosystem components to wildfire is high. Large fires have occurred recently within or near the Weaverville Watershed (Browns Fire, 1994; Lewiston Fire, 2000; Oregon Fire, 2001) and have severely damaged riparian and fish habitat.

Indirect effects to fish habitat from **Alternatives 3** and **4** may include short-term increases in turbidity during precipitation events. These effects may occur due to erosion caused by ground disturbance from yarding, fuels treatment, and road decommissioning. Some sedimentation may occur in pools of Little Browns Creek for a distance of about ½-mile below the area where roads are decommissioned on the flood plain. This sedimentation may increase fine sediment stored in pools, slightly reducing the pool volume and depth temporarily. The greatest effect would occur following the first rains after the project is completed and effects may linger up to three years until sediments are flushed from the stream. Long-term benefits would result as decommissioned roads become re-vegetated and the watersheds' hydrograph assumes a more normal pattern. Positive indirect effects include lowering the risk that future severe fire events would damage the watershed.

Indirect effects to riparian reserves may include small changes in microclimate in localized areas such as slightly lower humidity and slightly warmer temperatures due to increased sunlight. However, these effects would be short-term (less than 10 years) and changes would decrease as the forest canopy fills in. Areas where roads would be decommissioned on the flood plains of Little Browns Creek would be re-vegetated and fragmentation of the riparian reserves in these areas would be reduced over time. Indirect benefits would result from lowering the risk of severe fire behavior, and resultant damage to timber stands, within the riparian reserves.

Aquatic Conservation Strategy

Table 4-4 summarizes how the project is consistent with the nine Aquatic Conservation Strategy (ACS) Objectives. The ACS was established in the Northwest Forest Plan (USDA and USDI, 1994), and is reiterated in the Shasta-Trinity LRMP (page 4-53).

Table 4-4. Evaluation of project consistency with ACS objectives

Aquatic Conservation Strategy Objectives	How the Proposed Activities for All Action Alternatives meets the ACS
1.) Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.	Thinning in both riparian reserves and upland areas in the project area would contribute to the restoration of the distribution, diversity, and complexity of the Weaverville Watershed and landscape-scale features. Young pole-stands are low in species diversity and structural complexity, which thinning would be expected to increase. Due to thinning, individual tree growth rates would speed the development of late-successional characteristics, such as large live trees, snags, and down wood, over the long-term.
2.) Maintain and restore spatial and temporal connectivity within and between watersheds.	Thinning in riparian reserves would be highly unlikely to cause any degradation of connectivity or increase in landscape fragmentation because of the influence of the residual stand and the small area of riparian reserves that would be thinned. Any reduction in connectivity for riparian-dependent species would be minor and short-lived. Thinning both in riparian reserves and upland areas would speed the development of late-successional characteristics, and therefore would contribute to the restoration of a network of late-successional forest stands over the long-term. No new roads would be constructed in riparian reserves that could degrade connectivity for aquatic or riparian-dependent species. The installation of several new Q100 pipes is not anticipated to reduce or hinder the connectivity between watersheds or obstruct the routes to areas critical for fulfilling life history requirements of aquatic or riparian dependant species.
3.) Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The project would not adversely affect the physical integrity of the aquatic systems because the residual stands in areas thinned would maintain root strength; the unthinned buffers would ensure that thinning would not affect streambank integrity; and proposed activities would not cause any alteration in water flows that could affect channel morphology.
4.) Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.	The project would not alter stream temperature because the thinning in riparian reserve would not alter stream shading. The combination of untreated riparian reserves and the minimal change to existing canopy closure would maintain existing stream temperature conditions. Fuels treatments would primarily occur in upland areas and would not affect water quality because of the small area that would be burned within riparian reserves. Leaks of toxic materials (oil, gas, etc.) from machinery into stream channels would be unlikely. Water quality necessary to support healthy, riparian, aquatic, and wetland ecosystems is maintained at the 5th field watershed scale. Although some sediment could result from road construction due to the duration, scope, and intensity, the amount will be insignificant and discountable. Water quality is expected to be maintained or improve in the basin as a result of recovering vegetation and implementation of watershed restoration projects.

Aquatic Conservation Strategy Objectives	How the Proposed Activities for All Action Alternatives meets the ACS
5.) Maintain and restore the sediment regime under which aquatic ecosystems evolved.	The project would have only short-term effects to the fine sediment regime as a result of decommissioning a road within riparian reserve. No new roads or landings would be constructed in riparian reserves, and existing roads that would be used would be improved, which will result in a slight decrease in road-related sediment production over the long - term. Directional falling and yarding would minimize soil disturbance from logging in the treatment areas in riparian reserves. No thinning would occur on areas with unstable soils. Untreated riparian reserves would be adequate to continue performing sediment filtering functions before it reaches the stream because of generally low risk of hillslope erosion, and the low risk of substantial sediment inputs. Vegetative ground cover is expected to be > 50% immediately post-harvest. The project would contribute to restoration of the sediment regime under which this aquatic ecosystem evolved. Untreated buffers would adequately filter any sediment from harvest areas before it reaches streams. The direct disturbance of road reconstruction and maintenance could result in production of a minor amount of sediment only during the immediate periods of reconstruction and maintenance, which would have negligible effects on the aquatic ecosystem. There will be no new road construction within riparian reserves and existing roads and stream crossings would be only temporarily reconstructed.
6.) Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing	The project may contribute to a minor increase in peak flows, summer low flows, and overall water yield because of the decrease in canopy closure, construction of new landings and creation of additional skid trails. The exact extent of the effect on flow is not certain; most research on hydrologic response to timber harvesting has been conducted in clearcuts, and the effect of density management treatments on stream flows has not yet been extensively studied. However, any effect is likely to be negligible and short-lived because of the influence of residual stands. Newly constructed landings would be scarified, mulched and seeded after use. Current riparian buffers are adequate to maintain the current sediment regime. The riparian reserve and understory litter would be effective at filtering sediment in most situations. Limiting all road construction to temporary roads that would be built, used and decommissioned in the same dry season will also reduce overland flow, compacted areas will be scarified to reduce the effects from past compaction to maintain or reduce peak flows. Timing, duration and intensity of in-stream flows are not likely to be affected by the project. Although flow regimes have been altered in this watershed by roads, this proposed action will not increase peak flows because more miles of road are being decommissioned than are being built, and over the longer term, vegetation recovery is occurring across the watershed. Hydrologic recovery in the basin from growth of vegetation on large scale land allocations in the watershed far exceeds loss of vegetation that may result from the proposed action.
7.) Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The project would not alter existing patterns of floodplain inundation and water table elevation because it would have no effects or only negligible effects on existing flow patterns and stream channel conditions. Maintaining riparian areas as well as not constructing roads within floodplains would help to maintain exiting conditions. The proposed action will not alter the timing, duration, and variability of floodplain inundation. There will be no effect on wetlands.

Aquatic Conservation Strategy Objectives	How the Proposed Activities for All Action Alternatives meets the ACS
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands …	The project would contribute to the restoration of the species composition and structural diversity of plant communities by speeding the development of late-successional forest characteristics, including large trees and a multi-story canopy, in the riparian reserves that would be thinned. The project would not alter the restoration of the species composition and structural diversity of plant communities in untreated areas. The project would contribute to restoration of species composition and structural diversity of plant communities, and habitat to support well-distributed populations of some riparian-dependent species by speeding the development of late-successional forest characteristics. The project would cause a reduction in canopy closure for several decades in thinned areas, which could result in some micro-climatic alteration or other adverse effects for species that prefer complete canopy closure or do not tolerate disturbance. Any such effect would be minor because of the effect of residual trees, the extensive untreated and lightly-thinned areas, and because of the current poor habitat condition of stands for most species associated with late-successional forests. The project will not affect plant communities in wetlands or riparian reserves.
9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species	The project would contribute to restoration of habitat to support well-distributed populations of riparian-dependent species by speeding development of late-successional forest characteristics, including large trees and a multi-story canopy, in treated riparian reserves. Current stand condition provides relatively poor habitat for riparian-dependent species associated with late-successional forests. The project could cause a short-term reduction in canopy closure in thinned riparian reserves, which could result in some micro-climatic alteration or other adverse effect for species that prefer complete canopy closure; any such effect would minor because of the effect of residual trees, the small proportion of riparian reserves treated, and the current poor habitat condition for species associated with late-successional forests. This habitat would be maintained through active retention of hardwoods within riparian reserves and uplands. Habitat would be restored spatially and temporally, as the aquatic system becomes late-successional habitat. The project will not affect habitat such that well distributed populations of native plant and animal riparian-dependent species could not be maintained. Over time, decommissioning and hardening of roads and natural recovery of vegetation in the basin will contribute to this objective by reducing peak flows, sediment and debris flows from roads.

Forest Productivity – Direct and Indirect Effects

Table 4-5 summarizes the environmental consequences on the timber resource of implementing the alternatives.

Table 4-5. Environmental Consequences on the Timber Resource for Each Alternative.

Timber Management Environmental Consequences:	Alt. 1	Alt. 3	Alt. 4
Timber stand density (basal area per acre average) of 90-140 year old stands	120-340 sq. ft.[1]	80-140 sq. ft	80-140 sq. ft
Acreage improved by managing density (thinning the smaller trees within stands)	0 acres	744 acres	543 acres
Average number of trees/acre	140-400 trees per acre	40-70 trees per acre	40-70 trees per acre
Acreage regenerated with planted trees	0 acres	37 acres	25 acres
Timber volume removed	0 mmbf[2]	8.8 mmbf	6.3 mmbf

[1] sq. ft. = square feet. [2] mmbf = million board feet

The thinning treatments in **Alternatives 3** and **4** are intended to maintain suitable stand growth and to improve tree health and vigor over time by providing space for remaining trees to grow. The thinning treatments also reduce potential timber stand mortality from wildland fire while providing merchantable wood removed as an economic offering.

Direct Effects on Forest Stand Productivity

Alternative 1 would result in neither a change in existing stand densities nor any improvements in stands identified as having excessive fuel loadings. Therefore, **Alternative 1** would forego opportunities to improve timber stand health and fire protection at this time. In addition, no timber volume (yield) would be provided toward sustained yield objectives.

The direct effect of the implementation of **Alternatives 3** and **4** would be the removal of approximately 150 trees per acre over the acreage proposed for thinning. The timber harvesting would reduce stand density, which increases individual growth of the residual trees. Reducing stand density also decreases fuel loading and ladder fuels, which lowers the risk to wildfire. Therefore, **Alternative 3** would provide the most benefit to timber stand growth and yield and it would also provide the most protection to the residual timber stands from the threat of a stand-replacing wildfire due to acreage involved (744 acres). **Alternative 4** (543 acres) would benefit timber stand growth and yield and stand protection from wildfire, but ***less*** than **Alternative 3** by 2.5 mmbf and 201 acres (see Table 4-5).

Another direct effect would involve the two-acre pre-designated landing areas included in **Alternatives 3** (37 acres) and **Alternative 4** (25 acres). These two-acre landings have been located within areas of higher ground fuel concentrations and/or understocked live conifers. These two-acre areas are expected to accommodate the large landing sizes needed for whole-tree yarding and would add an element of age diversity to the thinned timber stands following successful reforestation.

A sustained level of forest (wood) products from suitable Matrix lands is part of the desired future condition of the project area (LRMP, page 4-108). Timber volume harvest is a direct effect of **Alternatives 3** (8.8 mmbf) **and Alternative 4** (6.3 mmbf), whereas **Alternative 1** would provide no wood products.

Indirect Effects on Forest Stand Productivity

As young-growth conifer stands age, the number of trees per acre decreases as inter-tree competition occurs. The basal area tends to constantly increase up to a point where the maximum basal area that the site can support is attained. In the absence of harvest or another disturbance, this trend would continue at a rate of 1 to 2% per year. For example, an 80-year-old mixed conifer stand would, on average, experience about an 8% reduction in trees per acre (Dunning & Reineke, 1933). For stands that average 100 years of age (the approximate age of treated acres in **Alternatives 3** and **4**), it is anticipated that about 40% of the trees per acre would die by the time the stand reaches 150 years of age (Dunning & Reineke, 1933). **Alternative 1** is likely to result in this amount of mortality within the project area over the next 50 years. Additionally, if a wildfire occurred mortality would be dramatically increased in areas of high or moderate burn intensity. Many areas would result in stands being entirely eliminated, while a few stands would have a few surviving trees. **Alternative 1** would not contribute to LRMP objectives for managing stand densities to maintain and enhance growth and yield or improve forest health and vigor.

Alternatives 3 (744 acres) and **4** (543 acres) would result in increased (diameter) growth and (board foot) yield over time based on professional experience with similar thinning treatments and site capabilities on adjacent projects. Residual trees would grow in an environment with reduced stress and mortality would decline. Inter-tree competition in thinned stands would not become a significant factor for approximately 30 years due to the increased sun, water, and nutrients available to the residual trees. While **Alternatives 3** and **4** would be consistent with management objectives for the project area as identified in the LRMP, **Alternative 3** best meets the Forest Goals and Objectives in the LMRP by treating more acres.

Heritage Resources – Direct and Indirect Effects

The Forest Archaeologist has approved the ARR for the Browns Project, ARR #05-14-569/5. The project proposals are in accordance with Provision III (D) (1) of the Programmatic Agreement for Compliance with Section 106 of the National Historic Preservation Act. As indicated in the ARR, nine sites are located in or adjacent to proposed activities. The environmental consequences of implementing any one of these alternatives would have “no effect” to historic properties because these properties would be avoided by the project design. Historic properties will be fully protected utilizing avoidance protection measures.

Land Stability – Direct and Indirect Effects

The broad scale project area and the smaller unit areas of each alternative were evaluated for potential to increase, maintain, or decrease natural landslide process rates. The broad scale level of analysis encompassed the project area based upon aerial photo interpretation and initial field review (Level 1). At this stage, the mass wasting features were first mapped on 1944 (B&W) 1980, 1983 (color infrared) and 2003 vintage aerial photos and the mass wasting processes identified. Analysis of the area during various decades was performed to better identify the distribution, timing, and relative size

of mass wasting processes and their relationship with forest practices. The 1944 aerial photo set essentially depicts pre-logging conditions. Scale of photography ranged from 1:15840 to 1:60000.

An interpretation of the mass wasting hazard potential was then made by associating the occurrence of landslides with geologic, hydrologic, or terrain features.[27] These associations form the basis for the mapping of mass wasting hazard map units in the watershed. Potential mass wasting map units were drawn for each area with similar mass wasting characteristics and triggering mechanisms. These mechanisms are the specific processes that appear to contribute to mass wasting.

Unique units are created if the mass wasting processes are similar (i.e., shallow debris flows) but the triggering mechanisms are different (i.e., roads versus loss of root strength on hillslopes). Other factors can include: (1) run-out behavior; (2) location of harvest *and* fuel break units as related to terrain features; (3) total acreage of proposed disturbed area; (4) proposed harvest methods; (5) unit silvicultural prescription; and (6) amount of temporary road construction or reconstruction. This latter factor also included slope positions of roads and the amount and size of landings.

The mass wasting potential for the units are thus qualitatively rated, guided by criteria based on the foregoing information *and* field evidence according to the likelihood of occurrence. These ratings determine the level of "potential hazard." No one of the factors delineated were used by themselves, but were evaluated in conjunction. Overall, a high level of confidence in mapping accuracy can be applied to the study area; nevertheless, this is a subjective, relative rating meant only to *compare* different mass wasting features within the area and is not meant as a site specific analysis (a specific level of analysis occurs at Level 2, explained in the following portion of the land stability analysis).

A *secondary* level of analysis was incorporated whereby all harvest units were individually field evaluated (Level 2). At this stage a detailed field analysis addressed the specific problems identified at the previous level 1 stage. Specifically the relationships between land use activities and landslide processes are identified more accurately and precisely and with greater spatial resolution.

For **Alternatives 3** and **4**, all areas and road locations demonstrating instability or potential instability were flagged to be avoided and deleted from further consideration. The project design resulted in excluding all unstable or potentially unstable areas through individual unit layout, prescription, and road location modification. Therefore, no direct or indirect[28] effects to land stability are anticipated from the action alternatives.

Under **Alternative 1**, no activities would occur. Therefore, there would be no potential for direct impacts associated with land management activities under this proposal. Indirectly, opportunities to improve the watershed would be deferred, as none of the beneficial effects of project implementation would occur. The threat of large wildfires would be increased and, should they occur, would have the

[27] Specifically these can include: mass wasting features, bedrock type, structure, geotechnical properties or behavior, slope range and aspect, hydrological conditions, and occasionally rainfall, climate, and seismic activity.

[28] As defined "indirect effects" are caused by the action and are later in time or *farther removed in distance*, but still reasonably foreseeable. This analysis has reviewed not only the chances that a landslide may form at a particular place but also the chances that a proposed action from further upslope may form a landslide downslope or that a landslide from farther upslope may strike further downslope.

potential to increase mass wasting within the project area by removing ground cover over large areas thus reducing root support, and possibly changing infiltration rates by reducing transpiration and concentrating runoff.

Scenery – Direct and Indirect Effects

Alternative 1 – No Action

The no action alternative will not affect the existing visual condition, which meets VQO's of Retention to Partial Retention as seen from Hwy 3 and County Rd. 204. However, the no action alternative would influence the future landscape character by allowing development of a forest with dense under growth. This condition creates less visual diversity and inhibits the sight distance of the viewer. This alternative takes no action to prevent catastrophic wildfire due to excessive fuels, and thereby could impact scenery indirectly. A devastating forest fire would leave a charred, denuded landscape, which many people find visually undesirable.

Alternative 3 – Proposed Action

Browns Project units seen from the foreground of Hwy 3 are 2, 3, 3B, 3C, 3E, 3F, 3G, 3H, 4A, 10a, 10c, 102, 108, 114. These units were specifically considered in the project scenery analysis, and evaluated for consistency with LRMP VQO requirements.

