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Revised Final Environmental Impact Statement

Moonlight and Wheeler Fires Recovery and Restoration Project

Mt. Hough Ranger District, Plumas National Forest
Plumas County, California

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Moonlight and Wheeler Fires Recovery and Restoration Project
Revised Final Environmental Impact Statement

Lead Agency: **USDA Forest Service**

Responsible Official: **Alice B. Carlton, Forest Supervisor**
PO Box 11500
159 Lawrence Street, Quincy, CA 95971

For Information Contact: **Rich Bednarski, Ecosystem Manager**
39696 Highway 70, Quincy, CA 95971
(530) 283-7641

Abstract: The Moonlight and Wheeler Fires Recovery and Restoration Project (Moonlight and Wheeler Project) Revised Final Environmental Impact Statement (RFEIS) documents the analysis of the no-action alternative and four action alternatives.

Alternative A (proposed action and preferred alternative) proposes: 1) to remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism; 2) to recover the value of the fire-killed trees before natural deterioration occurs in the treatment areas; and 3) to plant native conifer seedlings to recover forested conditions.

Alternative B (no action) represents current conditions and proposes no management actions.

Alternative C is similar to alternative A, but it reduces the number of acres where fire-killed merchantable trees would be removed to ground-based units.

Alternative D is consistent with the 2001 Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA 2001a, 2001b) and avoids the Old Forest Emphasis (OFE) land allocation (including California spotted owl Home Range Core Areas (HRCAs), Protected Activity Centers (PACs), and Spotted Owl Habitat Areas (SOHAs). There are no restrictions to removing hazard trees from any land allocation due to safety.

Alternative E is comprised of roadside hazard and reforestation activities only and does not include any road construction or reconstruction.

Summary

The proposed action would harvest dead (fire-killed) and/or dying (fire-injured) conifer trees on approximately 14,755 acres (10,366 acres of fire-killed trees and 4,389 acres of fire-killed and fire-injured roadside hazard trees) using the following methods: ground based, skyline, and helicopter. Up to 18 miles of temporary roads would be constructed and decommissioned after use. About 14 helicopter landings (30 acres) would be constructed. About 16,006 acres would be reforested with conifer seedlings. The area affected by the proposal includes 16,006 acres that burned primarily with high severity that resulted in a deforested condition characterized by relatively large areas of standing fire-killed trees of a total of 68,408 acres of public land within the Moonlight and Antelope Complex Fires.

Hazard trees need to be removed in a timely, efficient, and cost-effective manner so that access to affected areas can be restored and normal National Forest operations can resume. The wood quality, volume, and value of fire-killed trees deteriorate rapidly. Given the rate of deterioration of the fire-killed trees within the project area, there is an immediate need to recover the economic value. The National Forest Management Act sets policy to maintain appropriate forest cover in accordance with Forest plans and requires best effort to reforest within 5 years after harvest. As it relates to wildfires, it is Agency policy (FSM 2471 and 2472) to consider post-fire salvage harvest the functional equivalent of a regeneration harvest and to make a best effort to recover forested conditions within 5 years after harvest.

In December 2007, the Mt. Hough Ranger District of the Plumas National Forest (PNF) began the process to determine the scope (the depth and breadth) of the environmental analysis. At that time, it was anticipated that the Moonlight Fire Recovery and Restoration Project analysis would be documented in an Environmental Impact Statement (EIS) and the Wheeler Fire Recovery and Restoration Project analysis would be documented in an Environmental Assessment.

An open house was held for interested parties on December 20, 2007, in Taylorsville, California. The news release concerning the meeting was distributed to 262 key Forest contacts and members of the media. An article informing the public of the meeting was also published in several local newspapers, including the *Feather River Bulletin*, the Newspaper of Record for this project. Eighteen members of the public attended the meeting and several submitted comments.

In late December 2007, individual letters for each project were mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, individual letters for each project were mailed to 231 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

A Notice of Intent (NOI) for the Moonlight Fire Recovery and Restoration Project was published in the Federal Register on January 7, 2008 (Federal Register, Vol. 72, No. 4, Monday, January 7, 2008). Sixteen comments on the proposed action were received.

Fourteen comments on the Wheeler Fire Recovery and Restoration Project proposed action were received.

In December 2007 it was anticipated that the Moonlight Fire Recovery and Restoration Project analysis would be documented in an EIS and the Wheeler Fire Recovery and Restoration Project analysis would be documented in an Environmental Assessment. From comments received it was determined to document the analysis for both projects in one EIS. The new project name is Moonlight and Wheeler Fires Recovery and Restoration Project.

A revised NOI for the Moonlight and Wheeler Project was published in the Federal Register on May 22, 2008 (Federal Register, Vol. 73, No. 100, Thursday, May 22, 2008). The two projects were merged because each had similar actions, the fire perimeters are adjacent to one another, and it was uncertain to what degree, if any, the proposed action may have a significant effect on the quality of the human environment.

On May 15, 2008, a scoping update letter regarding the combined project was mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, the scoping update letter was mailed to 231 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

The Moonlight and Wheeler Fires Recovery and Restoration Project DEIS was sent to 37 agencies, organizations, and individuals in June 2008.

Nine comments were received on the DEIS for Moonlight and Wheeler Fires Recovery and Restoration Project.

The Moonlight Safety and Roadside Hazard Tree Removal Project was a separate project identified to remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism. Moonlight Safety and Roadside Hazard Tree Removal Project was being analyzed utilizing a categorical exclusion (category 4) and overlapped with a portion of the Moonlight and Wheeler Fires Recovery and Restoration Project. From comments received, it was determined to document the analysis for both projects in one EIS.

Twelve comments were received for Moonlight Safety and Roadside Hazard Tree Removal Project.

On December 5, 2008, a scoping update letter regarding the combined project was mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, the scoping update letter was mailed to 226 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

The interdisciplinary team considered the scoping comments received and the potential effects of the proposed action. No major issues were identified for the project; however minor issues were identified. They developed cause and effect relationship flow charts to identify potential issues.

A revised draft EIS (RDEIS) for the Moonlight and Wheeler Fires Recovery and Restoration Project, which now includes the Moonlight Roadside Safety and Hazard Tree Removal Project, was sent to 45 agencies, organizations, and individuals in February 2009.

Eleven comments on the Moonlight and Wheeler Fires Recovery and Restoration Project RDEIS were received.

The revised final EIS (RFEIS) will be sent to agencies, organizations, and individuals that submitted comments through project planning, individuals who requested a copy, and the appropriate reviewing agencies as listed under chapter 4, section 4.1.1.2.

In addition to the Proposed Action, the following alternatives will be fully analyzed:

Alternative B, the no action alternative.

Alternative C was designed to meet project objectives using a different mix of log yarding systems and was developed from comments and preliminary analysis. Alternative C would harvest fire-killed and/or fire-injured conifer trees utilizing ground-based equipment on 8,536 acres, construction of 18 miles of temporary roads, and reforestation on 9,306 acres.

Alternative D was developed from comments and was designed to be consistent with the 2001 SNFPA FSEIS ROD (USDA 2004a, 2004b) Alternative D would harvest fire-killed and/or fire-injured conifer trees utilizing ground-based equipment on 5,656 acres, constructing 3 miles of temporary roads, and planting native conifer seedlings on 16,006 acres.

Alternative E was designed to provide a range of alternatives and developed after merging the Moonlight Safety and Hazard Tree Removal Project into Moonlight and Wheeler Fires Recovery and Restoration Project. Alternative E would harvest hazardous fire-killed and fire-injured conifer trees utilizing ground-based equipment on 4,389 acres, reforesting on 16,006 acres, and no road construction.

The following alternatives were developed and considered but are eliminated from detailed study:

- An alternative (F) utilizing natural regeneration, wildland fire use, prescribed fire, and pile burning;
- An alternative (G) that has an upper diameter limitation of 24 inches for conifer removal;
- An alternative (H) that proposes harvest activities by California Wildlife Habitat Relationships (CWHR) density and size classes and excludes: ground-based logging and road construction and reconstruction from high vegetation burn severity areas, and harvesting from PACs and HRCAs;
- An alternative (I) that proposes to salvage harvest with only a helicopter logging system;
- An alternative (J) as proposed by the John Muir Project with specific activities. These include excluding salvage harvesting in moderate or high severity areas, exclude removal of snags greater than 20 inches diameter at breast height (dbh),

decommissioning roads, excluding road construction or reconstruction, and suspending grazing within the fire areas for 20 years; and

- An alternative (K) that proposes harvesting within the watersheds that are currently under thresholds.

Major conclusions include:

- Alternative A provides more jobs, employee related income, and sawlog and biomass volumes; however alternative A is marginal at about five percent below the net revenues.
- No change in CWHR forest types resulting from proposed salvage activities.
- Seven wildlife species with "May Affect Individuals" determinations: mountain yellow-legged frog, bald eagle, California spotted owl, Northern goshawk, American marten, pallid bat, and Western red bat.
- Seventeen of 26 analysis watersheds are over thresholds set by the Forest, for management impacts that affect runoff. All but two of the watersheds over threshold are due to the effects of the fire.
- Large woody debris guidelines would be met in areas proposed for treatment, including ground-based units and Riparian Habitat Conservation Areas (RHCAs).
- The impact of the proposed action relative to erosion potential would not be higher than that of the wildfire, though the salvage activities would prolong natural recovery from 2 to 5 years.
- Within treatment units that contain weeds, there is a high risk of being spread within the units, but a low risk of spread from one treatment unit to another.
- Reforestation efforts should hasten restoration of forested conditions; resulting in CWHR class 3 stands in approximately 40 to 50 years.
- All action alternatives are designed to exclude salvage logging entirely from 78 percent (under alternative A) to 94 percent (under alternative E) of public lands within the area and would only treat 6 (under alternative E) to 30 percent (under alternative A) of the public lands that burned with high severity.

Based upon the effects of the alternatives, the Responsible Official will decide to implement the project as proposed, implement the project based on an alternative, or not implement the project at this time.

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1 Purpose of and Need for Action

1.1 Document Structure

The Forest Service has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters, with appendices and an index:

- **Chapter 1. Purpose of and Need for Action:** This chapter briefly describes the proposed action, the need for action, and other purposes to be achieved by the proposal. This section also details how the Forest Service informed the public of the proposed action and how the public responded.
- **Chapter 2. Alternatives, including the Proposed Action:** This chapter provides a detailed description of the Agency's proposed action, as well as alternative actions that were developed in response to comments raised by the public during scoping.
- **Chapter 3. Affected Environment and Environmental Consequences:** This chapter describes the environmental impacts of the proposed action and alternatives.
- **Chapter 4. Consultation and Coordination:** This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental impact statement.
- **Index:** The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project area resources, may be found in the project record located at the Mt. Hough Ranger District, 39696 Highway 70, Quincy, CA 95971.

1.2 Background

The Antelope Complex fires began on July 5, 2007, burned approximately 23,000 acres, over 13,000 of which burned with high vegetation burn severity, and affected lands on both Mt. Hough and Beckwourth Ranger Districts. As a result of several lightning strikes, nine wildland fires began; the Wheeler fire became the largest fire within the Antelope Complex.

The Moonlight fire began on September 3, 2007, burned approximately 65,000 acres, and was contained on September 15, 2007. Based on the most recent fire severity assessment methods and severity maps (Safford et al. 2007; Miller 2007; Miller and Thode 2007), over 54,000 acres burned with high vegetation burn severity (killing 75 to 100 percent of the trees). This has resulted in a deforested condition characterized by relatively large areas of standing dead trees.

1.3 Purpose and Need for Action

The Moonlight and Wheeler Project is proposed to respond to the goals and objectives of the Plumas National Forest (PNF) Land and Resource Management Plan (PNF LRMP) as amended by Herger-Feinstein Quincy Library Group (HFQLG) Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA 1999a, 1999b, 2003b, 2003c), and the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, 2004b). Comparison of the existing condition and the desired conditions for the PNF LRMP indicates a need to address undesirable resource conditions as a result of the Moonlight and Antelope Complex fires.

The SNFPA ROD (2004) identifies the need to incorporate ecosystem restoration following catastrophic events (D. Management Standards and Guidelines, Salvage, pages 52 and 53). This project specifically includes eliminating safety hazards for public safety, recovering the economic value of dead trees (high vegetation burn severity), and planting conifer seedlings.

The action of recovering economic value of dead trees would contribute to the wood supply for local manufacturers and sustaining a part of the employment base in rural communities. Harvesting hazard trees along roads would eliminate those public safety hazards. The action of conifer seedling planting would meet National Forest Management Act (NFMA) standards.

1.3.1 Purpose 1: Remove roadside safety hazards

Objective: Remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism.

Need for action: The Forest Service is required to maintain roads for access and safety, and the agency routinely removes hazardous trees as part of road maintenance (23 Code of Federal Regulations (CFR) 500.108, 36 CFR 212.4, Forest Service Manual (FSM) 7700, Forest Service Handbook (FSH) 6709.11, 27.62d, PNF Roadside/Facility Hazard Tree Abatement Action Plan 2008). It is not uncommon for high, gusty winds associated with winter or summer storms to suddenly blow down many such hazardous trees at one time, posing an unacceptable risk to forest workers and visitors alike. It is important to remove these hazardous trees in a timely, efficient, and cost-effective manner so that access to affected areas can be restored and normal National Forest operations can be resumed.

Measurement indicators:

- Miles of National Forest System (NFS) roads treated for hazard tree removal

1.3.2 Purpose 2: Recover the value of the fire-killed trees

Objective: Recover the value of the fire-killed trees before natural deterioration occurs in the treatment areas.

Need for action: The Forest Service has a role to play in providing a wood supply for local manufacturers and sustaining a part of the employment base in rural communities (SNFPA ROD 2004, page 4). The SNPFA provides for salvage logging following

wildfires for the objective of recovering economic value from fire-killed trees (SNFPA ROD 2004, page 52). Based on Geographic Information Systems (GIS) and cruise plot data, it is estimated that approximately 500,000 mbf in sawlogs exists within the Moonlight and Wheeler Fires that burned with high vegetation burn severity.

Roads and landings are absent in several areas of the project. Temporary road and landing construction is needed to permit the removal and utilization of material.

Measurement indicators:

- Acres of public land treated for salvage recovery
- Acres of public land treated for hazard tree removal
- Volume (thousand board feet - mbf) of salvage and hazard tree timber recovered from public land
- Net value (dollars) of salvage and hazard tree sawlogs recovered from public land
- Combined (sawlog and biomass) net value (dollars) recovered from public land
- Total project value (dollars)
- Total full-time jobs (#)
- Total employee-related income (dollars)

1.3.3 Purpose 3: Re-establish forested conditions

Objective: Plant native conifer seedlings to recover forested conditions.

Measurement indicator:

Percent of public land reforested within the Moonlight Fire and Antelope Complex perimeters

Need for action: The National Forest Management Act sets policy to maintain appropriate forest cover in accordance with forest.

The Moonlight and Antelope Complex fires burned thousands of acres with high severity resulting in deforested conditions where seed source of desired species is insufficient to naturally regenerate these areas. As a result, shrub species would dominate these areas for decades and delay re-establishment of forested conditions. The early establishment of conifers through reforestation would expedite forest regeneration and the development of forested conditions.

In addition, as it relates to wildfires, it is current Agency policy (FSM 2471 and 2472) to consider post-fire salvage harvest the functional equivalent of a regeneration harvest and to make a best effort to re-establish forested conditions within 5 years after salvage harvest.

1.4 Proposed Action Summary

A brief description of the proposed action is provided in this section. The proposed action and other alternatives are described in detail in chapter 2.

The United States Department of Agriculture (USDA) Forest Service, PNF, Mt. Hough Ranger District proposes the Moonlight and Wheeler Project to harvest fire-killed conifer trees (10,366 acres), including Riparian Habitat Conservation Areas (RHCAs); harvest fire-killed and fire-injured trees along roadsides (4,389 acres, and plant native conifer tree

seedlings (16,006 acres). The project would include 8,536 acres of ground-based, 872 acres of skyline, and 5,347 acres of helicopter logging systems. The project would start in the summer of 2009.

The proposed project is located in Plumas County, California, on the Mt. Hough Ranger District of the PNF. The project is located in all or portions of: sections 13, 23-27, 34, and 35, T28N, R10E; sections 13, 14, 17-19, 23, 24, 29-34, T28N, R11E; sections 19, 20, and 29-32, T28N, R12E; sections 1, 2, 13, 14, and 23-25, T27N, R10E; sections 2-11, 13-15, 17, 19-22, 25, 35, and 36, T27N, R11E; sections 5, 8, 17-20, and 29-32, T27N, R12E; sections 1-5, 9-12, 14-16, 21-23, and 26-27, T26N, R12E; sections 23-29 and 31-36, T27N, R12E; and sections 19, 20, and 30, T27N, R13E; Mount Diablo Meridian.

1.5 Decision Framework

The Responsible Official is the Forest Supervisor for the PNF. Given the purpose and need, the Responsible Official will review the no action and action alternatives and decide to implement the project as proposed, implement the project based on an alternative, or not implement the project at this time.

1.6 Public Involvement

An open house was held for interested parties on December 20, 2007, in Taylorsville, California. The news release concerning the meeting was distributed to 262 key Forest contacts and members of the media. An article informing the public of the meeting was also published in several local newspapers, including the *Feather River Bulletin*, the Newspaper of Record for this project. Eighteen members of the public attended the meeting and several submitted comments.

In late December 2007, individual letters for each project were mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, individual letters for each project were mailed to 231 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

A Notice of Intent (NOI) for the Moonlight Fire Recovery and Restoration Project was published in the Federal Register on January 7, 2008 (Federal Register, Vol. 72, No. 4, Monday, January 7, 2008). Sixteen comments on the proposed action were received.

In December 2007 it was anticipated that the Moonlight Fire Recovery and Restoration Project analysis would be documented in an EIS and the Wheeler Fire Recovery and Restoration Project analysis would be documented in an Environmental Assessment. From comments received it was determined to document the analysis for both projects in one EIS. The new project name is Moonlight and Wheeler Fires Recovery and Restoration Project.

A revised NOI for the Moonlight and Wheeler Project was published in the Federal Register on May 22, 2008 (Federal Register, Vol. 73, No. 100, Thursday, May 22, 2008). The two projects were merged because each had similar actions, the fire perimeters are

adjacent to one another, and it was uncertain to what degree, if any, the proposed action may have a significant effect on the quality of the human environment.

On May 15, 2008, a scoping update letter regarding the combined project was mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, the scoping update letter was mailed to 231 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

The Moonlight and Wheeler Fires Recovery and Restoration Project DEIS was sent to 37 agencies, organizations, and individuals in June 2008.

Nine comments were received on the DEIS for Moonlight and Wheeler Fires Recovery and Restoration Project.

The Moonlight Safety and Roadside Hazard Tree Removal Project was a separate project identified to remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism. Moonlight Safety and Roadside Hazard Tree Removal Project was being analyzed utilizing a categorical exclusion (category 4) and overlapped with a portion of the Moonlight and Wheeler Fires Recovery and Restoration Project. From comments received, it was determined to document the analysis for both projects in one EIS.

Twelve comments were received for Moonlight Safety and Roadside Hazard Tree Removal Project.

On December 5, 2008, a scoping update letter regarding the combined project was mailed to Native American entities (including federally recognized tribal governments, tribal groups currently applying for federal recognition, and Native American organizations/non-profit groups) that are interested in projects that are located on this portion of the PNF.

In addition, the scoping update letter was mailed to 226 agencies, organizations, adjacent landowners, and individuals who expressed interest in projects of this type.

The interdisciplinary team considered the scoping comments received and the potential effects of the proposed action. No major issues were identified for the project; however minor issues were identified. They developed cause and effect relationship flow charts to identify potential issues.

A revised draft EIS (RDEIS) for the Moonlight and Wheeler Fires Recovery and Restoration Project, which now includes the Moonlight Roadside Safety and Hazard Tree Removal Project, was sent to 45 agencies, organizations, and individuals in February 2009.

Eleven comments on the Moonlight and Wheeler Fires Recovery and Restoration Project RDEIS were received.

The revised final EIS (RFEIS) will be sent to agencies, organizations, and individuals that submitted comments through project planning, individuals who requested a copy, and the appropriate reviewing agencies as listed under chapter 4, section 4.1.1.2.

A complete record of public and internal scoping activities is in the project record at the Mt. Hough Ranger District, Quincy, CA.

The following individuals, organizations, and agencies provided scoping comments on the proposed action and/or comments during the official 30 day comment period for Moonlight Safety and Roadside Hazard Tree Removal Project:

- Chad Hanson, John Muir Project
- Bill Wickman, American Forest Resource Council
- Hugh Panghorn
- Frank Stewart, Counties' QLG Forester
- David C. Allen, Honey Lake Power
- Ren Reynolds, Estom Yumeka Maidu Tribe of Enterprise Rancheria
- Michael DeSpain, Greenville Rancheria
- Mike Lazzarino, Sierra Access Coalition

The following individuals, organizations, and agencies provided scoping comments on the proposed action and/or comments during the official 45 day comment period Moonlight and Wheeler Fires Recovery and Restoration Project:

- Keith and Wanda Crummer
- Monica Bond, John Muir Project
- Joe Musser
- Albert C. Will
- Leslie Mink
- Randy Pew, Pew Forest Products
- Jay C. Francis, Collins Pine
- Gale Dupree, Nevada Wildlife Federation
- Frank Stewart, Counties' Quincy Library Group Forester
- Jonathan Rhodes, Planeto Azul Hydrology, John Muir Project
- John Forno, Sierra Pacific Industries
- Darrel Cruz, Washoe Tribe of California and Nevada
- Sam Longmire, Northern Sierra Air Quality Management District
- Brian Wayland, Sierra Pacific Industries
- One joint letter signed by Craig Thomas for Sierra Forest Legacy; Pat Gallagher for Sierra Club; John Preschutti for Plumas Forest Project; and Chad Hanson for John Muir Project
- Shaun McCloud, Northern Sierra Air Quality Management District
- Bill Wickman, American Forest Resource Council
- Jennifer Johnson, Washoe Tribe of California and Nevada
- Rose Comstock, Plumas County Board of Supervisors
- Chad Hanson, John Muir Project
- Nancy Marker
- Linda Blum
- Darca Morgan, Sierra Forest Legacy
- Michael DeSpain, Greenville Rancheria
- Harry L. Dietrich
- Robert and Barbara MacAurthur
- Max Merlich, Columbia Helicopters Inc.
- Bill Davies

- Marsha and Daryl Gardner
- Vivian Parker, California Native Plant Society
- Kathleen Goforth, U.S. Environmental Protection Agency
- Patricia Sanderson Port, U.S.D.I, Office of Environmental Policy and Compliance
- Michael DeSpain, Mechoopda Indian Tribe of Chico Rancheria
- David C. Allen, Honey Lake Power

Using the comments from the public and other agencies, the interdisciplinary team (IDT) developed a list of minor issues (Project Record, Mt Hough Ranger District, Quincy, CA).

1.7 Scope of the Analysis

The need for the project led to the development of the project objectives (section 1.3). These objectives were used to develop the proposed action (alternative A), alternative C, D and E, and the alternatives eliminated from detailed study in chapter 2. Analysis of these objectives appears in chapter 3. The comparison of the alternatives relative to the objectives and the indicator measures appears in the comparison summary Table 21 at the end of chapter 2.

Public and agency scoping is the process used to identify major, minor, and non-issues and to determine the extent of environmental analysis necessary for an informed decision to be made concerning the proposed action.

The public and IDT identified potential issues and the Responsible Official approved those issues to be carried through the analysis as minor issues.

1.7.1 Major Issues

No major issues were identified for the project. The IDT considered the scoping comments received and the potential effects of the proposed action. They developed cause and effect relationship flow charts to identify potential issues. Some analyses were completed to determine the effects of the proposed action and none of the analyses showed more than minor effects to any resources. Due to restrictions on proposed project activities imposed by laws, PNF LRMP Standards, and overall design of the proposed action, the project was developed to have relatively low impacts to resources.

1.7.2 Minor Issues

Following the analysis of the proposed action, the IDT found that there were minor effects to some resources. The cause and effect relationships, with levels of effects too low to drive the development of additional alternatives or influence a decision, were determined to be minor issues. The effects related to these minor issues are described in chapter 3.

1.7.3 Issues Eliminated from Detailed Study

The IDT found that some of the potential issues were outside the scope of the defined analysis, related to resources that do not exist in the project area, or had a faulty cause and effect relationship. The following section lists these issue statements along with an

explanation of why each was eliminated from detailed study. No further information on these concerns appears in this revised final EIS.

1.7.3.1 Economics

1. Concentrating snag retention in California spotted owl PACs, where the largest and most valuable trees are, would reduce economic benefits to local communities.

Approximately 1,060 acres (10 percent) of the proposed treatment units would be identified as snag retention areas. Approximately 39 percent of the acreage in snag retention areas (671 acres) is within former PACs. The estimated volume for these snag retention areas is approximately 4,900 mbf and accounts for less than five percent of the volume proposed to be removed under Alternative A. Consequently, it is anticipated that these snag retention areas would not substantially reduce economic benefits to local communities.

2. Implementing Stewardship Contracts would reduce economic benefit to local communities, specifically funds for Plumas County schools and roads.

The Moonlight and Wheeler Project has not identified the need for Stewardship Contracting. Currently there are no actions identified where Stewardship Contracting would be appropriate to implement.

1.7.3.2 Forest Vegetation

1. Post-fire seeding generally damages natural ecological values.

Post-fire seeding is not included as an activity within the proposed action.

2. The Forest Service is likely to be logging significant numbers of important live green trees without an assessment of mortality that is based on a green needle assessment done well into the growing season of 2008.

The guidelines, used for roadside hazard trees only, are based upon tree mortality models developed through the latest scientific research (Hood et al. 2007). The sampling methods have been used previously as documented in other papers published by natural resource scientists and are widely accepted by the scientific community (Fire Sciences Laboratory, Rocky Mountain Research Station).

1.8 Laws, Regulations, or Planning Documents Influencing the Scope of this Environmental Analysis

Management proposals by the PNF are determined by direction contained in the Plumas National Forest (PNF) Land and Resource Management Plan (PNF LRMP) as amended by Herger-Feinstein Quincy Library Group (HFQLG) Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA 1999a, 1999b, 2003b, 2003c), and the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, 2004b). In addition, the HFQLG/SNFPA Implementation Consistency Crosswalk, revised December 2007, provides clarification for applying standards and guidelines for 2004 SNFPA FSEIS and ROD (USDA 2004a, 2004b) and for HFQLG FSEIS and ROD (USDA 1999a, 1999b, 2003b, 2003c) (HFQLG / SNFPA

Implementation Consistency Crosswalk and cover letter, December 12, 2007)(USDA 2007c).

HFQLG Management Direction of the SNFPA ROD (USDA 2004b, pages 66-68) applies to salvage activities included in this EIS. Salvage guidance is not specifically addressed in table 2 of the SNFPA ROD (USDA 2004b, pages 68 and 69). Under the SNFPA ROD errata (USDA 2004c), guidance of the SNFPA ROD (2004b, pages 52 and 53) clarifies salvage direction (subject to HFQLG limitations).

Table 2 of the SNFPA ROD (USDA 2004b) provides standards and guidelines applicable to the HFQLG Pilot Project area for the life of the pilot project. Standards and guidelines that are applicable to this project from table 2 include those for HFQLG land allocations (table 2, pages 68-69), Scientific Analysis Team (SAT) Guidelines (USDA 2004b, page 67; USDA 1999a, Appendix L, pages APP L 9 – APP L 12), and down wood and snags (page 69).

According to the HFQLG ROD (USDA 1999b) “The Lassen, Plumas, and Tahoe Forest Plans are amended to prohibit scheduled timber harvest in Riparian Habitat Conservation Areas (RHCAs), except for salvage harvest, or to meet SAT guidelines for riparian management objectives”.

In addition, there is no set diameter limit within the SNFPA ROD (USDA 2004b) for trees with 100 percent mortality or snag removal for salvage; therefore as long as the recommended snag guidelines are met (USDA 2004b, table 2, pages 68-69), all other large trees (greater than 30 inches dbh) with 100 percent mortality may be removed as salvage.

According to the SNFPA ROD (USDA 2004b, page 37) the Forest Service is to evaluate habitat conditions after a stand-replacing event within a 1.5-mile radius around the activity center to identify opportunities for re-mapping the PAC. If there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network. The Moonlight and Wheeler fires impacted twenty-five PACs.

Direction of Spotted Owl Habitat Areas (SOHAs) is found in the HFQLG FEIS (USDA 1999a, Appendix Q) to determine if a SOHA should be retained or removed from the network. After analyzing the evaluation criteria found in appendix Q and areas of the SOHA are rendered unsuitable, salvage harvest is acceptable in those areas but not in the remainder of the SOHA. If the SOHA is determined to be 100 percent unsuitable then salvage may occur within the entire SOHA. A complete record of PAC and SOHA analyses are in the project record at the Mt. Hough Ranger District, Quincy, CA.

The Moonlight and Wheeler Project has incorporated “snag retention areas” where salvage harvest would not occur (USDA 2004b, pages 52).

1.9 Applicable Permits, Licenses, and Other Consultation Requirements

State requirements based on federal laws for air quality management would be followed. These requirements include burning only on permissive burn days, or receiving a special authorization prior to ignition. Smoke permits are required from the Northern Sierra Air

Quality Management District. Silviculture Waiver for waste discharge would be required from the California Regional Water Quality Control Board.

2 Alternatives, Including the Proposed Action

2.1 Introduction

This chapter describes and compares the alternatives considered for the Moonlight and Wheeler Project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choice among options by the decision maker.

The acres and volumes displayed are estimates based on aerial photography, map interpretation, on-the-ground estimates, collected Global Positioning System (GPS) data. The estimated acres of harvest treatment and planting acres discussed throughout this document are the maximum that would be considered for logging and planting. The actual figures may be less when implemented, but would not exceed the stated acres.