Project units should be unnoticed from the foreground of County Rd. 204 (Rush Creek Rd.) due to topography and vegetative screening and thus meet the required LRMP VQO of Partial Retention immediately upon project completion.

The project is likely to meet required LRMP Retention VQO in the foreground of Hwy 3 upon project completion because harvest prescriptions include design criteria for protecting visual quality (described in Chapter 2). After one year, the project should blend further into the natural environment due to needle cast and new growth of grasses and herbaceous plants.

There will be changes to the existing scenery, however the casual forest visitor will see a primarily natural setting. Timber harvesting activities will be noticeable during project implementation. Even though there will be changes to the scenery, research has shown that reducing competing vegetation increases the diameter and health of trees resulting in stands that are more resilient to disease and insect mortality. Many people like to look at larger, vigorous trees in a semi-open forest setting rather than smaller trees with dense understory. The mature trees, increased visual access, and shadow patterns emulate a park-like setting which is perceived as scenic.

Alternative 4

With this alternative timber harvest and road activities associated with units 3E, 3F, 3G, 3H, 5A, 5B, 5C, 5D, 5E, 5F, 5G, 5H, 9A, 9B, 9C, 9D, and 9E would not be implemented. Alternative 4 will meet the same VQO's as Alternative 3 from LRMP sensitive viewing areas; however this alternative may be preferred over Alternative 3 for views from local residences and other forest vistas. This alternative would have fewer effects to scenery than Alternative 3 as seen from local residences near

Raspberry Lane, China Gulch Road, and other forest vistas. There would be less changes to scenery from this alternative due to reduced amount of temporary roads and the associated units and landings.

Soils – Direct and Indirect Effects

The effects of each alternative on the soil resource have been assessed using the Region 5 Soil Quality Standards. Three soil quality standards will be used as the evaluation criteria to evaluate each alternative:

- **Soil Stability**. Erosion is the detachment, transport, and deposition of soil particles by water, wind, or gravity. Vascular plants, soil biotic crusts, and litter cover are the greatest deterrent to surface soil erosion. Visual evidence of surface erosion may include rills, gullies, pedestalling, soil deposition, erosion pavement or loss of the surface "A" horizon. Erosion models are also used to predict on-site soil loss.
- **Soil Hydrology**. This function is assessed by evaluating or observing changes in surface structure, surface pore space, consistence, bulk density, infiltration, or penetration resistance using appropriate methods. Increases in bulk density or decreases in porosity results in reduced water infiltration, permeability, and plant available moisture.
- **Nutrient Cycling**. This function is assessed by evaluating the vegetative community composition, litter, coarse woody material, and root distribution. These indicators are directly related to soil organic matter, which is essential in sustaining long-term soil productivity. Soil organic matter provides a carbon and energy source for soil microbes and provides nutrients needed for plant growth. Soil organic matter also provides nutrient storage and capacity for cation and anion exchange.

Soil Quality Standards (Refer to Table 4-6)

Erosion (tons per acre): Needs to be less than or equal to one to two tons per acre depending on slope and parent material which equates to an erosion hazard rating in the low-moderates (4-7).
Cover necessary to keep erosion less than two tons per acre:

- Granitics – 90% cover necessary
- Metasediments – 50 to 70% cover necessary

Compaction (grams per cubic centimeter, g/cm^3): Not to exceed 0.9 g/cm^3 for fine textured soils (depends on rock fragments and textures) and will be expressed as total acres compacted.
Fertility or Nutrient Recycling (tons per acre): Tons of duff and fine slash less than three inches left after fuel treatment or nutrient recycling.

Table 4-6. Soil Quality Standards Matrix for Alternatives.

Soil Quality Standard	Alternative 1	Alternative 3	Alternative 4
Anticipated % cover	90 – 100%	50 – 70%	60 – 75%
Erosion (erosion hazard rating)	Low (2-4)	Moderate (7-8)	Moderate (5-7)
Compaction (acres compacted)	300 acres	100 acres	200 acres
Acres to be treated	0 acres treated	200 acres treated	100 acres treated
Fertility (tons per acre of slash and duff)	6 - 12 tons per acre	3 – 4 tons per acre	5 - 6 tons per acre

Direct and Indirect Effects on the Soils **(refer to Table 4-6)**

Alternative 1 would result in no change to existing soil conditions. With existing soil cover at 90 to 100%, erosion is low but over time slash and ground surface fuels would create a fuels hazard. A large fire could severely burn the area removing cover and causing accelerated erosion. This alternative would not treat legacy[29] compaction, which would continue to reduce infiltration and increase runoff.

Alternative 3 thins the most forested acres (744) with track mounted equipment and cable suspension. With planned soil cover of 50 to 70% post-project, erosion would be in the low to moderate range, keeping erosion below forest thresholds. The area of compacted soils would be reduced by 200 acres from the existing conditions. Road decommissioning would greatly benefit the soil resource in terms of increasing soil infiltration. This alternative reduces total fuels for the project area (791 acres) to favorable levels for fertility by encouraging residual tree biomass and fine root development thus increasing soil organic matter. Pre-designated landings and staging areas will be subsoiled and mulched after use, thus reducing legacy and activity compaction in these areas.

Alternative 4 would result in less area (543 acres) receiving fuels reduction treatment, so potential for wildfire damage would be elevated over **Alternative 3**. Erosion overall would be less than **Alternative 3,** but compaction treatment would be less by 100 acres. Overall, the effects on soil erosion would be less than **Alternative 3**. **Alternative 4** reduces fuels on 543 acres. The risk of accelerated erosion due to potential wildfire is lower than **Alternative 1** but greater than **Alternative 3**. Pre-designated landing areas will be subsoiled and mulched after use thus reducing legacy and activity compaction in these areas. Road decommissioning will be the same as in Alternative 3 thus reducing compaction, improving infiltration and decreasing runoff.

Water Quality – Direct and Indirect Effects

Effects Analysis

To analyze the direct and indirect effects on water quantity and quality, the unit of measure used to quantify the effects is the probability of changing the magnitude, frequency, timing, and duration of

[29] Legacy compaction – cumulative existing compaction from past actions listed on Table 4-10.

runoff and sediment delivery. The proximity to a riparian reserve, slope position, and slope steepness of each proposed activity is used to quantify the probability of an effect. Each timber harvest unit, road, and fuel treatment is ranked based on the above criteria. For example, a road located near a perennial fish bearing stream has a greater probability of directly affecting water quality, than a road on top of a ridge. This is the appropriate unit of measure because it is consistent with the LRMP (USDA, 1995b), Shasta-Trinity National Forest CWE Analysis Process (see Hydrologist Report in Appendix G), and the best available science.

Bounding the Effects

Geographic Boundary

The Browns Project direct and indirect effects analysis area includes four 7th field Hydrologic Unit Code (HUC) subwatersheds (Table 4-7). Within the 7th field subwatersheds are 11 – 8th field subwatersheds. The topographic boundaries defining a given watershed are used to geographically define the watershed analysis area because land disturbances within a given watershed directly and indirectly affect downstream water quantity and quality. Upland disturbances that change the magnitude, frequency, timing, and duration of rainfall, runoff, and sediment delivery strictly follow watershed boundaries.

This analysis evaluates the potential direct and indirect effects of each individual activity on Rush, Little Browns, and East Weaver Creeks. Activities near perennial fish bearing streams have a greater risk of directly affecting water quality. For example, a timber harvest unit adjacent to Little Browns Creek has the greatest risk of controllable sediment discharge. Activities that affect upslope intermittent, ephemeral, and unstable areas have the greatest risk of indirectly affecting water quantity and quality. For example, a timber harvest unit within an active landslide has the greatest risk of indirectly affecting downstream water quality.

Time Frame

This direct and indirect effects analysis compiled a land use history to quantify the past and present effects. For this project, placer and strip mining effects that occurred before 1940 are presently directly and indirectly affecting stream channel stability. In addition, the existing roads, urban, and timber harvest activities are directly affecting the analysis area (Table 4-7).

The timeframe for potential effects of the proposed action depends on the recovery period of a given activity. The longest lasting effects are from road construction and use, and do not recover with time unless specific measures are taken to reduce runoff and controllable sediment discharge (i.e. decommissioning). Improvements to road stability reduce the additive and compound effects, but recovery is very slow. Most direct disturbances caused by timber harvest recover within 10 to 30 years, depending on the type of activity. Fuels treatments and fire suppression actions tend to recover in five to 10 years. Watershed restoration activities tend to recover in one to three years. This analysis assumes that it would take three years to complete timber harvest activities, whereas fuel treatments and watershed restoration activities would take up to 10 years to complete. This analysis uses BMPs

and mitigation measures to prevent the direct and indirect effects of short- and long-term land use activities. Treatments like soil ripping and road decommissioning will help prevent direct and indirect effects caused by timber harvest.

The timeframe for potential additive effects of the project with foreseeable actions is 20 years after project implementation. It is difficult to predict what activities would occur on private land during this time period; however, road and timber activities are very likely to continue for the reasonably foreseeable future. It is also likely that watershed restoration activities would continue. For example, Trinity County is planning to improve fish migration through Roundy Road at Little Browns Creek, which would have a direct beneficial effect on overall watershed condition.

Table 4-7. List of Watersheds and Land Use Activities Analyzed.

7th Field HUC	6th Field HUC Watershed Name	Drainage Area (acres)	Activities Analyzed
18010211060101 & 02	Rush Creek	14,388	Mining, roads, and timber
18010211060401	E Weaver Creek	8,892	Mining, roads, timber, and urban
18010211060403	L Browns Creek	4,989	Mining, roads, timber, and urban

Actions Considered

Alternative 1: Presently, streams draining the Browns project area are in a degraded condition and are not supporting aquatic beneficial uses (see Hydrologist Report in Appendix G). The magnitude, frequency, timing, and duration of peak flood flows and sediment yield are negatively affecting the fish habitat and water quality of Rush, Little Browns, and Weaver Subwatersheds (EPA, 2001). Past and present land use activities have altered the balance between stream discharge and sediment yield. As a result, the baseline watershed condition is degraded and effects are major locally, offsite, and are long-term (See Appendix G).

With no action, the analysis area would remain in a degraded condition. Past watershed disturbances caused by mining, roads, and timber harvest would continue to have direct and indirect effects on water quantity and quality. Direct effects include channel destabilization from placer mining and roads and sediment delivery from controllable sediment discharge sources (e.g. road runoff and erosion). Indirect effects include upland sediment delivery from management caused landslides, and runoff diversion from roads and historic mine ditches.

Alternative 3: This alternative, as described in Chapter 2, includes BMPs and mitigation measures designed to prevent project activities from directly and indirectly affecting the water quality and beneficial uses of streams draining the analysis area (see Appendix B). This analysis evaluates the direct and indirect effects of the proposed timber harvest activities, temporary road construction, fuel treatments, road drainage improvements, and post-project road decommissioning on magnitude, frequency, timing, and duration of peak flood flows and sediment yield.

As designed, Alternative 3 would not cause any long-term direct or indirect effects that would further exacerbate runoff and sediment delivery. During project implementation, however, the

probability of sediment delivery increases where temporary road construction, road decommissioning, and timber harvest activities dissect stream channels. Short-term sediment delivery is probable at stream road or skid trail crossings. The potential effects would be localized (i.e., less than ¼-mile downstream), minor, and last for two to three years.

Alternative 4: This alternative, as described in Chapter 2, also includes BMPs and mitigation measures designed to prevent project activities from directly and indirectly affecting the water quality and beneficial uses of streams draining the analysis area (Appendix B). For Alternative 4, some harvest activities proposed in Alternative 3 would not be implemented. As a result, this alternative is less likely to affect water quantity or quality in Little Browns Subwatershed. Compared to Alternative 3, this alternative would result in less ground disturbance in Little Browns Creek.

As designed, Alternative 4 would not cause any long-term direct or indirect effects that would further exacerbate runoff and sediment yield. During project implementation, however, the probability of sediment delivery increases where road decommissioning and timber harvest activities dissect stream channels. Short-term sediment delivery is probable at stream road or skid trail crossings. The potential effects would be localized (i.e., less than ¼-mile downstream), minor, and last for two to three years.

Wildlife – Direct and Indirect Effects

A Biological Assessment (Wildlife BA, April 5, 2005) and Biological Evaluation (Wildlife BE, August 2005) have been completed for this project. The findings identified in these reports include the expected effects to federally listed species and Forest Service Sensitive species respectively. The effects are examined relative to LRMP objectives, species recovery, and habitat management strategies. Based upon field reviews and habitat mapping, it is anticipated that only late-successional habitat would be measurably affected by either of the action alternatives. Potential effects to the old-growth subset of late-successional habitat is the main wildlife concern.

"Provide for Retention of Old-Growth Fragments Where Little Remains" Standard and Guideline (15% S&G)

Both Alternative 3 and 4 fully meet the 15% S&G as described in the Northwest Forest Plan ROD and the Shasta-Trinity LRMP. Early in the planning process, the Browns Interdisciplinary Team (IDT) recognized that consistency with this S&G was not a concern due to the amount of late-successional habitat currently within the Weaverville Watershed (Table 4-8). The IDT emphasized the importance of retaining old-growth habitat (see the first paragraph of the S&G; LRMP pages 4-62 and 4-63), although the amount of late-successional forest in the Weaverville Watershed was not a concern. Of the 20,533 acres of federal forest land in the watershed, approximately 15,418 acres (75 percent) are currently late-successional forest. The Browns Project would have to remove or downgrade more than 12,000 acres of late-successional forest to approach the 15% threshold. Alternatives 3 and 4 would affect about 790 and 568 acres of late-successional forest respectively. Potential effects to late-successional habitat includes areas that will be 'downgraded' and 'degraded' (see definitions below), but would still qualify as late-successional forest after treatment. Alternatives 3 and 4 would remove

about 27 and 23 acres (less than 0.2 percent) of the existing late-successional forest respectively in the watershed due to regeneration harvest (on pre-designated landings) and temporary road construction. Therefore, both action alternatives would fully meet the 15% S&G, maintaining late-successional forest at well over the 15 percent threshold in the Weaverville Watershed.

The IDT concluded that the proposed limited removal (two acres) of existing old-growth with Alternative 3 was prudent because doing so would reduce the risk of large-scale catastrophic fire that would likely affect existing and developing old-growth habitat. The proposed temporary roads were located to access areas of dense conifers needing thinning. Harvest in pre-designated landings were identified to give cable access to thinning areas and to handle the large amount of woody material (fuel) produced by whole-tree yarding of large numbers of relatively small diameter trees. The proposed prescriptions with Alternative 3, and to a lesser extent Alternative 4 since fewer acres would be treated, would result in a long-term increase in stands with the characteristics of old-growth habitat that provide high quality habitat to species such as the MIS Northern spotted owl habitat (both acres of old-growth and total owl habitat) compared with no action (Figure 4-1).

Table 4-8. 15% S&G current late-successional habitat conditions within the Weaverville 5th Field watershed are shown for the no action Alternative 1. The post treatment acres of late-successional habitat are shown for all levels of intensity in the second column, even though areas downgraded or degraded due to thinning would still qualify as late-successional habitat. The last column displays the effects for just areas where habitat would be removed due to landings or roads. The percentages of the 20,533 acres of federal forest land in the watershed federal forest land that would remain are in (parentheses) and are carried out to two decimal places to detect the minor changes.

Alternative	Effects Intensity	
	"removed", "downgraded" and "degraded"	**"removed"**
Alt. 1 Existing Conditions	15,418 acres (75.08 percent)	15,418 acres (75.08 percent)
Alt. 3 Post-project	14,625 acres (71.23 percent)	15,319 acres (74.96 percent)
Alt. 4 Post-project	14,850 acres (72.32 percent)	15,395 acres (74.98 percent)

Effects to Old-Growth (and other Late-Successional) Habitat Using the Northern Spotted Owl as the Management Indicator Species (MIS)

The descriptions of the effects analysis in this EIS use the federally-listed (threatened) Northern spotted owl as the late-successional forest habitat Management Indicator Species (See Appendix H for the Wildlife MIS analysis). Thus, existing habitat conditions and anticipated effects to habitat related to the spotted owl "indicate" similar conditions and effects for other species associated with LSOG habitat (called "late seral assemblage" in the LRMP) such as the Forest Service Sensitive Pacific fisher, American marten, and northern goshawk as well as a number of migratory bird species (see Appendix G of the LRMP EIS).

Alternatives 3 and 4 would affect approximately 545 and 457 acres of existing NRF habitat respectively. Effects to existing NRF habitat are analyzed using four criteria and at three categories of

intensity (described below). Table 4-8 presents the amount (acres) of each habitat type that would be affected, segregated by relative owl habitat quality, effects intensity and the three spatial scales: 1) the owl Action Area, and 2) the home range and 3) territory (core area) of the one known owl activity center (state ID# TR150) that would experience effects to existing habitat.

Direct Short-Term Effects to Owl Nesting/Roosting and Foraging Habitat (<30 years)

- Reduction in overall canopy closure: This is the major short-term impact of the action alternatives. A moderate to dense canopy closure moderates environmental extremes (e.g., temperature, rain/snow fall, etc.). This effect is related to thinning, regeneration (pre-designated landings), and road construction.
- Simplification in vertical structure: Multiple canopy levels provided by understory conifers and hardwoods provide lower (cooler) roost sites in the hot summer months and provide perch sites for foraging and eating. This effect is related to thinning, regeneration, and temporary road construction. The proposed thinning and riparian prescriptions target viable understory hardwoods for retention.
- Reduction in smaller diameter (<24" dbh) snags and logs: Snags can provide owl nest sites and both snags and logs provide habitat for owl prey species. Few large (>24"dbh) snags or logs would be removed by the proposed fuels treatments. Long-term experience suggests that spotted owls would not likely use snags less than 24"dbh for nest sites.
- Reduction in potential nesting opportunities: Larger decadent (broken-topped) conifers and snags provide typical nest sites for spotted owls. This effect is related to regeneration, and temporary road construction (i.e., removal, see effects intensity below) within existing NR habitat. The proposed thinning and riparian prescriptions target larger conifers and snags for retention.

Effects Intensity

Removed indicates the habitat would no longer function as late-successional habitat at any level resulting from *regeneration prescriptions* and *temporary road construction*. Long-term experience with similar treatments indicates that regenerated areas should recover to connectivity habitat conditions in roughly 35 to 40 years after the first commercial thinning. Foraging habitat and nesting/roosting habitat conditions should develop in roughly 80 years and 100+ years respectively.

Alternative 3 (removed):

- 2 acres high quality nesting/roosting habitat (4G)
- 15 acres moderate quality nesting/roosting habitat (3G)
- 10 acres foraging habitat (3N)

Alternative 4 (removed):

- zero acres high quality nesting/roosting habitat (4G)

- 9 acres moderate quality nesting/roosting habitat (3G)
- 9 acres foraging habitat (3N)

Downgraded indicates a temporary reduction (about 30 years) owl nesting/roosting habitat down to foraging habitat resulting from *thinning prescriptions* within existing moderate quality nesting/roosting habitat (3G). There would be a reduction in overall canopy closure from the existing 70-90% to approximately 40-60% and a reduction in smaller diameter (≤19" diameter at breast height) recruitment snags and logs (live trees that will provide for snags and logs into the future). The retention of large predominant (legacy) conifers, larger snags (>19") and viable hardwoods would maintain snags and decadent conifers large enough to provide owl nest sites and contribute to vertical structure. Visual estimates based upon field reviews indicate that the LRMP S&G of 1.5 snags and 5 tons of course woody material (i.e., logs) would be met at a 40-acre average. Thinning within existing owl foraging habitat would maintain foraging habitat conditions.

- **Alternative 3 (downgraded):**
  zero acres high quality nesting/roosting habitat (4G)
  275 acres moderate quality nesting/roosting habitat (3G)
  zero acres foraging habitat (3N)

- **Alternative 4 (downgraded):**
  zero acres high quality nesting/roosting habitat (4G)
  210 acres moderate quality nesting/roosting habitat (3G)
  zero acres foraging habitat (3N)

Degraded indicates some habitat components (e.g., smaller snags, canopy closure ≥ 60%, and vertical structural complexity) may be somewhat reduced but the habitat would continue to function at the current level resulting from *thinning* within high quality NR (4G) and foraging habitat (3N) and *riparian reserve prescriptions* within NRF habitat. The retention of large predominant (legacy) conifers, larger snags (>19") and viable hardwoods would maintain snags and decadent conifers large enough to provide owl nest sites and contribute to vertical structure.

- **Alternative 3 (degraded):**
  59 acres high quality nesting/roosting habitat (4G)
  22 acres moderate quality nesting/roosting habitat (3G)
  162 acres foraging habitat (3N)

- **Alternative 4 (degraded):**
  52 acres high quality nesting/roosting habitat (4G)
  22 acres moderate quality nesting/roosting habitat (3G)
  155 acres foraging habitat (3N)

Indirect Long-Term (≥30 years) Effects to Owl NRF Habitat

The thinning (including riparian reserve) prescriptions within existing NRF habitat and other conifer stands not currently NRF would result in a net increase of forest stands with old-growth (nesting/roosting habitat) characteristics after about 30 years. For example, in approximately 30 years Alternative 3 would result in an increase of conifer habitat with old-growth characteristics to 1,271 acres from the existing 814 acres within the owl Action Area (Figure 4-1).

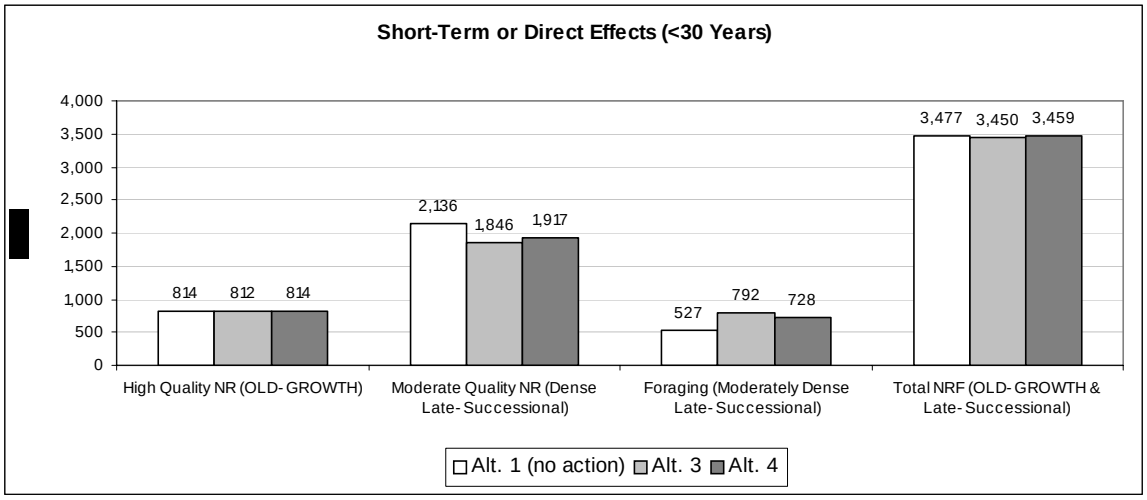
The proposed thinning within the overcrowded conifer stands would improve the health of these forest areas by making more water, nutrients, and sunlight and growing space available to the remaining trees (conifers as well as hardwoods). In addition, the smaller trees that act as fuel ladders likely to contribute to crown fires (and the loss of NRF habitat) would be removed. Long-term experience with thinning conifer stands indicates that within about 30 years the thinned (degraded) old-growth would have recovered and thinned late-successional stands (including stands that are currently below owl foraging habitat conditions) would have redeveloped a moderate to dense canopy closure. The conifers would have developed larger, fuller crowns with larger lateral branches. These trees would ultimately provide recruitment for larger snags and logs. Small diameter (<19” dbh) snags and logs would be rare because of the past removal of smaller diameter recruitment trees. Understory hardwoods would have persisted in the stands adding to vertical structural complexity. Most of the preexisting large snags and logs would still be present.

Table 4-9. Browns Project Alternatives 3 and 4 effects (acres) to spotted owl nesting/roosting (NR) and foraging (F) habitat within the *spotted owl "Action Area"* and within the *home range* and the *territory or "core area"* of the one known owl activity center (state ID# TR150) affected. The percent of existing available habitat within these areas that would be affected is in shaded cells.

Spotted Owl "Action Area"												
Effects Intensity to Habitat	***Old-Growth* (high quality NR habitat)**			**Dense Late-Successional (moderate quality NR habitat)**			**Mod. Dense Late-Successional (foraging habitat)**			**Total NRF Habitat**		
	Existing Available Habitat	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**
Removed	814	2	0	2,136	15	9	527	10	9	3,477	27	18
		O.2%	0%		0.7%	0.4%		1.9%	1.7%		0.8%	0.5%
Downgraded		0	0		275	210		0	0		275	210
		0%	0%		12.9%	9.8%		0%	0%		7.9%	6.0%
Degraded		59	52		22	22		162	155		243	229
		7.2%	6.4%		1.0%	1.0%		30.7%	29.4%		7.0%	6.6%
TOTAL		61	52		312	232		172	164		545	457
		7.5%	6.4%		14.6%	10.9%		32.6%	31.1%		15.7%	13.1%
Spotted Owl Home Range												
Removed	245	1	0	1,183	12	9	288	10	9	1,716	23	18
		O.4%	0%		1.0%	0.8%		3.5%	3.1%		1.3%	1.0%
Downgraded		0	0		222	180		0	0		222	180
		0%	0%		18.8%	15.2%		0%	0%		12.9%	10.5%
Degraded		26	52		18	18		162	154		206	198
		10.6%	6.3%		1.5%	1.5%		56.3%	53.5%		12.0%	11.5%
TOTAL		27	52		252	207		172	163		451	396
		11.0%	6.3%		21.3%	17.5%		59.7%	56.6%		26.3%	23.1%
Spotted Owl Territory or "Core Area"												
Removed	138	0	0	315	3	2	18	0	0	471	3	2
		0%	0%		1.0%	0.6%		0%	0%		0.6%	0.4%
Downgraded		0	0		88	81		0	0		88	81
		0%	0%		27.9%	25.7%		0%	0%		18.6%	17.2%
Degraded		10	10		7	7		5	5		22	22
		7.2%	7.2%		2.2%	2.2%		27.8%	27.8%		4.7%	4.7%

Spotted Owl "Action Area"												
Effects Intensity to Habitat	***Old-Growth* (high quality NR habitat)**			**Dense Late-Successional (moderate quality NR habitat)**			**Mod. Dense Late-Successional (foraging habitat)**			**Total NRF Habitat**		
	Existing Available Habitat	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**	**Existing Available Habitat**	**Alt. 3**	**Alt. 4**
TOTAL		10	10		98	90		5	5		113	105
		7.2%	7.2%		31.1%	28.6%		27.8%	27.8%		24.0%	22.3%

Figure 4-1 displays the short-term (30 years) and long-term (≥30 years) effects to spotted owl nesting/roosting and foraging habitat within the spotted owl action area. High quality nesting/ roosting habitat (old-growth), moderate quality nesting/roosting habitat (relatively dense mature late-successional) and foraging habitat (moderately dense mature late-successional) are displayed separately. **Alternatives 3** and **4** would result in a direct short-term loss of nesting/roosting habitat, a direct short-term gain in foraging habitat and an indirect long-term net increase in total nesting/roosting/foraging habitat acres along with an improvement in overall habitat quality. No changes to habitat quality are expected with **Alternative 1** (no action), thus this represents both the existing conditions and long-term conditions without the proposed stand treatments. Figure 1 in Appendix D (the Wildlife Biological Assessment) shows similar effects to the territory or "core area" of the one known owl activity center in the Action Area.



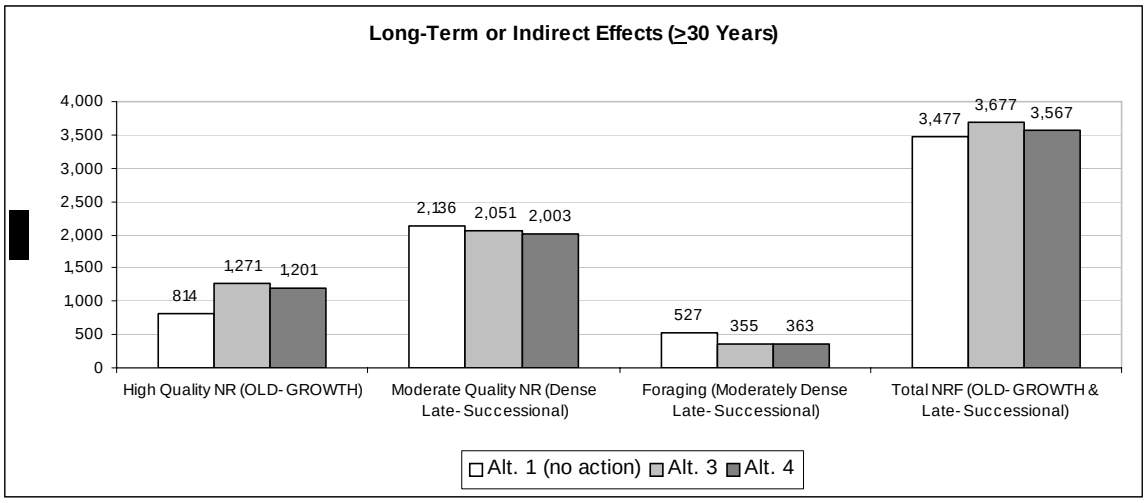


Figure 4-1. Short and Long-term Effects to Spotted Owl Nesting/Roosting and Foraging Habitat within the Spotted Owl Action Area.

Other TE&S Species

The Biological Assessment (Wildlife BA) and Biological Evaluation (Wildlife BE) completed for this project present the likely effects of **Alternative 3** to federally-listed and Forest Service Sensitive species respectively. Table 4-9a summarizes the findings identified in the Wildlife BA and BE that would also hold true for **Alternative 4**.

Actions proposed in **Alternatives 3** and **4** do not lie within designated critical habitat for any federally-listed species or areas set aside for species associated with late-successional or old-growth habitat (Late-Successional Reserves).

Table 4-9a. A Synopsis of the Determinations and Effects to TE&S Species from the BA and BE.

Determination from the BA/BE	Federally Listed Threatened or Endangered (TE) or Forest Service Sensitive (FS) Species.	Comments
No Effect.	**TE** - Shasta crayfish, bald eagle, marbled murrelet, valley elderberry longhorn beetle, vernal pool fairy shrimp, and California red-legged frog. **FS** - California wolverine, pallid bat, Western red bat, Townsend's big-eared bat, peregrine falcon, willow flycatcher, Western pond turtle, Cascade frog, foothill yellow-legged frog, Southern torrent salamander, California floater, topaz juga, montane peaclam, Shasta sideband snail, Wintu sideband snail, Shasta chaparral snail, Tehama chaparral snail, Shasta hesperian snail, nugget pebble snail	The project area is either outside the known or expected range, the species is not known or expected to occur in the project area, or suitable habitat conditions do not occur or would not be affected in or near the project area. Note that this applies to wildlife Survey and Manage species also.
May affect and likely to adversely affect.	**TE** - **northern spotted owl**	There would be a short-term (30 years) reduction in habitat quality and a long-term increase in habitat quality. Actions are consistent with the Draft Recovery Plan.
May affect individuals but would not cause a trend towards federal listing or a loss of viability.	**FS** -*Pacific fisher, American marten, northern goshawk **FS** - Pressley hesperian snail	*There would be a short-term (30 years) net reduction in habitat quality and a long-term net increase in habitat quality. Actions are consistent with the LRMP habitat management strategy for these species

Direct Effects on TE&S Species (physical harm, mortality or disturbance of breeding activity)

Alternative 1 would result in no direct effects to TE&S species.

Alternatives 3 and **4** include a limited operating period for the Northern spotted owl and would avoid physical harm, mortality, or disturbance of breeding activity for spotted owls and the fisher, marten, and goshawk.

Indirect Effects on TE&S Species

Alternative 1 would result in habitat conditions for TE&S species remaining largely unchanged over the next 30 years. Increasing fuel loading would increase the probability of loosing existing and developing old-growth habitat to wildfire.

Alternatives 3 and **4** actions are consistent with the LRMP management strategies and S&Gs associated with TE&S species and their habitats. In 35 to 40 years, regenerated stands would function as at least marginal connectivity habitat (see Wildlife BA for definition) for species associated with late successional/old-growth habitat. In roughly 80 years, the habitat would function as at least moderate quality late successional/old-growth habitat. In about 30 years within thinning units, habitat conditions for species associated with late successional/old-growth habitat would be improved. The habitat alteration for **Alternatives 3** and **4** may temporarily displace two pairs of spotted owls outside the breeding season (Wildlife BA, pages 11-13, 19). The thinning and overall reduction in fuel loading would reduce the probability of loosing existing and developing old-growth habitat to wildfire.

The U.S. Fish and Wildlife Service determined that **Alternative 3** is in accordance with the Endangered Species Act of 1973, is not likely to jeopardize the continued existence of the Northern spotted owl, is not anticipated to compromise the conservation and recovery strategy established by the NWFP or contribute to an appreciable reduction in the likelihood of survival and recovery of the Northern spotted owl in the wild by reducing the owl numbers, reproduction, or distribution (U.S. Fish and Wildlife Service Formal Consultation for the Browns Project; June 7, 2005, file 1-12-2005-F-12). **Alternative 4** would have lesser impact to the owl and its habitat.

Cumulative Effects Relative to Resources Affected

This cumulative effects analysis has been completed in accordance with the CEQ memorandum of June 24, 2005, regarding “guidance on the consideration of past actions in cumulative effects analysis.” In addition, this analysis incorporates guidance identified in the Region 5 white paper titled “Analysis of Cumulative Effects in NEPA,” dated August 4, 2005.

Actions Considered (Table 4-10)

Table 4-10. Summary of Other Management Actions Considered in the Evaluation of Cumulative Effects within the Browns Project Area.