2.2 Alternatives Considered in Detail

The Forest Service developed five alternatives, including the no action and four action alternatives developed in response to the project objectives. Tables 1-15 display the design elements for each alternative.

2.2.1 Alternative A – Proposed Action

The proposed action includes four groups of activities: salvage timber harvest, roadside hazard timber harvest, construction of temporary roads and landings for access, and reforestation.

2.2.1.1 Salvage Timber Harvest

Fire-killed conifer trees would be felled and removed (up to 10,366 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within treatment units. Refer to the map specific to alternative A located in envelope on the back cover of the revised FEIS. Table 1 displays the design elements for salvage timber harvest under alternative A.

Table 1. Design elements for salvage timber harvest actions for alternative A.

CRITERION	DESIGN
Vegetation Burn Severity	▪ Harvest activities would occur in high vegetation burn severity areas, up to 10,366 acres, within the project area. Logging systems used on these areas are described below. No mortality guidelines would be used. ▪ No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 14 inches dbh would be removed as sawlog product and trees less than 14 inches dbh would be removed as a biomass product on up to 4,147 acres. ▪ Ground-based equipment would be restricted to slopes less than 35 percent except on

CRITERION	DESIGN
	decomposed granitic soils where equipment would be restricted to slopes less than 25 percent, to reduce displacement and erosion on highly erodible soils. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
Skyline Logging System	▪ Harvest and remove trees greater than 16 inches dbh, up to 872 acres, as sawlog product. ▪ To increase ground cover in order to prevent runoff and/or erosion, and to provide erosion control, limbs and tops would be lopped and scattered to a depth of less than 18 inches in height. ▪ Skyline yarding would require one end suspension with full suspension over stream courses, which would reduce furrowing cause by cabled logs. Full suspension over channels would avoid damage to banks, beds, and riparian vegetation, and turbidity from stirred up bottom sediments.
Helicopter Logging System	▪ Harvest and remove trees greater than 16 inches dbh, up to 5,347 acres, as sawlog product. ▪ To increase ground cover in order to prevent runoff and/or erosion, and to provide erosion control, limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
RHCA Equipment Constraints	▪ To reduce erosion and runoff into streams, no ground-based mechanical equipment operations on slopes steeper than 25 percent. ▪ To reduce erosion and runoff potential, equipment restriction zones adjacent to stream channels would be established based on stream type and slope class. This is displayed in Table 2. ▪ In the advent that the riparian zone is wider than standards and guidelines prescribe, extend the equipment restriction zones to 25 feet beyond the outer or upslope extent of the “green line” (actual or potential extent of riparian vegetation) or the inner channel slope break, where these features are present and these widths would exceed the above-listed

CRITERION	DESIGN
	widths. ▪ To prevent initiating mass wasting, exclude equipment from unstable slopes (landslide-prone areas or unstable mined lands) outside the riparian equipment restriction zones. ▪ To minimize soils disturbance, harvesting and removal of products within equipment exclusion zones would require directional felling and end-lining. ▪ To reduce soil compaction, allow low ground pressure equipment to travel into the outer RHCA zone (outside the equipment restriction zone) to retrieve harvest trees and bring them to skid trails. ▪ To minimize catchment areas for runoff into streams, locate skid trails at angles acute or perpendicular to stream channels to minimize erosion into the channel, and allow skidders to enter the outer RHCA on these skid trails. ▪ To minimize soil displacement, no equipment would be permitted to turn around while off a skid trail in RHCAs.
Snag Retention	▪ Retain the number of snags per acre appropriate for each forest type on a landscape basis. In Sierra mixed conifer types and ponderosa pine forest types, retain four of the largest snags per acre. In the red fir forest type, retain six of the largest snags per acre. Retaining 4-6 snags per acre includes snag retention areas within treatment units, RHCAs, and remaining snags outside of treatment units. ▪ Snags larger than 15 inches dbh and 20 feet in height would be used to meet this guideline. ▪ “Snag retention areas” about 10 acres in size would be designated, up to 1,060 acres, throughout 10 percent of the treatment areas. ▪ Primary selection criteria for snag retention areas are: 1) areas formerly identified as spotted owl PACs, 2) along treatment unit boundaries adjacent to non-burned and low severity areas, 3) within RHCAs, and 4) in stands that supported a minimum of 40 percent canopy cover pre-fire. ▪ No harvesting would occur within snag retention areas. ▪ Incidental removal of snags may occur to allow for operability and safety.
Down Woody Material Retention	▪ Generally retain an average of 5 to 15 tons of down woody material per acre. Emphasize retention of wood that is in the earliest stages of decay.

CRITERION	DESIGN
Landing Piles and Fireline	▪ Excess fuels on landings would be piled, firelines constructed around the piles, and the piles burned. ▪ Firelines would be hand or machine line as appropriate and would incorporate existing roads, landings, skid trails, rock fields, bare areas, and other features where logical and feasible.

Table 2. Equipment restriction zones in RHCAs for ground-based equipment based on stream type and slope class.

Stream Type	Equipment Restrictions by Slope Class		
	0–15%	**15–25%**	**>25%**
Perennial, fish bearing	100 feet	150 feet	300 feet
Perennial, no fish	50 feet	100 feet	150 feet
Intermittent	25 feet	50 feet	100 feet
Ephemeral	25 feet	50 feet	100 feet

2.2.1.2 Roadside Hazard Timber Harvest

Fire-killed and fire-injured conifer trees would be felled and removed (up to 4,389 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within 150 feet from the road prism. Table 3 displays the design elements for roadside hazard actions under alternative A.

Table 3. Design elements for roadside hazard actions for alternative A.

CRITERION	DESIGN
Vegetation Burn Severity	▪Harvest activities would occur within 150 feet from the road prism along 123 miles of National Forest System roads within the Moonlight Fire perimeter. With a 150 foot buffer this totals to approximately 4,389 acres of roadside hazard timber harvest. Logging systems used on these areas are described below. Hazard trees proposed for felling have been identified using the PNF Roadside/Facility Hazard Tree Guidelines and Identification Criteria and PNF: Mt. Hough Ranger District Marking Guidelines for Fire-Injured Trees within the Moonlight Fire Roadside Safety and Hazard Tree Removal Project (see Project Record) ▪No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 10 inches dbh would be removed as sawlog product and trees less than 10 inches dbh would be removed as a biomass product, on up to 4,389 acres. ▪ Ground-based equipment would operate from National Forest System or non-system roads. ▪ To prevent erosion on sensitive slopes, no off road operations on slopes, road cutbanks, or road fill slopes greater than 25 percent. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height. ▪ Incidental removal of green trees may occur to allow for temporary road and landing construction. ▪ Slash may be piled, firelines constructed around the piles, and the piles burned. ▪ No piles would be constructed within RHCAs.

2.2.1.3 Access

Approximately 13 miles of new temporary roads (6 miles of temporary roads exist) would be constructed to access the treatment units; these temporary roads would be constructed according to current standards for short-term use. Approximately 30 acres of new temporary helicopter landings (14) would be constructed. Table 4 displays the design elements for access actions under alternative A.

Table 4. Design elements for access actions for alternative A.

CRITERION	DESIGN
Temporary Roads and Landings	Existing roads, skid trails, and landings would be utilized where possible to reduce the extent of detrimental disturbance to soils. To hasten restoration of disturbed soil areas, new temporary roads, skid trails, and landings would be subsoiled to a minimum of 18 inches in depth, reforested, and closed following the completion of harvest. Refer to appendix C for Best Management Practices (BMPs) and Standard Management Requirements (SMRs) specific to temporary roads and landings.
	Incidental removal of green trees may occur to allow for temporary road and landing construction.

2.2.1.4 Reforestation

Reforestation includes site preparation and planting of native conifer seedlings in areas of moderately high and high vegetation burn severity, up to 16,006 acres. Table 5 displays the design elements for reforestation under alternative A.

Table 5. Design elements for reforestation for alternative A.

CRITERION	DESIGN
Reforestation of Fire-killed Stands	Reforestation would be accomplished through a combination of planting and natural regeneration. Areas that burned with moderately high and high vegetation burn severity resulting in inadequately stocked forest land would receive preference for planting, up to 16,006 acres.
Site Preparation/Release for Planting	Manual grubbing and/or removal of competing vegetation down to mineral soil five feet in diameter around the planting site.
Tree Species	Species to be planted would include ponderosa pine, Jeffrey pine, Douglas-fir, incense cedar, rust resistant sugar pine, and true firs.
Planting Spacing	One hundred to two hundred trees per acre would be planted in widely-spaced clusters.

2.2.2 Alternative B – No Action

Under the no action alternative, current management plans would continue to guide management of the project area. Under the no action alternative, there would be no removal of fire-killed trees, construction of temporary roads and landings, or planting of

tree seedlings, except for Burned Area Emergency Rehabilitation (BAER) activities. The following ongoing activities would occur: firewood cutting, fire suppression, Christmas tree cutting, right-of-way maintenance for telephone and power lines, road use and maintenance, mining operations, and recreational use. The no action alternative could be viewed as passive management as described by Beschta and others (2004).

2.2.3 Alternative C – Ground-based Logging System

Alternative C includes four groups of activities: salvage timber harvest, roadside hazard timber harvest, construction of temporary roads and landings for access, and reforestation. Alternative C does not include harvest, access, or reforestation activities within the areas designated in alternative A for skyline or helicopter logging systems.

2.2.3.1 Salvage Timber Harvest

Merchantable trees would be felled and removed (up to 4,147 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within treatment units. Table 6 displays the design elements for salvage timber harvest under alternative C.

Table 6. Design elements for salvage timber harvest actions for alternative C.

CRITERION	DESIGN
Vegetation Burn Severity	▪ Harvest activities would occur with moderately high and high vegetation burn severity areas, up to 4,147 acres, within the project area. No mortality guidelines would be used. ▪ No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 14 inches dbh would be removed as sawlog product and trees less than 14 inches dbh would be removed as a biomass product, on up to 4,147 acres. ▪ Ground-based equipment would be restricted to slopes less than 35 percent except on decomposed granitic soils where equipment would be restricted to slopes less than 25 percent, to reduce displacement and erosion on highly erodible soils. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
RHCA Equipment Constraints	▪ To reduce erosion and runoff into streams, no ground-based mechanical equipment operations on slopes steeper than 25 percent. ▪ To reduce erosion and runoff potential, equipment restriction zones adjacent to stream channels would be established based on stream

CRITERION	DESIGN
	type and slope class. This is displayed in Table 2. ▪ In the advent that the riparian zone is wider than standards and guidelines prescribe, extend the equipment restriction zones to 25 feet beyond the outer or upslope extent of the "green line" (actual or potential extent of riparian vegetation) or the inner channel slope break, where these features are present and these widths would exceed the above-listed widths. ▪ To prevent initiating mass wasting, exclude equipment from unstable slopes (landslide-prone areas or unstable mined lands) outside the riparian equipment restriction zones. ▪ To minimize soils disturbance, harvesting and removal of products within equipment exclusion zones would require directional felling and end-lining. ▪ To reduce soil compaction, allow low ground pressure equipment to travel into the outer RHCA zone (outside the equipment restriction zone) to retrieve harvest trees and bring them to skid trails. ▪ To minimize catchment areas for runoff into streams, locate skid trails at angles acute or perpendicular to stream channels to minimize erosion into the channel, and allow skidders to enter the outer RHCA on these skid trails. ▪ To minimize soil displacement, no equipment would be permitted to turn around while off a skid trail in RHCAs.
Snag Retention	▪ Retain the number of snags per acre appropriate for each forest type on a landscape basis. In Sierra mixed conifer types and ponderosa pine forest types, retain four of the largest snags per acre. In the red fir forest type, retain six of the largest snags per acre. Retaining 4-6 snags per acre includes units, RHCAs, and remaining snags outside of treatment units. ▪ Snags larger than 15 inches dbh and 20 feet in height would be used to meet this guideline. ▪ "Snag retention areas" about 10 acres in size would be designated throughout 10 percent of the treatment areas, up to 580 acres. ▪ Primary selection criteria for snag retention areas are 1) areas formerly identified as spotted owl PACs, 2) along treatment unit boundaries adjacent to non-burned and low severity areas, 3) within RHCAs, and 4) in stands that supported a minimum of 40 percent canopy

CRITERION	DESIGN
	cover pre-fire. ▪No harvesting would occur within snag retention areas. ▪Incidental removal of snags may occur to allow for operability.
Down Woody Material Retention	▪Generally retain an average of 5 to 15 tons of down woody material per acre. Emphasize retention of wood that is in the earliest stages of decay.
Landing Piles and Fireline	▪Excess fuels on landings would be piled, firelines constructed around the piles, and the piles burned. ▪Firelines would be hand or machine line as appropriate and would incorporate existing roads, landings, skid trails, rock fields, bare areas, and other features where logical and feasible.

2.2.3.2 Roadside Hazard Timber Harvest

Fire-killed and fire-injured conifer trees would be felled and removed (up to 4,389 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within 150 feet from the road prism. Table 7 displays the design elements for roadside hazard actions under alternative C.

Table 7. Design elements for roadside hazard actions for alternative C.

CRITERION	DESIGN
Vegetation Burn Severity	▪Harvest activities would occur within 150 feet from the road prism along 123 miles of National Forest System roads within the Moonlight Fire perimeter. With a 150 foot buffer this totals to approximately 4,389 acres of roadside hazard timber harvest. Logging systems used on these areas are described below. Hazard trees proposed for felling have been identified using the PNF Roadside/Facility Hazard Tree Guidelines and Identification Criteria and PNF: Mt. Hough Ranger District Marking Guidelines for Fire-Injured Trees within the Moonlight Fire Roadside Safety and Hazard Tree Removal Project (see Project Record) ▪No upper diameter limit would be used.

CRITERION	DESIGN
Ground-based Logging System	▪ Trees greater than 10 inches dbh would be removed as sawlog product and trees less than 10 inches dbh would be removed, as a biomass product on up to 4,389 acres. ▪ Ground-based equipment would operate from National Forest System roads. ▪ To prevent erosion on sensitive slopes, no off road operations on slopes, road cutbanks, or road fill slopes greater than 25 percent. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height. ▪ Incidental removal of green trees may occur to allow for temporary road and landing construction. ▪ Slash may be piled, firelines constructed around the piles, and the piles burned. ▪ No piles would be constructed within RHCAs.

2.2.3.3 Access

Approximately 12 miles of new temporary roads (6 miles of temporary roads exist) would be constructed to access the treatment units; these temporary roads would be constructed according to current standards for short-term use. Table 8 displays the design elements for access actions under alternative C.

Table 8. Design elements for access actions for alternative C.

CRITERION	DESIGN
Temporary Roads and Landings	Existing roads, skid trails, and landings would be utilized where possible to reduce the extent of detrimental disturbance to soils. To hasten restoration of disturbed soil areas, new temporary roads, skid trails, and landings would be subsoiled to a minimum of 18 inches in depth, reforested, and closed following the completion of harvest. Refer to appendix C for Best Management Practices (BMPs) and Standard Management Requirements (SMRs) specific to temporary roads and landings.
	Incidental removal of green trees may occur to allow for temporary road and landing construction.

2.2.3.4 Reforestation

Reforestation includes site preparation and planting of native conifer seedlings in areas of moderately high and high vegetation burn severity, up to 9,306 acres. Table 9 displays the design elements for reforestation under alternative C.

Table 9. Design elements for reforestation for alternative C.

CRITERION	DESIGN
Reforestation of Fire-killed Stands	Reforestation would be accomplished through a combination of planting and natural regeneration. Areas that burned with moderately high and high severity resulting in inadequately stocked forest land would receive preference for planting, up to 9,306 acres.
Site Preparation/Release for Planting	Manual grubbing and/or removal of competing vegetation down to mineral soil about five feet in diameter around the planting site.
Tree Species	Species to be planted would include ponderosa pine, Jeffrey pine, Douglas-fir, incense cedar, rust resistant sugar pine, and true firs.
Planting Spacing	One hundred to two hundred trees per acre would be planted in widely-spaced clusters.

2.2.4 Alternative D – 2001 SNFPA ROD Consistent

Alternative D is consistent with the 2001 SNFPA ROD and avoids the Old Forest Emphasis (OFE) land allocation (including California spotted owl Home Range Core Areas (HRCAs) and California spotted owl Protected Activity Centers (PACs). All standards and guidelines consistent with the 2001 SNFPA and ROD and those amended by the HFQLG FEIS and ROD (USDA 1999a, 1999b, 2003b, 2003c) would be incorporated into this alternative. There are no restrictions to removing hazard trees from any land allocation due to safety. There is no upper diameter limit on salvage harvest activities under the 2001 SNFPA EIS or ROD.

Fire-killed conifer trees would be felled and removed (up to 1,267 acres). It includes harvesting within Riparian Habitat Conservation Areas (RHCAs) within treatment units. Alternative D does not include harvest or access activities within the areas designated in alternative A for skyline or helicopter logging systems. Alternative D identifies the same areas as alternative A for reforestation. Table 10 displays the design elements for salvage timber harvest under alternative D.

Table 10. Design elements for salvage timber harvest actions for alternative D.

CRITERION	DESIGN
Vegetation Burn Severity	▪ Harvest activities would occur in high vegetation burn severity areas, up to 1,267 acres, within the project area. Logging systems used on these areas are described below. No mortality guidelines would be used. ▪ No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 14 inches dbh would be removed as sawlog product and trees less than 14 inches dbh would be removed, up to 1,267 acres, as a biomass product. ▪ Ground-based equipment would be restricted to slopes less than 35 percent except on decomposed granitic soils where equipment would be restricted to slopes less than 25 percent, to reduce displacement and erosion on highly erodible soils. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height.
RHCA Equipment Constraints	▪ To reduce erosion and runoff into streams, no ground-based mechanical equipment operations on slopes steeper than 25 percent. ▪ To reduce erosion and runoff potential, equipment restriction zones adjacent to stream channels would be established based on stream type and slope class. This is displayed in table 2. ▪ In the advent that the riparian zone is wider than standards and guidelines prescribe, extend the equipment restriction zones to 25 feet beyond the outer or upslope extent of the “green line” (actual or potential extent of riparian vegetation) or the inner channel slope break, where these features are present and these widths would exceed the above-listed widths. ▪ To prevent initiating mass wasting, exclude equipment from unstable slopes (landslide-prone areas or unstable mined lands) outside the riparian equipment restriction zones. ▪ To minimize soils disturbance, harvesting and removal of products within equipment exclusion zones would require directional felling and end-lining. ▪ To reduce soil compaction, allow low ground

CRITERION	DESIGN
	pressure equipment to travel into the outer RHCA zone (outside the equipment restriction zone) to retrieve harvest trees and bring them to skid trails. ▪ To minimize catchment areas for runoff into streams, locate skid trails at angles acute or perpendicular to stream channels to minimize erosion into the channel, and allow skidders to enter the outer RHCA on these skid trails. ▪ To minimize soil displacement, no equipment would be permitted to turn around while off a skid trail in RHCAs.
Snag Retention	▪ Retain the number of snags per acre appropriate for each forest type on a 10 acre basis. In Sierra mixed conifer types and ponderosa pine forest types, retain four of the largest snags per acre. In the red fir forest type, retain six of the largest snags per acre. Retaining 4-6 snags per acre includes snag retention areas within treatment units, RHCAs, and remaining snags outside of treatment units. ▪ Snags larger than 15 inches dbh and 20 feet in height would be used to meet this guideline. ▪ “Snag retention areas” about 10 acres in size would be designated, up to 1,060 acres, throughout 10 percent of the treatment areas. ▪ Primary selection criteria for snag retention areas are: 1) areas formerly identified as spotted owl PACs, 2) along treatment unit boundaries adjacent to non-burned and low severity areas, 3) within RHCAs, and 4) in stands that supported a minimum of 40 percent canopy cover pre-fire. ▪ No harvesting would occur within snag retention areas. ▪ Incidental removal of snags may occur to allow for operability and safety.
Down Woody Material Retention	▪ Retain 10 to 20 tons of large down wood per acre over the treatment unit.
Landing Piles and Fireline	▪ Excess fuels on landings would be piled, firelines constructed around the piles, and the piles burned. ▪ Firelines would be hand or machine line as appropriate and would incorporate existing roads, landings, skid trails, rock fields, bare areas, and other features where logical and feasible.

2.2.4.1 Roadside Hazard Timber Harvest

Fire-killed and fire-injured conifer trees would be felled and removed (up to 4,389 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within 150 feet from the road prism. Table 11 displays the design elements for roadside hazard actions under alternative D.

Table 11. Design elements for roadside hazard actions for alternative D.

CRITERION	DESIGN
Vegetation Burn Severity	▪ Harvest activities would occur within 150 feet from the road prism along 123 miles of National Forest System roads within the Moonlight Fire perimeter. With a 150 foot buffer this totals to approximately 4,389 acres of roadside hazard timber harvest. Logging systems used on these areas are described below. Hazard trees proposed for felling have been identified using the PNF Roadside/Facility Hazard Tree Guidelines and Identification Criteria and PNF: Mt. Hough Ranger District Marking Guidelines for Fire-Injured Trees within the Moonlight Fire Roadside Safety and Hazard Tree Removal Project (see Project Record). ▪ No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 10 inches dbh would be removed as sawlog product and trees less than 10 inches dbh would be removed, as a biomass product on up to 4, 389 acres. ▪ Ground-based equipment would operate from National Forest System roads. ▪ To prevent erosion on sensitive slopes, no off road operations on slopes, road cutbanks, or road fill slopes greater than 25 percent. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height. ▪ Incidental removal of green trees may occur to allow for temporary road and landing construction. ▪ Slash may be piled, firelines constructed around the piles, and the piles burned. ▪ No piles would be constructed within RHCAs.

2.2.4.2 Access

Approximately 3 miles of new temporary roads would be constructed to access the treatment units; these temporary roads would be constructed according to current standards for short-term use. Table 12 displays the design elements for access actions under alternative D.

Table 12. Design elements for access actions for alternative D.

CRITERION	DESIGN
Temporary Roads and Landings	Existing roads, skid trails, and landings would be utilized where possible to reduce the extent of detrimental disturbance to soils. To hasten restoration of disturbed soil areas, new temporary roads, skid trails, and landings would be subsoiled to a minimum of 18 inches in depth, reforested, and closed following the completion of harvest. Refer to appendix C for Best Management Practices (BMPs) and Standard Management Requirements (SMRs) specific to temporary roads and landings.
	Incidental removal of green trees may occur to allow for temporary road and landing construction.

2.2.4.3 Reforestation

Reforestation includes site preparation and planting of native conifer seedlings in areas of moderately high and high vegetation burn severity, up to 16,006 acres. Table 13 displays the design elements for reforestation under alternative D.

Table 13. Design elements for reforestation for alternative D.

CRITERION	DESIGN
Reforestation of Fire-killed Stands	Reforestation would be accomplished through a combination of planting and natural regeneration. Areas that burned with moderately high and high vegetation burn severity resulting in inadequately stocked forest land would receive preference for planting, up to 16,006 acres.
Site Preparation/Release for Planting	Manual grubbing and/or removal of competing vegetation down to mineral soil five feet in diameter around the planting site.
Tree Species	Species to be planted would include ponderosa pine, Jeffrey pine, Douglas-fir, incense cedar, rust resistant sugar pine, and true firs.
Planting Spacing	One hundred to two hundred trees per acre would be planted in widely-spaced clusters.

2.2.5 Alternative E – Roadside Hazard

Alternative E includes roadside hazard timber harvest and reforestation. Alternative E does not include salvage timber harvest or access activities. No new roads, skid trails, or

landings would be constructed. Alternative E identifies the same areas alternative A for reforestation plus roadside hazard timber harvest areas.

2.2.5.1 Roadside Hazard Timber Harvest

Fire-killed and fire-injured conifer trees would be felled and removed (up to 4,389 acres) and would be harvested from Riparian Habitat Conservation Areas (RHCAs) within 150 feet from the road prism. Table 14 displays the design elements for roadside hazard actions under alternative E.

Table 14. Design elements for roadside hazard actions for alternative E.

CRITERION	DESIGN
Vegetation Burn Severity	▪ Harvest activities would occur within 150 feet from the road prism along 123 miles of National Forest System roads within the Moonlight Fire perimeter. With a 150 foot buffer this totals to approximately 4,389 acres of roadside hazard timber harvest. Logging systems used on these areas are described below. Hazard trees proposed for felling have been identified using the PNF Roadside/Facility Hazard Tree Guidelines and Identification Criteria and PNF: Mt. Hough Ranger District Marking Guidelines for Fire-Injured Trees within the Moonlight Fire Roadside Safety and Hazard Tree Removal Project (see Project Record). ▪ No upper diameter limit would be used.
Ground-based Logging System	▪ Trees greater than 10 inches dbh would be removed as sawlog product and trees less than 10 inches dbh would be removed, as a biomass product on up to 4, 389 acres. ▪ Ground-based equipment would operate from National Forest System roads. ▪ To prevent erosion on sensitive slopes, no off road operations on slopes, road cutbanks, or road fill slopes greater than 25 percent. ▪ In general, ground based logging would remove trees under approximately 24 inches dbh using whole tree yarding; trees greater than 24 inches dbh would be bucked to log lengths, limbed, and topped. To increase ground cover in order to prevent runoff and/or erosion and to provide erosion control, residual limbs and tops would be lopped and scattered to a depth of less than 18 inches in height. ▪ Incidental removal of green trees may occur to allow for temporary road and landing construction. ▪ Slash may be piled, firelines constructed around the piles, and the piles burned. ▪ No piles would be constructed within RHCAs.

2.2.5.2 Reforestation

Reforestation includes site preparation and planting of native conifer seedlings in areas of moderately high and high vegetation burn severity, up to 16,006 acres. Table 15 displays the design elements for reforestation under alternative E.

Table 15. Design elements for reforestation for alternative E.

CRITERION	DESIGN
Reforestation of Fire-killed Stands	Reforestation would be accomplished through a combination of planting and natural regeneration. Areas that burned with moderately high and high vegetation burn severity resulting in inadequately stocked forest land would receive preference for planting, up to 16,006 acres.
Site Preparation/Release for Planting	Manual grubbing and/or removal of competing vegetation down to mineral soil five feet in diameter around the planting site.
Tree Species	Species to be planted would include ponderosa pine, Jeffrey pine, Douglas-fir, incense cedar, rust resistant sugar pine, and true firs.
Planting Spacing	One hundred to two hundred trees per acre would be planted in widely-spaced clusters.

2.3 Alternatives Considered but Eliminated from Detailed Study

During the development of the proposed action, other action alternatives were considered. These alternatives varied from the proposed action by 1) introducing natural regeneration, wildland fire use, prescribed burning; 2) providing variation in upper diameter limit diameter at breast height (dbh), California Wildlife Habitat Relationships (CWHR) density and size classes, road maintenance activities, and logging systems; 3) removing specific land allocation from treatment and modifying amounts of pile burning, and recovery and restoration treatments.

2.3.1 Alternative F – Natural Regeneration and Wildland Fire Use, Prescribed Fire, and Pile Burning

This alternative would incorporate natural regeneration and a combination of wildland fire use, prescribed fire, and pile burning as a basis for aiding restoration and treating excess small diameter trees (16 inches dbh or less) in the burned area.

This alternative was eliminated from detailed study for the following reasons:

- Wildland fire use is not authorized by the PNF LRMP (USDA 1988) within the Moonlight and Wheeler Project.
- This alternative would require an extended time frame to implement. Currently, the Mt. Hough Ranger District uses prescribed fire (pile and underburning) to treat approximately 1,000-2,000 acres per year. Past and current trends with air quality restrictions, limited burn days, and extended fire seasons, are expected to continue. Given these factors, treating up to 14,756 acres of excess small diameter

trees in Moonlight and Wheeler Project area using prescribed fire and pile burning would take nearly two decades to implement. This would not meet purpose 2 (section 1.3.2) due to timber deterioration. Within the fire perimeters standing dead trees have begun to deteriorate due to insect activity, weather, and the degree to which the trees burned. If treatment of small diameter trees was delayed by two decades there would no economic value.

- Alternative F would not meet purpose 1 (section 1.3.1) because standing fire-killed trees greater than 16 inches would continue to pose a safety hazard along public access routes on approximately 4,389 acres.
- Natural conifer regeneration is expected to occur in unburned areas and at a hindered, lower rate in moderate and high burn severity areas. Natural regeneration would be analyzed under alternative B, the no action alternative.

2.3.2 Alternative G – Reduce Upper Diameter Limit of Harvested Fire-killed Trees to 24 inches dbh

This alternative would include significantly less post-fire logging than Alternative A while retaining all larger diameter (24 inches dbh and greater) fire-killed trees. All other design criteria would remain identical to the proposed action.

This alternative was eliminated from detailed study for the following reasons:

- Alternative G would not meet purpose 1 (section 1.3.1) because standing fire-killed trees 24 inches dbh and greater would continue to pose a safety hazard along 123 miles of public access routes.
- Alternative G would only partially meet purpose 2 (section 1.3.2) because the value of the fire-killed trees 24 inches dbh and greater would remain on the landscape rather than being incorporated into local communities through sawlog values, creation of jobs, and employee related income. Larger diameter trees generally retain the most value during post-fire deterioration therefore leaving all of the largest trees on the ground would leave a disproportionately large amount of value on the ground. This would result in only partially meeting purpose 2.
- Table 16 displays the subsequent effects of alternative G on estimated volume, value, costs, revenues, and employment as compared to alternative A. Alternative G would partially meet purpose 2 for the following reasons. Alternative G would result in the same number of acres treated as alternative A (14,756 acres), except trees 24 inches dbh and greater would remain. The volume of salvage and hazard tree timber recovered from public land for alternative G would be 38,671 mbf or 32 percent of alternative A (Table 16). The combined net value recovered from public land is approximately $11 million dollars or 34 percent of alternative A (Table 16). Therefore, 66 percent of the salvage and hazard tree timber and more than $21.2 million dollars in sawlog and biomass value would not be recovered or incorporated into the local communities as compared to alternative A. Although alternative G has more net revenue than alternative A, alternative G would contribute 960 jobs, which is 47 percent of the jobs offered under alternative A. Alternative G results in approximately $41.2 million dollars in employee related income, which is only 47 percent of the income resulting under alternative A. Alternative A is a more balanced approach to obtaining a commodity to stimulate

economic stability and potential growth for Plumas County with an intrinsic aspect of managing our National Forest.

- Ninety three percent of all timber within the Moonlight Fire and Antelope Complex would remain under alternative G and 76 percent would remain under alternative A. Therefore, approximately $110 million dollars in value would remain on the landscape under alternative F and $88.6 million dollars would remain under alternative A.
- Maximum production would be compromised under this alternative. Because an upper diameter limit would be established, ground-based equipment would maneuver around all leave trees 24 inch dbh and greater resulting in less efficient harvesting processes. The amount of landings, skid trails, and temporary roads; as well as the amount of soil compaction realized from ground-based equipment would remain the same as alternative A.

Table 16. Comparison of objective 2 measurement indicators between alternatives A and G.

REVENUE/COST/EMPLOYMENT	ALTERNATIVE A	ALTERNATIVE G
Sawlog Volume	120,194 mbf	38,671 mbf
Total Sawlog and Biomass Value	$32,339,549	$11,062,073
Total Costs	$44,226,249	$17,447,879
Net Revenue	- $11,886,700	-$6,385,806
Percent above value	-37%	-58
Total direct and indirect jobs	2020	960
Total employee-related income	$86,861,975	$41,290,618

2.3.3 Alternative H – Harvest by CWHR Density and Size Classes, Not to Exceed 20 inches dbh, and Excludes Former Protect Activity Centers (PACs) and Home Range Core Areas (HRCAs)

This alternative would include significantly less post-fire logging while retaining all larger diameter fire-killed trees, where harvest would occur in CWHR size classes 2 and 3, size and density classes 4S and 4P, and not exceed 20 inches dbh. Ground-based logging and road construction and reconstruction would not occur within high vegetation burn severity areas. No activities would occur within former California spotted owl PACs and HRCAs.

This alternative was eliminated from detailed study for the following reasons:

- Alternative H would not meet purpose 1 (section 1.3.1) because standing trees within high severity areas and those trees with 20 inches dbh or greater would continue to pose a safety hazard along public access routes. Hazard trees would be removed from public access routes within moderate and low severity areas.
- Alternative H would only partially meet purpose 2 (section 1.3.2) because the value of the fire-killed trees 20 inches dbh and greater would remain on the landscape rather than being incorporated into local communities through sawlog values, creation of jobs, and employee related income.

- Table 17 displays the subsequent effects of alternative H on estimated volume, value, costs, revenues, and employment as compared to alternative A, the proposed action. Alternative H would result in treating 7,220 acres (49 percent of alternative A), except trees 20 inches dbh and greater would remain. The volume of salvage and hazard tree timber recovered from public land for alternative H would be 17,397 mbf or 14 percent of alternative A (Table 17). The combined net value recovered from public land is approximately $6.7 million dollars or 21 percent of alternative A (Table 17). Therefore, 79 percent of the salvage and hazard tree timber and more than approximately $25 million dollars in sawlog and biomass value would not be recovered or incorporated into the local communities as compared to alternative A. Although alternative H has more net revenue than alternative A, alternative H would contribute 734 jobs, which is 36 percent of the jobs offered under alternative A. Alternative H results with $31.5 million dollars in employee related income, which is 36 percent of the income resulting under alternative A. Alternative A is a more balanced approach to obtaining a commodity to stimulate economic stability and potential growth for Plumas County with an intrinsic aspect of managing our National Forest.
- Ninety seven percent of all timber within the Moonlight Fire and Antelope Complex would remain under alternative H and 76 percent would remain under alternative A. Therefore, approximately $114.2 million dollars in value would remain on the landscape under alternative F and $88.6 million dollars would remain under alternative A.
- Maximum production would be compromised under this alternative. Because an upper diameter limit would be established, ground-based equipment would maneuver around all leave trees 20 inch dbh or greater. Although alternative H incorporates less acres (7,200 acres) treated than alternative A (14,756 acres), alternative H would utilize ground-based harvest methods only within the same treatment units of alternative A, resulting in less efficient harvesting processes. The amount of landings, skid trails, and temporary roads; as well as the amount of soil compaction realized from ground-based equipment would remain the same as alternative A.

Table 17. Comparison of objective 2 measurement indicators between alternatives A and H.

REVENUE/COST/EMPLOYMENT	ALTERNATIVE A	ALTERNATIVE H
Sawlog Volume	120,194 mbf	17,397 mbf
Total Sawlog and Biomass Value	$32,339,549	$6,727,586
Total Costs	$44,226,249	$11,714,933
Net Revenue	- $11,886,700	-$4,987,346
Percent above value	-37%	-74%
Total direct and indirect jobs	2020	734
Total employee-related income	$86,861,975	$31,548,375

2.3.4 Alternative I – Helicopter Logging System

This alternative would only utilize helicopter harvest systems. No trees less than 16 inches dbh (biomass) would be removed. All other design criteria would remain identical to the proposed action.

This alternative was eliminated from detailed study for the following reasons:

- Alternative I would not meet purpose 1 (section 1.3.1) because standing fire-killed trees less than 16 inches dbh would not be removed along public access routes and would continue to pose a safety hazard.
- Table 18 displays the subsequent effects of alternative I on estimated volume, value, costs, revenues, and employment as compared to alternative A, the proposed action. Alternative I would result in the same number of acres treated as alternative A (14,756 acres). The volume of salvage and hazard tree timber recovered from public land for alternative I would be 120,194 mbf identical to alternative A (Table 18). The net value for sawlogs recovered from public land is $28.6 million dollars or 89 percent of alternative A (Table 18). Therefore, more than $3.6 million dollars in sawlog value would not be recovered or incorporated into the local communities as compared to alternative A. The net revenue from alternative I is more negative than alternative A by more than $11 million dollars. Alternative I would contribute 1,883 jobs, which is 93 percent of the jobs offered under alternative A. Alternative I results in $80.9 million dollars in employee related income, which is 93 percent of the income resulting under alternative A.
- Seventy six percent of all sawlog timber within the Moonlight Fire and Antelope Complex would remain under alternative H and alternative A.

Table 18. Comparison of objective 2 measurement indicators between alternatives A and I.

REVENUE/COST/EMPLOYMENT	ALTERNATIVE A	ALTERNATIVE I
Sawlog Volume	120,194 mbf	120,194 mbf
Total Sawlog Value*	$32,339,549	$29,159,629
Total Costs	$44,226,249	$51,694,705
Net Revenue	- $11,886,700	-$22,535,076
Percent above value	-37%	-77%
Total direct and indirect jobs	2020	1883
Total employee-related income	$86,861,975	$80,953,606

* Alternative A values are sawlog and biomass values, Alternative I has no biomass removal

2.3.5 Alternative J - As proposed by the John Muir Project

This alternative is designed as follows:

1. Exclude salvage harvesting in moderate and high severity areas (50 to 100 percent basal area mortality); salvage harvesting would occur within low to moderate severity areas (less than 50 percent basal area mortality).
2. Exclude removal of snags greater than 20 inches dbh.

3. Decommission and revegetate all roads in moderate and high severity areas wherever such roads are not essential to access private land inholdings and rehabilitate all existing landings.
4. Exclude any road construction or road reconstruction.
5. Suspend livestock grazing within the fire areas for 20 years.

This alternative was eliminated from detailed study for the following reasons:

- Alternative J would not meet purpose 1 (section 1.3.1) where standing fire-killed trees are along public access routes within low to moderate burn severity areas (less than 50 percent basal area mortality). Standing fire-killed trees along public access routes within high and moderate severity areas (50-100 percent basal area mortality) would continue to pose a safety hazard. All roadside hazard trees greater than 20 inches dbh would also continue to pose a safety hazard.
- Alternative J would only partially meet purpose 2 (section 1.3.2), as there are very few fire-killed trees within low and moderate burn severity. Stand exam data indicates that low to moderate areas with less than 50 percent basal area mortality contain approximately two to seven dead trees per acre under the proposed upper diameter limit (20 inches) available for salvage harvesting under this proposed alternative. Volume deterioration of trees under 20 inches ranges from 45 to 70 percent in the second year after the fire. Given the few trees per acre and the rapid rates of deterioration in such small trees, less than 1 mbf per acre would be available for economic recovery. Assuming there are two to seven dead trees per acre across the 14,756 acres in alternative A, alternative J would yield a sawlog volume of 12 percent of alternative A.
- Alternative J would not meet purpose 3 (section 1.3.3), re-establish forested conditions. Since salvage harvest would not occur within moderate and high severity areas, re-establishment of forested conditions in these areas would not occur for many decades or possibly centuries due to the incursion of brush and minimal seed source availability for conifers.
- Decommissioning roads in moderate and high severity areas would reduce public access for multiple use and fragment thoroughfare throughout the area. Approximately 195 miles of level one and level two roads fall within moderate and high severity areas. An additional 45 miles of level three roads fall within moderate and high severity areas.
- Livestock grazing does not relate to the purpose and need for this project. Changes to grazing are not part of the project because grazing is an ongoing activity managed under a permit. The permit and annual operating instructions guide grazing activities to ensure that resources are protected. This RFEIS includes analysis of range resources in section 3.11. Grazing is included in the cumulative effects analyses.

2.3.6 Alternative K – Watersheds Under Threshold of Concern

This alternative would include significantly less post-fire logging than alternative A. Logging would only occur within the watersheds that are currently under thresholds of concern. In addition, the cumulative effects of this alternative and past, present, and

future projects would not cause the watersheds to go over threshold. All other design criteria would remain the same as the proposed action.

This alternative would treat about 500 acres of helicopter and about 2,400 acres of ground-based logging systems. The total acres results with about 7,415 mbf in volume.

This alternative was eliminated from detailed study for the following reasons:

- Alternative K would not meet purpose 1 (section 1.3.1) because standing fire-killed trees would continue to pose a safety hazard along public access routes would be removed on about 2,889 acres. Hazard trees would be removed along public access routes on approximately 1,500 acres.
- Table 19 displays the subsequent effects of alternative K on estimated volume, value, costs, revenues, and employment as compared to alternative A. Alternative K would result in less acres treated (2,900 acres) compared to alternative A (14,756 acres). The volume of salvage and hazard tree timber recovered from public land for alternative K would be 7,415 mbf or 6 percent of alternative A (Table 19). The combined net value recovered from public land is $2.1 million dollars or 6 percent of alternative A (Table 19). Therefore, 94 percent of the salvage and hazard tree timber and more than $30 million dollars in sawlog and biomass value would not be recovered or incorporated into the local communities as compared to alternative proposed under alternative A. Although alternative K has more net revenue than alternative A, alternative K would contribute 445 jobs, which is 22 percent of the jobs offered under alternative A. Alternative K results in $19.1 million dollars in employee related income, which is 22 percent of the income resulting under alternative A.
- Ninety nine percent of all timber within the Moonlight Fire and Antelope Complex would remain under alternative K and 76 percent would remain under alternative A. Therefore, approximately $118.8 million dollars in value would remain on the landscape under alternative F and $88.6 million dollars would remain under alternative A.

Table 19. Comparison of objective 2 measurement indicators between alternatives A and K.

REVENUE/COST/EMPLOYMENT	ALTERNATIVE A	ALTERNATIVE K
Sawlog Volume	120,194 mbf	7,415 mbf
Total Sawlog Value	$32,339,549	$2,165,390
Total Costs	$44,226,249	$2,942,353
Net Revenue	- $11,886,700	-$776,963
Percent above value	-37%	-36%
Total direct and indirect jobs	2020	445
Total employee-related income	$86,861,975	$19,138,321

2.4 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the Table 20, is focused on activities and Table 21, is focused on effects

where different levels of effects or outputs can be distinguished quantitatively, or qualitatively, between alternatives.

Table 20. Comparison of activities.

ACTIVITY	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
Acres of ground-based harvest	8,536	0	8,536	5,656	4,389
Acres of skyline salvage	872	0	0	0	0
Acres of helicopter salvage	5,347	0	0	0	0
Acres of planting	16,006	0	9,306	16,006	16,006
Miles of temporary road construction	19	0	18	3	0

Table 21. Comparison of measurement indicators by alternative.

OBJECTIVE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
Remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism.	Miles of National Forest System (NFS) roads treated for hazard tree removal	123	0	123	123	123
Recover the value of the fire-killed trees before natural deterioration occurs in the treatment areas.	Acres of public land treated for salvage recovery	10,366	0	8,536	5,656	0
	Acres of public land treated for hazard tree removal	4,389	0	4,389	4,389	4,389
	Volume (mbf) of salvage and hazard tree timber recovered from public land	120,194	0	57,987	23,135	14,013
	Net value (dollars) of salvage and hazard tree sawlogs recovered from public land	-$11,442,895	$0	-$740,692	-$717,530	-$599,701
	Combined (sawlog and biomass) net value (dollars) recovered from public land	-$11,886,700	$0	-$2,568,742	-$871,982	-$599,701
	Total project value (dollars)	-$22,726,764	$0	-$8,871,230	-$11,712,045	-$7,494,983
	Total full time jobs (#)	2,020	0	1,077	663	502
	Total employee-related income (dollars)	$86,861,975	$0	$46,326,262	$28,502,986	$21,598,427
Plant native conifer seedlings to recover forested conditions.	Percent of public land reforested within the Moonlight Fire and Antelope Complex	23.4%	0%	13.6%	23.4%	23.4%

OBJECTIVE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D	ALT. E
	perimeters					

3 Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2.

The following resource specialist analyses are incorporated by reference: Moonlight and Wheeler Fires Recovery and Restoration Project Forest Vegetation, Fuels, Fire, and Air Quality Report (Ryan Tompkins, June 2009)(USDA 2009c), Moonlight and Wheeler Fires Recovery and Restoration Project Wildlife Biological Assessment/Biological Evaluation (Chris Collins, June 2009)(USDA 2009g), Management Indicator Species Report for Moonlight and Wheeler Fires Recovery and Restoration Project (Chris Collins and Kristina Van Stone Hopkins, June 2009)(USDA 2009a) Moonlight and Wheeler Fires Recovery and Restoration Project Wildlife Supplemental Information Migratory Birds Report (Chris Collins, June 2009)(USDA 2009h), Moonlight and Wheeler Fires Recovery and Restoration Project Watershed Report (Eric Moser, Vince Archer, and Bill Overland, June 2009)(USDA 2009f), Moonlight and Wheeler Fires Recovery and Restoration Project Botanical Biological Evaluation (James Belsher-Howe, May 2009)(USDA 2009b), Moonlight and Wheeler Fires Recovery and Restoration Project Noxious Weed Risk Assessment (James Belsher-Howe, May 2009)(USDA 2009e), and Moonlight and Wheeler Fires Recovery and Restoration Project Cultural Resource Inventory Report ARR# 02-40-2008 (Cristina Weinberg, June 2009)(USDA 2009d).

3.1 Past, Present, and Reasonably Foreseeable Actions

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

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

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

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

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

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

In determining cumulative effects, the past, present, and future actions displayed in appendix B were added to the direct and indirect effects of the proposed action and alternatives.

Affected environments have been divided by resource areas, where as environmental consequences have been divided by resource areas and then by alternative, where each alternative is discussed separately. Further, effects analyses that are required by law are discussed per alternative.

3.2 Safety

3.2.1 Affected Environment

There are approximately 123 miles of roads in the Moonlight Fire perimeter on National Forest System land accessible to the public and forest workers (Table 22). These individuals are at risk from dead and dying trees located along roads, because they deteriorate, become unstable, and eventually fall. Falling trees may hit individuals, their cars or may trap people in the area. The influence of fire increased the annual snag fall rate from 8% in unburned conditions to an annual rate of 20% in burned conditions in Eastside Pine Forests (Landram et al. 2002). Annual fall rates vary by species and diameter. Fall rates were greater for smaller diameter classes. It takes just 6 years for 50% of the Jeffrey Pine and Ponderosa Pine to fall. It takes 8 years for 50% of the white fir to fall. The fall rates appear to be slow at first and then to increase as time goes by and then to decrease again. Fire killed trees may also have structural damage from fire scarring of the bole and burned roots. In addition to roadside hazards, dead trees pose hazards to hikers, loggers, slash crews, tree planters, and workers conducting future prescribed burns or projects to improve seedling survival and growth on both National Forest and private lands.

Table 22. Miles of Maintenance Level 1-5 roads in the Moonlight Fire perimeter.

Maintenance Level	Moonlight Fire (Miles)	Alternatives A, C, D, and E Treated (Miles)	Alternative B (No Action) Treated (Miles)
1	35.2	7.4	0
2	119.8	79.8	0
3	46.5	35.5	0
4	0	0	0
5	11.0	0.3	0
Total	**201.8**	**123.0**	**0**

3.2.2 Environmental Consequences

3.2.2.1 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative Effects

Alternative A removes roadside hazards and significantly reduces hazards away from roads in the Moonlight Fire perimeter. Similarly alternative A removes dead and dying hazard trees from 123 miles of roads. In the salvage recovery units, dead and dying trees are retained in the snag retention areas, RHCAs, and in resource protection areas, posing a risk to workers and the public in these areas. Risks from falling snags would remain along some streams and where dispersed recreation occurs.

Along roadsides the vast majority of trees with structural defects, likely to cause failure in all or part or the tree that may fall and hit the road prism would be removed.

There is a short-term risk to loggers and crews from dead trees that are currently unstable, and smaller snags that deteriorate quickly. In the Stream Fire, it was observed that numerous snags along roads, particularly along paved roads fell during and immediately after the fire (Lazzarino 2008).

Danger to the public from falling snags would be significantly reduced along roads. As was observed through the Antelope Fire hazard tree removal projects, trees that were left because they were partially green have since died and are now hazards (Lazzarino 2008).

The ability for fire suppression resources to access the areas within the Moonlight Fire perimeter and prevent any further loss of stands in an event of a wildfire is greatly increased.

There is a short term increased risk of vehicle accidents under the action alternative due to the increased traffic from logging. The number of log trucks, crew vehicles, and individual cars and trucks would increase substantially during the next 1 to 2 years to accomplish the work required under the alternatives. This increase would affect safety on the forest roads within the fire area as well as Highway 70/89. Upwards of 100 log truck loads per day would be hauling from the Moonlight Fire area from National Forest System lands during the late summer and fall of 2009. The risk of a collision is greatest where trucks are entering or exiting the highway. The Forest Service requires safety signing as part of the administration of timber sale contracts, which alerts the public to traffic hazards.

Cumulative Effects

Under all action alternatives the roads would remain open, allowing wood cutting, recreation, road maintenance, the Moonlight and Wheeler Fires Recovery and Restoration Project, Wildcat Ridge Stewardship Project, and reforestation work to continue. Wood cutting by locals provides needed firewood to supplement the use of gas, and electricity to heat homes during the winter. On-going recreation includes fishing and dispersed camping.

The roadside hazard trees within the Antelope Complex fire area were the Sage, Antelope, Last Chance, and Dry Flat Roadside Safety and Hazard Tree Removal Projects. The purpose of these projects was to provide for safe travel along roads within the fire areas. Under these projects, fire-killed and fire-injured trees expected to die within three years are removed resulting in a reduction of standing snags near the roadway. Since these projects are limited to 150 to 200 feet on either side of the road, these effects are localized and restricted to roadsides, approximately 11 percent of public lands within the analysis area. This calculation represents the maximum and furthest extent of measurable effects on forest vegetation that would occur as a result of implementing these projects. Since the removal of hazardous, fire-killed and fire-injured trees would only occur within striking distance of roads and facilities under these projects, the effects would be limited to these areas, and subsequently, dispersed across the 87,647 acre analysis area resulting in a minimal scale of effects. Due to the limited and dispersed nature of these effects, these activities would not substantially affect forest vegetation, fuel loading, fire behavior, air quality, or wildlife species or habitat on the stand or landscape level.

Reforestation work would be allowed to continue. Releasing of the planted trees would be allowed to take place. Stocking exams and survival surveys would be permitted. Subsequent reforestation efforts that might need to occur would also be allowed to occur.

In summary, the alternative A would have a positive cumulative effect on public and forest worker safety and the ability to maintain roads in the Moonlight Fire area.

3.2.2.2 Alternative B (No Action) – Direct, Indirect, Cumulative

Effects

Under alternative B, all dead and dying trees would be retained, posing a very high risk to the public and forest workers as time goes on. The public would be at high risk from snags falling into roads as they drive by. Activities such as fishing and camping would be dangerous where snags are numerous.

If additional reforestation were undertaken, tree-planting crews would be at great risk of injury or death from falling snags. Small snags would pose a risk in approximately one to three years. Larger snags may become a high risk after two or more years, by six years over half of the snags may have fallen (Landram et al. 2002). Future seedling tending, thinning, and prescribed burning would be high-risk endeavors, and may be precluded due to the risk to workers.

On the Storrie Fire of August, 2000 on the Lassen National Forest, the deteriorated timber resulting from delay created such extreme safety risks that a timber sale contract was cancelled after it was awarded (Personal Comm. Franco 2009). In this case, the Romeo #2 Fire Salvage Sale was one of three fire salvage sales awarded from the Storrie Fire (Franco 2005). Logging on the sale started 3 years after the fire. After three days of cutting trees using feller bunchers (machines that cut trees and lay them on the ground), the timber sale purchaser shut down his operations because crumbling portions of trees were hitting the feller buncher. Eighty to ninety percent of the trees being cut were breaking off, leaving only 8 to 12 feet of the lower portion of the tree intact. Some trees were as large as 30 inches diameter. The agreement to cancel the contract noted that "field operations indicated that the included trees are too unstable to safely harvest with mechanical harvesters" and "due to the recurring problem of trees falling on top of the harvesters while the tree is being cut and placed on the ground, there is a danger that one of the trees will come through the roof of the harvester".

This example illustrates the safety risk posed to workers, including firefighters, working in the vicinity of high levels of snags. Fire fighters typically need to fell snags near firelines. This activity would be unacceptably dangerous, resulting in the fire fighters retreating to areas of low to no snags for effective and safe fire fighting.

The safety risks posed by breaking and falling snags would ultimately preclude safe fire fighting, tree planting, fuel treatment and other uses by humans of the fire area. Log truck traffic would not increase under this alternative, and this alternative would not contribute to cumulative effects on safety from traffic accidents.

There would be no additional vehicle traffic due to the operations. The Forest may be forced due to safety concerns to close the roads that would not receive treatment until such time as enough appropriated dollars would be obtained to treat the roadside hazards internally or by writing another environmental analysis to treat the roadside hazards alone with out the recovery. The estimated cost to treat the roadside hazard either internally or externally is approximately $3,944,782. This would mean that the purpose and need for recovering the economic value of trees killed by the Moonlight Fire would not be fulfilled. Nor would the purpose and need to improve public safety by removing hazard trees along roadside areas.

Cumulative Effects

Under alternative B the roads would likely have to be closed once trees began to fall at such a rate that they can not safely be treated by the road crew. Mining operations, wood cutting, recreation, road maintenance, the Moonlight and Wheeler Fires Recovery and Restoration Project, Wildcat Ridge Stewardship Project, and reforestation work would be limited or not occur at all. Miners and recreation users would have to find alternative ways to enter the project area either through alternative routes or by hiking into the Moonlight Fire area. Reforestation activities would not be allowed to occur in the recovery units for safety reasons after one year. No seedling release would occur unless it happened in the next year. The reason is that it has been the Forests experience that the trees begin to fall in concentrations approximately one year after the fire (Lazzarino 2008). After that time road maintenance would not occur, which could have very serious watershed affects. Corky Lazzarino, Resource Maintenance Team Leader wrote a declaration for the Moonlight Roadside Safety and Hazard Tree Removal Project. She testified that after a fire burns through an area the interval of road maintenance in the fire perimeter changes to an annual cycle because culverts plug quickly. This yearly maintenance schedule occurs for several years (Lazzarino 2008). If the road maintenance were not to occur due to road closure for safety reasons then "there could be increased soil movement in the high severity areas, some rockfall would occur, and trees and debris would fall into the drainages and culvert pipe inlets. There would also be increased flashy runoff from the high severity burn areas. It is predictable that the majority of the culverts would clog in the first year or two, and the roads would wash out as the culverts failed. The resulting damage would create a severe impact to the watershed and wildlife, as well as to downstream residences."

There are special use permits within the Moonlight Fire perimeter as well as a lot of public enthusiasm around Antelope Recreation Area.

In summary, alternative B would have a detrimental effect to public and forest worker safety and the ability to maintain roads in the Moonlight Fire perimeter causing unnecessary damage to resources and potential closing off the area to mining, recreation use and future project work including reforestation, DFPZ construction and roadside hazard work.

3.3 Economics

3.3.1 Affected Environment

The economic environment of the Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988), as amended by the Herger-Feinstein Quincy Library Group (HFQLG) final supplemental environmental impact statement (FSEIS) and Record of Decision (ROD) (USDA 1999a, 1999b, 2003b, 2003c), and the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, 2004b). The demographic and economic information for the counties in which the Plumas National Forest is situated has been compiled to provide a baseline for studying socioeconomic impacts of the Moonlight and Wheeler Fires Recovery and Restoration Project.

The Plumas National Forest contributes to the regional economy in two primary ways: (1) through the generation of income and employment opportunities for residents of the immediate area, and (2) through direct and indirect contributions to local county

revenues. The Plumas National Forest also contributes in secondary ways, such as through production of goods and services in local and regional markets. Although some economic effects are dispersed over a broad area, the most substantial impacts are felt locally in Butte, Plumas, Lassen, Sierra, and Yuba Counties. Table 23 shows the percentage of Plumas National Forest land in local counties. The Plumas National Forestlands account for approximately 72 percent of Plumas County. Consequently, management of national forestlands has a notable effect on the regional economy of Plumas County.

Table 23. Percentage of Plumas National Forest lands by county (based on GIS data).

County	County Acres	Beckwourth Ranger District (acres)	Feather River Ranger District (acres)	Mount Hough Ranger District (acres)	Total Plumas National Forest Lands in Each County (acres)	Plumas National Forest Lands within Each County (percent)
Butte	1,072,708	0	143,517	0	143,517	13.4
Lassen	3,022,136	39,686	0	1,635	41,320	1.4
Plumas	1,672,778	448,365	183,210	579,196	1,210,771	72.4
Sierra	615,514	14,794	33,522	0	48,316	7.8
Yuba	411,695	0	33,734	0	33,734	8.2
Totals	**6,794,830**	**502,844**	**393,984**	**580,831**	**1,477,659**	**21.7**

The two employment sectors most related to forest planning processes are the timber industry and tourism. Forest planning processes can positively affect the farm industry (logging operations), manufacturing (mills), transportation (trucks and railroad) and utilities (biomass power plants). They are very difficult to quantify, in terms of both total employment and their relative importance to local economies, because state and federal employers generally do not break down employment data into these categories.

The Bureau of Economic Analysis's data collection, groups the timber industry predominantly in two different categories: (1) Farm, and (2) Manufacturing. According to there 2006 reporting, Farm and Manufacturing earnings in Plumas County represent 11.73% of the earnings of the major industries in Plumas County. Earnings in these two industries have gone down and are experiencing negative growth. Employment in farm and manufacturing represents 7.87% of the jobs in Plumas County. The per capita personal income in 2006 was $33,800 for all industries. The total earnings for all major industries are $429,436,000.

There are 6 employers in logging operations, and 7 employers related to forestry services. There are two large mills in the local area within distance of the project area each employing 200 to 300 employees.

3.3.1.1 Energy

In the local area of Plumas County there are two co generation plants and two biomass power plants operating within a reasonable haul distance. The Wendell facility is 35 megawatt plant and to operate at full capacity would need 550 bd tons/ day or 37 truck loads. The Wendell facility sells to PG&E approximately 30 megawatts a day when they can produce at full capacity. Presently they can not produce full capacity due to the lack

of biomass material. Westwood facility is a 10 megawatt that employs 10 to 19 people. The Westwood facility would need 200 bd tons/day to operate at full capacity.

Forest contributions to local county revenues come from three sources: (1) Payments in Lieu of Taxes, (2) timber yield taxes, and (3) *Receipt Act* payments or payments from the *Secure Rural Schools and Community Self-Determination Act of 2000*. Of these, the *Receipt Act* or *Secure Rural Schools and Community Self-Determination Act* payments are by far the most significant in terms of total contributions to each county and are therefore most likely to be affected by forest land management decisions.

3.3.1.2 Payments in Lieu of Taxes

The Bureau of Land Management administers the Payments in Lieu of Taxes, which apply to many different types of federally owned land, including National Forest System lands. Payments in Lieu of Taxes compensate counties for the loss of property tax revenues due to nontaxable federal land in the county. Payments are made annually and are based on local population, federal acreage in the county, and other federal payments during the preceding fiscal year. The minimum payment is 75 cents per entitlement acre. The county may use these funds for any purpose. The forest has no control over the disbursement of these funds, and the amount disbursed every year is unaffected by forest land management decisions.

3.3.1.3 Timber Yield Taxes

The second source of revenues to local government is the timber yield tax, which is administered by the State Board of Equalization. The forest does not pay this tax; instead, it is paid by private timber operators, based on the amount of timber harvested in a given year on both private and public lands. The tax is 2.9 percent of the value of the harvested timber. The taxes are collected by the state, and approximately 80 percent is returned to the counties from which the timber was harvested. The amount of revenues disbursed to the counties can be affected by decisions about the amount of timber to be offered for sale each year on the forest.

3.3.1.4 Receipt Act

Receipt Act payments are distributed pursuant to the *National Forest Management Act* (Public Law 94-588). Under this law, 25 percent of National Forest revenues are allocated to the state in which the forest is situated. The amount returned is based on the National Forest acreage within each county. According to state law, *Receipt Act* funds must be divided evenly between public schools and public roads of the county or counties in which the National Forest is located and may not be spent on anything else.