Subwatershed Name	Past Projects (prior to January 2006)	Present Project (Estimated implementation of the Alternatives considered - from 2006 to 2009)	Foreseeable Projects (after January 2006)	Resource Affected									
				Botany	Economic Effects	Fire and Fuels	Fisheries	Forest Productivity	Heritage Resources	Land Stability	Soils	Water Quality	Wildlife
Rush Creek (14,388 acres)			FS Road Decommissioning (implemented according to March 29, 2007 Browns Decommissioning ROD) = 2.5 miles	X	X		X				X	X	X
	Precommercial Thinning-175 acres (2004): Baker 1 = 11 ac.; Baker 2 = 41 ac.; Baxter = 121 ac.; East Weaver = 2 ac.		Precommercial Thinning: Baxter = 17 ac. (2005).			X	X	X				X	
			PTEIR Projects (185 acres in 2006, 190 ac. in 2007)	X			X					X	
	- Roadside Fuels (131 ac. in 2004)		- Bear FMZ (74 ac. in 2006)		X	X	X					X	
	FS Timber Harvest (379 ac. from 1986 to 1997) Patch Clearcutting: Baker 2 units = 29 ac. (1991-1992); Baxter units = 111 ac. (1986-1989); Browns units = 14 ac. (1989); East Weaver units = 2 ac. (1987); Rush units = 10 ac. (1990). Overstory Removal Cut: Baker 2 units = 180 ac. (1991-1992). Stand Clearcutting: Baker 1 units = 11 ac. (1991); Baker 2 units = 8 ac (1991). Sanitation Cut: Baker = 11 ac. (1991). Natural Changes (Slide): Baxter = 3 ac. (1997).			X	X		X	X			X	X	X
		Alt. 3 harvests 126 acres. Alt. 4 harvests 94 acres.	- Bear & Rush Creek Comm Fuels (73 ac. in 2006)	X	X	X	X	X			X	X	X
			- Plantation Prune- Baxter units (6 ac. 2007); Browns units (23 ac. 2007).			X							
	Private Timber Harvest (5901 ac. from 1940 to 2005)		Private Timber Harvest (205 ac. in 2007)	X			X					X	X
	FS Road Construction (53 mi. from 1950 to 2005)	Alt. 3 builds 0.25 mi. of road.	Private Road Construction (3 mi. in 2007)				X	X				X	X

Subwatershed Name	Past Projects (prior to January 2006)	Present Project (Estimated implementation of the Alternatives considered - from 2006 to 2009)	Foreseeable Projects (after January 2006)	Resource Affected									
				Botany	Economic Effects	Fire and Fuels	Fisheries	Forest Productivity	Heritage Resources	Land Stability	Soils	Water Quality	Wildlife
	Private Road Construction (43 mi. from 1940 to 2005)		Road decom (2 mi. following Alt. implementation)				X					X	X
	Wildland Fire (year)		Highway 299 Bypass (2 mi. in 2010)				X					X	X
	- Rush Fire (75 ac. in 1996)						X					X	X
	- Brown Fire (428 ac. in 1994)						X					X	X
	Domestic Water Use		Domestic Water Use				X					X	
	Historic placer and strip mining			X			X					X	
E Weaver Creek (8,892 acres)			FS Road Decommissioning (implemented according to March 29, 2007 Browns Decommissioning ROD) = 17 miles	X	X		X				X	X	X
	Precommercial Thinning- 157 acres: East Weaver units = 157 ac. (1999-2004).		Precommercial Thinning - 0 acres			X	X	X				X	
			PTEIR Projects (63 acres in 2006, 44 ac. in 2007)	X			X					X	
	- Musser Hill Fuelbreak (313 ac. in 2004)		- 5 cent Gulch Wildlife Burn (130 ac. in 2006)		X	X	X					X	
	- Roadside Fuels (17 ac. in 2004)		- Croften Gulch Wildlife Burn (78 ac. In 2006)		X	X	X					X	
	- Musser Hill 46 ac. in 2005)		- 5 Cent Gulch Mastication (334 ac. in 2006)		X	X	X					X	
	FS Timber Harvest - 175 ac. Patch Clearcutting: East Weaver units = 158 ac. (1987-1989). Slide: East Weaver unit = 1 ac. (1998). Musser Hill Brush Clearing = 16 ac. (1973).			X	X		X	X			X	X	X
		Alt. 3 harvests 19 acres. Alt 4 harvests 18 acres.		X	X	X	X	X			X	X	X

Subwatershed Name	Past Projects (prior to January 2006)	Present Project (Estimated implementation of the Alternatives considered - from 2006 to 2009)	Foreseeable Projects (after January 2006)	Resource Affected									
				Botany	Economic Effects	Fire and Fuels	Fisheries	Forest Productivity	Heritage Resources	Land Stability	Soils	Water Quality	Wildlife
	Private Timber Harvest (1747 ac. from 1940 to 2005)			X			X					X	
			Plantation Prune, E. Weaver units (60 ac. 2007)			X							
	FS Road Construction (31 mi. from 1950 to 2005)		Road decom (9 mi. following Alt. implementation)				X	X				X	X
	Private Road Construction (19 mi. from 1940 to 2005)		Highway 299 Bypass (2 mi. in 2010)				X					X	X
	Wildland Fire (4 ac. in 1931)		PTEIR new road construction (2 mi. in 2007)				X					X	
	Domestic Water Use		Domestic Water Use				X					X	
			Musser Hill Wildlife Burn (282 ac. in 2006)			X	X					X	
	Historic placer and strip mining		East Branch fish passage	X			X				X	X	
L Browns Creek (4,989 acres)	Precommercial Thinning- 63 acres: Browns = 27 ac. (2004); East Weaver = 36 ac. (1999-2004).		Precommercial Thinning - 26 acres: Browns units = 26 ac (1997-2006).			X	X	X				X	
			PTEIR Projects (354 acres in 2006, 328 ac. in 2007)				X					X	
	- China Gulch Fuelbreak (21 ac. in 2001)		- Bear FMZ (62 ac. in 2006)		X	X	X					X	
	- Musser Hill Fuelbreak (291 ac. in 2004)		- Finley FMZ (62 ac. in 2006)		X	X	X					X	
	- Musser Hill (71 ac. in 2005)		- Lil Browns FMZ (151 ac. in 2006)		X	X	X					X	
	- Roadside Fuels - (76 ac. In 2004)				X	X	X					X	
			- Plantation Prune- Browns units (75 ac. 2007)			X							

Subwatershed Name	Past Projects (prior to January 2006)	Present Project (Estimated implementation of the Alternatives considered - from 2006 to 2009)	Foreseeable Projects (after January 2006)	Resource Affected									
				Botany	Economic Effects	Fire and Fuels	Fisheries	Forest Productivity	Heritage Resources	Land Stability	Soils	Water Quality	Wildlife
	FS Timber Harvest (175.5 ac. from 1973 to 1989) Patch Clearcutting: East Weaver units = 36 ac. (1987-1989); Browns units = 126 ac. (1987-1989). Bug Fire Thin: 5 ac. (1984). Square Fire Thin: 8 ac. (1985). Musser Hill Brush Clearing: 16 ac. (1973).			X	X		X	X			X	X	X
		Alt. 3 harvests 652 acres. Alt 4 harvests 456 acres.		X	X	X	X	X			X	X	X
	Private Timber Harvest (2578 ac. from 1940 to 2005)		Private Timber Harvest (130 ac. in 2007)	X			X					X	X
	FS Road Construction (37 mi. from 1950 to 2005)	Alt. 3 builds 4.1 mi. of road.	Private Road Construction (5 mi. in 2007)				X	X				X	X
	Private Road Construction (14 mi. from 1940 to 2005)		Road decom (20 mi. following Alt. implementation)				X					X	X
	Browns Fire (9 ac. in 1994)												
			Domestic Water Use				X					X	
	Domestic Water Use		Highway 299 Bypass (3 mi. in 2010)				X					X	
	Historic placer and strip mining			X			X					X	
			PTEIR new road construction (2 mi. in 2007)				X					X	
			Roundy Road Fish Passage (1 ac. in 2008)				X					X	

Notes: Past Forest Service road construction includes Highways.
Private road construction includes urban and industrial timber lands.
Foreseeable highway improvement distances are estimates.
Present and foreseeable private road construction distances are estimates.
Road construction distances related to PTEIR projects are estimates.

Each of the resources affected consider the past, present, and foreseeable projects listed on Table 4-10 as part of cumulative effects analysis. Where the geographic area considered in individual cumulative effects analyses varies from the subwatersheds listed on Table 4-10, those analyses identify the area of consideration relevant to the resource affected.

Air Quality - Cumulative Effects

Alternatives 3 and **4** would produce smoke, which adds to the smoke likely to occur from private landowners within the Weaver Basin (the valley in which the town of Weaverville is located). This is foreseeable since burning is a common practice in Trinity County. However, it is unknown as to when or how much landowners will burn. Smoke from the proposed project is expected to remain in the area for about one to two days each time burning occurs. There would be approximately ten days of burning over an estimated two month period. Permissive burn days would be determined each day by the North Coast Unified Air Quality Management District (Eureka, California); therefore, smoke emissions from project activities would not exceed acceptable levels[30].

Botany – Cumulative Effects

Effects Analysis

To analyze the cumulative effect(s) on Sensitive plants and fungi, the unit of measure used to quantify the effects is acres. This is the appropriate unit of measure because plant and fungi populations are typically described by the geographic area they occupy. The direct and indirect effects of implementing the alternatives considered have been disclosed earlier in this chapter and in the Plant BE. This cumulative effects analysis quantifies the Sensitive fungi effects as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered). Since **Alternative 1** has no direct or indirect effects, there are no cumulative effects resulting from this alternative.

Sensitive Plants

Because there are no populations of any Sensitive plant species within any treatment units, there will be no direct or indirect impacts. In the absence of direct or indirect impacts, there will be no cumulative impacts to Brownie lady's-slipper, mountain lady's-slipper, copper moss, or English Peak greenbriar.

Bounding the Effects

Similar spatial and temporal boundaries were used for branched collybia, *Cudonia monticola*, olive phaeocollybia, and orange-peel fungus because they all have similar growth patterns and habitat characteristics.

[30] Acceptable levels (determined by the North Coast Unified Air Quality Management District) fluctuate day to day, which is determined by atmospheric conditions, and local complaints (Green 2006).

Spatial Boundary

It is difficult to determine the most important factor that influences healthy fungi populations. Influences include a diverse underground fungal community that comes with stand age, species aboveground diversity to provide multiple host species and organic matter inputs, and adequate moisture to grow the plants necessary to create the first two factors listed. The most reasonable spatial boundary for analysis is the 5th field watershed that contains the project area (Weaverville Watershed). The watershed boundary determines the scope of subsurface hydrology, which is one driving factor in plant community composition. The geographic extent of the Weaverville Watershed is approximately 53,647 acres.

Temporal Boundary

All activities occurring from approximately 80 years in the past to approximately 80 years into the future are considered to contribute to cumulative impacts to branched collybia, *Cudonia monticola*, olive phaeocollybia, and orange-peel fungus. Eighty years is about the time necessary for mature or late-seral forest communities to develop habitat characteristics that are minimally suitable for the 4 fungi species to survive in healthy populations. Although stand development rates will vary depending on local conditions, the Northwest Forest Plan (USDA and USDI, 1994) identifies old-growth forest conditions occurring at a minimum of 80 years old.

Sensitive Fungi

There are about 489 acres of conifer plantations present within the Weaverville watershed, 90% of which are within two miles of the Browns project area. Plantations primarily, if not entirely, fall within conifer habitat that would have been suitable for Sensitive fungi species prior to historic disturbance. These plantations were established over 7 timber sales that took place in the early 1980's prior to NEPA analysis for effects to Sensitive plants or fungi.

Timber harvest occurred on approximately 18,550 acres within the Watershed in the past 80 years, but the actual acres of tractor harvest are unknown. Assuming 40% of harvest acres occurred on slopes less than 35%, a conservative estimate of acres disturbed by tractors would be 7419. Within those 7419 acres, disruption of organic matter and fungal mass layers would have occurred throughout.

The entire project area was impacted by mining in the mid-19th century, with greatest emphasis on riparian areas that contain the most suitable habitat for Sensitive fungi. Although this activity extends beyond the temporal cumulative impacts boundary, many of these areas have still not recovered to pre-mining habitat characteristics. 2,733 acres of suitable habitat for Sensitive fungi (late-seral characteristics) are present at the current time. The total amount of habitat present prior to mining is unknown.

The Browns RAC Decision Memo, signed April of 2004, will treat roadside fuels on 787 acres along Musser Hill Road. These treatments will occur entirely along roadsides to reduce fuel hazard. These areas are already highly disturbed with compaction and established annual grasses, yellow

starthistle, and Klamath weed. The activities occurring under that project will add no additional impacts to those occurring under the Browns Project.

Discussion

Smaller-diameter, mid-seral plant communities occupy the majority of forested stands receiving stand density reduction treatments. Assuming suitable habitat for Sensitive fungi exists in forested stands with mature to late-seral conifer habitat, there are currently 2733 acres of suitable habitat within the Weaverville Watershed. Historically, all areas that received timber harvest treatments may have had suitable habitat for fungi, but the exact amount is unknown. Between 55 and 63 acres (less than 3%) of mature to late-seral habitat, depending on the action alternative, will be treated with timber stand density treatments.

Thinning treatments in overstocked stands would retain all pre-dominant and dominant trees to continue to act as suitable host trees for olive phaeocollybia. An average of 4-6 logs of the largest available diameter will be maintained to meet wildlife habitat standards; these will provide an inoculum source of Sensitive and common fungi species after treatments. At least 60% canopy cover will be maintained in riparian reserves where the habitat conditions are best for fungi and the greatest species diversity exists. A 60% canopy is relatively shady and will provide suitable shade for fungi maintenance and regeneration.

Minimization of size and configuration of regeneration cuts (at pre-designated landings) to maximize edge will reduce impacts to fungi. Restriction of these cuts to two acres or less helps to maintain diversity in other areas, while still allowing for a space large enough to accommodate a whole-tree yarder for thinning activities. Spreading whole-tree landings throughout the project area will help with reintroduction of residual fungi after treatments. Machine piling on these landings will result in soil compaction and disturbance, and potentially greater impacts to soil fungi. However openings will be distributed, not concentrated, and will occupy no more than 25 acres, or less than 1%, of the total project acreage. **Alternatives 3** and **4** would create 2-acre landings on 37 and 25 acres respectively, roughly 5% of total project acres. All regeneration cuts will be surrounded by forest that can be expected to provide a reinoculation source for maintenance of fungal diversity, including the four Sensitive fungi species if they are in the vicinity currently. Landings would be ripped after completion of treatments to reduce compaction, allowing fungi habitat to recover at a faster pace.

Tractors will cause heavy soil disturbance on 26 acres (**Alt. 3**) or 21 acres (**Alt. 4**) out of a total of 744 acres (**Alt. 3**) or 543 acres (**Alt. 4**). This will result in heavy soil disturbance on less than 1% of the potential suitable habitat for Sensitive fungi (2733 acres) in the Weaverville Watershed under either alternative. The proposed action in combination with past and planned disturbance on 7419 acres will result in a total of up to 7445 acres of disturbance. There is uncertainty as to how many acres of fungi habitat were present prior to historic timber sales. The proposed action would contribute soil disturbance from tractors on no more than 1% of the current habitat for Sensitive

fungi. This is a small amount of disturbance relative to the available habitat in the Watershed and relative to other past projects.

Temporary road construction and decommissioning impacts would occur on less than 14 acres under **Alternative 3** and less than 6 acres under **Alternative 4**. Assuming all temporary road construction would occur within suitable habitat for Sensitive fungi, these activities would heavily impact less than 1% of the suitable habitat in the Weaverville Watershed. This would be a negligible amount of disturbance in addition to all other impacts.

Several additional measures have been incorporated into the project design to minimize impacts to natural resources within the project area. All of these will reduce impacts to and benefit the four Sensitive fungi species.

- Soil productivity standards described in Forest Service Handbook 2509.18 (2.2.1 Soil Productivity) require maintenance of 50% fine organic matter cover, preferably undisturbed and where capability exists, and at least 5 well distributed logs per acre in a range of decomposition classes. Soil porosity should not be reduced more than 10% of natural conditions. Organic matter will be maintained in amounts sufficient to prevent significant sort or long-term nutrient cycle deficits.
- The Shasta-Trinity National Forest Land and Resource Management Plan Appendix G lists minimum requirements for down and woody material left on site after treatments to be no less than 5 tons per acre for most target wildlife species.
- Aquatic Conservation Strategy Objective #8 requires maintenance and restoration of species composition and structural diversity of plant communities in riparian areas and wetlands to provide several hydrologic functions including nutrient filtering, limiting surface erosion, and sustaining physical complexity and stability. Objective #9 requires maintaining and restoring habitat to support well-distributed populations of native plant, invertebrate and riparian-dependent species. Both objectives work to minimize disturbance and disruption of belowground fungal networks in riparian areas where fungi are most likely to grow on the Shasta-Trinity National Forest.

The Browns Project lies within the Weaverville Watershed, which contains a portion of the Trinity Alps Wilderness. The Wilderness contains abundant suitable habitat for all three Sensitive fungi species. Habitat is relatively undisturbed except for historic mining actions that occurred in most drainages throughout the Wilderness. Wildfires have occurred within the Wilderness also. Wildfire can be considered an integral part of fungi ecology and absence of wildfire has probably had greater impacts on fungi than all historic wildfires. Abundant suitable habitat for the four Sensitive fungi species is provided in the Trinity Alps Wilderness and loss of viability of branched collybia, *Cudonia monticola*, olive phaeocollybia, and orange-peel fungus on the Shasta-Trinity National Forest is not threatened by the proposed project.

Regardless of the numerical differences, none of the alternatives will have significant adverse impacts on Sensitive fungi. Low-intensity timber and fuel treatments will be implemented, such as

hand thinning, whole-tree harvesting, and cable yarding. Machine piling will occur on less than 1% of total project acres (pre-designated landings). These landings will support whole-tree yarding in commercial thinning units and will minimize the area receiving more intensive impacts.

It is likely that implementation of the proposed action will contribute to some measurable increase in impacts generated by off-road vehicle use, but the exact amount or even the general amount of increases is unknown. Use of whole-tree harvesters and low-impact fuel reduction techniques will decrease impacts to the land throughout the project area. The proportion of suitable habitat being impacted by all treatment activities relative to the total amount of suitable habitat within the Watershed is very low. Impacts to Sensitive fungi from the proposed action are not expected to be great enough to threaten the viability of branched collybia, *Cudonia monticola*, olive phaeocollybia, or orange-peel fungus.

Noxious Weeds

Spatial Boundary

Defining a geographic boundary for noxious weeds is difficult because once weeds are established in an area they can change the successional pathways of the native plant community they replace. Unlike native plants, recovery of the original plant community after a period of time may not occur, especially in the absence of aggressive prevention or control treatments. An additional complication is that weeds are most often transported in on vehicles that can travel from long distances outside of the project area.