Receipt Act payments are based on 25 percent of the total revenues collected from timber, grazing, land use, recreation, power, minerals, and user fees. Within the 11 western states, however, payments are based on 50 percent of revenue from grazing. Historically, at least 90 percent of total revenues have come from timber sale receipts. As a result, the amount of money available for distribution each year fluctuates widely, depending on the amount of timber harvested on National Forests.

3.3.1.5 Secure Rural Schools and Community Self-Determination Act

Congress passed the *Secure Rural Schools and Community Self-Determination Act* in 2000, offering counties an alternative to the *Receipt Act*. Under the *Self-Determination Act*, a state's three highest payment amounts between 1986 and 1999 are averaged to

arrive at a "compensation allotment" or "full payment amount." During the first phase of this legislation, a county could choose to continue to receive variable revenue-dependent payments under the *Receipt Act* or to receive stable funding for local schools and roads via its share of the state's full payment amount under the *Secure Rural Schools and Community Self-Determination Act*. National Forests and other federal agencies that contribute to the 25 percent fund would have to generate approximately $56.4 million in total revenues in order to offset the $14 million that the counties receive under the *Secure Rural Schools and Community Self-Determination Act*. Consequently, most counties elected to receive funding through the *Secure Rural Schools and Community Self-Determination Act*.

The legislation promotes local involvement, decisions, and choice by creating well-balanced resource advisory committees that recommend forest projects to the Secretary of Agriculture or advise counties on proposals for county projects. The counties that elect to receive the full payment amount under the *Secure Rural Schools and Community Self-Determination Act*, and receive more than $100,000, are required to allocate 15 to 20 percent of their funding to projects under Title II or Title III. Like traditional 25 percent funds, Title I funds are expended for public schools and roads. Title II funds are allocated for projects on federal lands or projects that benefit federal lands. Resource Advisory Committees are established to determine Title II fund distribution. Title III funds are allocated for county projects that include search and rescue, community service work camps, easement purchases, forest-related education opportunities, fire prevention, and county planning or cost-share for urban community forestry projects. The *Secure Rural Schools and Community Self-Determination Act* payments are set to expire at the end of fiscal year 2008; however, the act has been re-authorized through 2011.

Table 24. *Secure Rural Schools and Community Self-Determination Act* full payment amounts to counties for fiscal years 2001-2007.

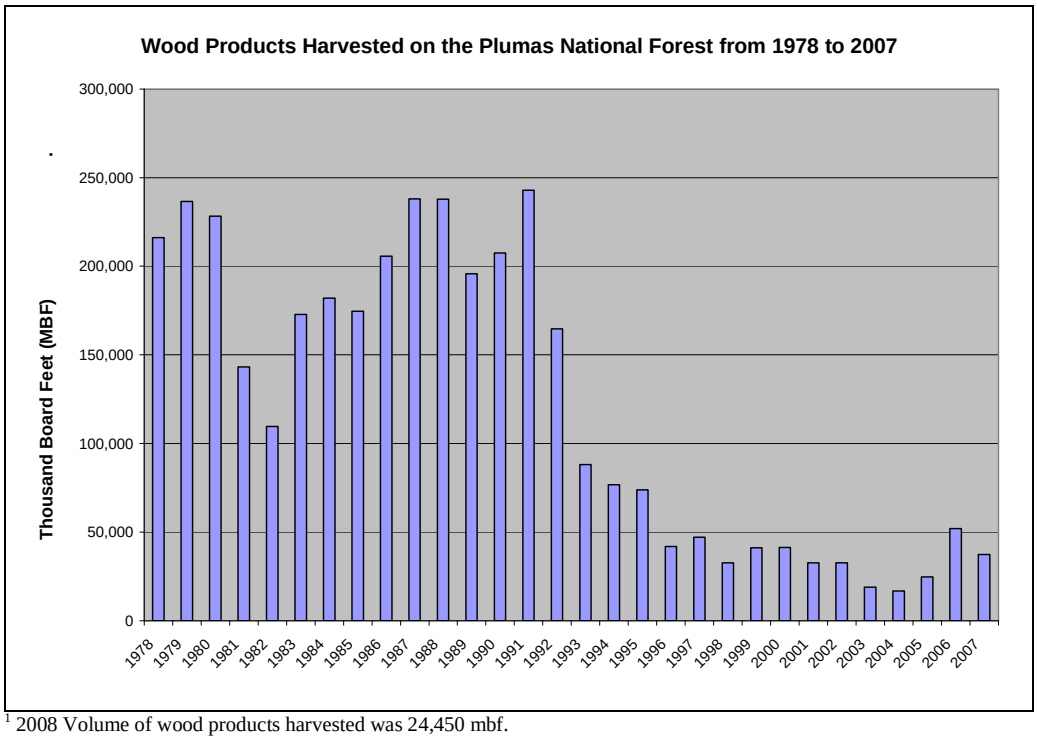
	Butte	Lassen	Plumas	Sierra	Yuba
2001	$866,419	$3,751,241	$7,024,648	$1,788,350	$231,268,
2002	$873,350	$3,781,250	$7,080,847	$1,802,657	$233,118
2003	$883,830	$3,826,626	$7,165,816	$1,824,289	$235,915
2004	$895,320	$3,876,372	$7,258,972	$1,848,005	$238,982
2005	$915,912	$3,965,528	$7,425,928	$1,890,509	$244,479
2006	$925,071	$4,005,183	$7,500,187	$1,909,414	$246,924
2007	$923,173	$3,996,963	$7,484,795	$1,905,495	$246,417
Total	$6,283,075	$27,203,163	$50,941,193	$12,968,719	$1,677,103

Relative to the local economy, there is a potential to harvest 14-120 million board feet of timber over one to two years as part of the Moonlight and Wheeler Fires Recovery Project. Over 99 percent of the Moonlight and Antelope Complex fires area is located in Plumas County, and the remainder is in Lassen County. Employment opportunities would be created from proposed salvage harvesting and reforestation activities. Furthermore, indirect and induced economic employment and monies would be generated when income received by contractors and the timber industry is re-spent within the local economy.

3.3.1.6 Timber Harvest Trends

The harvest of trees provides commercial and noncommercial wood products, such as sawlogs and biomass, to the local economy. Local sawmills that rely, at least in part, on logs from National Forest lands include Sierra Pacific Industries in Quincy and Collins Pine Company in Chester. Figure 1 displays the volume of timber harvested on the PNF since 1974. Local sawmills have processed most of this volume although mills as far away as Weaverville have bid or purchased timber from the forest.

Figure 1. Annual amount of wood products harvested on the Plumas National Forest from 1978 to 2007[1].



[1] 2008 Volume of wood products harvested was 24,450 mbf.

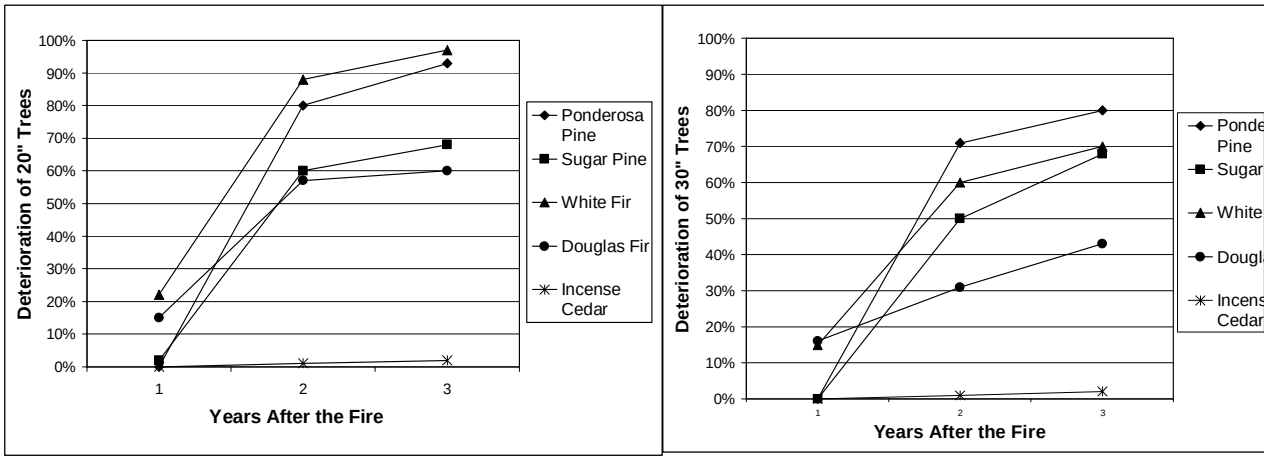
The harvest of dead trees also provides commercial and noncommercial wood products to the local economy, such as sawlogs and firewood; however, the value of fire-killed trees is lost rapidly. The value of fire-killed trees is lost rapidly because the sapwood begins to rot within 1 to 2 years, heartwood within 3 to 5 years, and small diameter logs crack, making them unsuitable for lumber.

Insects (primarily beetles), stain and decay fungi, and weather all act as deterioration agents in fire-killed timber. Insect activity usually precedes fungal activity and provides a mechanism for introducing fungi that accelerate sapwood deterioration. Fungal decay, once introduced, will deteriorate the sapwood ahead of any insect damage. Decay causes reductions in strength properties of wood, rendering the wood useless from a structural standpoint, and thus decreasing useable log volume. Insects such as ambrosia beetles and roundheaded borers, among others, introduce stain fungi and create boring holes that destroy the structural integrity of wood. In addition to the deterioration caused by stain, decay, and insects, weather checking also contributes to loss. Weather checking is cracks that form vertically in the wood as the tree dries out. With time, the cracks go deeper into the log. In the portion of the log that is checking, the log is unusable for manufacturing boards.

By the second year following the fire, most trees have significant sapwood decay and weather checking, culling about 65 percent of the board foot volume, with small trees deteriorating faster than large trees (refer to the charts below) (Lowell et al. 1992, Kimmey 1955). After one year following the fire, blue stain in ponderosa and sugar pine is expected to be significant (45% of Ponderosa pine volume, 75% of sugar pine) (Lowell

and Cahill 1996, Lowell et al. 1992). Blue stain seriously affects the lumber grade and value. The window of opportunity for recovering value is therefore short.

Figure 2. Percent board foot deterioration of 20 inch and 30 inch diameter trees, respectively, based on Lowell et al (1992) and Kimmey (1955).



3.3.2 Analysis Scope and Methods

This economic analysis focuses on those revenues and treatment costs associated with implementing salvage harvest and reforestation treatments in the Moonlight and Wheeler Fires Recovery and Restoration Project area. The purpose of this economic analysis is to present the potential revenues and costs associated with each of the alternatives for comparison purposes.

This analysis does not include monetary values assigned to resource outputs such as wildlife, watersheds, soils, recreation, visual quality, and fisheries. It is intended only as a relative measure of differences between alternatives based on direct costs and values used. Other values are discussed in the appropriate sections of this document.

Timber harvest values used in this economic analysis were based on the pond values (delivered log prices) of local mills from State Board of Equalization. Harvest costs and road improvement costs were developed from the latest timber sale appraisal values. Reforestation treatments are based on the latest service contract prices and Knutson-Vandenberg sale area improvement plans.

3.3.3 Environmental Consequences

Economic consequences are a measure of the overall value of the three alternatives (which includes the no-action alternative) considered in this analysis. The level and mix of goods and services available to the public varies by alternative, resulting in a range of effects on the social and economic environment. The effects discussed in this section include estimated government expenditures and revenues, as well as monetary impacts on local communities.

Direct monetary effects are discussed in terms of net cash value to the U.S. Treasury, including the costs associated with implementing the treatments and direct, indirect, and induced job opportunities. In general, the monetary value of each alternative depends on

the amount and method of timber harvest and the acreage planned for salvage harvest and reforestation treatments.

3.3.3.1 Employment

Employment opportunities can have direct, indirect, or induced effects on the local economy. Direct effects are associated with the primary producer. For example, the manufacturing of lumber from the Moonlight and Wheeler Fires Recovery and Restoration project would have a direct effect on employment opportunities. Indirect effects account for employment in service industries that serve the lumber manufacturer. These industries may include logging, trucking, and fuel supplies. Induced effects are driven by wages, and the wages paid to workers by the primary and service industries are circulated through the local economy for food, housing, transportation, and other living expenses. The sum of direct, indirect, and induced effects is the total economic impact in terms of jobs, which typically range from 10 to 15 jobs per million board feet of timber harvested. Though not a requirement, it was assumed for this analysis that most products from the Moonlight and Wheeler Fires Recovery and Restoration project would be processed locally due to high hauling costs of products and equipment. Likewise, it is also assumed that most employment would largely be derived from Plumas and Lassen Counties, particularly for the timber harvesting activities.

Plumas County Labor Statistics indicated a seasonal labor force with employment up during timber harvesting season. In the winter unemployment rises as the timber harvesting season stops. This project can have a significant effect to the numerous industries employment in the local labor force and transient labor force. The Bureau of Labor Statistics does not maintain data on the number of temporary non-local employment. The economy of the local area is enhanced by both types of labor forces.

Table 25. Bureau of Labor Statistics, December 2008 Plumas County Unemployment Rate

2007	12.4	12.6	12.2	9.8	7.5	6.4	6.8	6.2	5.8	6.3	8.0	9.9
2008	13	12.8	12.7	10.9	8.0	7.5	7.5	7.3	7.1			

Table 26. Bureau of Labor Statistics, December 2008 Plumas County Labor Force

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	9477	9438	9359	9953	10367	10956	11250	11170	10788	10675	10460	10403
2008	10479	10518	10661	10846	10945	11435	11557	11442	11045			

3.3.3.2 Revenue to the Government

Net revenue is the difference between the revenues generated by an alternative and the costs required to implement the alternative. In this analysis, revenues come from harvest of timber.

3.3.3.3 Payments to Counties

Local counties receiving payments through the Receipt Act rather than the Secure Rural Schools and Community Self-Determination Act would share part of the revenues generated from the timber harvest. The actual payment amount depends on estimated stumpage value and the price bid by the purchaser awarded the timber sale contract.

3.3.3.4 Treatment Costs

Treatment or management costs include those costs associated with timber harvesting, biomass removal, road improvements, and reforestation, as well as costs of resource enhancement measures not associated with the sale of timber. Costs vary widely depending on the amount of mechanical or manual treatments prescribed; the board feet of sawlogs or tons of biomass removed per acre; and the accessibility of the treatment units.

3.3.3.5 Nonpriced Costs and Benefits

It should be noted that not all costs and values are represented in the economic analysis. Calculations do not include costs and values for those items that cannot be estimated in dollar terms. For a detailed discussion of these nonpriced benefits and costs, refer to the appropriate resource section in this document. These nonpriced benefits and costs were considered along with the net economic value of each alternative so a judgment could be made as to which alternative would offer the best overall mix of costs and benefits to society.

3.3.3.6 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative

The anticipated timber volume, value, costs, jobs, and revenues are displayed for all alternatives in Table 27. As mentioned above, the volumes and values of the fire-killed trees will deteriorate over time, which underscores the time-sensitivity of fire recovery salvage harvesting treatments. The revenue generated would also depend on the availability of logging equipment, haul distances to available mills, and fuel prices. The appraisal used for the displayed figures assumed haul to the closest sawmills, however, haul to other mills is feasible as evidenced by past and current timber sales. Table 27 summarizes the economic effects on the local economy that would occur from implementation of alternative A, B, C, D, or E.

Table 27. Comparison of economic effects by alternative.

Volume/ Revenue & Cost/ Employment	Alternatives					Burned Area[1]
	A	B	C	D	E	
Sawlog Volume	120,194 mbf	0 mbf	57,987 mbf	23,135 mbf	14,013 mbf	549,534 mbf
Biomass Volume	161,000 tons	0	118,000 tons	36,000 tons	0 tons	
Total Sawlog and Biomass Value	$32,339,549	$0	$16,468,190	$6,524,329	$3,345,081	$121,007,765
Total Costs	$44,226,249	$0	$19,036,931	$7,396,310	$3,944,782	
Net Revenue	-$11,886,700	$0	-$2,568,742	-$871,982	-$599,701	
Percent above value	-37%	0%	-16%	-13%	-18%	
Total direct and indirect jobs	**2020**	**0**	**1077**	**663**	**502**	
Total employee-related income	**$86,861,975**	$0	**$46,326,262**	**$28,502,986**	**$21,598,427**	

[1] Gross Estimation of Volume and Value of areas within the fire perimeter that burned with high fire severity.

Salvage harvesting and reforestation treatments would generate 2020 direct and indirect jobs under alternative A to 502 direct and indirect jobs under alternative E. These jobs temporarily add benefits to the local economy by the dollars spent in the area for of cost of living. All action alternatives would create additional employment opportunities in service industries (such as logging supply companies, trucking companies, and fuel suppliers) that serve the timber industry. There would also be an induced effect driven by wages. Wages paid to workers by the primary and service industries would be circulated through the local economy for food, housing, transportation, and other living expenses. The direct and indirect jobs represent 5 percent (under alternative E) to 18 percent (under alternative A) of the counties labor force with potentially equivalent percent increase in cash flow in the community. This project will require at least two harvesting seasons enhancing labor force stability.

Under Alternative A, helicopter and skyline salvage harvesting treatments contribute more volume to the overall economic analysis, but also contribute more costs. Alternative A provides the largest income and jobs to the economy. The treatment of these units should be subject to agreement under the timber sale contract for alternative A. Allowing flexibility for purchasers to negotiate harvesting the timber is anticipated since the timber value maybe marginal due to defect and the timing of implementation is a direct effect to the amount of defect. Removal of trees may become uneconomical for helicopter and skyline systems due to increases in defect. Allowing for such flexibility would likely reduce the amount of volume and acres subject to salvage harvesting in Alternative A.

The biomass removed from the units will be utilized for electric energy production. Alternative A would provide a 35 megawatt generation plant to operate for 7 months at full capacity generating 35 megawatts of energy per day. The mill in Quincy has an annual production of scaled timber of 160,000 mbf. For Example, alternative A would allow this mill to operate at full capacity for approximately 9 months if all the timber went to the one mill within the haul distance of the project. The mill in Chester has an annual production of scaled timber of 75,000 mbf; however, the mill for the past two years has been operating at 80% capacity due to the lack of logs. Alternative A for example provides 19 months supply of logs to the mill allowing full capacity of production.

In comparison, alternatives D and E would provide far less sawlog volume to local mills and biomass volume to co-generation facilities—alternative E would not produce any biomass volume for energy production. Alternatives D and E would produce 14,000 to 23,000 mbf. For example, alternatives D and E would provide enough supply to allow the larger Quincy mill to operate at full capacity for approximately 1 to 2 months or to allow the smaller Chester mill to operate 2 to 4 months. This is a substantially less log supply, which would be provided under alternatives A and C.

Cumulative Effects. Each of the action alternatives would result in the similar cumulative effects—an increase in the overall economic activity in the local counties—to varying degrees. All action alternatives would provide employment opportunities and generate harvest revenues and timber yield taxes. Alternative A would generate the largest harvest revenues, employment, and employee-related income, while Alternative E would generate the notably less harvest revenues, employment, and employee-related income. The saw timber provided by any of the action alternatives would contribute to the stability of local employment by providing a supply of wood products to local industries dependent on forest management activities.

Table 28. Plumas National Forest, Planned Timber Harvest Volume in mbf.

	2008[1]	**2009**	**2010**	**2011**
Total Planned Green Timber Harvest	703 mbf	39,452 mbf	93,783 mbf	62,800 mbf
Total Planned Salvage Timber Harvest	15,044 mbf	13,500 mbf[2]	6,000 mbf	6,000 mbf
Total Planned Timber Harvest	15,747 mbf	52,952 mbf[2]	99,783 mbf	68,800 mbf

[1] Volumes for 2008 reflect actual sold volume, not estimated planned volumes.

[2] Salvage volume does not include estimated volume from the Moonlight and Wheeler Project. Dependent on the action alternative, this volume could increase by 14,013 to 120,194 mbf.

Table 28 displays the planned timber harvest volume in mbf for the Plumas National Forest. Green timber sales planned for 2007 and 2008 were lost as a result of both the Antelope Complex and Moonlight fires, which burned through the planned units. The remaining units from these sales that didn't burn would be analyzed and offered in 2009

and 2010. Consequently, the green timber sale program decreased as a result of the fires and focus on the salvage program.

In the short term, implementation of action alternatives would provide for an increase in volume with alternative A providing the largest increase. The local industry infrastructure has the capacity to complete this work as evidenced by the increase in salvage timber operation on the private lands within the fire perimeter. The loss of timber in areas that burned with high severity would preclude future harvest treatments therefore having local long term effects. Implementation of the action alternatives would provide a large short term increase in economic recovery of timber products on lands, which would not produce timber products for decades to come. In addition, implementation of reforestation treatments under all action alternatives, expedite the re-establishment of forested conditions which would provide both economic and land stewardship opportunities on these lands in the future.

See appendix A of this final EIS for the complete economic analysis by alternative.

3.3.3.7 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

Under alternative B, no timber volume or value would be recovered from the Moonlight and Wheeler Fires Recovery and Restoration Project and no implementation costs would be incurred. Costs associated with future restoration such as reforestation, if any, would not be offset by timber revenue, and implementation of any future projects in the burned area would be dependent on appropriated tax dollars or other funding sources.

Under the no-action alternative, no funds would be generated for the U.S. Treasury or returned to local counties through the receipt tax. No additional employment opportunities or wages paid to primary and service industry employees would be circulated through the local economy.

Cumulative Effects. The no-action alternative would result in a negative effect on the local industries that depend on service contracts or a steady supply of timber, as well as counties that use timber yield taxes to fund county programs. These local industries would have notably reduced opportunities related to forest management activities such as timber harvesting, particularly because the burned area would not be available for commercial harvest for decades. In addition, reforestation treatments would not occur resulting in a delay in re-establishing forested conditions. This would have a long term adverse effect on local communities dependent on forest management activities on National Forest Lands. Consequently, the local economy would not receive benefits from associated employment, such as in food, lodging, and transportation businesses. Throughout northern California, cumulative years of reduced timber harvesting activities (including those on federal lands) have resulted in the loss of infrastructure to complete such activities. The loss of such infrastructure, including local mill closures and corresponding loss of logging companies could significantly reduce or eliminate future economic and land stewardship opportunities from National Forest lands. The continuation of current conditions under alternative B would preclude and/or notably limit opportunities for long-term employment and rural community stability.

3.4 Forest Vegetation, Fire, Fuels, and Air Quality

3.4.1 Affected Environment

3.4.1.1 Forest Vegetation, Fire, and Fuels

The ecological dynamics between vegetation, fire, and fuels are inherently linked; fire has a profound effect on vegetation establishment and development and conversely, vegetation treatments (and the absence thereof) have a profound effect on fuels accumulation and arrangement and fire behavior. The analysis area considers this relationship on the landscape level by including the entire fire perimeter of both the Moonlight and Antelope Complex fires, and allows for a congruent analysis of forest vegetation, fuels, and fire at the stand and landscape levels.

Direct effects are effects on forest vegetation that are directly caused by treatment implementation or, as with alternative B (no action), a lack of treatment.

Indirect effects are effects on forest vegetation that are in response to the direct effects of treatment implementation or, as with alternative B (no action), a lack of treatment.

Direct effects would likely be limited to the project implementation phase. Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effects analysis.

The analysis area used to analyze the direct, indirect, and cumulative effects on forest vegetation, fire, fuels, and air quality is the 87,647 acre perimeter where the Moonlight and Antelope Complex fires burned (appendix B, figure B-1). The analysis area is based on 1) acres burned in a distinct geographic area and administrative setting, 2) impacts to forest vegetation from the wildfire and subsequent effects of timber salvage harvest and reforestation, including cumulative effects, are limited to the burned area, and 3) the areas including forest vegetation occurring within the treatment areas as well as the vegetation outside the treatment areas, but within the fire perimeter and represents the furthest measurable extent that effects on forest vegetation and fuels would occur as a result of implementing any of the proposed alternatives. Areas beyond the fire perimeter were not considered within the analysis area because including extensive areas of unburned forest would dilute the extent of impacts of the fire and post-fire activities.

The direct, indirect, and cumulative effects analyses are based on a temporal scale. Documented past projects, including timber harvesting, wildfires, watershed improvements, and other activities described in Appendix B: Past, Present, and Reasonably Foreseeable Future Actions ranging as far back as 1974 were considered past actions within the analysis area. In a broader sense, current vegetation structure and composition reflects the historical management regimes prior to 1974. This vegetation structure and composition includes attributes of the current landscape including existing vegetation types, fuel treatments, burned areas, past sanitation harvest, and plantations.

For the purpose of the vegetation, fire, and fuels analysis, the temporal bounds include a 30-year horizon for future effects because modeling indicates that, within 30 years, the treated stands would approach stocking levels corresponding with forest development. In addition, past stand replacing fires within the project vicinity such as the Elephant fire (1981) that were treated with similar management actions (salvage fire-killed timber and

reforestation) developed into young forested stands within 30 years. This stand development is commensurate with the modeling performed in this analysis. Stand development modeling was extended beyond this to examine general trends and trajectories of stand development under no further management beyond those documented in Appendix B: Past, Present, and Reasonably Foreseeable Future Actions. The air quality analysis considers potential impacts to communities within 20 miles of the analysis area as these are the communities that would be most impacted by any activities within the alternatives.

Post-fire conditions were assessed through field observations, stand exams, and remote sensing. The areas burned by the Moonlight and Antelope Complex fires were prone to burning under high severity, and did so during these fire events. Together, the Moonlight and Antelope Complex fires burned approximately 88,000 acres, with over 54,000 acres (62 percent) of the total area burning under what is classified as high fire severity, (Safford et al. 2007; Miller 2007; Miller and Thode 2007) (Table 29). Areas which burned with low severity typically consumed up to 90 percent of existing surface fuels with the majority of trees killed in the less than 10 inches dbh size class; the majority of trees greater than 20 inches dbh have signs of needle scorch, but are still alive. Within the moderate severity size class, large pockets, several acres in size are completely killed with some larger trees in the overstory being completely scorched and now fire-killed. Within the high severity class, up to 100 percent of all trees are fire-killed, showing extensive signs of bark char and with most not having any foliage. Due to high consumption of existing surface fuels and a lack of scorch needle foliage, surface fuels and associated ground cover in high severity burn areas is low to non-existent.

Table 29. Acres by fire severity class for lands within the perimeter of the Moonlight and Antelope Complex fires.

Acres	Unclassified due to Satellite Imagery [1]	Low Severity	Moderate Severity		High Severity	Total for all severity classes
		BA Mortality 0-25%	BA Mortality 25-50%	BA Mortality 50-75%	BA Mortality 75-100%	
Total within Analysis Area	258	16679	8401	7770	54539	87647
Percent of Analysis Area	0.3%	19%	10%	9%	62%	100%
Total on Private Land	258	3078	1418	1240	13245	19238
Percent of Private Land	1%	16%	7%	6%	69%	100%
Total on NFS lands	0	13600	6983	6531	41294	68408
Percent of NFS lands	0%	20%	10%	10%	60%	100%

[1] Unclassified area is within private lands on the Northwest portion of the Moonlight Fire. This area was unclassified as it was off the edge of the satellite imagery. BA=basal area.

Over 41,000 acres or 60 percent of the total NFS lands burned under high severity. This is equivalent to over 85 square miles that burned resulting in 75-100 percent mortality of forest vegetation. The large scale of these fires, including the vast areas that burned under high severity, are well outside the natural range of variability in fire size and severity experienced on the PNF in the past and are uncharacteristic of the “natural” fire regimes typically described for the dry Sierra Nevada forests (Miller 2008, Safford 2007, Safford et al. 2007, Safford 2008b, Stephens et al 2007, Beaty and Taylor 2007, Moody and Stephens 2002, Beaty and Taylor 2001, Gruell 2001, McKelvey et al. 1996, Weatherspoon 1996, Weatherspoon and Skinner 1996, Skinner and Chang 1996, McKelvey and Johnston 1992, Leiberg 1902). In addition, proximity and adjacency of these two fires and similar severity effects has had a major effect on this landscape.

The effect of the fires caused a large scale vegetation type change from mid to late seral closed canopy forested conditions to non-forest vegetation types, which are expected to be dominated by brush. CWHR (Mayer and Laudenslayer 1988) typing is used to examine changes in forest vegetation as it classifies vegetation by vegetation type, size, and density. Conifer forest types include ponderosa pine, Sierra mixed conifer, white fir, red fir, eastside pine, and lodgepole pine forest vegetation. Hardwood forest types include aspen, montane hardwood, montane hardwood conifer, and montane riparian vegetation. Non-forest vegetation types include montane chaparral, wet meadow, perennial grassland, and sage brush types, as well as water and rock substrate types.

A large majority of CWHR 4 and 5 stands in conifer forest types were converted to non-forest vegetation types as a direct result of the fires. Of these post-fire non-forest vegetation types, over 95 percent (52,000 acres of NFS lands) are expected to be dominated by brush such as Ceanothus and manzanita species. In addition, early seral forest conditions characterized by CWHR size classes 1, 2, and 3 are converted to non-forest vegetation types (brushfields) due to high mortality in young trees and vigorous post-fire basal sprouting of brush species which can rapidly colonize the site effectively out-competing natural regeneration. Table 30 26 displays pre and post fire vegetation as classified by CWHR, displays the change in acres by CWHR type as a result of the fire.

Table 30. Pre- and post-fire vegetation as classified by CWHR (includes all private and NFS lands within the forest vegetation analysis area).