The Browns project area contains few residences and it is unlikely that travelers from outside of Trinity County will travel on roads through the project area. Outside of vehicle spread, most weeds move only short distances in dispersal. With those parameters, the spatial analysis boundary can be set at Musser Hill Road to the west, China Gulch Road to the east, the intersection of Rush Creek Road and Highway 3 to the north, and Highway 3 to the south.

Temporal Boundary

The temporal analysis boundary would be that timeframe in which soils would become stabilized once again after disturbance, and suitable habitat for noxious weed introduction would no longer be available. Past actions that have created suitable noxious weed habitat in the area would also be considered. Because past actions have differing degrees of disturbance and stabilization times, it would not be appropriate to define an exact timeframe. Past actions will be considered on a case-by-case basis to determine if they are appropriate for cumulative impacts analysis.

Past, Present, and Reasonably Foreseeable Future Actions

There are approximately 489 acres of conifer plantations present within the Weaverville Watershed, 90% of which are within 2 miles of the Browns project area. These plantations were established within 7 timber sales that took place in the early 1980's. Soil disturbance from harvesting activities

occurred during these timber sales. Little noxious weed management occurred prior to the mid-1990's, and it is likely that noxious weeds were imported into the project area.

The Browns RAC Decision memo, signed April of 2004, will treat roadside fuels on 787 acres along Musser Hill Road. These treatments will occur entirely along roadsides to reduce fuel hazard. Roadsides in these areas are already highly disturbed with compaction and established annual grasses, yellow starthistle, and Klamath weed. The activities occurring under that project will add no additional impacts to those occurring under the Browns Project.

Many roads in the project area, including the 9 miles of existing road that will be decommissioned, have contributed to local off-road vehicle (OHV) use. OHV's have been responsible for spreading weeds because they pick up seeds and plant pieces and deposit them in unoccupied areas. With regular OHV traffic, disturbed soil is not allowed to stabilize and there remains a perpetual source of suitable habitat for noxious weeds. Decommissioning under the proposed action may lead to a decrease in noxious weed spread.

Discussion

Less temporary road construction would occur under **Alternative 4** (2 miles less than **Alt. 3**). Each time the road is ripped or bladed, the road base becomes ideal suitable habitat for noxious weed introduction and spread until the road is occupied with vegetation or unless the road is surfaced or receives enough vehicle traffic that it cannot support weeds. **Alternative 4** would result in less creation of suitable habitat for weeds, but suitable habitat will be created under either alternative.

Soil disturbance will occur as a result of yarding, landing use, machine piling and pile burning, but heavy disturbance will occur only with tractor piling treatments on 26 acres (**Alt. 3**) or 21 acres (**Alt. 4**). A difference of 5 acres between the two alternatives is insignificant. All of these activities are occurring on a limited area, less than 5% of the total project acreage, minimizing soil disturbance to a low level. Excluding treatment activities within the area of the Canada thistle population will reduce or eliminate the chance of stimulating spread of that weed. Removing the tops of scotchbroom plants and excluding burning within the two populations will reduce or eliminate the chance of spreading that weed.

Equipment cleaning will avoid importation of new weeds from outside areas and seeding with native grasses will help to occupy habitat before weeds can become established. Reseeding with locally collected blue wild rye (*Elymus glaucus*) has proven successful in restoration efforts on decomposed granite in Trinity County in the Grass Valley Watershed (Trinity County Resource Conservation District, 1998). Similar results are expected here. Low amounts of disturbance in combination with mitigation measures described above will help to minimize the spread and/or establishment of weeds as a result of project implementation.

Contract Provision C6.36 [Equipment Cleaning 5/01] will be incorporated into the final sale contract as an additional mitigation to prevent the spread of invasive weeds. This provision requires the purchaser to insure his equipment is free of weed seeds or propagules prior to entering the project

area. A copy of the complete text of the contract provision can be obtained at the Weaverville Ranger Station.

Economic Effects – Cumulative Effects

Effects Analysis

To analyze the cumulative effect(s) on economics, the unit of measure used to quantify the effect is the net public benefit. This is the appropriate unit of measure because the net public benefit considers the overall value of outputs and benefits less the associated Forest Service inputs and costs, whether they can be quantitatively valued or not. The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of Chapter 4. This cumulative effects analysis quantifies the net public benefit effect(s) as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered).

Bounding the Effects

Geographic Boundary

The area most affected by the project is the Weaverville area of Trinity County since the value of timber products is expected to benefit the County receipts and local employment. In addition the Weaverville community would benefit in terms of increased fire protection, which is a non-priced benefit that is not accounted for in quantitative present net value outputs.

Time Frame

The time frame selected is beyond the financial benefits from the timber sale activities since the fire protection benefit would last for about 30 years. Therefore, the selected time frame for the cumulative effects considered is 30 years.

Table 4-11. Summary of Effects of Alternatives Considered Along With Other Management Actions Affecting Economics.

Alternative/Unit of Measurement	Direct Effects (Present Net Value)	Indirect Effects	Present Actions	Past Actions	Future Actions	Sum of Effects within the Selected Time Frame
Alt. 1 effect on Weaverville area in net public benefit terms	$0	No change in fire protection	No change in fuels conditions	Timber harvests, fire suppression	Timber harvests, fire suppression, fuels work	No effect, but opportunity lost
Alt. 3 effect on Weaverville area in net public benefit terms	$1,177,100	Increased fire protection	Improved fuels conditions	Timber harvests, fire suppression	Timber harvests, fire suppression, fuels work	Positive effects related to revenue generated and increased fire protection
Alt. 3 effect on Weaverville area in net public benefit terms	$935,750	Increased fire protection	Improved fuels conditions	Timber harvests, fire suppression	Timber harvests, fire suppression, fuels work	Positive effects related to revenue generated and increased fire protection

The direct effects in terms of revenue generated from a timber sale activity are shown as present net value outputs. Changes in fire protection are indirect effects resulting from the implementation of **Alternative 3** or **4**. Other actions (past, present, and future) are considered to be independent from the Browns Project.

Conclusion of Cumulative Effects on Economics

The net public benefit would be a positive effect from either **Alternative 3** or **4**, with **Alternative 3** being a greater benefit since acreage treated for fire protection and revenue generated in terms of present net value would be higher than **Alternative 4**. **Alternative 1** would have no effect outside of the opportunities lost in improving fire protection and generating revenue.

Fire and Fuels – Cumulative Effects

Effects Analysis

To analyze cumulative effect(s) on fire and fuels, the unit of measure used to quantify the effect(s) is the amount of acres resulting with a change in fire behavior and tree mortality. This is an appropriate unit of measure because it shows the amount of landscape that would be affected. One theory suggests that more than 20 to 30 percent of the landscape must be changed from a fast spread rate to a slow spread rate before fire behavior and tree mortality can be substantially reduced[31]. The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of this report. This cumulative effects analysis quantifies the output effect(s) as a sum of the

[31] Finney, Mark A. 2003. *Calculation of fire spread rates across random landscapes*. International Journal of Widland Fire, 2003, 12, 167-174.

direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered).

Bounding the Effects

Geographic Boundary

The area considered for the cumulative effects analysis is a subset of the 3 affected subwatersheds, based on topographic features, and is shown on a map in Appendix D of the Fire and Fuels Specialist Report. The selected geographic area was chosen because topography is a major factor in fire behavior, and is commonly used when managing wild and prescribed fires. The selected boundaries are effective barriers to fire spread due to factors such as high humidity, lack of vegetation, and/or ridgetops.

Time Frame

The period used to analyze cumulative effects is about 30 years. It is estimated to take this long for affected vegetation to grow back within timber stands; and for surface fuel loadings to somewhat resemble that of its current condition. The effects of fuels reduction in brush fields from past and reasonably foreseeable projects would last for approximately 10-20 years. Although the proposed project would not occur in brush fields, these acres were used to calculate total area with desired conditions (Table 4-11b).

Baseline

A baseline was established for the comparison of environmental effects in order to assess a possible change in conditions. Its purpose is to serve as an anchor point for adding the incremental effects of past, present, reasonably foreseeable, and proposed project effects. A discussion of how the baseline was determined is located in the Browns Fire and Fuels Specialist Report (Appendix F). The baseline for assessing cumulative effects is the current condition (2007) because it considers how conditions have changed over time; and how they are likely to change in the future with or without proposed actions. Current conditions will be compared with the estimated effects from proposed projects, in addition to past and foreseeable actions, to determine whether or not there is a benefit to fire behavior and fire severity.

Actions Considered

The actions considered are the proposed alternatives and the actions included in Table 4-10.

Table 4-11a. A summary of past, present and reasonable foreseeable projects considered in the evaluation of fire and fuels cumulative effects[32] for the Browns Project.

Geography	Acres	Past Projects	Present Projects	Foreseeable Projects
Fire and Fuels Cumulative Effects Area	6,276	**Fuels Projects:** Musser Hill FMZ- 554 ac. 2004 Musser Hill Mastication- 117 ac. 2005 China Gulch FMZ- 10 ac. 2001 Browns Roadside FMZ- 178 ac. 2004 **Timber:** Pre-commercial Thinning- 55 ac. 2004	**Proposed Project:** Alternative 1- 0 ac. Alternative 3- 781 ac. Alternative 4- 568 ac.	**Fuels Projects:** Bear FMZ- 136 ac. 2006 Finley FMZ- 62 ac. 2006 Lil. Browns FMZ- 151 ac. 2006 Musser Wildlife Burn-282 ac. 2006 Croften Wildlife Burn- 78 ac. 2006 Bear and Rush Shaded Fuel Break (RCD)- 18 ac. 2006 Plantation Prune- 80 ac. 2007 **Timber:** USFS Pre-commercial Thin- 69 ac. 2007

This table is a subset of the Cumulative Effects Table 4.10 and is bounded by a smaller area, therefore acres shown here will be different. Reasons for projects not considered in this analysis are listed in Appendix D of the Browns Fire and Fuels Specialist Report.

Table 4-11b. Summary of proposed acres treated, from alternatives and other management actions, which benefit fire behavior[33] and fire severity (tree mortality) within the Browns cumulative effects analysis area.

Past Actions (acres)	Present Actions (acres)	Future Actions (acres)	Sum of Effects Lasting 10-20 years (acres)	Total Area with Desired Conditions (6,276 acres)	Sum of Effects Lasting 20-30 years (acres)	Total Area with Desired Conditions (6,276 acres)
Fuels- 859 USFS Timber- 72	Alternative 1 0	Fuels- 807 USFS Timber- 69	1790	29%	1313	21%
Fuels- 859 USFS Timber- 72	Alternative 3 781	Fuels- 807 USFS Timber- 69	2571	41%	2094	33%
Fuels-859 USFS Timber- 72	Alternative 4 568	Fuels- 807 USFS Timber- 69	2358	38%	1881	30%

Musser Hill Mastication, Musser Hill Wildlife Burn and Croften Wildlife Burn acres were taken out of the sum of effects within the 20-30 year time frame since these areas contain at least 75% brush. Fuel treatments in these areas are not expected to last as long as treatments which occur in timber stands.

The cumulative effects of **Alternative 1** would result in no change from existing conditions. Past and foreseeable projects make up approximately 29 percent (includes brush stands) of the cumulative effects analysis area (Table 4-11a), and 21 percent in timber stands (excludes brush areas). This would reduce fire behavior across the landscape because more than 20 percent is being treated. Finney (2003) states that more than 20-30 percent of the landscape must be changed from a fast spreading

[32] A map of the Fire and Fuels cumulative effects analysis boundary is located in Appendix F.
[33] Beneficial effects to fire behavior and tree mortality result from fuel model 8, which is the desired condition for fire suppression and fire severity effects to vegetation. In addition, it reflects the desired fuel loadings stated in the LRMP pg. 4-65.

fuel type to one with a slower spread rate before fire growth can be substantially reduced. This would allow firefighters to safely suppress fire in past and future treatment areas. The effectiveness of past and foreseeable treatments would last approximately 10-20 years (includes all projects); and 20-30 years in timber stands (excludes brush treatments). Since many untreated stands are currently overstocked with small diameter trees and decadent brush; high severity effects would occur. However, past and foreseeable treatment areas would result in low mortality rates, which comprise about 21 percent of the cumulative effects analysis area (Table 4-11b).

Alternative 1 would treat no acres near private industrial timberland. This alternative would have negative effects because there would be no buffer from wildfire impacts; and no place for firefighters to safely work.

The cumulative effects of **Alternatives 3** and **4** with past, present, and reasonably foreseeable actions would decrease fire behavior and fire severity across a greater area (compared to **Alternative 1**). Furthermore, proposed units would be more strategically located within the middle of other fuels reduction projects. This is important because random patterns of fuels treatments are unlikely to substantially affect the overall growth rate or size of a fire until large areas of the landscape are treated (Finney, 2003). **Alternatives 3** and **4** would create more protection across the landscape by increasing the amount of strategically placed treated acres. For **Alternative 3**, this would occur over approximately 41 percent of the landscape; and **Alternative 4**-approximately 38 percent for an estimated 10-20 years (Table 4-11b). At the end of this time, the amount of area resulting with desired conditions would begin to decline (Table 4-11b. 20-30 years column).

Other benefits from implementing Alternatives 3 and 4:

- Alternative 3 would result in desired fire behavior and severity effects on about 296 acres in the Blue Rock and China Gulch area (combined) that border private industrial timberland; whereas Alternative 4 would only improve about 13 acres. Fuel treatments would provide safe conditions for suppression, and would allow more trees to survive a wildfire. In addition, this would create a buffer from wildfire impacts to Forest Service land if a fire were to spread from private land.
- Alternatives 3 and 4 would either border or be adjacent to future and existing fuel management zones (FMZs). Both alternatives would benefit FMZs by slowing or possibly stopping fire growth.
- Alternatives 3 and 4 would lower fire behavior and fire severity effects in proposed units that are adjacent to approximately 105 acres of plantations; allowing firefighters to slow or stop a fire before it entered the plantation and provide a safe place for them to work.

Fisheries – Cumulative Effects

Effects Analysis

To analyze the cumulative effect(s) on threatened and MIS fish, fish habitat, and riparian reserves, the unit of measure used to quantify the effect is the proper functioning condition based on Watershed Condition Class (WCC). The condition of instream (fish and fish habitat) and near stream (riparian

reserves) resources is highly dependant on the overall condition of the watershed. The WCC is derived from the water quality cumulative effects model and is rated from WCC I to WCC III. Instream surveys in the project area have validated the WCC as derived from the cumulative watershed effects modeling.

Bounding the Effects

Geographic Boundary

Cumulative effects to threatened and MIS fish, fish habitat, and riparian reserves are addressed by 7th field subwatershed. Three subwatersheds are addressed: Rush Creek, East Weaver Creek, and Little Browns Creek. The 7th field subwatershed is the most appropriate scale to analyze effects to threatened and MIS fish, fish habitat, and riparian reserves because 8th field subwatersheds are generally too small to support fish. Larger scale (6th field) subwatersheds dilute effects enough that effects from an individual project is likely unrecognizable.

Time Frame

See the Water Quality effects section for a discussion of WCC time frames. Effects from permanent features such as roads will persist in perpetuity and effects from activities such as tree thinning may be completely recovered in 15 years or less. The effects to fish habitat often lag behind upland effects due to the length of time that it takes for streams to recover. Changes to fish habitat and its effects to fish are often five to ten years behind those noticed in upland areas.

Actions Considered

Alternative 1

Effects of past management (Table 4-10) have degraded the project subwatersheds to WCC II (East Weaver Creek) or III (Rush and Little Browns Creeks) (see the "WCC (existing)" column in either Table 4-14 or 4-15). The incremental effect of each action checked in Table 4-10 is represented in the CWE spreadsheets contained within the project file and these effects are summarized by subwatershed. The effects of all activities listed in Table 4-10 when added to **Alternative 1** maintain the degraded condition at the current level. Foreseeable projects include fish passage upgrades at Roundy Road and East Branch Road, and road decommissiong in the Weaverville Watershed (see Appendix C). Some recovery would occur over time as previously harvested areas grow, however much of the cumulative effect comes from roads that would not recover without mechanical rehabilitation. The watershed would remain at high risk of wildfire.

Alternatives 3 and 4

Temporary road construction and maintenance, timber harvest activities, fuels reduction treatments, fire suppression actions, domestic water use, urban development and watershed restoration activities all contribute to changes in the watershed which ultimately result in changes to aquatic habitat and to fish. Incremental effects of each action checked in Table 4-10 is represented in the CWE spreadsheets

contained within the project file and these effects are summarized by subwatershed. The effects of all activities listed in Table 4-10 have degraded the project subwatersheds to WCC II (East Weaver Creek) or III (Rush and Little Browns Creeks). Watersheds in condition class II may exhibit an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses. Watersheds that are in condition class III have conditions in soil, riparian and aquatic systems that no longer fully support beneficial uses, including fish and their habitat.

Fish habitat surveys support the watershed condition class ratings and demonstrate that negative effects to fish habitat have occurred and are currently manifested as elevated turbidity levels, elevated sediment levels and reduced quality of fish habitat. The incremental effects of the past, present and reasonable foreseeable actions added to the Browns Project will result in some increase in cumulative effects to fish habitat over the short term (5- 10 years) but will lead to some recovery over longer time periods (over 10 years). Cumulative effects are expected to be limited to short-term increases in turbidity and sediment levels.

Conclusion of Cumulative Effects on Threatened Fish, MIS Fish, Fish Habitat, and Riparian Reserves

The subwatersheds and streams channels of the Browns project area are currently in a degraded condition due to the cumulative effects of past management activities. **Alternative 1** proposes only passive restoration. When combined with foreseeable actions of removing fish migration barriers on county roads and road decommissiong in the Weaverville Watershed, slight improvements to fish habitat and fish populations may occur over the long-term. However, under **Alternative 1** the risk of wildfire remains high and continues to pose a threat to the health of the watershed. The WCC for Rush Creek, East Weaver Creek, and Little Browns Creek would not change as a result of this alternative (see “WCC Existing” in Table 4-14).

Alternatives 3 and **4** propose some active watershed restoration (road decommissioning) as well as lowering the risk of wildfire. Foreseeable actions include fish passage upgrades at Roundy Road and East Branch Road, and road decommissioning in the Weaverville Watershed as displayed in Appendix C. Although the watershed may show some improvement over the long-term, fish habitat and populations would only show slight improvements because permanent road systems and urban development would remain. The WCC for East Weaver and Rush Creek would not change, but the WCC for Little Browns Creek would change from III to II (Tables 4-14 and 4-15).

The fisheries MIS assessment demonstrates that it is highly unlikely that that the Browns Project would have any impact on the population trend of winter–run steelhead at the Forest scale due to the short section of habitat affected, the small number of steelhead that may spawn in the project area and the intermittent nature of the Little Browns Creek.

Forest Productivity – Cumulative Effects

Effects Analysis

To analyze the cumulative effect(s) on forest stands, the unit of measure used to quantify the effect is the acreage affected by managing stand density. This is the appropriate unit of measure because timber stand growth and yield is benefited by achieving adequate stocking of well-distributed trees in regeneration harvests and by using commercial thinning to maintain or improve tree health and vigor (as recognized in the LRMP, page 4-27). The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of Chapter 4. This cumulative effects analysis quantifies the acreage affected by managing stand density effect as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered).

Bounding the Effects

Geographic Boundary

The geographic area considered for the forest stand productivity cumulative effects analysis is the three subwatersheds affected by the proposed action. This includes the Rush Creek, East Weaver Creek, and Little Browns Creek Subwatersheds (Table 4-10). Since the affected environment relative to forest productivity is associated with water and nutrient availability, the appropriate analysis area for evaluating effects to forest stands is the subwatershed drainage area. These subwatersheds include both National Forest and other ownership lands.

Time Frame

The three affected subwatersheds are expected to experience pulsed stand density effects over time since similar actions would continue into the foreseeable future (although no quantifiable future actions are foreseeable at this time). Re-entry into the same stands proposed for thinning in **Alternatives 3** and **4** is expected in about 30 years. Therefore, the time frame selected for evaluating the cumulative effects of the alternatives considered is 30 years.

Table 4-12. Summary of Effects of Alternatives Considered Along With Other Management Actions Affecting the Rush Creek, East Weaver Creek, and Little Browns Creek subwatersheds. (The past, present, and foreseeable future actions are summarized from projects identified in Table 4-10.)

Alternative Effects within the Three Affected Subwatersheds (37,709 acres)	Direct Effects (acres)	Indirect Effects (acres)	Past Actions* (acres)	Present Actions** (acres)	Future Actions** (acres)	Sum of Effects within 30 Years (acres)
Alternative 1 acreage affected by managing stand density	0	0	17,559	0	43	17,642
Alternative 3 acreage affected by managing stand density	791	0	17,559	0	43	18,352
Alternative 4 acreage affected by managing stand density	568	0	17,559	0	43	18,127

* Past actions include approved Timber Harvest Plans on private land. Of the 17,559 acres identified, 13,202 acres are on private land.

** There are no quantifiable acreages for future actions (other than Forest Service precommercial thinning) known at this time. However, more future actions are assumed to occur on private timberland than on federal land over the next 30 year period.

Most of the past actions within the three affected watersheds have occurred on private land. The acreages affected by managing stand density show that **Alternative 1** would cause no increase in acreage affected by managing stand density. **Alternatives 3** and **4** would cause increases by 791 and 568 acres, respectively, within the 28,269 acres of the three affected subwatersheds. Since the acreages treated by **Alternatives 3** and **4** are expected to result in increases in stand productivity, the result of the 30-year effect would be positive.

Conclusion of Cumulative Effects on Forest Productivity (Timber)

As described earlier, **Alternative 1** would result in high stand densities and increasing tree mortality. In the absence of wildfire, the stands within the project area would continue to produce less than desired growth and yield within managed timber stands while providing increased fire hazard conditions which may lead to stand replacement and/or increased fire risk to adjacent forested lands. Long-term timber product outputs would be less than could be achieved with active stand management. LRMP goals (Forest Goals #34 and #35, LRMP page 4-5) for managing timber stands and providing timber and other wood products would not be achieved within the project area with implementation of **Alternative 1 –** contributing to a Forest-wide departure from LRMP resource goals.

Alternatives 3 and **4** would contribute toward meeting LRMP resource goals (approximately 23 million board feet of wood products per decade is desired to come out of Management Area 7, LRMP page 4-108) by managing the timber resource in a manner to improve the health and vigor of timber stands. This, in turn, is expected to provide a sustained yield of timber and other wood products, yielding a positive cumulative effect of increased timber growth.

Heritage Resources – Cumulative Effects

Effects Analysis

To analyze the cumulative effect(s) on archaeological sites, the unit of measure used to quantify the effect(s) is/are the number of sites in the project area. This is the appropriate unit of measure because the project area is "area of potential effect" (APE). The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of this report. This cumulative effects analysis quantifies the effect(s) as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered).

Bounding the Effects

Geographic Boundary

The physical geographic boundary for the Browns Project was surveyed for heritage resources. The area of potential effect is located in the Weaverville Watershed. The legal location is: T34N R10W, sections 23, 24; and T34N, R9W, sections 16, 17, 18, 20, 21, 22, 27, 28, 29, 32, 33, and 34, MDM. As identified in 36 CFR 800 and in the Region 5 Programmatic Agreement, the APE is defined as the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist. Therefore, the effects analysis was determined by utilizing the area of potential effect boundary.

Time Frame

The time frame for determining effects would continue until the proposed project had been implemented. This approach would consider the additive effects of project implementation. Historic properties would continue to be protected.

Actions Considered

Since all alternatives analyzed would have no direct or indirect effect to historic properties, it has been determined that there would be no cumulative effect on historic properties.

Conclusion of Cumulative Effects on Heritage Resources

Historic properties would not be affected by this proposed undertaking. Since the proposed action would have no direct or indirect effects to historic properties there would be no cumulative effects to historic properties.

Land Stability – Cumulative Effects

Since there are no direct or indirect effects from the project, there are no cumulative effects.

Scenery – Cumulative Effects

To analyze the cumulative effects on visual quality, the unit of measure used to quantify effects is consistency with LRMP Visual Quality Objectives as seen from sensitive viewing areas. The direct and indirect effects of implementing the alternatives considered have been disclosed in the Scenery section of Chapter 3. This cumulative effects analysis quantifies the effects as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered).

Geographic Boundary

The physical geographic boundary for the Browns Project was the areas seen from Hwy 3 and County Rd. 204 within the project area. Views were limited to the foreground (up to ½ mile) of these roads due to topography and vegetative screening. The cumulative effect boundary was not calculated in acres due to the following variables: the vision capability of the viewer, line of sight, distance, and viewer perceptual differences will affect ones ability to see the project area the same. Current conditions were utilized as the baseline to assess cumulative effects.

Time Frame

The period used to analyze cumulative effects is about 30 years. It is estimated to take this long for trees to grow back within timber stands. Brush and other understory vegetation can regenerate from 1 to 10 years.

Alternatives 3 and 4

The cumulative effects for scenery from the Browns Project will meet the required LRMP VQO's of Retention and Partial Retention for foreground views from Hwy 3 and County Rd. 204 respectively.

Soils – Cumulative Effects

Effects Analysis

To analyze the cumulative effects on soils, the units of measure used to quantify the effects are the regional soil quality standards developed and adopted in 1995 (USDA, 1995c). These are the appropriate units of measure because they are regional standards that evaluate measurable changes in soil productivity that have been tested and peer reviewed. The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of this report. This cumulative effects analysis quantifies the effects as a sum of the direct and indirect effects of the alternatives considered in addition to the past and foreseeable future actions (which are independent of the alternatives considered).

Bounding the Effects

Cumulative effects on the soil ecosystem have two scales. The first deals with the number and types of management activities occurring within an individual stand; the second deals with the number and

types of management activities and their distribution occurring within a project area or watershed over time.

Geographic Boundary

The soils analysis provided for this project only considered the proposed treatment areas – Units 2 through 17; it did not evaluate cumulative effects on all of the watersheds that pass through the project area. The rationale for bounding at the treatment unit scale is that the direct and indirect effects occur at this scale. Soil quality standards only apply to the affected soils in regards to project area erosion, compaction, and fertility of past, present, and future planned activities.

Time Frame

The effect of management on soil recovery is dependent on soil type, climate, moisture, cover, and time. By using the Universal Soil Loss Equation[34] typical recovery rates can be developed that show soils in and around the Trinity River Basin, with 50 to 70% cover, recovery would be in three to five years.

Actions Considered

The actions considered are the proposed alternatives and the actions included in Table 4-13 below.

Conclusion of Cumulative Effects on Soils (Table 4-13)

Table 4-13. Summary of Effects.

Soil Resource	Background (past + undisturbed)	Proposed 1st Year	Future in 3-5 years	Cumulative
Alternative 1				
Erosion Hazard	Low (3-4)	-	**Wildfire**	**V. high (20-35)**
Compaction	300 acres	-	**Wildfire**	**300 acres**
Fertility	Moderately low	-	**Wildfire**	**Low**
Hydrologic Group	Fair (C)	-	**Possible wildfire**	**Fair - poor**
Alternative 3				
Erosion Hazard	Low (3-4)	Moderate (6-8)	Low (3-4)	Low (3-4)
Compaction	300 acres	200 acres treated	None	100 acres
Fertility	Moderately low	Moderately low	Moderate	Moderate
Hydrologic Group	Fair (C)	Good (B)	Good (B)	Good (B)
Alternative 4				
Erosion Hazard	Low (3-4)	Low-moderate (5-7)	Low (3-4)	Low (3-4)
Compaction	300 acres	100 acres treated	None	200 acres
Fertility	Moderate-low	Moderately low	Mod-low	Moderately low
Hydrologic Group	Fair (C)	Fairly Good (low B)	Fairly Good	Fairly Good

[34] USLE – Universal Soil Loss Equation is an empirically based erosion model used to predict upland soil erosion rates from various land management activities.

With erosion control measures implemented, cumulative erosion will be slightly elevated for the first year but will go to background levels in 3 to 5 years for **Alternatives 3** and **4**. For **Alternative 1**, if a wildfire were to occur, erosion levels would be greatly elevated (high to very high) for the first year and would go back to background levels in 3 to 5 years.

For **Alternative 1,** compaction would not be treated and hydrologic function would be in an impaired state. For **Alternative 3**, legacy compaction would be significantly reduced by subsoiling 200 acres thus increasing infiltration and improving overall site conditions. **Alternative 4**, 100 acres of legacy compaction will be treated increasing infiltration and improving overall site conditions but to a lesser degree as **Alternative 3**. With compaction mitigation measures for all other units without legacy compaction, infiltration will not be impeded and overall soil quality will be maintained. Decompaction mitigation measures of subsoiling would be done after timber and fuel treatments on landings, temporary roads, and main skid-trails.

Soil fertility for **Alternative 1** is stable at present, but if a wildfire occurred short-term fertility would be greatly increased due to released nitrogen; but as erosion occurred, long-term nutrients would be lost. In contrast, soil fertility would be increased by **Alternatives 3** and **4** due to better infiltration and tree growth, which equates to more fine-root development and increase of organic matter in the soil. In Mediterranean climates[35] the bulk of soil nutrients reside in the duff and soil organic matter of which is released slowly over time. Maintaining duff and fine slash of at least 50% of the area would insure the maintenance soil health and fertility. Post harvest fuel treatments with these alternatives would be moderate and soil health will be adequately protected and enhanced. Burning would be done with a low to moderate prescription, will not affect soil fertility significantly and will be done with the assurance of protecting soil cover, and soil organic matter. Mastication will be an added benefit to soil fertility by hastening slash breakdown and speeding the release of nutrients over its decomposition period of 3 to 5 years.

Hydrologic function would be unchanged with **Alternative 1,** but would be improved by **Alternatives 3** and **4** due to decompaction mitigation measures which would improve drainage and lessen surface runoff. The extent of decompaction would be less with **Alternative 4** than **Alternative 3** (by 100 acres) thus reducing overall effects for hydrologic function.

Water Quality – Cumulative Effects

Effects Analysis

To analyze the cumulative effects on water quantity and quality, the unit of measure used to quantify the effects is the WCC, which is the quotient of the ERA and the TOC. The TOC for this analysis area is 16%. The WCC is verified using upland and instream data (see Appendix G). A sediment budget was developed for Little Browns Creek because this watershed is at risk of negative cumulative watershed effects. The unit of measure used to quantify the potential impact on water quality is percent above background sediment yield. The risk of sediment contributing to CWE was measured

[35] Mediterranean climate – warm dry summers and cool moist winters.

using a threshold of 125% above background. These are the appropriate units of measure because they are consistent with the Forest Plan (USDA, 1995b), Shasta-Trinity National Forest CWE Analysis Process (see Appendix G, page 10), Trinity River TMDL (EPA, 2001), and the best available science.

The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous section of this report. This cumulative effects analysis quantifies the potential effects as a sum of the direct and indirect effects of the alternatives considered in addition to the other past, present, and foreseeable actions (which are independent of the alternatives considered).

Bounding the Effects

Geographic Boundary

Refer to description of the geographic boundary earlier in the chapter under Water Quality - Direct and Indirect Effects. Different watershed scales are analyzed to evaluate the spatial extent of potential effects. This analysis evaluates streams draining the project area within the Upper-Middle Trinity River Sub-basin, that directly contribute water and sediment to Rush, Little Browns, and East Weaver Creeks. As watershed size increases, the overall risk of the proposed project activities affecting downstream water quantity and quality decreases. For example, for this analysis area, as watershed size increases several other land use effects are present that, at a broad scale, make the potential effects of this project discountable. For example, domestic water uses by the town of Weaverville, and channel constrictions, runoff, and erosion, from Highways 3 and 299.

Time Frame

This cumulative watershed effects analysis compiled a land use history to quantify the baseline WCC. The land use history is summarized from the late 1800s to present. Land use activities that occurred from 1940 to present and that change rainfall, runoff, and sediment delivery patterns are used to quantify the past, present, and future watershed condition. Land use effects prior to 1940 are assumed to be fully recovered or have a lingering effect on watershed condition. For this project, placer and strip mining effects that occurred before 1940 are not fully recovered and are accounted for in the effects analysis. The additive land use disturbances analyzed include: mine operations, road construction and maintenance, timber harvest activities, fuels reduction treatments, fire suppression actions, and watershed restoration activities (Table 4-10). Road, urban, and timber harvest activities are chronically affecting the analysis area. In addition, past mine operations continue to compound the recent land use disturbances. Refer to the section under Water Quality - Direct and Indirect Effects with regards to the timeframe of the proposed action potential effects and foreseeable actions.

Actions Considered

Disturbances caused by land use were accounted for in this CWE analysis, and the past, present, and future land use activities included are listed in Table 4-10. This analysis quantified the past, present, and foreseeable cumulative impacts and benefits from road use and construction, timber harvest

activities, plantation management, wildland fire, fuel treatment activities, mine operations, and watershed restoration activities. The impacts of domestic water use were considered, however, they were not quantified. The lack of long-term streamflow and water diversion data prevent a quantitative analysis of the impact of domestic water use on instream flow and water quality.

CWE Effects of Alternative 1

Presently, streams draining the Browns project area are in a degraded condition and are not supporting aquatic beneficial uses. The magnitude, frequency, timing, and duration of peak flood flows and sediment yield are negatively affecting the fish habitat and water quality of Rush, Little Browns, and Weaver Subwatersheds (EPA, 2001). Past and present land use activities have altered the balance between stream discharge and sediment yield. As a result, the baseline watershed condition is degraded and effects are offsite, and long-term (See Hydrologist Report).

The baseline ERA is listed for each 7th and 8th field subwatershed within the analysis area and used to calculate the baseline (i.e., existing) WCC. The TOC for the project area is 16%. There are four 7th field subwatersheds draining the analysis area to include:

- Rush Creek (i.e., broken into two 7th Field HUC),
- Little Browns Creek, and
- East Weaver Creek.

(At the end of this section, Plate 4-1 depicts the WCC of each subwatershed by Alternative.)

A sediment budget was developed for the Little Browns Creek Subwatershed to better understand and predict the potential effects. The sediment budget shows that present chronic sediment yield is 13% above background and acute sediment yield is 36% above background. Main chronic sources of management-related sediment are erosion from roads and private timber harvest activities. The main source of acute sources of management-related sediment is roads and private and Forest Service timber harvest activities. The sediment budget indicates that present sediment yield is below the target of 125% above background set by the Trinity River TMDL (EPA, 2001). Relative to other Subwatersheds like Indian Creek and Browns Creek, Little Browns within Weaver Creek is presently not a significant sediment producer (GMA, 2001). The project sediment budget supports this conclusion. However, Weaver Creek as a whole has a high sediment yield (GMA, 2001).

CWE Effects of Alternative 3

Alternative 3, as described in Chapter 2, includes BMPs and mitigation measures designed to prevent timber harvest and temporary road building from further degrading the beneficial uses of watersheds draining the Browns project area. This analysis evaluates the cumulative effects of the proposed harvest activities, temporary road construction, road drainage improvements, and road decommissioning. It also analyzes the cumulative effects of the proposed action combined with future foreseeable actions to include fuel treatments, plantation management, and road decommissioning that are not part of this alternative (Table 4-10).