Forest Type	CWHR Size Class	CWHR Density	Pre-Fire Acres	Pre-Fire Percent of Acres	Post-Fire Acres	Post-Fire Percent of Acres	Percent Change
Conifer Forest Types	**1**	**Total**	**63**	**0.1%**	**62**	**0.1%**	-1%
	2	**Total**	**3279**	**3.7%**	**540**	**0.6%**	-84%
	3	**Total**	**3824**	**4.4%**	**1538**	**1.8%**	-60%
	4	D	3282	3.7%	383	0.4%	-88%
		M	36620	41.8%	3861	4.4%	-89%
		P	9525	10.9%	15767	18.0%	66%
		S	2045	2.3%	6537	7.5%	220%
		Total	**51471**	**58.7%**	**26548**	**30.3%**	-48%
	5	D	3858	4.4%	110	0.1%	-97%
		M	16809	19.2%	519	0.6%	-97%
		P	1225	1.4%	557	0.6%	-55%
		S	153	0.2%	288	0.3%	88%
		Total	**22044**	**25.2%**	**1474**	**1.7%**	-93%
Hardwood Forest Types		**Total**	**3604**	**4.1%**	**2603**	**3.0%**	-28%
Non-Forest Types		**Total**	**3361**	**3.8%**	**54883**	**62.6%**	1533%

Table 31 displays existing post-fire stand conditions within primarily CWHR 4 and 5 stands in conifer forest types contained by the proposed treatment units. The treatment units were designed to encompass areas of moderately high and high severity where the vast majority, if not all, trees within the stands are fire-killed and economic recovery treatments are appropriate.

Table 31. Average existing stand conditions by severity and site class within the burned area.

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Live Basal Area
	Total	0-10"	10-16"	16-30"	>30"	Total	0-10"	10-16"	16-30"	>30"	
High to Moderate Severity Conditions (> 50% BA Mortality); Region 5 sites III & IV											
Existing	11.6	2.1	4.1	3.8	1.0	434.7	354.1	40.9	32.9	5.7	23
High to Moderate Severity Conditions (> 50% BA Mortality); Region 5 site V											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Low to Moderate Severity Conditions (< 50% BA mortality); Region 5 sites III & IV											
Existing	84.1	0.0	40.9	34.7	8.4	42.6	33.3	5.2	1.4	2.6	213
Low to Moderate Severity Conditions (< 50% BA mortality); Region 5 site V											
Existing	96.7	40.0	40.7	12.1	4.0	187.4	180.0	4.3	2.4	0.6	94

In areas that burned under moderately high and high burn severity (areas with greater than 50 percent basal area mortality), the high numbers of fire-killed trees relative to live trees underscores high levels of mortality that exist within these areas. Subsequently, these are the areas where proposed action alternatives focus economic recovery treatments. In low to moderate burn severity (areas with less than 50 percent basal area mortality), tree survival, particularly in codominant and dominant overstory trees (10 inches in diameter and greater), underscores that forest vegetation remains and,

consequently, green trees or low to moderate fire severity areas are not targeted for removal or treatment respectively.

3.3.1.2 Air Quality

The entire analysis area is contained in the Northern Sierra Air Quality Management District (NSAQMD) within the Mountain Counties Air Basin. The air quality attainment status for ozone, carbon monoxide, sulfur dioxide, and other compounds was derived directly from the NSAQMD Annual Air Monitoring Report (2005).

Currently, Plumas County is in non-attainment status for particulate matter $(PM)_{10}$ (county wide) and $PM_{2.5}$ (Portola Valley only). The analysis area is 20 miles northwest of Portola Valley at its closest point. According to the NSAQMD 2005 report, the major contributors to both PM_{10} and $PM_{2.5}$ levels include forestry management burns, woodstoves, residential open burning, vehicle traffic, and windblown dust. These problems can be relieved or made worse by local meteorology, winds, and temperature inversions. In addition, large areas in and adjacent to local communities can be heavily impacted by smoke for extensive summer periods (several weeks) due to wildfire such as in the 3,500 acre Stream fire, 3,000 acre Boulder fire, and the Antelope Complex and Moonlight fires . The community of Quincy is subject to strong inversions and stagnant conditions in the wintertime. Those conditions, coupled with intensive residential wood burning, can result in very high episodic $PM_{2.5}$ levels (NSAQMD 2005). Levels of PM_{10} have been greatly decreased due to a reduction of non-EPA (Environmental Protection Agency) approved woodstoves in existing residences.

Current sources of particulate matter from the burned area include smoke from large wildfires, smoke from underburning and pile burning, emissions and dust from standard and off-highway vehicles, dust and emissions from harvest activities occurring on private lands, smoke from campfires, emissions from boats at Antelope Lake, and wind-generated dust from exposed soil surfaces. The amount and duration of these emissions vary by season, with most emissions from wildfires, timber harvest, and recreational activities occurring between May and late August, and emissions from prescribed burning occurring from late September through mid-November.

3.4.2 Environmental Consequences

3.4.2.1 Direct, Indirect, and Cumulative Effects Common to All Alternatives

3.4.2.1.1 Forest Vegetation, Fire, and Fuels

3.4.2.1.1.1Effects of Harvesting

Construction of skid trails, landings, and temporary roads may require incidental removal of trees beyond those described for silvicultural purposes. This may include incidental removal of live trees for operability. However, the location and size of skid trails, landings, and temporary roads, and the trees harvested for the construction of such facilities must be approved and agreed upon by the Forest Service. Live tree removal would be permitted by necessity to facilitate such facilities, and would be avoided whenever practicable; it is estimated that removal of green trees would account for less than one percent of harvested trees. Therefore, the removal of trees for operability would

be an incidental component of harvesting activities, of minimal size and scale, and highly dispersed, and would have negligible effects on stand structure.

Damage to residual trees and vegetation may occur during harvesting operations including damage to stems, bark scraping, wrenched stems, broken branches, broken tops, and crushed foliage (McIver et al. 2003). These effects are typical in logging operations, but care would be taken to minimize the potential for damage to residual trees. The Forest Service would inspect timber sales during harvesting to ensure that damage to residual trees and vegetation is within reasonable tolerances.

Damage and/or mortality of natural regeneration may occur during harvesting operations, particularly in ground-based harvesting treatments (Donato 2006). Areas where the risk of seedling damage and/or mortality is greatest would be within or near skid trails and landings. The PNF LRMP (1988) soil quality standards provides direction that landings and permanent skid trails should not encompass more than 15 percent of timber stands. Consequently, damage and/or mortality of natural regeneration due to harvesting operations would be limited in size and scale to skid trails dispersed through the stand.

Snags would be removed during salvage harvesting. Incidental removal of snags may occur for operability and safety; however, guidelines set forth in the Sierra Cascade Province Timber Theft and Detection Plan would be used to ensure that operability, safety, and minimum snag densities would be met. The snags to be retained would receive preference in locations where operability and safety are not anticipated to be issues. Snags within falling distances of roads, landings, and heavily used public areas would receive preference for removal.

Existing skid trails, landings, and temporary roads would be used, when available, to facilitate the harvesting and removal of forest products (biomass and sawlogs). Skid trails, landings, and temporary roads could be constructed under all action alternatives to facilitate the removal of forest products when existing infrastructure does not exist.

Under all action alternatives, no more than 13 miles of temporary road under alternative A, 12 miles of temporary road under alternative C, and 3 miles of temporary road under alternative D would be constructed, and any temporary roads constructed would be decommissioned after use. Zero miles of temporary road would be constructed under alternative E. All harvest operations including the use and construction of skid trails, landings, and temporary roads would adhere to the standards and guidelines set forth in the timber sale administration handbook (FSH 2409.15 including Region 5 supplements) and the Best Management Practices as delineated in the Water Quality Management for Forest System Lands in California: Best Management Practices.

The direct effect of harvesting fire-killed trees under the action alternatives are displayed in Table 32 and Table 33. The tables show the predicted effects of treatment prescriptions on stand structure (by site class) for all action alternatives by treatment. The tables include harvesting fire-killed conifers in Riparian Habitat Conservation Areas (RHCAs) and exclude snag retention areas. The number of snags per acre (greater than 15 inches dbh) retained across the Moonlight and Antelope Complex fires perimeters is the measurement indicator when predicting the effects of the treatment prescriptions across the range of alternatives.

Within treatment areas, all dead trees of merchantable size would be harvested with the exception of snag retention prescriptions in RHCAs and snag retention areas. Within RHCAs, generally four to six of the largest snags per acre would be retained, preferably within falling distance of the channel where available, to provide for large down woody debris recruitment to best meet riparian management objectives. Within ground-based salvage harvesting treatments, snag retention in RHCAs would be most preferable and efficient within equipment exclusion zones where snags would be within reasonable falling distance of the channel for large woody debris recruitment and harvesting safety issues would be minimized due to equipment exclusion. Within snag retention areas, no salvage harvesting would occur; thereby retaining, the entire suite of small to large sized snags, which would enhance structural diversity and break up continuity of treatment units.

Table 32. Predicted effects of treatment prescriptions on stand structure (Site class V) for all action alternatives.

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Basal Area
	Total	0-10"	10-16"	16-30"	>30"	Total	0-10"	10-16"	16-30"	>30"	
Alternative A: Helicopter & Skyline Salvage Harvest-- Harvest Trees > 16 inches DBH											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	15.6	0.0	0.0	13.6	2.0	--
Post	9.6	0.0	7.9	1.5	0.2	272.1	223.6	48.5	0.0	0.0	12
10 years	9.4	0.0	5.8	3.4	0.2	127.7	98.6	29.1	0.0	0.0	16
20 years	101.0	91.7	2.4	6.1	0.4	14.5	4.3	10.2	0.0	0.0	22
30 years	100.1	90.9	0.1	8.6	0.4	1.1	0.8	0.2	0.0	0.0	30
Alternative A: Helicopter & Skyline Salvage Harvest within RHCAs -- Harvest Trees > 16 inches DBH, Retain 4 - 6 Snags per Acre											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	12.0	0.0	0.0	10.6	1.4	--
Post	9.6	0.0	7.9	1.5	0.2	275.7	223.6	48.5	3.0	0.6	12
10 years	9.4	0.0	5.8	3.4	0.2	128.7	98.6	29.1	0.7	0.3	16
20 years	101.0	91.7	2.4	6.1	0.4	15.2	4.3	10.2	0.5	0.2	22
30 years	100.1	90.9	0.1	8.6	0.4	1.6	0.8	0.2	0.4	0.2	30
Alternatives A, C, and D: Ground-based Salvage Harvest -- Harvest Trees > 14 inches DBH, Biomass Harvest or Site Prep Trees < 14 inches DBH											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	103.3	39.2	48.5	13.6	2.0	--
Post	9.6	0.0	7.9	1.5	0.2	184.4	184.4	0.0	0.0	0.0	12
10 years	9.4	0.0	5.8	3.4	0.2	77.5	77.3	0.2	0.0	0.0	16
20 years	101.0	91.7	2.4	6.1	0.4	1.3	1.0	0.3	0.0	0.0	22
30 years	100.1	90.9	0.1	8.6	0.4	1.0	0.8	0.1	0.0	0.0	30
Alternatives A, C, and D: Ground-based Salvage Harvest within RHCAs -- Harvest Trees > 14 inches DBH, Biomass Harvest or Site Prep Trees < 14 inches DBH; Retain 4 – 6 Snags per acre											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	99.3	39.2	48.0	10.6	1.4	--
Post	9.6	0.0	7.9	1.5	0.2	188.4	184.4	0.5	3.0	0.6	12
10 years	9.4	0.0	5.8	3.4	0.2	78.5	77.3	0.2	0.7	0.3	16
20 years	101.0	91.7	2.4	6.1	0.4	2.1	1.0	0.3	0.5	0.2	22
30 years	100.1	90.9	0.1	8.6	0.4	1.5	0.8	0.1	0.4	0.2	30
All Action Alternatives: Snag Retention Areas											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	--	--	--	--	--	--
Post	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
10 years	9.4	0.0	5.8	3.4	0.2	139.3	98.6	29.1	9.9	1.8	16
20 years	101.0	91.7	2.4	6.2	0.4	22.2	4.3	10.2	6.1	1.5	22

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Basal Area
	Total	0-10"	10-16"	16-30"	>30"	Total	0-10"	10-16"	16-30"	>30"	
30 years	100.1	90.9	0.1	8.2	0.4	4.5	0.0	0.4	2.9	1.3	30
Note: For low sites, all stands for helicopter, skyline, and ground-based systems were averaged.											

Table 33. Predicted effects of treatment prescriptions on stand structure (Site classes III & IV) for all action alternatives.

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Basal Area
	Total	0-10”	10-16”	16-30”	>30”	Total	0-10”	10-16”	16-30”	>30”	
Alternative A: Helicopter and Skyline Salvage Harvest–Harvest Trees > 16 inches DBH											
Existing	5.5	4.2	0.6	0.5	0.2	452.1	355.8	49.1	41.9	5.3	4
Harvest	--	--	--	--	--	47.2	--	--	41.9	5.3	
Post	5.5	4.2	0.6	0.5	0.2	404.9	355.8	49.1	0.0	0.0	4
10 years	4.8	2.7	1.4	0.4	0.3	174.2	146.8	27.4	0.0	0.0	5
20 years	96.4	93.6	2.1	0.5	0.3	20.6	11.8	8.8	0.0	0.0	9
30 years	95.2	92.3	0.9	1.7	0.4	1.0	0.8	0.1	0.0	0.0	18
Alternative A: Helicopter and Skyline Salvage Harvest within RHCAs – Harvest Trees > 16 inches DBH, Retain 4 – 6 Snags per Acre											
Existing	5.5	4.2	0.6	0.5	0.2	452.1	355.8	49.1	41.9	5.3	4
Harvest	--	--	--	--	--	43.2	--	--	38.4	4.7	
Post	5.5	4.2	0.6	0.5	0.2	408.9	355.8	49.1	3.4	0.6	4
10 years	4.8	2.7	1.4	0.4	0.3	175.5	146.8	27.4	1.1	0.2	5
20 years	96.4	93.6	2.1	0.5	0.3	21.4	11.8	8.8	0.8	0.1	9
30 years	95.2	92.3	0.9	1.7	0.4	1.5	0.8	0.1	0.6	0.0	18
Alternative A, C, and D: Ground-based Salvage Harvest – Harvest Trees > 14 inches DBH, Biomass Harvest or Site Prep Trees < 14 inches DBH											
Existing	16.5	0.0	7.7	7.0	1.8	415.1	352.5	32.7	24.0	6.0	43
Harvest	--	--	--	--	--	150.1	87.4	32.7	24.0	6.0	
Post	16.5	0.0	7.7	7.0	1.8	265.0	265.0	0.0	0.0	0.0	43
10 years	16.3	0.0	6.5	7.3	2.4	108.0	107.1	0.6	0.3	0.0	46
20 years	96.0	80.4	5.1	7.9	2.6	9.1	7.9	0.8	0.4	0.0	50
30 years	103.6	88.6	3.6	8.6	2.9	2.0	0.7	0.8	0.4	0.0	60
Alternative A, C, and D: Ground-based Salvage Harvest within RHCAs – Harvest Trees > 14 inches DBH, Biomass Harvest or Site Prep Trees < 14 inches DBH; Retain 4 – 6 Snags per acre											
Existing	16.5	0.0	7.7	7.0	1.8	415.1	352.5	32.7	24.0	6.0	43
Harvest	--	--	--	--	--	125.7	71.6	27.9	21.2	5.0	
Post	16.5	0.0	7.7	7.0	1.8	289.4	280.9	4.8	2.8	1.0	43
10 years	16.3	0.0	6.5	7.3	2.4	112.6	109.9	1.1	1.2	0.4	46
20 years	96.0	80.4	5.1	7.9	2.6	10.3	7.9	1.0	1.1	0.2	50
30 years	103.6	88.6	3.6	8.6	2.9	2.6	0.7	0.8	1.0	0.1	60
All Action Alternatives: Snag Retention Areas											
Existing	11.6	2.1	4.1	3.8	1.0	434.7	354.1	40.9	32.9	5.7	23
Harvest	--	--	--	--	--	--	--	--	--	--	
Post	11.6	2.1	4.1	3.8	1.0	434.7	354.1	40.9	32.9	5.7	23
10 years	10.4	1.5	3.8	3.7	1.3	200.4	148.4	23.5	22.7	5.0	24
20 years	10.0	1.0	3.6	3.9	1.4	40.1	13.2	8.0	14.2	4.4	26

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Basal Area
	Total	0-10”	10-16”	16-30”	>30”	Total	0-10”	10-16”	16-30”	>30”	
30 years	9.6	0.8	2.2	4.9	1.5	10.8	0.1	0.6	6.2	3.8	28

Direct and indirect effects under all action alternatives would include the removal of trees greater than 14 to 16 inches in diameter within treatment units. In areas proposed for ground-based logging, trees less than 14 inches in diameter would be removed as biomass product or treated through site preparation. Trees less than 6 inches in diameter would likely be crushed, felled, or pushed over, although some may remain standing. The net effect would be a reduction in standing snags and a decrease in recruitment of large down woody debris, which would contribute to a simplification of forest structure within treatment units except for the snag retention areas and large snag retention within RHCAs where all or portions of such structure would be maintained. This is consistent with effects as noted in McIver and Ottomar (2007).

3.4.2.1.1.2 Effects of roadside hazard removal treatments

Roadside hazard tree removal is common to all action alternatives and is designed to insure safe travel routes on Forest Service System Roads for public, special use permittees, private landowners, employees, contractors, recreational users, and any visitor who drives these roads to access private and/or National Forest Lands. The purpose is to remove hazardous trees with structural defects likely to cause failure in all or part of the tree, which may fall and hit the road prism in a timely, efficient, and cost-effective manner.

In the context of recreation resource management, hazard is some exposure to the possibility of loss or harm. With reference to trees, it is the recognized potential that a tree or tree part will fail and cause injury or damage by striking a target. All standing trees, alive or dead, within areas occupied by people, structures, and property present some level of hazard. Potential for failure by itself does not constitute a hazard. Hazard exists when a tree of sufficient size and mass to cause injury or damage is within striking distance of any object of value (people, property, etc.) Hazard increases with increasing tree defect, potential for failure, potential for damage, and target value. Management actions are taken to mitigate the hazard when risks are unacceptable. It is the responsibility of the land manager to discover and correct any unreasonably dangerous conditions to minimize the potential for injury to invited users or damage to their personal property.

The Plumas National Forest Roadside /Facility Hazard Tree Abatement Action Plan (2008) and corresponding removal guidelines provides direction on hazard tree identification and abatement, however, do not include identification criteria for recently affected fire-injured trees. It is reasonably anticipated that tree mortality associated with fire-injury may occur for years subsequent to the Moonlight Fire. Fire-injured tree marking guidelines for this project were developed by the Pacific Southwest Region Forest Health Protection Staff, based upon tree mortality models from the latest scientific research by Fire Sciences Laboratory at the Rocky Mountain Research Station (Hood et al. 2007) and Pacific Southwest Region Forest Health Protection Staff. These guidelines are based on tree data collected on over 5,000 trees, which is the largest database

available of fire-injured trees in California. These marking guidelines incorporate 4 year post-fire data from Smith and Cluck (2007), as well as research from "Predicting post fire mortality of seven western conifers (Ryan and Reinhardt, 1988), and field examination and recommendations by Danny Cluck, Forest Health Protection staff entomologist (July 27, 2007).

Identification and designation of hazard trees is consistent with and follows the Plumas National Forest Roadside/Facility Hazard Tree Abatement Action Plan (2008). The cambium sampling and stratified random sampling methods used in the study (Hood et al 2007) is consistent with scientific literature on monitoring fire-injured trees and ensures that data were collected from a wide range of tree injuries and sizes.

The roadside hazard tree removal as implemented through the marking guidelines would result in reduced snags and downed logs within striking distance of roads and facilities. It would also reduce the amount of fire-injured trees that would likely die resulting in reduced snag recruitment within striking distance of roads and facilities. The purpose of the marking guidelines is to remove those trees that would be likely to die and fail to abate potential hazards to forest visitors and improve safety and access, while retaining those trees that do not meet the removal guidelines to provide continuous forest cover.

Many factors contribute to the rate at which snags may fall. Among these are tree size, species, cause of mortality, occurrence of severe weather events, soils, and climate. The Moonlight fire combines many of the factors that have been reported to cause higher and faster fall rates of snags.

The Moonlight fire burned in the transition zone between the westside and eastside forests of the Sierra Nevada. There are a mix of species that occur in this transition zone, including ponderosa pine, sugar pine, Jeffery pine, white fir, red fir, Douglas-fir, and incense cedar. The two most abundant species that burned under high severity in the Moonlight fire were ponderosa pine and white fir. Ponderosa pine has been reported to have a faster fall rate than white fir (Landram et al. 2002, Raphael and Morrison 1987). However, Cluck (FHM Report: NE07-08) in his report to the District Ranger of the Mt. Hough Ranger District addressing potential bark beetle mortality within the Moonlight and Antelope Complex fires stated that fire-injured white fir, 8-inch to 24-inch DBH, have been reported to fall in as little as three years post-fire with rate of fall dramatically increasing after the fourth year (FHM Report: SPR-07-05). In a 22 year study of ponderosa pine snags, Dahm (1949) reported that 50 percent of snags fell within 10 years and 78 percent after 22 years.

The diameter of the snag contributes to its fall rate. Most studies cited here found that the greater the snag diameter the longer it would stand, especially for snags greater than 16-inches DBH due to the larger amount of wood to decay. The Dahm (1949) study reported that larger snags (averaging 26-inches DBH) stood longer than smaller snags (averaging 22-inches DBH). Although the average size of the "smaller" snag was 22-inches DBH, a half-life of 10 years was still reported in this study.

The cause of mortality has been shown to be a factor in snag fall rates. Sixty-two percent of all acres in the Moonlight and Antelope Complex fires burned at high severity. Based

on 30 years of local experience and observation from district staff of snagfall in the Will (1979) and Elephant (1982) fires, it is noted that fire-killed stands tended to have higher and faster rates of snagfall than the "natural background mortality" snagfall. These local observations are generally consistent with trends described in the Russell (2006) study showing that fire-killed snags have lower half lives and that snags fell much faster in areas that had been logged. Also, a Chambers and Mast study (2005) suggests differences in burned and unburned snag fall rates concluding that burned snags fell faster and at a higher rate than unburned snags. Therefore, the assumption of district staff is reasonable and reflective of local conditions. Furthermore, the Russell (2006) study showed that ponderosa pine and Douglas-fir, two of the more common occurring species killed in the Moonlight fire, have a half-life of 7 – 16 years depending on whether the area had been salvaged logged or not with ponderosa pine predicted to fall sooner than Douglas-fir.

The Moonlight fire combines many attributes that have been reported to cause a higher and faster rate of snagfall. As reported in Raphael and Morrison (1987), fire-killed snags tend to fall at higher rates than beetle-killed snags, but as reported in FHM Report: NE07-08, beetle activity is expected to occur on fire-killed trees in the Moonlight fire, which will further weaken the structure of the tree and possible cause mortality to trees that were weakened by the fire. The amount of insect activity and the resulting tree mortality depends on factors such as the timing of the fire, level of fire injury, level of insect activity in the area prior to the fire, and precipitation. The Boulder fire (2006) burned very near to both the Moonlight and Antelope Complex fires. Insect activity was occurring on the Boulder fire prior to the Moonlight fire, which could result in an increase of beetle activity on the Moonlight fire. This, in conjunction with the high level of fire injury and drought, could increase the rate of snagfall (Keen 1955). Keen studied the fall rates of bark beetle-killed ponderosa pine in northern California for 30 years. The snags in his study had an average diameter of 24-inches DBH and all snags combine were reported to have a half life of 7 years. Snags fell at a rapid rate in year 5 and continued until year 15. After 10 years, 40% were still standing and after 25 years 10% were still standing. Snags on loam soils, like soils on the Moonlight fire, were shown to have a half life of 6-7 years. Although the Keen report studied the snag fall rate for bark beetle-killed snags, as mentioned above other studies (Raphael and Morrison 1987) report a higher and faster snag fall rate for fire-killed snags over beetle-killed snags, so with the fire-killed trees also under attack by insects it can be expected that the snagfall rate on the Moonlight fire could be higher and faster than some studies cited.

Based on past roadside hazard projects on the Mt. Hough Ranger District, the roadside hazard portion of the project directly reduces the short and long-term risk of injury or death to the public, Forest Service employees, and contractors, and reduces damage to roads or property along traveled routes within the project area. Removal of hazard trees and the subsequent treatment of activity slash effectively meet the desired conditions within the project by mitigating hazards and providing for public safety along roads and facilities. Effective ground cover would be provided to stabilize soils and reduce erosion potential while not exceeding fuel arrangement leading to hazardous fuel conditions.

3.4.2.1.1.3 Effects of post-logging slash treatments on fuel loading

Surface fuels loading in lop and scatter material (as represented by surface fuel loads) would not substantially increase in treated areas compared to the no action alternative. Refer to Table 34 for surface fuels loads specific to each alternative.

Table 34. Measurements for surface fuel loadings and potential fire severity.

	Alternative A	Alternative B	Alternative C & D	Alternative E
Avg. Tons/Ac (Surface Fuel Load –post Harvest)	9.9 -13.0	9.1	9.9 - 10.4	9.1 – 10.4
Avg. Tons/Ac (Surface Fuel Load –10 years post Harvest)	9.1 - 20.0	19.0	9.1 – 14.9	9.1 - 19.0
Total Flame Length (ft) under 90th percentile weather conditions (Post harvest)	6.1	4.0	6.1	4.0 - 6.1
Total Flame Length (ft) under 90th percentile weather conditions (10 years)	6.3	7.7	6.3	6.3 - 7.7
Percent of basal area killed under 90th percentile weather conditions (Post harvests)	88.9 %	58.3 %	88.9%	58.3% - 88.9%
Percent of basal area killed under 90th percentile weather conditions (10 years)	87.3 %	93.2 %	87.3 %	87.3% - 93.2%

Action alternatives would have a short-term increase of surface fuel loads immediately post harvest due to lop and scatter treatments. While an increase in fuel loading may cause an increase in fire behavior and potential severity, this would be a short-term effect and the total tons per acre would still be relatively low. This short-term increase would be greatest in helicopter and skyline treatment units (approximately 13.0 tons per acre, representing a 42 percent increase) and substantially less in ground-based units (approximately 9.9 tons per acre, representing a 9 percent increase).

However, within ten years, surface fuel loads under the action alternatives would be more varied and diverse ranging from substantially less than the no-action alternative (within ground-based units) to surface fuel loads that do not notably differ from the no-action alternative (within helicopter and skyline units). While surface fuel loads in lop and scatter material may contribute to an increase in total flame length (under 90th percentile weather conditions) and predicted percent of basal area killed (under 90th percentile weather conditions) immediately post harvest, this effect is not substantially different from the no action alternative within 10 years post harvest due to natural breakage of limbs and tops and snag fall of dead trees. Due to the variable surface loads created across the landscape, the action alternatives may create conditions, which would promote a diversity of potential future fire effects versus the no action alternative where greater homogeneity of surface fuel loads would exist.

Alternative D is expected to be consistent with the post-logging fuel loading and predicted flame lengths for alternative C. Alternative E (roadside hazard tree removal only) is expected to more closely relate to effects shown under alternative B, although alternative E will result in slightly lower flame lengths and average tons per acre of fuel 10 years post harvest because of the roadside treatments and subsequent piling along the roadside. Alternative E is fairly small in scale (treating only 6 percent of the public lands within the analysis area) leaving the remaining 94 percent to exist as shown under alternative B above in Table 34.

3.4.2.1.1.4Effects of Salvage Treatments on the Diversity of Fire Severity

The effects of all action alternatives on the diversity of fire effects (low, moderate, and high burn severity) across the landscape are displayed in Table 35. Table 35 shows the

effects of salvage and roadside hazard harvest proposed by all alternatives by burn severity. Treatments under the action alternatives primarily target areas that burned with moderately high and high severity; however, when considered cumulatively with other post fire projects within the analysis area, the diversity of fire effects (as represented by fire severity) is maintained on public lands.

Table 35. Comparison of alternatives: Percent of acres by fire severity affected by the proposed post-fire harvest treatments in the Moonlight and Wheeler project under all alternatives.

	Unclassified due to Satellite Imagery	Low Severity	Moderate Severity		High Severity	Total for all severity classes
		BA Mortality 0-25%	BA Mortality 25-50%	BA Mortality 50-75%	BA Mortality 75-100%	
Total within Analysis Area	258	16679	8401	7770	54539	87647
Percent of Analysis Area	0.3%	19%	10%	9%	62%	100%
Total on NFS lands	0	13600	6983	6531	41294	68408
Alternative A	0%	7%	7%	9%	30%	22%
Alternative B	0%	0%	0%	0%	0%	0%
Alternative C	0%	7%	6%	7%	16%	12%
Alternative D	0%	7%	6%	6%	9%	8%
Alternative E	0%	7%	6%	6%	6%	6%

3.4.2.1.1.5 Effects to Natural Regeneration

Lopping and scattering of limbs and tops may also bury or hinder natural regeneration under all alternatives; however, this material may also provide ancillary benefits as “fire-killed shade”, particularly for those species such as Douglas-fir and true fir types that prefer partial shading.

Post-fire logging activities may damage, kill or otherwise hinder natural regeneration as noted in Donato et al (2006), particularly in ground-based harvesting treatments. Mortality of natural regeneration due to crushing or compaction by equipment would be limited in size and scale to skid trails, and dispersed throughout the timber stand.

3.4.2.1.1.6 Effects of Reforestation on Fire Severity

Under all action alternatives, treatment units would be reforested with a mixture of species native to the ecological stand type utilizing the wide-spaced cluster planting design. This cluster planting is designed to establish planted seedlings in order to meet desired stocking levels or desired species within acceptable temporal bounds while allowing for any natural regeneration that may occur. This would enhance re-establishment of forested conditions while allowing for and mimicking the heterogeneity and pattern of a naturally occurring forest.