As designed, **Alternative 3** is unlikely to further degrade the long-term WCC. The predicted cumulative short- and long-term effects from peak flood flows and fine/coarse sediment yield

increases are not significant. Rather, long-term improvements in WCC are predicted (Table 4-14). This alternative contains measures to improve road drainage, increase soil infiltration rates, and reduce the risk of stream-road crossing failure. During project implementation, however, the probability of sediment delivery increases where temporary road construction, timber harvest activities, and road decommissioning dissect streams. Short-term fine sediment delivery from sheet and rill is probable at stream road or skid trail crossings. However, the potential cumulative short-term effects are discountable and would be localized (i.e., less than ¼-mile downstream), minor, and last for two to three years. Project implementation and effectiveness monitoring will be used to document watershed condition trends. It is possible that other actions may occur that increase the ERA in the long-term, for example, private land use activities mainly road, timber, and urban development.

For Rush Creek, the ERA increases 2% in the upper middle watershed (HUC#: 1801021106010102). The ERA increase is a result of timber harvest, landing development, and temporary road use. In the long-term, the ERA decreases from 15 to 8%, showing an improvement in watershed condition (Table 4-14). On NFS lands, road decommissioning reduces the ERA 1%, while timber harvest activities increase the ERA 2%. There are several roadside fuel reduction projects that would be implemented using hand methods and the potential effects are discountable.

Short-term increases in ERA are shown for the middle watershed (HUC#: 1801021106040102) of East Weaver Creek (Table 4-14) and result from the proposed fuels treatments. The two major fuels projects are Musser Hill Fuel Break and roadside fuels reduction. Mechanized equipment will be used to treat the fuel reduction units. These effects would be short-term and recover within two to five years of project implementation. Long-term benefits to watershed condition are the reduced risk of high severity fire. The ERA decreases at the 7th Field HUC scale as a result of road drainage improvements and road decommissioning and the WCC moves from II to I (Table 4-14).

For Little Browns Creek, the ERA increases from 16 to 21% in the short-term (Table 4-14) as a result of the proposed timber harvest and temporary road construction. To prevent direct, indirect, and cumulative effects from these activities, Forest Service geoscientists developed unit- and road-specific mitigation measures that would limit timber harvest operations and road location. Unstable landforms were flagged and avoided with no cutting or yarding within the protected areas. The new road design incorporates measures to prevent triggering landslides and sediment delivery at stream-road crossings.

The Little Browns Creek sediment budget indicates that **Alternative 3** would not significantly increase the long-term sediment yield and would have discountable effects to beneficial uses. The short-term sediment yield increases (i.e., one to five years) to 25% above background for the Q_2 event, and to 72% above background for the Q_{25} event. Long-term, the sediment yield is predicted to decrease to 14% above background for the Q_2 event, and to 39% above background for the Q_{25} event. The sediment yield is not expected to exceed the TMDL target of 125% for two to five years following implementation. The main sources of chronic and acute sediment during the first five years following implementation are roads and private land and Alternative 3 timber harvest activities. BMP

implementation and effectiveness monitoring, including specific monitoring as outlined in the Browns Project Instream and Upland Monitoring Plan, would be used to prevent and eliminate controllable sediment discharge sources.

The mitigation measures, listed in Chapter 2 and Appendix B, are designed to minimize the short-term cumulative effects of timber harvest and road building and improve long-term watershed condition. The CWE analysis indicates watershed condition would improve as a result of this alternative (Table 4-14). The mitigation measures applicable to reducing peak flood flows focus on disconnecting the road network from the stream channel by reducing road-stream crossing diversion and improving road drainage. In addition, disturbed areas would be ripped to improve soil infiltration rates and vegetation recovery at the watershed scale. For example, in critical areas identified on the Timber Sale Contract map, landings, skid trails, and unclassified roads would be sub-soiled up to 18-inches to improve soil quality. To mitigate effects from timber harvest in tractor units, mechanical harvesters and whole tree yarding would be used to reduce the relative amount of soil disturbance (see Chapter 2).

The mitigation measures applicable to reducing chronic and acute fine/coarse sediment sources are focused on controlling existing erosion sources and preventing new ones. The project would decommission about 14 miles of existing roads, trails, old temporary roads, and old skid trails that have compacted soil and contribute sediment. Decommissioning entails removing culverts, ripping and out-sloping road surfaces, and closing road junctions. Other activities may occur depending on site conditions. The goal is to control surface runoff, erosion, and mass failure and leave the road unavailable for future use. See Appendix B for specific erosion control measures.

Table 4-14. Summary of CWE Analysis Results for Alternative 3.

8th Field HUC	7th Field HUC Watershed Name	Drainage Area (acres)	Forest Plan TOC ERA %	Existing ERA %	Alt 3 (1-5 years) ERA %	Alt 3 (5-20 years) ERA %	WCC existing	Short-Term WCC (Alt 3)	Long-Term WCC (Alt 3)
1801021106010101	Rush Creek	2,860	16	1	1	0	I	I	I
1801021106010102	Rush Creek	2,997	16	10	12	10	II	II	II
1801021106010201	Rush Creek	3,470	16	14	15	11	III	III	II
1801021106010202	Rush Creek	2,676	16	27	27	12	III	III	II
1801021106010203	Rush Creek	2,384	16	23	23	10	III	III	II
7th Field Watershed	***Rush Creek***	***14,388***	***16***	***14***	***15***	***8***	***III***	***III***	***II***
1801021106040101	E Weaver Creek	2,148	16	1	1	1	I	I	I
1801021106040102	E Weaver Creek	1,567	16	17	18	7	III	III	II
1801021106040103	E Weaver Creek	2,291	16	11	11	7	II	II	II
1801021106040105	E Weaver Creek	2,886	16	14	13	9	III	II	II
7th Field Watershed	***E Weaver Creek***	***8,892***	***16***	***10***	***10***	***6***	***II***	***II***	***I***
1801021106040301	L Browns Creek	2,151	16	14	14	8	III	III	II
1801021106040302	L Browns Creek	2,838	16	17	26	15	III	III	III
7th Field Watershed	***L Browns Creek***	***4,989***	***16***	***16***	***21***	***12***	***III***	***III***	***II***

CWE Effects of Alternative 4

Like Alternative 3, **Alternative 4**, includes BMPs and mitigation measures designed to prevent further degrading the beneficial uses of streams draining the analysis area. However, this alternative includes less temporary road construction. Some timber harvest activities and fuel treatments included in Alternative 3 would not be implemented as part of Alternative 4. Overall, this alternative would have less short-term cumulative effects than Alternative 3 due to the decrease in temporary roads and less timber harvest. This alternative would result in less ground disturbance in Little Browns Creek (Table 4-15) since no temporary road construction is proposed within this subwatershed.

One of the purposes of **Alternative 4** is to maintain and improve the long-term WCC. The mitigation measures, listed in Chapter 2 and Appendix B, are designed to minimize the short-term effects of timber harvest and road building, and improve long-term watershed condition. In the 7th field subwatershed 1801021106040301, upper Little Browns Creek, the WCC would decrease from III to II (see Hydrologist Report). Combined with other watershed restoration efforts (e.g. Trinity County fish migration improvements), the trend would be positive in this subwatershed.

Table 4-15. Summary of CWE Analysis Results for Alternative 4.

8th Field HUC	**7th Field HUC Watershed Name**	**Drainage Area** (acres)	**Forest Plan TOC ERA %**	**Existing ERA %**	**Alt 4** (1-5 years) **ERA %**	**Alt 4** (5-20 years) **ERA %**	**WCC existing**	**Short-term WCC** (Alt 4)	**Long-term WCC** (Alt 4)
1801021106010101	Rush Creek	2,860	16	1	1	0	I	I	I
1801021106010102	Rush Creek	2,997	16	10	12	10	II	II	II
1801021106010201	Rush Creek	3,470	16	14	15	11	III	III	II
1801021106010202	Rush Creek	2,676	16	27	27	12	III	III	II
1801021106010203	Rush Creek	2,384	16	23	23	10	III	III	II
7th Field Watershed	***Rush Creek***	***14,388***	***16***	***14***	***15***	***8***	***III***	***III***	***II***
1801021106040101	E Weaver Creek	2,148	16	1	1	1	I	I	I
1801021106040102	E Weaver Creek	1,567	16	17	18	7	III	III	II
1801021106040103	E Weaver Creek	2,291	16	11	11	7	II	II	II
1801021106040105	E Weaver Creek	2,886	16	14	13	9	III	II	II
7th Field Watershed	***E Weaver Creek***	***8,892***	***16***	***10***	***10***	***6***	***II***	***II***	***I***
1801021106040301	L Browns Creek	2,151	16	14	13	7	III	II	II
1801021106040302	L Browns Creek	2,838	16	17	24	14	III	III	III
7th Field Watershed	***L Browns Creek***	***4,989***	***16***	***16***	***19***	***11***	***III***	***III***	***II***

Foreseeable Actions

This CWE analysis considers the past, present, and future watershed condition. To account for future condition, foreseeable actions that are likely to occur within the next 20 years are analyzed (specific calculations are documented in the Hydrologist Report in Appendix G). Table 4-10 lists the past, present, and foreseeable actions within the Browns project area. These projects include precommercial thinning, fuel reduction treatments, watershed restoration activities, and private timber

harvest. Some of these actions (i.e., private timber harvest) are expected to further increase the risk of CWEs. Several fuels reduction projects are ongoing, and additional projects and would be implemented within the next five years. These fuels projects would have minor short-term effects and long-term benefits to watershed condition.

The watershed improvement needs, identified in the Weaverville Watershed Analysis, would be implemented to reduce runoff, erosion, and improve water quantity and quality in the long-term. For example, road decommissioning would continue within the project area to reduce diversion potential, crossing failure, surface erosion, and mass wasting.

Conclusion of Cumulative Effects on Water Quality

This CWE analysis shows that neither Alternative 3 nor 4 of the Browns Project would further degrade the water quantity or quality of the Rush, Little Browns, Weaver Creek Subwatersheds and the upper-middle Trinity River Sub-basin. The baseline condition CWE analysis recognizes that the water quantity and quality within and downstream of the project area are presently degraded by past and present land uses. Although detailed analysis indicates that certain watersheds exceed estimated historic background levels for sediment, it is expected that through implementation of BMPs and mitigation that water quality standards will be met.

Compliance with the CWA is expected through guidance provided in EPA's Water Quality Standards Handbook (EPA's Water Quality Standards Handbook, Second Edition, Government Printing Office EPA-823-B-94-005a). In part, it says: "Once BMPs have been approved by the State, the BMPs become the primary mechanism for meeting water quality standards. Proper installation, operation and maintenance of State approved BMPs are presumed to meet a landowners or managers obligation for compliance with applicable water quality standards."

Based upon thorough analysis of the cumulative effects of proposed activities (including project specific BMPs, and other project design features designed to minimize adverse impacts to water quality) combined with a requisite examination of watershed conditions influenced by past, present and reasonably foreseeable actions, it is the agency's determination that Alternative 3 and 4 of the Browns Project will be in compliance with water quality objectives. This determination was reached through consultation, including field examination of this project, with the Regional Water Quality Control Board, the State agency with primary responsibility for water quality control in California. The Browns Project complies with the CWA, Porter-Cologne Water Quality Act, and was designed to conform with all applicable provisions of the Categorical Waiver for Discharges Related to Timber Activities on Federal Lands Managed by the USDA, Forest Service in the North Coast Region (Order No. R1-2004-0015). Implementation and effectiveness monitoring will be employed during execution of project activities to validate compliance with applicable state standards. Specific monitoring is described in the Browns Project Instream and Upland Monitoring Plan, available in the project file. Operations will be temporarily suspended if monitoring indicates non-compliance with water quality standards and necessary measures will be employed to meet compliance prior to re-initiating project activities.

For a description of the CWE analysis process methods, data, results, and interpretation see Hydrologist Report in Appendix G.

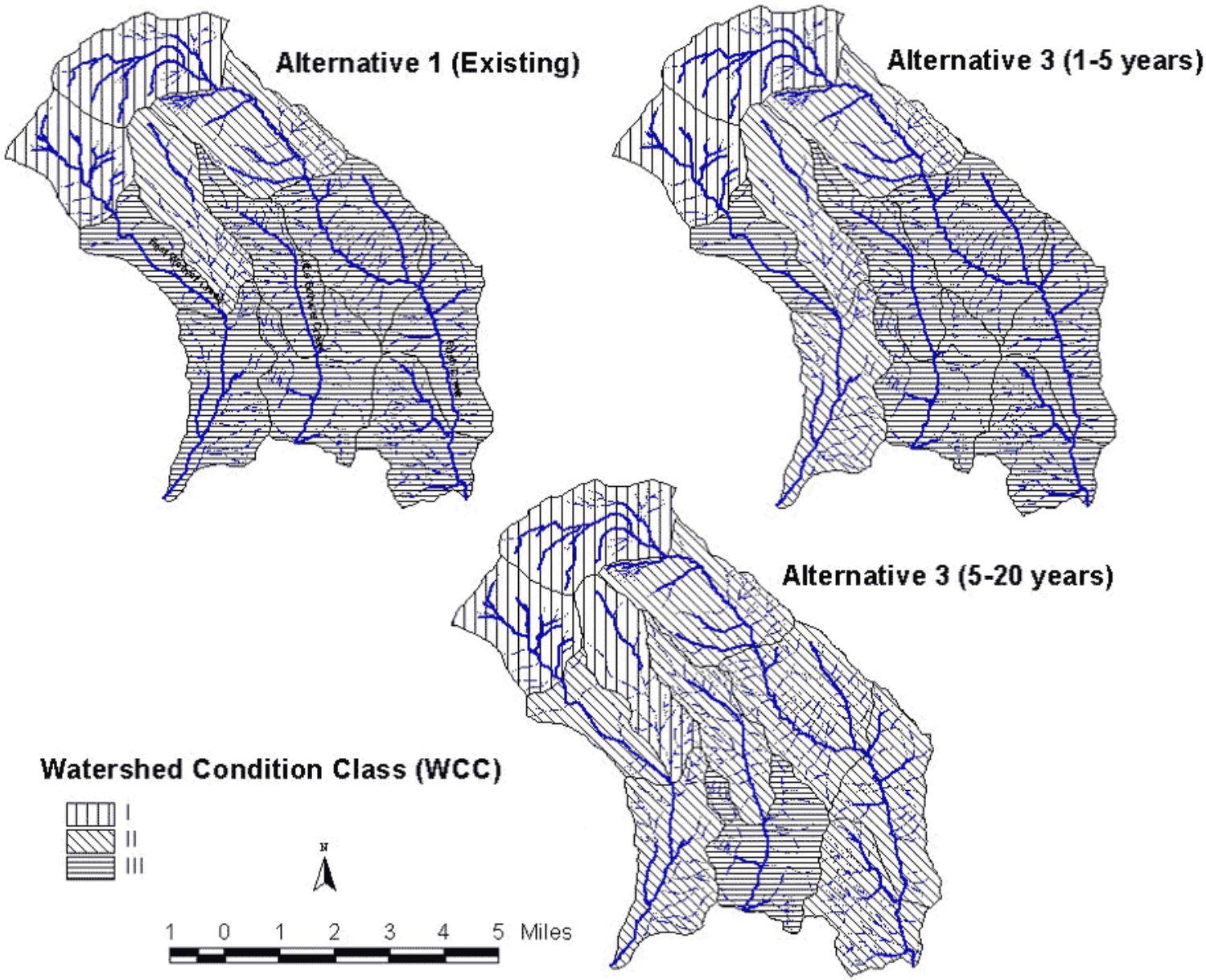


Plate 4-1. Map of Browns Project showing WCC for each alternative analyzed.

Wildlife – Cumulative Effects (Old-Growth Habitat)

Effects Analysis

To analyze the cumulative effect on old-growth habitat, the unit of measure used to quantify the effect is acres affected and the intensity of effects as described in the previous Wildlife Effects section. Acres is an appropriate unit of measure because old-growth is a combination of habitat components (e.g. total canopy closure, multiple canopy layers, large old trees, snags, logs, etc.) that must be measured over an area - not at the individual tree or snag level. For example, a 300-year-old Douglas-fir tree in the middle of a large grassy field does not represent old-growth habitat. The direct and indirect effects of implementing the alternatives considered have been disclosed in the previous Wildlife Effects section. This cumulative effects analysis quantifies the removal or downgrading of old-growth habitat as a sum of the direct and indirect effects of the alternatives considered in addition to the past, present, and foreseeable future actions (which are independent of the alternatives considered). Past actions (timber harvesting and road building), included in Table 4-10, were accounted for in Chapter 3 (Affected Environment).

Bounding the Effects

Geographic Boundary

The spotted owl represents the MIS of late-seral (old-growth) habitat for this project. The selected analysis area is the spotted owl "Action Area" that includes a 1.3-mile buffer around all the areas proposed for treatment, resulting in a 16,266-acre area (see Chapter 3 discussion). This area is expected to include any potential, current or future spotted owl activity centers (e.g. nest sites) that would be affected by habitat loss or modification related to the Browns Project. That is to say, owls nesting within this area may use suitable habitat that may be affected by the project.

Again, the "Provide for Retention of Old-Growth Fragments Where Little Remains" S&G applies to only federal (i.e., Forest Service) land within the 54,000-acre Weaverville 5th Field Watershed. No foreseeable actions are proposed on federal land within the watershed that would remove or downgrade existing old-growth habitat.

Time Frame

Timber (habitat that was likely at or near old-growth conditions) has been harvested within the project area since the 1800s. The future time frame selected for evaluating the cumulative effects of the alternatives considered is 30 years. Proposed thinning prescriptions would have, by far, the largest effect on developing old-growth habitat. The main old-growth attribute that would be affected by project thinning is canopy closure. That is to say, other existing important old-growth attributes, such as large (legacy) conifers, large snags and logs, and viable hardwoods, would be maintained. Canopy closure is expected to recover to pre-project levels in about 30 years.