Recent studies have found an “association of high-severity fire with conifer plantations” and suggests that “young forests, whether naturally or artificially regenerated, may be vulnerable to positive feedback cycles of high severity fire creating more early-successional vegetation and delaying or precluding the return of historical mature-forest

composition and structure" (Thompson et al. 2007). Reforestation treatments under action alternatives are designed in with these findings in mind and are designed to promote lower density open canopy plantations in order to reduce susceptibility of reforested areas to potential high severity fires. In addition, these studies suggest that young post-fire vegetation, whether naturally or artificially regenerated, is at high risk to high severity reburns, particularly in the early stages of forest development, and managers may have few options in these early successional forest types for reducing the risk of high severity.

Typical high density plantations (300 to 400 trees per acre planted 10 to 12 feet apart) that have close spacing would burn under high severity and this is acknowledged. High density plantations would not be established under any action alternative, though variable density stands of naturally regenerated conifers would likely occur on sites favorable for natural regeneration and would also be susceptible to burning under high severity.

Trees planted utilizing the wide-spaced cluster arrangement are expected have a lower likelihood of propagating a high severity crown fire under 90th percentile weather conditions as their live crowns would be well separated. One to two years following planting, a manual release would occur around the clusters to reduce competition with grasses and brush and enhance tree survival and growth. This reduction of fine grass, shrub, and associated surface fuels around the planted clusters would break up the continuity of live vegetation and surface fuels, and would contribute to a reduction in flame lengths and rates of spread in the immediate vicinity of planted trees, leading to decreased potential for torching of individual trees.

The combination of the proportion to be planted, the previously mentioned wide tree spacing and manual grubbing of vegetation, would result in open canopied forested stands with an overall lower likelihood of a high severity crown fire initiating in or moving through the planted stands. It is expected that due to the small size of both naturally regenerated and planted trees, wildfire under 90th percentile and above conditions would result in high mortality of these trees as well as shrubs. While the risk of potential high severity fire in the future is real, this risk should not warrant rational to forgo reforesting burned areas and promoting the re-establishment of previously forested conditions on NFS lands as described in NFMA. In addition, future high severity fire would likely perpetuate shrub habitat as discussed in.

3.4.2.1.1.7Effects of Reforestation on Shrub Habitat

Reforestation activities would have a positive long-term effect on forest vegetation types, by promoting re-establishment of conifer CWHR vegetation types (Sierra Mixed Conifer Size Class 1) across areas that would otherwise remain as non-forest vegetation types (Montane Chaparral) much longer. However, it is reasonably expected that these plantations would continue to have substantial shrub components characteristic of montane chaparral, particularly for the first twenty to thirty years of growth, and potentially longer in the absence of release treatments, or in locations of low tree survival.

Reforestation treatments would occur on approximately 44 (alternative C) to 56 percent (alternatives A, D, and E) of all public and private lands that burned with high severity in the Moonlight and Antelope Complex fires (Table 37). In relation to the entire fire area, reforestation treatments would occur on approximately 34 (alternative C) to 42 percent (alternatives A, D, and E) of all public and private lands that burned in the Moonlight and

Antelope Complex fires (Table 37). The remaining lands within the analysis area would be available to recover naturally without any reforestation activities.

3.4.2.1.1.8 Cumulative effects common to all alternatives

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

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. Focusing on individual actions would be less accurate than looking at existing conditions because there is limited information on the environmental impacts of individual past actions, and it is not reasonably possible to identify each and every action over the last century that has contributed to current conditions. By looking at current conditions, the Forest Service is sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” For these reasons, the analysis of past actions in this section is based on current environmental conditions.

Past Projects. The cumulative effects of past management practices, fire exclusion, and high-mortality fires (appendix B) have largely shaped forest structure prior to the Moonlight and Antelope Complex fires. On public and private lands, past harvest activities focused on removal of dominant and codominant trees and retention of biomass and even-aged management. During the Moonlight and Antelope Complex fires, much of the area in this condition (high fuel loads, high stand density) burned with high severity (Fites et al. 2007). Post fire, these areas are now dominated by dead trees with little surface fuel other than litter, twigfall, and down burned logs and will likely become dominated by shrub species within the next decade. Overall, past harvesting, which focused on removal of live dominant and codominant trees, retention of biomass, and no treatment of surface fuels combined with completely untreated reserve areas, contributed to high severity fire patches of fire in the analysis area.

Since 1996, commercial thinning from below, with and without prescribed fire, has been the principal silvicultural treatment implemented on public lands in the analysis area. This silvicultural treatment has been used to establish several fuel treatments within the analysis area (Hungry, Antelope Border, North Antelope, Pinebelt, Stony, and Dry Flat Projects). These areas were treated to meet desired conditions in terms of potential fire behavior and tree mortality. During the Moonlight and Antelope Complex fires, all of these treatments were impacted by the fire (Fites et al. 2007). A report completed after the fire concluded that 1) treated areas were utilized during suppression along several flanks of the fire for both direct attack with dozers and handcrews, as well as for indirect attack with burn operations, and 2) treated areas that burned during the first two days—when suppression resources were limited and fire behavior more uniformly intense—had reduced fire effects compared to untreated areas. In some areas, these treated sites had

moderate to high severity effects (Fites et al. 2007). Today, these treated areas typically have many live trees, some newly created snags, and surface fuels composed primarily of litter fall from scorched trees. Overall, past fuel treatments resulted in patches of lower fire severity within the analysis area.

Wildfire Suppression and Fireline and Burned Area Emergency Rehabilitation (BAER) Efforts. Suppression tactics taken during the Moonlight and Antelope Complex fires affected forest vegetation and fuels. The tactics included air drops of water and retardant, back burning, construction of control lines by bulldozers and hand crews, live and dead tree falling, and construction of staging areas, safety zones, escape routes, and drop points. These suppression tactics altered forest vegetation largely through removal of vegetation and/or fuel accumulations or re-arrangement of fuels. Due to the linear, localized, and dispersed effects of these activities, there is a negligible effect on remaining forest vegetation and fuels.

In addition, fireline and BAER rehabilitation efforts were implemented to reduce negative effects of these activities within the fire areas. Fire suppression rehabilitation activities include rehabbing roads, helispots, safety zones, and water sources to pre-incident conditions; applying erosion control measures such as waterbar construction to dozer and handlines, pulling vegetative debris back onto control lines, and removing debris deposited in stream channels as a result of suppression efforts.

BAER treatments within the analysis area included improvement of drainage structures, including culverts, to accommodate increased flows and debris resulting from the Moonlight and Antelope Complex fires. These fireline and BAER rehabilitation treatments are also localized and dispersed across the landscape and have negligible to no measurable effects on forest vegetation, fuel loading, fire behavior, fire severity, or air quality.

Roadside Safety Projects. The roadside hazard trees within the Antelope Complex fire area were the Sage, Antelope, Last Chance, and Dry Flat Roadside Safety and Hazard Tree Removal Projects. The purpose of these projects was to provide for safe travel along roads within the fire areas. Under these projects, fire-killed and fire-injured trees expected to die within three years are removed resulting in a reduction of standing snags near the roadway. Since these projects are limited to 150 to 200 feet on either side of the road, these effects are localized and restricted to roadsides, approximately 11 percent of public lands within the analysis area. This calculation represents the maximum and furthest extent of measurable effects on forest vegetation that would occur as a result of implementing these projects. Since the removal of hazardous, fire-killed and fire-injured trees would only occur within striking distance of roads and facilities under these projects, the effects would be limited to these areas, and subsequently, dispersed across the 87,647 acre analysis area resulting in a minimal scale of effects. Due to the limited and dispersed nature of these effects, these activities would not substantially affect forest vegetation, fuel loading, fire behavior, or air quality on the stand or landscape level.

Post-fire salvage projects. The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate

watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. These two projects would affect 0.7 percent of public lands within the analysis area and represent the smallest contribution towards cumulative effects to forest vegetation, fuel loading, fire behavior, or air quality within the analysis area. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area.

Reforestation projects. Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation, which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Post-fire Salvage and Reforestation on Private lands. Private lands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the present, fire salvage harvest has been occurring on these lands. Approximately 4,073 acres were planned for salvage harvest in 2007 and fire salvage timber harvest plans filed to date in 2009 account for an additional 7,381 acres approximately. Based on current activity, private fire salvage projects occur mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees on private lands. It is reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Christmas Tree and Firewood Cutting. Due to partial to complete scorch of most small trees (less than 10 inches in diameter) Christmas tree cutting would likely be limited within the analysis area; any negative effects from Christmas tree cutting would be highly dispersed and negligible. Firewood cutting will likely be limited as firewood cutters prefer not to cut trees that have blackened bark, and are only allowed to cut dead trees within 100 feet of the road. In addition, the quality for firewood would deteriorate over time, making this area undesirable for firewood cutting. Overall, Christmas trees cutting and fuel wood cutting, would have a negligible effect on future stand and landscape-level forest vegetation, fuel loading, fire behavior, fire severity, or air quality due to the

limited, highly localized, but largely dispersed nature of these activities. As a result cumulative effects would be negligible and immeasurable on a per acre basis.

Recreation. Under all alternatives, accessibility in the area to motorized traffic and recreation visitors would be maintained. Popular activities include camping, off-highway vehicle (OHV) based recreation, and hunting. OHV use can compact the soil and cause erosion which may negatively effect plant growth and establishment. OHV use can also damage and/or kill natural regeneration through crushing or compaction; however due to the dispersed nature of this type of recreation, the effects would be highly localized and have little to no measurable effect on forest vegetation across the analysis area. The primary effect of recreation activities, with respect to forest vegetation and fire, is the potential for ignition sources from campfires, vehicles, and other intentional or unintentional ignitions from forest users during summer months. It may be reasonably anticipated that recreational use within burned areas will decrease in the near future due to public safety and aesthetic issues in the burned area, resulting in fewer ignitions from human causes over the short term. As a result cumulative effects would be negligible and immeasurable on a per acre basis.

Livestock Grazing. Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to forest vegetation due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing forest vegetation, riparian vegetation and streambanks to recover.

Grazing in upland areas may be limited due to amounts of forage; however some damage and/or mortality may occur to natural regeneration and planted tree seedlings due to crushing or compaction from animals. Based on the existing stocking rates, the season of use, and the distribution of primary range across the project area, this is expected to be negligible due to scale and primary locality of the livestock.

Future HFQLG Projects. Future Herger-Feinstein Quincy Library Group projects that may occur within the analysis area include the Wildcat Project (2009) and the Keddie Project (2009). These projects would include Defensible Fuel Profile Zone fuel treatments, area thinning treatments, and group selection treatments which would involve timber harvesting and include silvicultural prescriptions which involve thinning from below to reduce hazardous accumulations of ladder and canopy fuels and promoting shade intolerant species. These projects would focus on harvesting green trees and would likely be modified to avoid areas affected by the fire; particularly areas that burned with moderate to high severity. Contribution to cumulative effects would include localized reduction of stand densities through timber harvest focusing on the removal of trees less than 30 inches diameter and the removal of snags. No treatment units from either the

Wildcat or Keddie projects would overlap with treatment units in any action alternatives. Approximately 155 acres of these projects (75 acres from the Wildcat Project and 80 acres from the Keddie Project) may occur within the analysis area; this would account for 0.2 percent of the analysis area. Consequently, the contribution of these projects to cumulative effects would be negligible since 1) treatments would occur in low severity areas, 2) prescriptions would be focused on maintaining mature forest cover and reducing hazardous fuel conditions, 3) the units are geographically disparate, and dispersed from the action alternatives, and 4) the vast majority of the units occur outside of the analysis area and the perimeter of the fires.

3.4.2.1.1.9 Cumulative Effects of Completed, Current, and Proposed Post-Fire Treatments

The cumulative effects of past projects may be characterized by the conditions that currently exist on the landscape. Present and planned future projects demonstrate a shift in land management practices that emphasize values such as public safety, maintenance and enhancement of surviving forest, re-establishment of forested conditions, and economic recovery over values which guided past practices.

Under the action alternatives (A, C, and D), salvage harvest, roadside hazard, and reforestation treatments would occur, and under alternative E, roadside hazard and reforestation treatments would occur. Due to the scope and design of the proposed treatments and silvicultural prescriptions, cumulative effects of salvage harvesting treatments would include reductions of fire-killed trees in primarily moderate to high fire severity areas. Cumulative effects in these areas would include a reduction in snags, and a reduction in large woody debris recruitment. Within treatment units, these reductions in snags and large woody debris recruitment would be the most apparent in the larger tree sizes since most of the smaller size trees would remain under helicopter and skyline salvage harvesting (alternative A). These effects would, in turn, affect fuel loading and potential fire behavior within the treatment units as discussed in section 3.4.2.1.1.3 and Table 34.

In McIver and Starr (2001), the authors explain that “two distinct types of environmental effects occur after a harvest operation: activity effects owing directly to the logging operation itself, and structural effects from the removal of merchantable material.”

The removal of dead trees through salvage logging has been documented in published literature, syntheses, and advocacy papers to have adverse long term effects on residual forest structure by removing the “biological legacy” component and subsequent recruitment necessary for habitat and ecosystem diversity (McIver and Starr 2001; Beschta et al. 2004; Karr 2004; DeLasalla 2006; Hutto 2006; Lindenmayer and Noss 2006; Reeves et al. 2006; Noss et al 2006). Such biological legacies include standing snags (both large and small), live fire-injured trees, and large down woody debris that serve as important components to habitat and ecosystem structure. However, “biological legacies differ by orders of magnitude in natural forests” (Franklin et al. 2003), and consequently, treatment effects on biological legacy components should be reconciled with scale and context of site specificity. As noted in Franklin and Agee (2003): “uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of post-fire fuels, including standing dead and down trees” and suggest that

"removing portions of that particular biological legacy may be appropriate part of an intelligent ecological restoration program and not simply salvage."

While some of the literature, syntheses, and opinion papers advocate no salvage and/or replanting, others recognize that some salvage and/or replanting may be appropriate given context and intensity of the fire disturbance relative to the natural fire regime (i.e. "uncharacteristic stand-replacing fires in dry forests"), land allocations, and management objectives. For example, Everett (1995), McIver and Starr (2001), Franklin and Agee (2003), Lindenmayer and Noss (2006), and Reeves et al (2006) all acknowledge that, while such practices may have negative effects, these treatments may be appropriate given either objectives, site specific analysis, and appropriate mitigations to protect for values such as maintaining components of biological legacies. The design of action alternatives address the potential for negative effects and provide incorporated design criteria, standard management requirements, and best management practices to reduce potential for negative effects. Furthermore, all action alternatives are consistent with direction and land management objectives.

All action alternatives are designed to *exclude* harvest activities entirely from 78 percent (under alternative A) to 94 percent (under alternative E) of public lands within the analysis area and would only treat 6 (under alternative E) to 30 percent (under alternative A) of the public lands that burned with high severity (Table 36). Other hazard tree removal and fire salvage projects are on-going or have been completed on public lands within the analysis area. These projects combine account for an additional 6 percent of public lands within the analysis area over all alternatives. Consequently, large areas of unsalvaged and untreated areas would exist under all action alternatives maintaining forest stand structure that would provide for biological legacy values as described by Lindenmayer and Noss (2006). In addition, snag retention areas within salvage harvest units and exclusion of salvage harvest from low to moderate burn severity patches would provide for biological legacies within and outside the proposed treatment perimeters such as fire-killed and fire-injured trees and large live and dead trees that have high habitat value (Lindenmayer and Noss 2006). Equipment restriction zones (in units where ground-based logging is proposed) and snag retention guidelines within RHCAs are designed to provide for protection of aquatic ecosystems and retain and recruit structure such as large down woody debris within riparian areas (Lindenmayer and Noss 2006; Reeves et al. 2006).

Table 36 below compares all alternatives by percentage of acres by fire severity affected by the completed, current, and proposed post-fire harvesting treatments within the analysis area. The percentage shown is the proportion of acres cumulatively affected for all post-fire harvest activities within the analysis area by alternative and fire severity. Refer to sections 3.4.2.2 through 3.3.2.6 below for individual cumulative effect analysis for post-fire harvest activities by alternative.

Table 36. Comparison of alternatives: Percent of acres by fire severity cumulatively affected by the completed, current, and proposed harvest treatments[1] within the analysis area that occurred after the fires under all alternatives.

		Unclassified due to	Low Severity	Moderate Severity	High Severity	Total for all severity

		Satellite Imagery	BA Mortality 0-25%	BA Mortality 25-50%	BA Mortality 50-75%	BA Mortality 75-100%	classes
Total Acres within Analysis Area		258	16679	8401	7770	54539	87647
Percent of Analysis Area		0.3%	19%	10%	9%	62%	100%
Alternative A	Percent of Acres Cumulatively Affected by Post-Fire Harvest Treatments	**0%**	**20%**	**19%**	**22%**	**44%**	**35%**
Alternative B	Percent of Acres Cumulatively Affected by Post-Fire Harvest Treatments	**0%**	**14%**	**14%**	**14%**	**20%**	**18%**
Alternative C	Percent of Acres Cumulatively Affected by Post-Fire Harvest Treatments	**0%**	**20%**	**19%**	**20%**	**33%**	**28%**
Alternative D	Percent of Acres Cumulatively Affected by Post-Fire Harvest Treatments	**0%**	**20%**	**19%**	**20%**	**27%**	**24%**
Alternative E	Percent of Acres Cumulatively Affected by Post-Fire Harvest Treatments	**0%**	**20%**	**19%**	**20%**	**25%**	**23%**

[1] As described in Appendix B and 3.4.2.1.1.8.

Table 36 displays the range of alternatives for the Moonlight and Wheeler Fires Recovery and Restoration Project for all harvest activities. The percentages above include the affected acreage for all post-fire harvest treatments proposed for the Moonlight and Wheeler Fires Recovery and Restoration Project, all other post-fire harvest treatments on public lands, and all post-fire harvest treatments on private lands (appendix B).

Cumulatively, alternative A would have the most affect, affecting just over one-third (35 percent) of all lands within the analysis area while alternative B (no action) would have the least, affecting 18 percent cumulatively over the analysis area. Of the action alternatives, alternative E would have the least cumulative effect with 23 percent of all lands affected by post-fire harvest activities.

Table 37 below compares all alternatives by percentage of acres by fire severity of completed, current, and proposed post-fire reforestation treatments within the analysis area. This table is displayed in the same format as Table 36 where the percentage shown is the proportion of acres cumulatively affected for all post-fire reforestation treatments within the analysis area by alternative and fire severity. Again, refer to sections 3.4.2.2 through 3.3.2.6 below for individual cumulative effects analysis for post-fire reforestation treatments by alternative.

Table 37. Comparison of alternatives: Percent of acres by fire severity cumulatively affected by the completed, current, and proposed reforestation treatments[1] within the analysis area that occurred after the fires under all alternatives.

		Unclassified due to	Low Severity	Moderate Severity	High Severity	Total for all severity

		Satellite Imagery	BA Mortality 0-25%	BA Mortality 25-50%	BA Mortality 50-75%	BA Mortality 75-100%	classes
Total Acres within Analysis Area		258	16679	8401	7770	54539	87647
Percent of Analysis Area		0.3%	19%	10%	9%	62%	100%
Alternative A	Percent of Acres Cumulatively Affected by Post-Fire Reforestation Treatments	**0%**	**14%**	**15%**	**29%**	**56%**	**42%**
Alternative B	Percent of Acres Cumulatively Affected by Post-Fire Reforestation Treatments	**0%**	**8%**	**8%**	**19%**	**31%**	**23%**
Alternative C	Percent of Acres Cumulatively Affected by Post-Fire Reforestation Treatments	**0%**	**14%**	**14%**	**26%**	**44%**	**34%**
Alternative D	Percent of Acres Cumulatively Affected by Post-Fire Reforestation Treatments	**0%**	**14%**	**15%**	**29%**	**56%**	**42%**
Alternative E	Percent of Acres Cumulatively Affected by Post-Fire Reforestation Treatments	**0%**	**14%**	**15%**	**29%**	**56%**	**42%**

[1] As described in Appendix B and 3.4.2.1.1.8.

Table 37 displays the range of alternatives for the Moonlight and Wheeler Fires Recovery and Restoration Project for all post-fire reforestation treatments. The percentages above include the affected acreage for all post-fire reforestation treatments proposed for the Moonlight and Wheeler Fires Recovery and Restoration Project, all other post-fire reforestation treatments on public lands, and all post-fire reforestation treatments on private lands.

Cumulatively, alternatives A, D, and E would have the most affect, affecting 42 percent of all lands within the analysis area. Alternative B would have the least affect with 23 percent of all lands being affected by post-fire reforestation treatments. Of the action alternatives, alternative C would have the least affect with 34 percent of all lands being affected by post-fire reforestation treatments.

3.4.2.1.2 Air Quality

Under alternatives A, C, D, and E pile burning would be concentrated in helicopter and/or tractor harvest landings and along the roadside corridor. Due to the dispersed nature of the burn piles, the near complete combustion of piled material, and the control over ignition times to favor good smoke dispersion, it is not anticipated that pile burning would substantially impact the local communities. Smoke would be blown to the northeast towards Susanville and Janesville by typically southwest winds during the day. At night, smoke from burn piles in the analysis area would move down the Indian Creek drainage towards the community of Genesee Valley or down Moonlight and Lights Creek towards North Arm/Indian Valley. All burning would be completed under approved burn

and smoke management plans. Piles would be constructed to minimize mixing of soil and burned under weather conditions that would allow efficient combustion. Particulate matter generated by alternative is summarized below in Table 38. Predicted emissions from smoke production would be spread out over a period of three to five years depending on the implementation timelines of salvage harvest treatments and the occurrence of favorable burning conditions.

Dust emissions would be spread out during the mechanical treatment implementation period of approximately one to three years. Dust emissions would be mitigated by road watering and other standard management practices. No known serpentine based soils in the project area would be disturbed by project activities.

Table 38. Measurements for smoke production and air quality.

	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Particulate Matter 10 (tons)	324	0	218	169	147
Particulate Matter 2.5 (tons)	292	0	196	152	132
Total Vehicle Dust Emissions (tons)	567	0	328	217	169

3.4.2.2 Alternative A (Proposed Action) – Direct, Indirect, and Cumulative Effects

The direct and indirect effects of alternative A would be as described in section 3.4.2.1. The cumulative effects would be most realized under alternative A due to the greater number of acres proposed for salvage harvesting utilizing helicopter and skyline harvest systems. Table 36 displays the percent of fire severity acres affected by the completed, current, and proposed post-fire harvest treatments under alternative A. Cumulatively, 35 percent of the acres within the analysis area would be affected by these projects. These areas are primarily areas that burned with moderate to high severity, and would experience reduced numbers of snags and large woody debris recruitment. Conversely, approximately 65 percent of the analysis area would not be affected by any post-fire projects and would continue to develop as described under the no action alternative. Alternative A represents the highest level of cumulative effects created out of all alternatives analyzed in detail. Reforestation treatments under alternative A would cumulatively affect 42 percent of all lands within the analysis area, (56 percent of all lands that burned with high fire severity) (Table 37). The 56 percent is the equivalent of reforesting approximately 48 square miles of all lands that burned at high severity within the analysis area while leaving approximately 37 square miles of the analysis area that burned at high severity untreated and reliant on natural regeneration processes to re-establish forested conditions. Reforestation treatments include those proposed under alternative A, those post-fire reforestation treatments on other public lands, and those post-fire reforestation treatments on private lands (appendix B).

3.3.2.3 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

Table 31 in section 3.4.1.1 displays the average existing stand conditions by severity and site class within the burned area. Table 39 below shows the existing and projected stand structure for alternative B.

Table 39. Existing and projected stand structure for alternative B, the no action alternative.

Time Frame	Live Trees Per Acre by Diameter Class					Fire-killed Trees Per Acre by Diameter Class					Basal Area
	Total	0-10"	10-16"	16-30"	>30"	Total	0-10"	10-16"	16-30"	>30"	
Alternative B: No Action (Site V) -- No Salvage Harvest, No Reforestation											
Existing	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
Harvest	--	--	--	--	--	--	--	--	--	--	--
Post	9.6	0.0	7.9	1.5	0.2	287.7	223.6	48.5	13.6	2.0	12
10 years	9.4	0.0	5.8	3.4	0.2	139.3	98.6	29.1	9.9	1.8	16
20 years	9.2	0.0	2.4	6.2	0.4	22.2	4.3	10.2	6.1	1.5	20
30 years	9.0	0.0	0.1	8.2	0.4	4.5	0.0	0.4	2.9	1.3	24
Alternative B: No Action (Site III & IV) -- No Salvage Harvest, No Reforestation											
Existing	11.6	2.1	4.1	3.8	1.0	434.7	354.1	40.9	32.9	5.7	23
Harvest	--	--	--	--	--	--	--	--	--	--	
Post	11.6	2.1	4.1	3.8	1.0	434.7	354.1	40.9	32.9	5.7	23
10 years	10.4	1.5	3.8	3.7	1.3	200.4	148.4	23.5	22.7	5.0	24
20 years	10.0	1.0	3.6	3.9	1.4	40.1	13.2	8.0	14.2	4.4	26
30 years	9.6	0.8	2.2	4.9	1.5	10.8	0.1	0.6	6.2	3.8	28
Notes: Stands combined for all harvest systems. Predicted emissions from smoke production would be spread out over a period of three to five years depending on the mechanical treatment implementation timeline and the occurrence of favorable burning conditions.											

Under the no action alternative, the harvesting of fire-killed and fire-injured trees would be limited to roadside hazard and salvage projects completed, currently underway, and proposed on public and private lands in the analysis area (Appendix B). The maximum cumulative effect of these activities would be 18 percent of the lands within the analysis area (Table 32). Due to the scale and scope of the projects, large areas of untreated burned areas would exist. Brush species and standing snags would dominate these areas, and, over time, these snags would fall resulting in a brush field with high fuel loads arranged in a jackstraw pattern.

Under alternative B, approximately 18 percent of the total acreage would be subject to timber harvesting under other post-fire projects on both public and private lands within the analysis area. Areas proposed for treatment under alternatives A, C, D, or E would remain untreated and would assume a passive management strategy (no action). Although all alternatives leave large areas of these fires largely untreated under a passive management strategy; alternative B (the no-action alternative) proposes to leave the largest proportion of the landscape untreated.

Brown et al (2004) in the paper titled “Forest Restoration and Fire: Principles in the context of place” suggests that areas that had historically low-severity fire regimes should have the highest priority for treatment; areas that historically had mixed-severity fire regimes are of intermediate priority, and areas that historically had high-severity fire regimes are of the lowest priority. The Moonlight and Antelope Complex fires area historically had low severity fire regimes with some mixed-severity (Safford 2008 pers. communication); however, within a three month period in the summer of 2007 over 85 square miles burned under high severity fire. This exemplifies how these events qualify as “uncharacteristic stand replacement fire” within the site specific context of the dry eastside and transition zone northern Sierra Nevada forests and underscores the need for appropriate treatments as described in Frankling and Agee (2003). Passive management strategies, although recommended in general site-unspecific syntheses regarding salvage

logging, would maintain an uncharacteristically large amount of dead standing snags and down fuel across a proportionally large portion of the landscape, which would persist far outside the range of natural variability for forest types, predominate in this area. Consequently, maintenance of these conditions would perpetuate a landscape, which may be susceptible to large scale shifts in vegetation type, species composition, and fire regime and deviates from historic ecosystem processes and function.

The Storrie Fire (2000) provides a local, recent, and relevant example of passive management within a dry pine dominated Sierra Nevada forest with a historically low severity fire regime, which burned with uncharacteristically high severity. In 2008, several lightning fires re-burned thousands of acres within the foot print of the Storrie fire sustained by dead and down fuels, snags, and brush. This resulted in killing any established natural regeneration as well as trees that had previously survived the Storrie fire, and further compounds the effects of a landscape already deficit in natural regeneration and capacity of live trees available to regenerate the site. In addition, the passive management strategy, effectively in place since 2000, limited fire management suppression and/or containment strategy in 2008. Since brush, standing snags, and downed logs dominated the site, the capacity to get fire personnel into the area and engage the fire was limited due to safety concerns; particularly falling snags. Consequently some of these fires have burned a bulk of the summer, and may continue to burn (in areas) until winter. The cumulative effects on natural regeneration and fire management should be considered under the cumulative effects of the no action alternative project as events within the Storrie Fire provide an interesting perspective of how the no-action alternative may affect management capacity, challenges, and limitations within the Moonlight and Antelope Complex fires.

Reforestation under alternative B would cumulatively affect 23 percent of all lands in the analysis area (31 percent of all lands that burned at high severity) (Table 37). In addition, alternative B would not implement reforestation treatments and subsequent release treatments to improve survival and growth of established trees as outlined in the action alternatives of the Moonlight and Wheeler Fires Recovery and Restoration Project. The no-action alternative would solely rely on natural regeneration to re-establish forested conditions on 69 percent of areas that burned at high fire severity in the analysis area.

Much of the areas that burned under high severity will likely become dominated by brush species. Where natural regeneration does not occur in amounts to re-establish forested conditions, the areas would experience a vegetation type change to brush fields that may persist for decades and potentially more than a century. The cumulative effect of failing to re-establish forested conditions could resonate the longest by delaying the development of mature forest conditions which would otherwise provide multiple benefits such as wildlife habitat and future economic opportunities through forest management. As mentioned above, this risk would be highest in areas that burned with high severity, an equivalent of approximately 53 square miles of public land throughout the analysis area.

3.3.2.4 Alternative C – Direct, Indirect, and Cumulative Effects

Direct and indirect effects of alternative C are as described in section 3.4.2.1. Cumulative effects would be reduced in scale proportionate to the reduced number of acres of salvage harvest and reforestation proposed in alternative C. Table 36 displays the percent of fire

severity acres affected by the completed, current, and proposed post-fire harvest treatments under alternative C. Cumulatively, 28 percent of the acres within the analysis area would be affected by these projects. These areas are primarily areas that burned with moderate to high severity, and would experience reduced numbers of snags and large woody debris recruitment. Conversely, approximately 72 percent of the analysis area would not be affected by any post-fire salvage harvest projects and would continue to develop as described under the no action alternative.