Actions Considered

Past and foreseeable Forest Service and private actions are considered such as timber harvesting and road building. As discussed below, private property in the project area does not currently provide meaningful amounts of spotted owl habitat and is not expected to provide meaningful amounts of owl habitat (especially old-growth) into the foreseeable future.

Past Forest Service timber harvesting removed approximately 400 acres of old-growth habitat. Additionally, roughly 400 acres of late-successional owl habitat (**not old-growth**) may be slightly degraded by Forest Service fuels treatments that are in early stages of planning. These areas would continue to function at current levels of owl habitat quality after treatment. No Forest Service projects are planned in the Action Area that would remove or downgrade high quality spotted owl habitat (i.e., old-growth).

Private property in the owl Action Area (approximately 8,400 acres) does not provide old-growth habitat. This property is either owned by Sierra Pacific Industries and intensively managed for timber production or is residential (including the town of Weaverville). Past private timber harvesting on approximately 6,000 of these acres removed owl habitat – much of which was likely at or near the old-growth stage. On March 30, 2005 Dr. Danielle Chi (then a Wildlife Biologist, U.S. Fish and Wildlife Service [FWS], Red Bluff Field Office), Ron Clementsen (Forest Plan Program Leader, FWS, Red Bluff Field Office), Laura Finley (Wildlife Biologist, Endangered Species Program, FWS, Yreka Field Office), Kelly Wolcott (Forest Wildlife Biologist, Shasta-Trinity National Forest) and Thomas Quinn (Wildlife Biologist, Trinity River Management Unit, Shasta-Trinity National Forest) met to discuss cumulative effects related to the Browns Project and forest management on private lands in the project area vicinity. Laura Finley provided maps and brief descriptions of all the private timber harvest plans (THPs) for projects in the owl Action Area for which the Yreka FWS office provided “technical assistance.” Inspections of 2003 aerial photographs of the THP areas indicated that these projects had been implemented and are accounted for (85% ground verified) in the Browns Project Hydrology Report, completed by Jim Fitzgerald (hydrologist, Shasta-Trinity National Forest). The meeting further revealed that the definition of spotted owl habitat (that includes old-growth as high quality habitat) used in the THP process is very much broader than the definition used in Browns Project Wildlife BA. Areas considered suitable owl habitat on private land during the THP process would barely qualify as owl connectivity habitat (i.e., 11-inch DBH conifers and 40 percent canopy closure) and are definitely not old-growth habitat.

Table 4-16 summarizes the old-growth habitat directly affected (removed or downgraded) due to alternatives considered, along with other Forest Service and private management actions affecting old-growth habitat (acres) in the past and over the next 30 years. Areas that would be degraded are not included because these areas would continue to function at current levels of old-growth habitat quality.

Table 4-16. Summary of Effects (acres) of Alternatives Considered Along With Other Management Actions Affecting Old-Growth Habitat in the Action Area.

Alternative	Direct Effects (habitat removed or downgraded)	Present Actions	Past Actions	Future Actions	Sum of Effects within the Selected Time Frame
3	61	0	6,400	0	6,461
4	52	0	6,400	0	6,452

Conclusion of Cumulative Effects on Old-Growth Habitat

Federal land in the owl Action Area would likely support two to three spotted owl pairs in about 30 years with the implementation of either **Alternative 3** or **4**, considering the capability of federal land to provide old-growth habitat. The additional one or two owl pairs and their offspring would aid in the recovery of this federally-listed species.

Past effects to old-growth habitat have reduced the ability of the owl Action Area to support successful breeding pairs of spotted owls and thus other species associated with late-seral (old-growth) habitat. Much of the past timber harvesting likely targeted larger (i.e. older) conifers in areas that were at or near the old-growth stage. Historically, the area may have been able to support four to five pairs of owls, whereas STNF records include only one pair today.

Residential lands are not likely to provide meaningful levels of old-growth habitat and the harvest cycle on Sierra Pacific Industries land would likely be well below the timeframe required to develop old-growth conditions (roughly 180 years). Therefore, older conifer forest habitat within the owl Action Area would likely be restricted to federal land (approximately 6,431 acres capable of growing to old-growth conditions) into the foreseeable future.

Relationship of Project Impacts to Effects on Old-Growth Habitat and Forest Level Trends

Since 1991, wildfire and timber harvesting reduced late-successional habitat from 741,850 acres down to about 688,972 acres (about a 2 percent decrease) on the STNF. **Alternatives 3** and **4** would affect about 791 and 568 acres of late-successional forest (0.1% and 0.08% of the existing 688,972 acres of late-successional habitat) respectively. **Alternatives 3** and **4** would remove about 27 and 23 acres respectively (less than 0.004 percent) of the existing late-successional forest on the Shasta-Trinity National Forest. Only **Alternative 3** would remove 2 acres of old-growth (high quality MIS spotted owl habitat). Given the small percentage of available habitat affected by either alternative, the Browns Project will not alter the current forest-wide trend in habitat or populations for the MIS spotted owl or other species associated with late successional habitat or the associated snag/log and hardwood components. See Appendix I for the comprehensive analysis of wildlife MIS.

Survey and Manage (S&M) Wildlife Species

There would be no effects to S&M wildlife species because surveys revealed none of these species occur in or near the areas proposed for treatment in the two action alternatives.

Other Effects and Compliance Needs

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses, and their effects, are those that occur within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act, and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the long-term productivity of the land is maintained. This long-term productivity is maintained through the application of key components that include protection measures described in Chapter 2, in particular those applying to the soil and water resources.

Openings would be created in pre-designated landings in the short-term, but well-stocked vigorous stands would be established for the long term as discussed in the Forest Productivity Section. Both action alternatives would provide timber products to benefit the community in the short-term; **Alternative 3** would provide a somewhat higher yield than **Alternative 4**. With either **Alternative 3 or 4**, there would be a very short-term increase in fuel hazard in the period between harvesting and fuel treatment. This would be accompanied by a long-term increase in stand vigor, a reduction in fuel hazard, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units. There would also be a three to five year increase in fuel hazard from post-harvest treatments and a corresponding increase in stand vigor as discussed in the Forest Productivity and Fire and Fuels Sections.

Road decommissioning and fuel hazard reduction would produce beneficial long-term effects to fish and fish habitat from reduced sediment delivery to stream channels with either **Alternative 3** or **4** as discussed in the Fisheries Section.

There would be a short-term loss of two acres and the temporary degradation of 59 acres of old-growth habitat due to proposed temporary road and landing construction, and thinning in **Alternative 3**. There would be a short-term degradation of 52 acres of old-growth habitat in **Alternative 4**. However, treatments under both **Alternatives 3** and **4** would result in net increases in old-growth forests and higher quality Northern spotted owl habitat in about 30 years. These effects are discussed in the Wildlife Section.

Unavoidable Adverse Effects

Implementation of any action alternative could cause some adverse environmental effects that cannot be effectively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources. Some adverse effects are short-term and necessary to achieve long-term beneficial effects. Many adverse effects can be reduced, mitigated, or avoided by limiting the extent or duration of effects. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen the significant adverse consequences. The application of LRMP S&Gs, design features, and mitigation measures are intended to further limit the extent, severity, and duration of potential effects. Such measures are discussed throughout this chapter. Regardless of the use of these measures, some adverse effects will occur.

Either **Alternative 3** or **4** would remove a very small amount of late-successional habitat from the Matrix, well within the acceptable levels identified in the LRMP as discussed in the Wildlife Section.

There is a very low likelihood of increasing the on-site landslide potential in both **Alternative 3** and **4** as discussed in the Geology Section.

Either **Alternative 3** or **4** would have a minimal short-term indirect effect of increased runoff with the potential for sediment delivery to streams, but no degradation of water quality is expected as discussed in the Water Quality Section.

Either **Alternative 3** or **4** would have negative short-term sediment effects and positive long-term effects to watershed function. Therefore, short-term adverse effects are expected to occur on EFH as discussed in the Fisheries Section.

The habitat alteration for **Alternatives 3** and **4** may temporarily displace two pairs of spotted owls. However, in the long-term habitat conditions for species associated with old-growth habitat would be improved. These effects are discussed in the Wildlife Section.

With **Alternative 1, n**o timber would be made available for local markets as discussed in the Economics Section.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, cultural resources, or the extinction of a species. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed. No irreversible commitments of resources were identified.

Irretrievable commitments apply to the loss of production, harvest, or use of natural resources. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production.

Proposed temporary road construction would result in an irretrievable loss of existing spotted owl habitat (five acres in **Alternative 3** and no acres in **Alternative 4**).

Cumulative Effects

Cumulative effects have been discussed in the individual resource sections earlier in this chapter, whenever applicable. Cumulative effects for this project include past, present, and on-going actions.

Either **Alternative 3** or **4**, when added to the effects of other past and current timber sales in the Weaverville Watershed, would degrade less than 3% of the old-growth vegetation, leaving well above the 15% late-successional stands required by the LRMP, as discussed in the Wildlife Section and Wildlife BA (Appendix D).

The combined effects of either **Alternative 3** or **4** with the other timber sales in the assessment area would have the beneficial effect of reducing overstocked stands and reducing the acreage with high fuel loading as discussed in the Fire/Fuels and Forest Productivity Sections.

Reducing the fire risk in individual units of multiple sales leads to a reduced fire risk across the landscape. The cumulative effects of road decommissioning in either **Alternative 3** or **4** in multiple projects would reduce the access for fire suppression and fuel management, but these are offset somewhat by the reduced opportunities for human-caused fire starts. The cumulative effects of road improvements in multiple projects would improve the access for fire suppression and fuel management. These effects are discussed in the Fire and Fuels Section.

The low intensity harvesting and fuel reduction activities in either **Alternative 3** or **4** would minimize any cumulative effects on nutrient cycling and the soil's strong buffering capacity would reduce the possibility of any measurable long-term cumulative effect on soil productivity. Guidelines for maintaining soil productivity would be met as discussed in the Soil Productivity Section.

The cumulative watershed effects of either **Alternative 3** or **4**, in conjunction with other projects, would range from none to low effect and minor, depending on the 7th field watershed, as discussed in the Water Quality effects section and Appendix G.

The cumulative watershed effects of either **Alternative 3** or **4**, in conjunction with other projects, would be negligible on water temperature, existing large woody debris in streams, and streambank condition. The effects to sediment are described above in the Water Quality and Fisheries Sections. With **Alternative 3**, there would be long-term beneficial effects, as described in the Water Quality Section.

Energy Requirements, Conservation Potential, Depletable Resource Requirements

Consumption of fossil fuels would occur with the action alternatives during logging and hauling timber and during decommissioning of temporary roads. No unusual energy requirements are included nor do opportunities exist to conserve energy at a large scale. Wood is a renewable resource. With the proper application of the LRMP S&Gs for soils, soil productivity would be conserved as discussed in the Soils Section.

Prime Farmland, Rangeland and Forest Land

The project area does not contain any prime farmland or rangeland. Prime forest land does not apply within the National Forest System.

Possible Conflicts with Other Land Use Plans

Alternative 3 and **4** are entirely on NFS land. Only small amounts of private land are intermingled. These alternatives are not in conflict with planning objectives for Trinity County or other agencies or Tribes.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

Consultation with National Marine Fisheries Service (NMFS) and the FWS has been completed as required by the ESA and is discussed in the Fisheries and Wildlife BAs (Appendices D and E, respectively). As no water impoundments or diversions are proposed, the Forest is not required to consult with the FWS under the Fish and Wildlife Coordination Act.

As no ground disturbance is proposed in historical places, no consultation under the National Historic Preservation Act is required.

Wild and Scenic Rivers are not present within the project area.

Chapter 5: Preparers and Contributors

A. Agencies and Persons Consulted

The following were consulted in the planning process for the Browns Integrated Project:

Danielle Chi representing US Fish and Wildlife Service

Garwin Yip representing National Oceanic Atmospheric Administration (NOAA Fisheries)

B. Interdisciplinary Planning Team

Sam Frink: Forester: 28 years experience in fuels, timber sale planning, and silviculture; BS Resource Management (Forestry), expertise as Certified Silviculturist; responsible for vegetation analysis, silvicultural prescriptions, economic analysis, writing and editing, team leader.

Loren Everest: Fishery Biologist: 18 years experience in fisheries; BS Fisheries, expertise in anadromous and cold water fishes; responsible for fisheries analysis and Fisheries Biological Assessment.

Jim Fitzgerald: Hydrologist: 10 years experience in geosciences; BS and MS in geoscience, Registered Professional Geologist, responsible for water quantity and quality assessment and Hydrologist Report.

Thomas Quinn: Wildlife Biologist: 18 years experience in wildlife/forest management and Endangered Species Act consultation; BS Wildlife Management; responsible for habitat and wildlife analysis and Wildlife Biological Assessment/Evaluation.

Lara A. Graham: District Fuels Specialist: 8 years experience in fire suppression, fire prevention, and fuels management; BS Forestry; responsible for hazardous fuels reduction planning and implementation.

Brad Rust: Soil Scientist: 15 years experience for the Natural Resource Conservation Service and the U.S. Forest Service; BA Range Management, MS Soil Science; expertise in soil mapping, soil management, monitoring, and inventory; responsible for soil analysis.

Dale Stanley: Transportation Planner: 30 years experience in transportation planning for harvest and removal of timber products; provided road location and road design recommendations.

Susan Erwin: Botanist: experience as a professional botanist for 9 years BS Forest Management, MS Forest Biology. Provided botany and weed input to document.

Sherry Chilcott: Archaeologist: 23 years experience in archaeology; BA Anthropology, expertise in Heritage Resource management, responsible for heritage resource analysis, restoration and reconnaissance.

Alisha Miller: Geologist: 3 years experience as FS Geologist; BA and MA Earth and Planetary Science; expertise in assessing forest management effects on geomorphic process and slope stability hazards mitigation; provided input for slope stability analysis and mitigation.

Bill Branham: Forester: 30 years experience in planning, silviculture, and land management. BS Forestry and MS Forest Ecology/Silviculture, Registered Professional Forester #2539 , Certified Silviculturist, responsible for program management.

Steve Graves: Unit Fuels Management Officer: 26 years experience in fire suppression and fuels management. Responsible for unit fuels project designs. Current qualifications include Division/Group Supervisor, Burn Boss Type II, and Fire Effects Monitor.

Abel Jasso: Geologist: 26 years with the Forest Service as a geologist with particular emphasis on slope stability hazards in forested terrain. BA and MS in Geology, provided land stability analysis and documentation.

Joyce Andersen: District Ranger for 10 years. Responsible for planning, implementation and supervision of personnel and programs on 2 ranger districts. BS in Environmental Planning and Management with 28 years of experience in natural resource planning, administration and silviculture. Served numerous details as Northern Spotted Owl Coordinator for Region 5, Fisheries Program Manager, State Community Revitalization Team Liaison, and Special Assistant to the Regional Forester for the Northwest Forest Plan.

C. Tribes

The following was consulted in the planning process for the Browns Project:

Ray Patton, representing the Nor-El-Muk Tribe of Wintu People.

D. Distribution of the Draft Environmental Statement

Federal Agencies

Advisory Council on Historic Preservation
Agriculture, U.S, APHIS PPD/EAD
Agriculture, U.S, Deputy Director
Agriculture, U.S, Natural Resources Conservation Service, National Environmental Coordinator
Agriculture, U.S, National Agricultural Library
BLM California State Office
National Marine Fisheries Service
US Environmental Protection Agency

State Agencies

California Regional Water Quality Control Board, North Coast Region
California Environmental Protection Agency

County

Trinity County Chamber of Commerce
Fire Safe Council, Trinity County Resource Conservation District
Trinity County Board of Supervisors
Trinity County Planning Department
Natural Resources Advisory Council
Trinity County Resource Conservation District

Organizations and Individuals

Petra Taylor-Vandormael, Californians for Alternatives to Toxins
Scott Greacen, Environmental Protection Information Center
Denise Boggs, Conservation Congress
Jeff Bryant, American Forest Resource Council
Scott Morris, Weaverville Basin Trail Committee
Jean Weese, Director Snyder Highland Foundation
Bob Morris & Norma Sorenson
Mark Lancaster
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F. Abbreviations and Acronyms

ARR	Archaeological Reconnaissance Reports
BA	Biological Assessment
BE	Biological Evaluation
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWE	Cumulative Watershed Effect
DEIS	Draft Environmental Impact Statement
DBH	Diameter at Breast Height
EIS	Environmental Impact Statement
EFH	Essential Fish Habitat
EPIC	Environmental Protection Information Center
ERA	Equivalent Roaded Acre
ERA/TOC	Equivalent Roaded Acre/Threshold of Concern Risk Ratio
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FSM	Forest Service Manual
FWS	United States Fish and Wildlife Service
HUC	Hydrologic Unit Code
LOP	Limited Operating Period
LRMP	Land and Resource Management Plan
LSOG	Late-Successional Old-Growth
LWD	Large Woody Debris
MIS	Management Indicator Species
MMBF	Million Board Feet
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NOAA Fisheries	National Oceanic and Atmospheric Administration (formally known as the National Marine Fisheries Service)
NWFP ROD	Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl
OHV	Off-Highway Vehicle
ROD	Record of Decision
S&G	Standard and Guideline
SONCC	Southern Oregon/Northern California Coast

TE&S	Threatened, Endangered, and Sensitive
THP	Timber Harvest Plan
TMDL	Total Maximum Daily Load
TOC	Threshold of Concern
TRMU	Trinity River Management Unit
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
WA	Watershed Analysis
WCC	Watershed Condition Class

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