Alternative C represents a moderately-high level of cumulative effects of all post-fire harvest activities in the analysis area when compared in the range of alternatives for the Moonlight and Wheeler Fires Recovery and Restoration Project. The 28 percent of all acres within the analysis area that would be cumulatively affected represents all post-fire harvest activities on both public and private lands shown in Appendix B.

Reforestation treatments under alternative C would cumulatively affect 34 percent of all lands within the analysis area (44 percent of lands that burned under high severity) (Table 37). Potential for high reburn severity would exist as described under section 3.4.2.2.

Under alternative C, approximately 44 percent of all lands that burned under high severity within the analysis area would be cumulatively affected by reforestation. This is the equivalent of reforesting approximately 37 square miles of all lands that burned with high fire severity while leaving approximately 48 square miles untreated and reliant on natural regeneration processes to re-establish forested conditions.

3.3.2.5 Alternative D – Direct, Indirect, and Cumulative Effects

Direct and indirect effects of alternative D are as described in section 3.4.2.1. Cumulative effects would be reduced by the number of acres proposed for post-fire harvest activities under alternative D. Alternative D is 2001 Sierra Nevada Framework Plan consistent and avoids Old Forest Emphasis areas and California spotted owl protected activity centers except where they intersect the roadside corridor. Table 36 displays the percent of fire severity acres affected by the completed, current, and proposed post-fire harvest treatments under alternative D. Cumulatively, 24 percent of the acres within the analysis area would be affected by these projects. These areas are primarily areas that burned with moderate to high severity and would experience reduced numbers of snags and large woody debris recruitment. Conversely, 76 percent of the analysis area would not be affected by any post-fire salvage harvest projects and would continue to develop as described under the no action alternative.

Alternative D represents a moderately-low level of cumulative effects of all post-fire harvest activities in the analysis area when compared in the range of alternatives for the Moonlight and Wheeler Fires Recovery and Restoration Project. The 24 percent of all acres within the analysis area that would be cumulatively affected represents all post-fire harvest activities on both public and private lands shown in Appendix B.

Reforestation treatments under alternative D would reflect that of alternative A with 42 percent of the analysis area being cumulatively affected by post-fire reforestation treatments (Table 37). Potential for high reburn severity would exist as described under section 3.4.2.2.

Alternative D includes reforestation on all areas harvested under this alternative plus the footprint of alternative A. As a result, the same amount of acres would be reforested in

alterative D as in alternative A. Under alternative D, approximately 42 percent of all lands, (56 percent of all lands which burned with high fire severity), would be cumulatively affected by post-fire reforestation treatments. The 56 percent is the equivalent of reforesting approximately 48 square miles of all lands that burned at high severity within the analysis area while leaving approximately 37 square miles of the analysis area that burned at high severity untreated and reliant on natural regeneration processes to re-establish forested conditions

3.3.2.6 Alternative E – Direct, Indirect, and Cumulative Effects

All action alternatives include the removal of roadside hazard trees. Alternative E represents roadside hazard tree removal and reforestation only while in alternatives A, C, and D, the roadside hazard tree removal supplements salvage harvest and reforestation.

Direct and indirect effects of alternative E are as described in section 3.4.2.1. Cumulative effects for the roadside hazard tree removal portion of this project rely on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect aggregate impacts of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

These effects are substantiated by past similar post-fire roadside hazard tree removal projects that have occurred on the Mt. Hough Ranger District. Roadside hazard tree removal projects on the Mt Hough Complex (1999), Storrie fire (2000), Stream fire (2001), and Antelope Complex (2007) were proposed and implemented to provide public safety along forest roads. Some of these similar projects overlapped with additional salvage proposals that were implemented such as the roadside hazard tree removal project that occurred within the Stream fire, while others did not (roadside hazard tree removal projects associated with the Mt. Hough Complex and Storrie fire). In either case, these projects displayed similar limited and dispersed effects that were minimal in scale and did not substantially affect forest vegetation on either the stand or landscape level.

Table 36 displays the percent fire severity acres affected by the completed, current, and proposed post-fire harvest treatments under alternative E. Alternative E represents the lowest level of cumulative effects of all post-fire harvest activities in the analysis area when compared in the range of alternatives for the Moonlight and Wheeler Fires Recovery and Restoration Project. Cumulatively, 23 percent of the acres within the analysis area would be affected by these projects. These are areas along traveled Forest Service roadways, and these areas would experience reduced numbers of snags and large woody debris recruitment. Conversely, approximately 77 percent of the analysis area would not be affected by any post-fire harvest projects and would continue to develop as described under the no action alternative. The 24 percent of all acres within the analysis area that would be cumulatively affected represents all post-fire harvest activities on both public and private lands shown in Appendix B.

Reforestation treatments under alternative E would reflect that of alternative A with 42 percent of the analysis area being cumulatively affected by post-fire reforestation treatments (Table 37). Potential for high reburn severity would exist as described under section 3.4.2.2.

Alternative E proposes reforestation of roadside acres plus the footprint of alternative A. Under alternative E, approximately 42 percent of all lands, (56 percent of all lands which

burned with high fire severity), would be cumulatively affected by reforestation treatments. The 56 percent is the equivalent of reforesting approximately 48 square miles of all lands that burned at high severity within the analysis area while leaving approximately 37 square miles of the analysis area that burned at high severity untreated and reliant on natural regeneration processes to re-establish forested conditions.

3.5 Wildlife – Terrestrial and Aquatic

3.5.1 Affected Environment

The treatment units are defined as the areas to be treated with fire-killed tree removal, roadside hazard tree removal, and reforestation. The wildlife analysis area is defined as the 87,647 acre area (68,408 acres or 78 percent is public land) where the Moonlight and Antelope Complex fires burned, with the exception of 82 acres of spot fires, which occurred outside of the main fire perimeters. The analysis area is located in predominately Sierra mixed conifer forest habitat ranging in elevation from 3,800 feet in the North Arm of Indian Valley to 7,500 feet at the top of Eisenheimer Peak. The analysis area is largely along the cusp of the Transition and Eastside ecological zones.

The Moonlight and Antelope Complex fires perimeters (87,647 acres) were chosen as the wildlife analysis area for the following reasons: 1) proximity and adjacency of these two fires and similar severity effects has had a major effect on the landscape; 2) The proposed actions would treat and modify burned areas only. Therefore, selection of the total area that burned within both fires for analysis provides a more appropriate context for reasonable determination of effects to habitat (and the species associated with this habitat) proposed for treatment; 3) Relevant cumulative effects, particularly other projects that have or will treat burned habitat resulting from the fires, are more effectively addressed; 4) The impacts to habitat as a result of the wildfires and the effects from cumulative actions within this burned landscape are not diluted by expanding the analysis area boundary to include larger parcels of unburned habitat outside the wildfire boundary; 5) The aquatic analysis is the same as the hydrology analysis area and includes the watersheds affected by the proposed action.

For the purpose of the wildlife analysis, the temporal bounds include a 30-year horizon for future effects because modeling indicates that, within 30 years, the treated stands would approach stocking levels corresponding with forest development (i.e. young forested stands could develop within this timeframe). General trends and trajectories of stand development that extends beyond this timeframe are discussed in this analysis to document when habitat conditions suitable for specific species will likely be reached.

Forest-wide vegetation typing into California Wildlife Habitat Relationships (CWHR) classifications was done for the Plumas-Lassen Administrative Study in 2002 (Vestra 2002). This vegetation layer was updated after various fires (including the 2001 Stream fire within the wildlife analysis area) and in 2008 updated again to reflect the Moonlight and Antelope Complex fires. Existing updated Vestra maps, vegetation severity maps and 2007 infra-red aerial photos were used to generate the post fire vegetation map used for this analysis. Vegetation severity maps were further evaluated using infra-red aerial photography flown post burn to verify the adequacy of the vegetation severity maps. Discrepancies were few, and these usually resulted in some moderate and low severity

clumps that appear to have survived being lumped within high severity polygons; the post fire updated vegetation mapping and CWHR types used in this analysis reflect post-fire existing conditions.

The updated layer produced by this typing is used in this analysis. All vegetation information is displayed using the CWHR vegetation codes and serves as the baseline acres for analysis. Table 40 summarizes the CWHR types within the analysis area. Other sources of information used in the assessment of effects were aerial photos, burn severity maps generated from satellite imagery, data generated from common stand exam plots, and field reconnaissance. Summary of CWHR acres within the wildlife analysis area from VESTRA 2002, updated with fire severity maps and 2007 aerial photography (public land only).

Table 40. Summary of CWHR acres within the wildlife analysis area from VESTRA 2002, updated with fire severity maps and 2007 aerial photography (public land only)

CWHR Type*	Pre-fire	Post Fire (first five years)	CWHR Type	Pre-Fire	Post Fire (first five years)	CWHR Type	Pre-Fire	Post Fire (first five years)
SMC1	23	57	RFR3M	5	0	EPN4P	1961	1861
SMC2S	1400	103	RFR4S	2	33	EPN4M	928	325
SMC2P	45	36	RFR4P	51	102	EPN4D	107	42
SMC2M	0	2	RFR4M	136	41	EPN5S	0	59
SMC2D	138	0	RFR4D	6	0	EPN5P	14	29
SMC3S	264	407	RFR5P	18	0	EPN5M	100	42
SMC3P	120	146	RFR5M	38	0	EPN5D	42	
SMC3M	111	31	PPN1	0	23	JPN5M	0	20
SMC3D	151	4	PPN2S	1052	199	LPN3P	0	1
SMC4S	551	3081	PPN2P	90	7	LPN3M	0	6
SMC4P	3469	6416	PPN2M	0	3	LPN3D	0	11
SMC4M	12529	1674	PPN3S	130	140	LPN4S	2	5
SMC4D	1313	149	PPN3P	542	116	LPN4P	0	19
SMC5S	84	187	PPN3M	571	0	LPN4M	0	11
SMC5P	899	403	PPN4S	199	427	LPN4D	8	
SMC5M	10211	296	PPN4P	575	757	LPN5P	0	3
SMC5D	3171	91	PPN4M	1358	176			
WFR2S	104	19	PPN4D	171	5	AGS	221	810
WFR3S	317	146	PPN5S	25	18	ASP	851	472
WFR3P	75	33	PPN5P	163	24	MCP	1338	39023
WFR3M	103	1	PPN5M	77	0	MHC	5	11
WFR3D	53	0	EPN1	33		MHW	1733	1214
WFR4S	799	1204	EPN2S	33	22	MRI	438	532
WFR4P	1967	3785	EPN2P	0	5	PGS	7	339
WFR4M	8775	938	EPN2M	26		SGB	188	132
WFR4D	1325	90	EPN3S	0	21	WTM	690	171
WFR5S	39	4	EPN3P	397	176	ROCK	192	242
WFR5M	4827	147	EPN3M	71		BAR	0	98
WFR5D	537	6	EPN3D	0	5			
RFR3P	50	23	EPN4S	284	1094			

	Total	68408	68408

*1 = seedling tree <1" dbh, 2 = Sapling tree 1-6" dbh, 3 = Pole tree 6-11" dbh, 4=small 11-24"dbh, 5=medium/large >24"dbh. D= Dense Canopy Cover > 60%, M= Moderate Canopy 40-59%, SMC=Sierra Mixed Conifer, PPN = Ponderosa Pine, WFR = White Fir, EPN = Eastside Pine, RFR = Red Fir, MHC = Montane Hardwood Conifer, MHW = Montane Hardwood, PGS = Perennial Grassland, MCP = Montane Chaparral, MRI = Montane Riparian, WAT = Water, WTM = Wet Meadow.

Table 40 indicates the following: 1) as a result of the wildfire, within the analysis area, 97 percent of the late seral closed canopy habitat (CWHR 5M, 5D) was consumed by wildfire (19,003 acres reduced to 602 acres); 2) a large majority of CWHR 4 and 5 stands were converted to non-forested vegetation types that are expected to be dominated by brush; 3) 519 acres of wet meadow were either converted to dry meadow (expressed as PGS) or some other CWHR type as a result of more precise mapping of this particular type; 4) losses in aspen habitat actually resulted from more precise mapping of this particular type; no aspen loss is anticipated as a result of wildfire or project actions.

Residual forest structures left over from the wildfires provide "biological legacy" components and subsequent recruitment necessary for habitat and ecosystem function (McIver and Starr 2001, Beschta et al 2004, Hutto 2006, Lindenmayer and Noss 2006, Reeves et al 2006). Such biological legacies include standing snags (both large and small), live fire-damaged trees, and large down woody debris; components that many unique plant and animal species depend on during those first few years of natural (postfire) succession. A specific example of this association is the black-backed woodpecker, a Plumas National Forest Management Indicator Species (MIS), which recent data shows is strongly dependent on snags created by stand-replacement fires (Hutto 1995, Kotliar et al. 2002, Smucker et al. 2005, Hanson and North 2008). The MIS analysis for black-backed woodpecker (under Section 3.4.2 of this FEIS) serves to address snags in burned forests and addresses the issue raised during public scoping regarding effects to burned forest as wildlife habitat.

3.5.1.1 Federally Threatened and Endangered (T&E) Species

A list of T&E species was provided by the "Federal Endangered and Threatened Species that may be affected by Projects in the Plumas National Forest", updated January 29, 2009, accessed via United States Fish and Wildlife Service (USFWS) county list web page (http//sacramento.fws.gov/es/spp lists/NFActionPage.cfm). Based on this list, and information regarding range of species, presence of species or presence of species suitable habitat within project area, it is determined that the Moonlight and Wheeler Project would have no affect on the two Federally listed species present on the Plumas National Forest. There are no Federally Proposed species identified by the USFWS as occurring on the PNF. Table 41 displays Federally listed species affects determinations.

Table 41. Federally-listed species affects determinations

Scientific Name	Common Name	Suitable Habitat in area	Observed in Project area (Y/N)	Finding
Desmoceras californicus dimorphus	Valley Elderberry Longhorn Beetle	No	No	No affect

Rana aurora draytonii	California Red-legged Frog	No	No	No affect

3.5.1.2 USDA Forest Service R5 Sensitive Species

The United States Forest Service (USFS) sensitive species brought forward in this RFEIS (and discussed fully in the Moonlight and Wheeler Fires Recovery and Restoration Project Biological Assessment/Biological Evaluation, Chris Collins, June 2009 (BA/BE)) are those in which a determination has been made that project activities may affect individuals. These species are: Mountain yellow-legged frog, bald eagle, California spotted owl (also a R5 Management Indicator Species on the PNF), Northern goshawk, American marten, pallid bat, and Western red bat. All other Forest Service R5 sensitive wildlife species resulted in a "Will Not Affect" determination. Additional species accounts and rationale for these determinations can be found in the BA/BE. Table 57 lists all sensitive species and their respective affects determination.

3.5.1.2.1 Mountain Yellow-legged Frog (MYLF)

In summary, three watersheds (and their associated creeks) within the wildlife analysis area have had MYLF detections; West Branch Lights Creek, Lower Lone Rock Creek, and Pierce Creek. A fourth watershed, Lower Indian Creek, which is located adjacent to Pierce Creek and Lone Rock Creek watersheds and flows into Antelope Lake, is suspected of having MYLF, although no individuals have been detected (Tina Hopkins, pers. comm.). Lone Rock Creek supports a well distributed, moderate to low-density, population of MYLF. This population is isolated due to the dam at Antelope Lake.

3.5.1.2.2 Bald Eagle

The bald eagle was federally listed as threatened but has now been removed from the list effective August 8, 2007 (Federal Register Vol.72, No. 130/Monday, July 9, 2007/Rules & Regulations). It is now considered a USDA Forest Service R5 sensitive wildlife species (R5 sensitive species list, October 15, 2007).

The closest known nesting area is at Antelope Lake, within the northern portion of the project area, where two active nesting pairs (Antelope I and Antelope III) have been present since 1995. These two nests have produced a total of 23 fledglings between 1995 and 2007 (USDA 2006a and 2006, 2007, and 2008 nesting records). In 2008, both nests were again active, with one young produced in Antelope I and two young produced in Antelope III.

The Antelope Complex fire encroached into two of the three territories within the Antelope Lake Bald Eagle Management Area (BEMA). The BEMA is approximately 8,220 acres including the 940 acre lake. Both nests successfully fledged two young each in 2007 after the Antelope Complex was extinguished. Approximately forty-one percent of the BEMA land acres were burned in the Moonlight and Antelope Complex fires. Table 42 displays the acres of Antelope BEMA burned. A reduction of 1,431 acres of suitable nesting habitat within the BEMA resulted from the Antelope Complex wildfires. Table 42 displays the acres of the Antelope BEMA burned.

Table 42. Acres of Antelope Lake BEMA burnt by Moonlight and Antelope Complex fires.

BEMA	Total Acres	Acres in Burn	% in burn
Antelope Lake	7,280 (land acres)	2,963	41%

The Moonlight and Antelope Complex fires resulted in an additional incremental reduction in the availability of suitable nesting habitat. Table 43 displays the cumulative reduction of available suitable nesting habitat within the BEMA (as defined in the Antelope Lake BEMA Plan; 4P, 4M, 4D, 5P, 5M, 5D). Since 2001, approximately 2,004 acres of live green suitable nesting habitat has been consumed by wildfire.

Table 43. Changes in nesting habitat within Antelope Lake BEMA resulting from wildfire since 2001

Suitable Nesting CWHR	Post Stream Fire Acres 2001	Post Boulder Fire Acres 2006	Post Moonlight and Antelope Complex Fires - 2007		
			Acres Reduced	Acres Gain	Total Remaining
5D	59	41	41	0	0
5M	316	272	144	0	128
5P	459	516	0	8	524
4D	94	79	79	0	0
4M	3083	2362	1285	0	1077
4P	1502	1695	25	85	1780
Total	5513 (75% of land base)*	4965 (67% of land base)	1524	+93	3509 (48% of land base)

*Baseline acres reported in January 2006 Antelope Lake BEMA Plan

The Antelope Complex burned within portions of two of the three nesting territories within the Antelope Lake BEMA (Moonlight fire did not enter any territory). Both territory I and III nest sites are located within the area consumed by the Stream fire in 2001. No vegetative changes in the nest stands resulted from the Antelope Complex, as a large number of the acres reported below in Table 44 were acres within the Stream fire that re-burned with the 2007 Antelope Complex.

Table 44. Acres within individual bald eagle territories burnt by Antelope Complex.

Territory	Mgt Zone*	Total Acres within Territory	Acres within Burn & Project Area	% in burn
Antelope I	Primary/Secondary	321	9	2.8%
Antelope III	Primary	345	153	44%
Antelope III	Secondary	296	280	95%
TOTAL		962	442	46%

*Zones described in the 2006 Antelope Lake Bald Eagle Management Plan.

3.5.1.2.3 California Spotted Owl

Table 45 displays the effects of the Moonlight and Antelope Complex fires on suitable California spotted owl (CSO) habitat within the analysis area. Approximately 18,301 acres of suitable nesting habitat was rendered unsuitable and 22,536 acres of foraging habitat was rendered unsuitable on public land as a result of the stand replacing wildfire.

Table 45. Effects of Moonlight and Antelope Complex fires on spotted owl suitable habitat within the wildlife analysis area (all acres approximate and all are public land).

Habitat	Pre-Fire Acres	Post Fire Acres	Reduction in suitable habitat (%)
Suitable Nesting Habitat (5M, 5D, 6)*	18,861	560	97%
Suitable Foraging Habitat (4M, 4D)*	25,622	3,086	88%
Total	44,483	3,646	92%

*SMC, PPN, WFR, RFR, LPN

All or a portion of twenty-five spotted owl Protected Activity Centers (PACs) are located within the perimeters of the Moonlight and Antelope Complex fires. Home Range Core Areas (HRCAs) associated with three additional PACs outside of the fire perimeters were also affected by the fires. Twenty PACs and their associated HRCAs are completely within the fire perimeter. Vegetation severity maps indicate that over 19,000 acres within PACs/HRCAs burned at either moderately high severity (50-75 percent basal area killed) or high severity (greater than 75 percent basal area killed), resulting in changing suitable owl nesting/foraging habitat to unsuitable habitat. Table 46 displays acres of the twenty-five PACs and twenty-eight HRCAs that burned at moderately high and high severity.

Table 46. Spotted owl PACs/HRCAs moderately high and high burn severity analysis.

PAC #	Total Acres		Total Mod-High Severity		PAC#	Total Acres		Total Mod-High Severity	
			Acres	%				Acres	%
PL005	PAC	345	260	75%	PL126	PAC	457	439	96%
	HRCA	550	407	74%		HRCA	457	380	83%
	total	895	667	75%		total	914	819	90%
PL006	PAC	316	308	98%	PL167	PAC	386	11	3%
	HRCA	498	366	74%		HRCA	687	185	27%
	total	814	675	83%		total	1,073	196	18%
PL041	PAC	360	203	56%	PL198	PAC	356	345	97%
	HRCA	797	405	51%		HRCA	861	819	95%
	total	1,157	608	53%		total	1,217	1164	96%
PL042	PAC	417	353	85%	PL199	PAC	396	209	53%
	HRCA	758	647	85%		HRCA	593	482	81%
	total	1,175	1000	85%		total	989	691	70%
PL043	PAC	316	314	99%	PL201	PAC	452	367	81%
	HRCA	613	608	99%		HRCA	743	610	82%
	total	929	922	99%		total	1,195	977	82%
PL044	PAC	387	360	93%	PL229	PAC	323	126	39%
	HRCA	662	402	61%		HRCA	909	736	81%
	total	1,049	761	73%		total	1,232	862	70%
PL071	PAC	383	209	54%	PL230	PAC	321	0	0%
	HRCA	645	308	48%		HRCA	649	29	4%
	total	1,028	516	50%		total	970	29	3%
PL073*	PAC	661	496	75%	PL253	PAC	359	225	63%
	HRCA	699	480	69%		HRCA	637	244	38%
	total	1,360	976	72%		total	996	470	47%
PL106	PAC	392	284	72%	PL262	PAC	409	409	100%
	HRCA	551	526	95%		HRCA	654	615	94%
	total	943	810	86%		total	1,063	1024	96%
PL107	PAC	290	164	57%	PL263	PAC	326	326	100%
	HRCA	755	270	36%		HRCA	398	391	98%
	total	1,045	434	42%		total	724	717	99%
PL109	PAC	336	0	0%	PL284	PAC	314	213	68%
	HRCA	761	86	11%		HRCA	680	474	70%
	total	1,097	86	8%		total	994	686	69%
PL122	PAC	322	266	83%	PL286	PAC	423	62	15%
	HRCA	800	558	70%		HRCA	660	203	31%
	total	1,122	824	73%		total	1,083	265	24%
PL123	PAC	301	300	100%	PL287	PAC	322	2	1%
	HRCA	708	584	83%		HRCA	750	538	72%
	total	1,009	885	88%		total	1,072	540	50%
PL125	PAC	499	397	80%	PL303	PAC	321	317	99%
	HRCA	508	433	85%		HRCA	391	359	92%
	total	1,007	830	82%		total	712	676	95%

*PL073 PAC boundaries were adjusted in 2002 after the Stream Fire and then adjusted again after a nest site was discovered in 2003. These adjustments resulted in the larger than normal PAC size reported above.

The existing amount of suitable nesting and foraging habitat available in each PAC and HRCA impacted by the Moonlight and Antelope Complex fires is presented in Table 47.

Table 47. Existing amount of suitable owl habitat present for each PAC/HRCA post Moonlight and Antelope Complex fires.

PAC/ HRCA #	PAC Suitable Acres		HRCA Suitable Acres		PAC/ HRCA #	PAC Suitable Acres		HRCA Suitable Acres	
	Nesting (5M,5D)	Foraging (4M,4D)	Nesting (5M,5D)	Foraging (4M,4D)		Nesting (5M,5D)	Foraging (4M,4D)	Nesting (5M,5D)	Foraging (4M,4D)
PL005	28	27	0	33	PL126	0		29	0
PL006	0	4	0	20	PL167*	179	138	102	266
PL041	3	47	93	79	PL198	0	10	2	14
PL042	0	16	0	15	PL199	0	22	0	12
PL043	0	0	0	5	PL201	0	26	1	51
PL044	0	8	0	105	PL229	0	32	0	16
PL071	5	49	0	221	PL230*	144	125	186	323
PL073	0	1	22	14	PL253	0	0	39	89
PL106	0	24	0	0	PL262	0	0	0	25
PL107	0	0	0	124	PL263	0	0	0	0
PL109*	134	175	79	437	PL284	0	0	0	38
PL122	0	2	33	120	PL286*	93	221	137	272
PL123	0	1	0	57	PL287*	239	44	110	15
PL125	0	43	0	2	PL303	0	0	0	1

^ based on post-fire vegetation mapping, crosswalked to CWHR
* PACs not affected by fire (PL109, PL230, PL287) or minimally affected by fire (PL167 – 3% burned at high severity, PL286 -15% burned at high severity. Both with 300+ existing suitable acres). These PACs will remain as PACs and are not carried forward in PAC evaluation process.

An Area of Concern (AOC), as identified in Verner et al (1992), pages 45 - 48, is an area where there is concern for the integrity of the California Spotted owls' range in the Sierra Nevada. AOC 2 is located in northern Plumas County and is a concern because of a gap in known distribution, mainly on private lands, which extends east-west in a band almost fully across the width of the owls range (Ibid). If few birds and little habitat exist in this area, north-south dispersal could be impeded. The Moonlight Fire, in relationship to this AOC, has potentially extended this east-west band eastward approximately 5-10 miles, creating a wide swath of unsuitable habitat that further impedes north-south dispersal. This new swath extends from the approximate eastern end of the delineated AOC 2 boundary across the northern Plumas County boundary toward Red Rock Lookout. Beyond Red Rock is open red fir and mixed conifer transitioning to eastside pine and then meeting the escarpment at Thompson Peak. Essentially the Moonlight Fire created a connection between AOC 2 and eastside pine/great basin influence.

The Moonlight Fire has created what appears to be a very large gap in the distribution of owls and owl habitat similar to that described for AOC 2. Since the Moonlight Fire meets the Antelope Complex, the wildfires have contributed cumulatively to a potential gap in owl distribution.

The 2006 meta-analysis for the California spotted owl (Blakesley 2006) indicated that there is no strong evidence for decreasing population trends from any of the demographic studies. In general lambda (λ), the finite rate of population change, where $\lambda < 1$ indicates a

declining population, was not different from that of a stationary population. Only the Lassen National Forest population decreased significantly based on the 95% confidence interval with steady decreases from 1995-1998, and 2002-2004, suggesting the Lassen owl population may be declining (Ibid). The USFWS, in its latest decision to not list the owl as threatened or endangered (Federal Register 50 CFR 17, Volume 71, Number 100, May 24, 2006) considered the information presented in the 2006 meta-analysis and found that populations of California spotted owl in the Sierras showed little evidence of a decline, and concluded that the owls' status in the Sierra Nevada, which includes Plumas County and the Plumas National Forest, is not deteriorating as is evidenced by the increasing adult survival and stationary trend of the populations.

Recent research has revealed that spotted owls can and do utilize unlogged severely burned forests (Bond et al. 2002, Jenness et al. 2004, Clark 2007). Moderately high to high severity burn patches create abundant large snags, large downed logs, and provide conditions in which dense areas of conifer regeneration and native shrub patches can grow – all habitat components which can support small mammal prey populations important to the spotted owl. Bond (2007) summarized existing published and unpublished information on fire effects to spotted owls as part of her expert testimony during deliberations regarding Storrie Fire impacts on a variety of species. Bond (2007) asserts that a "surprising number of owl sites" continue "to be occupied and reproductively successful after fires of all severities" and that the notion that moderately and highly burned forests results in lost owl habitat "belies the preponderance of scientific data" and is therefore an incorrect claim.

No published information is available that investigates whether severely burned landscapes can maintain occupied owl sites and viable populations over the long term. It is acknowledged that moderately high and high severity burn areas may have created some short term burned "suitable" habitat as defined by Bond (2007), especially within the ecotone between burned and unburned edges, but it is possible that owls may not be able to persist over the long-term after fires due to reductions in habitat suitability. For example, as snags fall within moderate and high severity burns, the perch component that allows for owls to carry out foraging behavior is eventually eliminated. Spotted owls are "perch & pounce" predators, selecting an elevated perch from which to locate potential prey, either by sight or sound, to carry out feeding behavior by dropping from the perch for the pounce (Verner et al, 1992, page 68). Spotted owls are also capable of "hawking" behavior, capturing flying prey, primarily insects and birds. It is suspected, based on longevity of snags and the growth potential of conifers competing through brush created by wildfire, that there would be a period of time where this burned habitat would in fact be unsuitable. Assuming most fire-killed snags fall by year 30 and conifer habitat (plantations) would take a minimum of 40 years to achieve a CWHR size class 3 (6-11 inches dbh) which is not considered suitable owl habitat, it is logical that high and moderate severity burns create long-term unsuitable owl habitat for a number of years because the majority of snag and tree perches (as well as potential nest structures) are not present.

Therefore, for management purposes, habitat identified as suitable for the spotted owl pre and post fire is consistent with what is recognized as suitable for this species in the California Spotted Owl Report (Verner, et al 1992), the 2004 SNFPA FEIS and Vol 71 Federal Register of May 24, 2006. Moderately high and high severity burn areas, in

which CWHR 4M, 4D, 5M, and 5D forested stands converted to CWHR 1 and 2 deforested stands, primarily within the Montane Chaparral type, results in both short and long-term unsuitable habitat conditions for the spotted owl.

Because of the unknowns and uncertainties associated with both the short and long-term responses of owls affected by wildfire, owl responses should be assessed post-fire and then monitored over time to determine if post-fire landscapes provide habitat used by spotted owls. In 2008 the first year of spotted owl surveys were conducted to protocol within the fire perimeter and within a 1 mile unburned buffer area surrounding the perimeter by Plumas Lassen Administrative Study owl crews. A primary objective of these surveys is to verify owl presence or absence, help determine any activity centers, and modify PAC boundaries or add new PACs to the network based on any results identifying activity centers. In 2009 these surveys will be repeated again. As well, longer term monitoring is being considered to gain further insight into the distribution and abundance of owls within and adjacent to the fire area over the next 5-10 years.

The 2008 surveys documented a single confirmed pair of CSOs (non-breeding) within the analysis area (PL107 – Freds Creek PAC), with the female from this pair being the only female detected. There were 10 single detections of male CSOs across the burned area. In each of these ten cases surveyors were not able to locate the birds at nests or roosts on follow-up status surveys. Each of these ten locations occurred primarily in the middle of the night when birds are out foraging and none of the detections occurred within 1/2-mile of each other as required to classify these individuals as territorial birds under currently accepted protocols. Within the unburned 1-mile buffer area surrounding the burned area there were documented 5 confirmed pairs, 1 unconfirmed pair, 1 territorial male single, and 6 single detections (4 males, 2 sex unknown). Thus, in the immediate unburned buffer area territorial sites were observed whereas only one confirmed territorial pair was documented within the burned area.

Direction for evaluating a PAC for retention or removal after a stand replacing event is found on page 37 of the SNFPA 2004 ROD. The process is as follows:

1. Evaluate habitat conditions within a 1.5-mile radius around existing 300 acre PACs.
    a. If opportunities exist (i.e. suitable habitat remains within a 1.5 mile radius) for re-mapping the PAC, re-map the PAC at a minimum of 300 acres. Based on SNFPA 2004, as well as GTR-133 (Verner et al. 1992), the PAC is 300 acres of the best possible owl habitat available, blocked up into as compact a unit as possible around an owl activity center (nest site, best roost, or repeated daytime detections). The existing PAC number could be retained or a new PAC number could be established.
    b. If opportunities do not exist (i.e. no suitable habitat remains within a 1.5 mile radius, 300 acres of contiguous suitable not present, suitable habitat scattered across the area and not arranged to logically create a compact unit, or an adjacent existing PAC already exists) for re-mapping, the PAC may be removed from the network. PAC may be removed after rationale has been documented for removal without the need to conduct owl surveys.

This evaluation process was conducted for the PACs that significantly burned within the Moonlight and Antelope Complex fires. PACs not affected by fire (PL109, PL230, PL287) or minimally affected by fire (PL167 – 3% burned at high severity, PL286 -15% burned at high severity) will remain as PACs and are not carried forward in this PAC evaluation process.

Table 48 displays areas of existing and available suitable acres within 1.5 mile radius of activity centers impacted by the Moonlight and Antelope Complex fires.

Table 48. Habitat analysis within 1.5 mile radius of activity centers impacted by the Moonlight and Antelope Complex fires.

	Existing Suitable Habitat within 1.5 mile radius (acres)*			Suitable Habitat Block Size within 1.5 mile radius			Suitable acres within other PAC/HRCA	Available suitable acres
PAC #	4M4D	5M5D	Total	>60 ac	<60 ac >1 ac	300+ ac		
PL005	133	145	278	1	11	0	PL041 = 74 LS009 = 73	131
PL006	522	153	676	1	26	1 (482 ac)	PL005 = 88 PL044 = 89 LS009 = 522	43
PL041	206	63	269	1	16	0	PL042 = 28	241
PL042	14	0	14	1	9	0	0	178
PL043	14	0	14	0	1	0	0	14
PL044	386	57	443	1 (297ac)	11	0	PL006 = 9 PL286 = 113 LS027 = 196	125
PL071	669	63	731	2 (269 ac)	18	0	PL109 = 53 PL287 = 35	644
PL073	362	588	950	1	9	1 (893 ac)	PL106 = 24 PL167 = 353 PL287 = 84	488
PL106	116	0	116	0	10	0	PL073 = 12 PL201 = 59	44
PL107	415	8	423	1	13	1 (323 ac)	PL109 = 82	341
PL122	115	35	149	0	9	0	0	149
PL123	285	13	297	0	19	0	PL107 = 9 PL284 = 25	263
PL125	53	7	60	0	3	0	PL126 = 7	53
PL126	164	86	250	0	12	0	PL073 = 22 PL125 = 36	192
PL198	139	20	159	1	12	0	PL201 = 23	136
PL199	183	58	241	1	6	0	PL043 = 3 PL262 = 25 PL284 = 28 PL303 = 1	184
PL201	272	138	410	1 (234 ac)	13	0	PL167 = 68 PL198 = 19	323
PL229	92	0	92	0	7	0	PL043 = 3 PL284 = 10	80
PL253	212	55	267	1	6	0	PL122 = 148	119
PL262	69	0	69	0	3	0	PL043 = 3 PL199 = 3	64
PL263	0	0	0	0		0	0	0

	Existing Suitable Habitat within 1.5 mile radius (acres)*			**Suitable Habitat Block Size within 1.5 mile radius**				
PL284	181	0	181	0	10	0	PL123 = 46 PL199 = 31 PL303 = 1	102
PL303	276	58	334	2	10	0	PL041 = 78 PL042 = 16 PL199 =17 PL262 = 18 PL284 = 9	197

* public land only

Based on this analysis, the following 20 PACs will be removed from the PNF PAC network: PL005, PL006, PL041, PL042, PL043, PL044, PL106, PL122, PL123, PL125, PL126, PL198, PL199, PL201, PL229, PL253, PL262, PL263, PL284, and PL303. None of these areas have any of the following: 1) enough suitable habitat to create a 300 acre PAC in a compact unit that is not already assigned to another PAC, 2) enough contiguous habitat in large (greater than 60 acre) blocks to make up 300 acres, and 3) an identified occupied activity center within the 1.5 mile radius circle that does not already have an assigned PAC number and boundary delineation. In addition, as stated earlier, survey results from 2008 did not detect any resident single owls or pairs in the territories to be removed.

In summary, of the twenty-five spotted owl PACs affected by the Moonlight and Antelope Complex fires, twenty PACs have been lost due to high severity wildfire effects and will be removed from the PNF PAC network. PL071 and PL073 were severely affected by the fires and have been tentatively re-mapped to the best available suitable acre blocks (greater than 300+ acres), which happen to fall outside of the analysis area. These two PACs may be modified in the future, based on owl survey results, to reflect more defined activity center locations. As stated earlier, survey results in 2008 determined pair status in PL107. This PAC has been retained and tentatively re-mapped to the best available suitable acres around this new activity center location.

Direction for evaluating Spotted Owl Habitat Areas (SOHAs) for retention after a stand replacing event is found in HFQLG FSEIS (USDA 1999, Appendix Q) and further clarified in the HFQLG / SNFPA Implementation Consistency Crosswalk and cover letter (revised 12/12/2007)(USDA 2007c). The process is as follows:

1. If SOHAs have large scale mortality, follow direction under Appendix Q, HFQLG EIS, to determine if a SOHA should be retained or removed from the network. Follow appendix Q evaluation and undesignate areas that are rendered unsuitable. Salvage is acceptable in those areas, but not in the remainder of the SOHA. If the SOHA is determined to be completely within unsuitable habitat, then salvage may occur in the entire SOHA.

2. If a SOHA or a portion thereof is rendered unsuitable by a catastrophic event such as wildfire, the remaining suitable habitat within the SOHA shall be

maintained as base habitat. However there is no requirement that these SOHAs be replaced or that additional habitat is added to the SOHAs.

There were five 1000 acre based SOHAs within the wildlife analysis area. Using the post-fire habitat conditions represented by the updated CWHR vegetation map, each SOHA was evaluated to determine if it should be retained or removed from the network.

Table 49. Habitat analysis for the five SOHAs within the wildlife analysis area.

SOHA #	SOHA Acres	Existing Suitable Habitat to be Maintained as Base Habitat			% of SOHA unsuitable
		4M4D	5M5D	Total	
S1	1083	0	0	0	100%
S2	1068	108	0	108	90%
S3	1130	87	41	128	89%
T2	1223	52	416	467	38%
T3	1127	43	0	43	96%

Based on the evaluation summarized in Table 49, SOHA S1 has been completely lost due to fire effects rendering all acres unsuitable. As a result, SOHA S1 will be removed from the PNF network. SOHAs S2, S3, T2, and T3 experienced severe fire effects as well but some suitable habitat still exists within each SOHAs boundary. Following the direction stated in Appendix Q of the HFQLG EIS, salvage is acceptable in areas rendered unsuitable while the remaining suitable habitat within each SOHA (746 total acres) will be maintained as base habitat.

3.5.1.2.4 Northern Goshawk

Seven goshawk PACs were impacted by the fire, all of which are completely within the burn area.

Table 50 displays the effects of the Moonlight and Antelope Complex fires on suitable goshawk habitat on public land within the analysis area. Approximately 41,605 acres of suitable nesting habitat was rendered unsuitable on public land as a result of the stand replacing wildfire.

Table 50. Effects of Moonlight and Antelope Complex fires on goshawk habitat (all acres approximate and only include public land).

Habitat	Pre-Fire Acres	Post Fire Acres	Reduction in suitable habitat (%)
Suitable Habitat (5M, 5D,4M, 4D)*	45,660	4,055	41,605 acres 91% reduction

*SMC, PPN, WFR, RFR, LPN, EPN

Table 51 shows the existing condition of the seven goshawk PACs within the analysis area. Six PACs burned at high to moderately high severity over greater than 60 percent of all acreage. PAC T14 burned at these severity levels on only 27 percent. The fire effects rendered most habitat within each PAC unsuitable with high severity burn areas converting to MCP or SMC1 and lower severity burn areas opening up the canopy to a CWHR closure class of P (25-39 percent canopy closure).

Table 51. Existing condition of Northern goshawk PACs within analysis area.

PAC #	PAC Acres	Acres Burned at High or Moderately High Severity (BAM* ≥ 50%)	% of PAC burned at High or Moderately High Severity	Remaining Suitable CWHR 4M/4D/5M/5D Acres**
T07	177	109	62%	48
T08	182	120	66%	4
T09	232	173	75%	33
T13	206	171	83%	0
T14	124	34	27%	15
T24	231	166	72%	36
T36	222	211	95%	0
TOTAL	920	600	65%	103

* BAM=basal area mortality **SMC, PPN, WFR, RFR, LPN, EPN;

The SNFPA ROD (USDA 2004b) defines Northern goshawk PAC land allocation and associated desired conditions. It also addresses what actions can be taken after a stand-replacing event, such as a wildfire. The SNFPA ROD states: “PACs may be removed from the network after a stand-replacing event if the habitat has been rendered unsuitable as a Northern goshawk PAC and there are no opportunities for re-mapping the PAC in proximity to the affected PAC” (SNFPA ROD 2004, pg. 38) (USDA 2004b). There doesn’t appear to be any opportunities to re-map any of the seven PACs, based upon no large (200 acres or more), contiguous patches of suitable habitat present within close proximity to each PAC. Therefore, goshawk PACs T07, T08, T09, T13, T14, T24, and T36 have been lost and will be removed from the PNF goshawk PAC network.

3.5.1.2.5 American Marten

American martens have not been detected in the watersheds impacted by the Moonlight and Antelope Complex fires. Extensive surveys using both soot covered track plates and baited photo stations have been conducted since the mid-90s across the majority of the Mt. Hough Ranger District landscape; no martens have been found (documented survey results on file, located on the Mt. Hough Ranger District). Based on project surveys conducted within and adjacent to the project area between 2000 and 2003 that have not detected marten (project surveys include Antelope/Border, Cold, Wild, Diamond, and Treatment Units 9 and 10 for the Plumas Lassen Administrative Study, it is suspected that marten are likely not present in the analysis area. Trends in marten detections in Plumas County, and by inference PNF, from the early 1900’s to the late 1900’s are downward, and are likely due to relatively small amounts of late seral/old growth forest attributes (Zielinski, 2005).

The American marten is no longer considered a management indicator species (MIS) on the PNF (USDA 2007b).

Table 52. Effects of Moonlight and Antelope Complex fires on suitable marten habitat (all acres approximate and all are public land).

Habitat	Pre-Fire Acres	Post Fire Acres	Reduction in suitable habitat (%)
Suitable Habitat (5M, 5D,4M, 4D)*	44,055	3,847	40,208 acres 91% reduction

* SMC, WFR, RFR, LPN, EPN

Table 52 shows the effects of the Moonlight and Antelope Complex fires on marten habitat within the analysis area. Approximately 40,208 acres of marten habitat was rendered unsuitable on public land as a result of the stand replacing wildfire. The remaining suitable habitat (3,847 total acres) provides 379 acres of marten denning habitat (CWHR 4D and 5D) and 3,468 acres of marten foraging habitat (CWHR 4M and 5M).

The PNF draft carnivore network consists of scattered known marten locations, large habitat management areas, and wide dispersal or connecting corridors. The management intent of the network is to provide a continuously connected system of habitats focused on the needs of marten and other mesocarnivores (fisher, wolverine, and Sierra Nevada red fox). This network is not incorporated into the Plumas National Forest (PNF) Land and Resource Management Plan (as amended) as a land allocation with standards and guidelines; it is a plan to project analysis tool designed to maintain future options.

There are 22,309 acres of the carnivore network in the Moonlight and Antelope Complex fires perimeters, much of which burned at moderately high to high severity. Based on the latest post fire vegetation map, crosswalked to CWHR, only 1,831 acres of suitable habitat exists in the carnivore network within the wildlife analysis area. The remaining 2,043 acres of post fire suitable carnivore habitat (3,874-1,831) occurs outside the draft network.

3.5.1.2.6 Pallid Bat

The pallid bat is most commonly found in open dry habitats with rocky areas for roosting (SNFPA 2001) and most prevalent within edges, open stands, and open areas without trees. Preferred day roost sites are rock outcroppings, caves, hollow trees, snags, mines, buildings and bridges (Ibid). Similar structures are used for night roosting. Pallid bats generally forage around rocky outcrops, cliffs, and crevices with access to open habitats and close to the ground. The SNFPA EIS (2001) emphasizes the protection and enhancement of both westside foothill oaks and montane oaks to provide for pallid bats, which have been identified as important foraging habitat for this species.

The analysis area supports numerous rock outcrops with associated crevices; hollow trees and snags have been recruited over time within the analysis area as there has been no salvage or hazard tree removal on NFS land for many years in this area. Black oak is scattered throughout in limited amounts within the stands to be treated. Incidental fire-killed black oak trees are scattered throughout the western portion of the analysis area.

Bat surveys using mist nets at selected locations on the Plumas NF were conducted in June and September 1991 and again in July and August 1992 (Lengas & Bumpus 1992, 1993). Habitats surveyed ranged from high and low elevation mixed conifer/red fir to eastside pine and sagebrush associations. A small portion of Indian Creek within the

analysis area was surveyed but no pallid bats were detected (Ibid). However, at Lowe Flat, approximately 4 miles north of Antelope Lake and less than a mile from the eastern boundary of the analysis area, one pallid bat was captured (Ibid). Based on these survey results, it is suspected that this species is present in or near the Moonlight and Wheeler wildlife analysis area.

3.5.1.2.7 Western Red Bat

There are no records of this species within or adjacent to the analysis area. Survey efforts and detections of Western red bats have occurred at various locations across the Forest since 1992. A portion of Indian Creek within the analysis area was surveyed for bats but no Western red bats were detected during this effort (Lengas and Bumpus 1992, 1993).

3.5.1.3 Management Indicator Species (MIS)

MIS for the PNF are identified in the 2007 Sierra Nevada Forests Management Indicator Species (SNF MIS) Amendment (USDA 2007f). The habitats and ecosystem components and associated MIS analyzed for the project were selected from this list of MIS, as indicated in Table 53. In addition to identifying the habitat or ecosystem components (1st column), the CWHR type(s) defining each habitat/ecosystem component (2nd column), and the associated MIS (3rd column), Table 53 discloses whether or not habitat for each MIS is potentially affected by the Moonlight and Wheeler Project (4th column).

Table 53. Selection of MIS for project-level habitat analysis for the Moonlight and Wheeler Project.

Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component[1]	Sierra Nevada Forests Management Indicator Species *Scientific Name*	Category for Project Analysis [2]
Riverine & Lacustrine	lacustrine (LAC) and riverine (RIV)	aquatic macroinvertebrates	3
Shrubland (west-slope chaparral types)	montane chaparral (MCP), mixed chaparral (MCH), chamise-redshank chaparral (CRC)	fox sparrow *Passerella iliaca*	3
Oak-associated Hardwoods & Hardwood/conifers	montane hardwood (MHW), montane hardwood-conifer (MHC)	mule deer *Odocoileus hemionus*	3
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	yellow warbler *Dendroica petechia*	3
Wet Meadow	Wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific tree frog *Pseudacris regilla*	3
Early Seral Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures	mountain quail *Oreortyx pictus*	3
Mid Seral Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures	mountain quail *Oreortyx pictus*	2
Late Seral Open Canopy Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P	sooty (blue) grouse *Dendragapus obscurus*	3
Late Seral Closed Canopy Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6.	California spotted owl *Strix occidentalis occidentalis*	3
		northern flying squirrel *Glaucomys sabrinus*	3
Snags in Green Forest	Medium and large snags in green forest	hairy woodpecker *Picoides villosus*	3
Snags in Burned Forest	Medium and large snags in burned forest (stand-replacing fire)	black-backed woodpecker *Picoides arcticus*	3

[1] All CWHR size classes and canopy closures are included unless otherwise specified; dbh = diameter at breast height; Canopy Closure classifications: S=Sparse Cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure); Tree size classes: 1 (Seedling)(<1" dbh); 2 (Sapling)(1"-5.9" dbh); 3 (Pole)(6"-10.9" dbh); 4 (Small tree)(11"-23.9" dbh); 5 (Medium/Large tree)(≥24" dbh); 6 (Multi-layered Tree) [In PPN and SMC] (Mayer and Laudenslayer 1988).

[2] Category 1: MIS whose habitat is not in or adjacent to the analysis area and would not be affected by the project.
Category 2: MIS whose habitat is in or adjacent to analysis area, but would not be either directly or indirectly affected by the project.
Category 3: MIS whose habitat would be either directly or indirectly affected by the project.

The two MIS addressed in detail in this RFEIS is the black-backed woodpecker (BBWO), due to the proposal to remove fire-killed trees, which is the habitat component for this MIS, and benthic macroinvertebrates, due to the cumulative effects to watersheds. Affected environment and environmental consequences to the California spotted owl, also a MIS, can be found in the Forest Service R5 Sensitive Species sections of this revised final EIS. It has been determined that the habitat for the remaining MIS in Table 53 will also be affected by this project but these effects are considered indirect, minor, and mostly associated with gradual, long-term habitat changes resulting from proposed reforestation. Please see the Moonlight and Wheeler Project MIS Report (USDA 2009a: Chris Collins and Kristina Hopkins-Van Stone, June 2009) for complete discussion of potential effects on all PNF MIS species due to implementation of this project.

3.5.1.3.1 Black-backed Woodpecker (BBWO)

The black-backed woodpecker was selected as the MIS for the ecosystem component of snags in burned forests. Detailed information on MIS is documented in the Sierra Nevada National Forests Bioregional MIS Report (USDA 2008b), which is hereby incorporated by reference. Recent data indicate that black-backed woodpeckers are dependent on snags created by stand-replacement fires (Hutto 1995, Kotliar et al. 2002, Smucker et al. 2005, Hanson and North 2008).

Hutto (1995) found that the number of small trees (10 to 30 cm dbh or 4-12” dbh) present in a burn served as the best correlate of black-backed woodpecker abundance. Dixon & Saab (2000) recommend that where post fire salvage logging is planned, retain snags in clumps rather than even spaced distributions and retain >104 to 123 snag/ha (42-50 snags/acre) of dbh size >23 cm (9” dbh). Vierling et al (2008) recommended that snags>26 cm (10”) dbh be retained because this represented the smallest snag size used by nesting woodpeckers, specifically BBWO and hairy woodpecker, in burned pine forest. In California, BBWO used nest trees >41 cm (16” dbh) and more than 13 meters (42 feet) tall in both burned and unburned forest (Raphael & White 1984).

Habitat conditions within the Moonlight and Wheeler project wildlife analysis area considered suitable for this species and analyzed in the environmental effects section of this EIS are: (1) medium (15-30 inches dbh) snags per acre within burned forest created by stand-replacing fire, and (2) large (greater than 30 inches dbh) snags per acre within burned forest created by stand-replacing fire. Russell et al. (2007) indicated that BBWOs were positively associated with burned areas that supported moderate or high pre-fire crown closure (greater than 40 percent). Moderately high and high severity burned forests have been shown to be used by BBWOs (Bock and Lynch 1970, Hoyt and Hannon 2002, Hutto 2008, Vierling et al. 2008). Based on these findings, pre-fire CWHR 4M, 4D, 5M and 5D that burned at moderately high (50-75% BAM) or high severity (>75% BAM) is used to determined trends in BBWO habitat.

Table 54. Summary of burned forest acres potentially supporting medium and large snags within the wildlife analysis area (all acres are approximate and only include public land).

CWHR Type * (pre-fires)	Created BBWO Habitat in Analysis Area as a result of stand replacement fire**

CWHR 4M/4D	17,896
CWHR 5M/5D	14,673
Total	32,569

*CWHR types include SMC, WFR, EPN, PPN
**High and moderately high severity ≥ 50% BAM is considered stand replacement

Table 55 discloses the estimated snag densities existing within the analysis area. This fire-killed tree (snag) data was collected using common stand exam plots located within the proposed treatment units. Snag density estimates were averaged across the analysis area within all Forest Service CWHR 4M, 4D, 5M, and 5D stands (totaling 45,895 acres).

Weighted averages are displayed to more accurately represent the proportion of areas, which burned at different severities on different soil site classes (please refer to the Moonlight Wheeler Project BA/BE, Attachment 1 for additional information).

Table 55. Estimated snag densities on public land within analysis area.

Diameter class of fire-killed tree (all species)	Number of fire-killed trees/acre
10-14.9 dbh	32.6
15 or greater dbh	16.8

Population Status and Trend. The black-backed woodpecker has been monitored in the Sierra Nevada at various sample locations by avian point counts, spot mapping, mist-netting, and breeding bird survey protocols, including: on-going monitoring through California Partners in Flight Monitoring Sites ; 2002 to present - Plumas and Lassen National Forests (Sierra Nevada Research Center 2007); 1992 to 2005 – Sierra Nevada Monitoring Avian Productivity and Survivorship (MAPS) stations (Siegel and Kaschube 2007); 1970 to present – various Sierra Nevada monitoring and study efforts (USDA 2008a, table BLWO-IV-1); and 1971 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that black-backed woodpecker continue to be distributed across the Sierra Nevada, and current data at the range wide, California, and Sierra Nevada scales indicate that the distribution of black-backed woodpecker populations in the Sierra Nevada is stable.

3.5.1.3.2 Benthic Macroinvertebrates

Benthic macroinvertebrates are MIS for riverine and lacustrine habitat in the Sierra Nevada. They have been demonstrated to be very useful as indicators of water quality and aquatic habitat condition (Resh and Price 1984; Karr et al. 1986; Hughes and Larsen 1987; Resh and Rosenberg 1989). They are sensitive to changes in water chemistry, temperature, and physical habitat; factors of particular importance are: flow, sedimentation, and water surface shade.

Benthic macroinvertebrates are invertebrates that live in water and can be seen by the unaided human eye. They provide an important ecological link between microscopic food organisms and fish. Benthic macroinvertebrates include insects, such as the commonly thought of mayflies, stoneflies, caddisflies, helgrammites and midges. Many of these groups are most highly developed for running water environments with adults and larvae living primarily in cold, running streams; many feed and breed under rocks, in the spaces

among loose gravel and rocks, piles of waterlogged leaves and debris, and submerged logs.

Habitat factors utilized for this analysis include: flow; sedimentation; and water surface shade (water temperature). In addition, large woody debris (LWD) was identified as an issue to maintain quality habitat for cold water fisheries and macroinvertebrates.

There are 790 miles of channel in the project area, including 604 miles of ephemeral, 80 miles of intermittent and 106 miles of perennial according to Forest GIS records. Reference the Aquatic MIS Report, appendix A, table 1 for the existing stream condition (SCI reaches) and appendix B, tables 1 and 2 for the existing macroinvertebrate composition and evaluation prior to the Moonlight and Wheeler Fires in the project area.

About 27 miles of channel, mostly ephemeral and intermittent in nature, have been surveyed for indication of flow regime and function, such as bank stability and amounts of LWD. Most of the survey reaches are in Pierce and Upper Indian creeks drainages with minor amounts in Cold Stream, Middle Lights Middle Creek, Moonlight and Moonlight Valley (Forest GIS records). About 6 percent of the total surveyed reaches or 1.6 miles had prevalent or extensive bank instability, primarily in Upper Indian Creek, and almost entirely within ephemeral and intermittent channels. About 1.4 miles of channel, all intermittent or ephemeral in nature were listed in the survey as having poor, inadequate amounts of LWD. All these reaches were in Middle and Upper Indian creek drainages (USDA 2008c).

Fire burned out the LWD in most channels, particularly first and second order streams. Sediment stored by LWD may be released, as well as new deliveries of sediment including ash may be freer to transport downstream (Faust 2007). In the larger channels LWD was only partially consumed. Burned trees on the banks have fallen into streams creating flow deflector that may divert water into stream banks and create more erosion as well as destabilizing the banks themselves (Rosel et al. 2007). In contrast, water could be deflected away from the banks and the additional LWD could stabilize the banks. Observation during field visits for this report was that those reaches within meadow areas were relatively untouched, and the burn severity was light on the meadow floodplain. Reaches in gorges such as lower Lights Creek with large areas of out cropping were also only lightly burned.

Stream condition inventory (SCI) attributes and macroinvertebrate metrics were evaluated to qualify streams with data collected as good, moderate and poor (Aquatic MIS Report, appendix A, table 1). SCI's have been conducted on Little Antelope, Antelope, Clark's, Stream, Moonlight, Lights and upper and lower Boulder Creeks. The SCI data and Rapid Bioassessment data were reviewed together for the following metrics (%fines, substrate size, residual pool depth, temperature, stream cover, and aquatic macroinvertebrate metrics) prior to the Moonlight and Wheeler Fires. In addition, in project area streams that were surveyed either by the Burned Areas Emergency Rehabilitation (BAER) effort after the fire or in stream surveys by forest staff of channel conditions prior to the fire, showed that channel condition was good overall.

Moonlight Creek, Boulder, Cold Stream and Hungry Creeks received an overall SCI condition rating (Aquatic MIS Report, appendix A, table 1) of moderate. The percentage of sediment in pool tails were good and the percentage of unstable banks were vulnerable. Shade was also rated as moderate to good. The current condition post fire for

all drainages is moderate to poor due to loss of riparian vegetation. Last Chance, Clark's Creek, Little Antelope and Pierce Creek were rated at moderate to poor. Shade was collected at only Clark's creek and was rated as poor. Sediment in pool tail fines was high in both reaches, which rated at poor to very poor. Current and historic grazing activity has occurred around both reaches (reference Wildlife Section), and may have contributed to high sedimentation, low shade and unstable banks within these four drainages. The overall rating of aquatic macroinvertebrate metrics for Antelope, Boulder, Moonlight, Hungry, Indian and Coldstream Creeks ranged from moderate to good, and for Last Chance, Clarks, and Little Antelope Creeks ranged from moderate to poor.

Summary of Aquatic Macroinvertebrate Status and Trend at the Bioregional Scale. The Plumas National Forest (PNF) Land and Resource Management Plan 9 (as amended), requires bioregional-scale Index of Biological Integrity and Habitat monitoring for aquatic macroinvertebrates; hence, the lacustrine and riverine effects analysis for the Moonlight and Wheeler Project must be informed by these monitoring data. Summaries of the Biological Integrity and Habitat status and trend data for aquatic macroinvertebrates is drawn from the detailed information on habitat and population trends in the Sierra Nevada National Forests Bioregional MIS Report (USDA 2008b).

Habitat and Index of Bioregional Integrity Status and Trend. Aquatic habitat has been assessed using Stream Condition Inventory (SCI) data collected since 1994 (Frasier et al. 2005) and habitat status information from the Sierra Nevada Ecosystem Project (SNEP) (Moyle and Randall 1996). Index of Biological Integrity is assessed using the River Invertebrate Prediction and Classification System (RIVPACS) and macroinvertebrate data collected since 2000 (see USDA 2008a, Table BMI-1). These data indicate that the status and trend in the RIVPACS scores is stable.

3.5.1.4 Migratory Landbirds

Migratory birds (MB) are defined as species whose breeding area includes the North American temperate zones and that migrate in many cases south of the continental United States during non-breeding seasons (Hunter et al 1993). The number of NTMBs found within the Sierra Nevada bioregion is large. They use a broad array of habitat associations (2004 SNFPA SFEIS, Chap. 3, page 172). Current management guidelines for the Sierra Nevada bioregion are designed to provide for a diversity of habitats, and management direction is not specific to individual bird species, except for those designated as threatened, endangered, or sensitive, and management is generally focused on habitats and overall population trends rather than individuals.

Implementation of the Moonlight and Wheeler Fire Recovery and Restoration Project is in accordance with the objectives of Executive Order 13186 and the 2008 Memorandum of Understanding (MOU) between USFS and USFWS, regarding compliance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which outline responsibilities of federal land management agencies relative to the conservation of migratory birds.

The January 2000 USDA Forest Service (FS) Landbird Conservation Strategic Plan, in addition to the Partners in Flight (PIF) Conservation Plans for landbirds associated with Riparian, Oak Woodlands, Sagebrush, Coastal Scrub and Chaparral habitats within California and the January 2004 PIF North American Landbird Conservation Plan all

reference goals and objectives for integrating bird conservation into forest management and planning. Although most of the goals and objectives identified in the these plans are focused on actions more appropriate for the national and regional office levels many opportunities exist to incorporate bird conservation strategies into project level planning at the district and forest levels. Project planning for the Moonlight and Wheeler Project evaluated potential risks to resident and migratory landbirds that could result from implementing the proposed actions.

The Plumas National Forest utilizes the U.S. Fish & Wildlife Service 2008 Birds of Conservation Concern (www.fws.gov/migratory**birds**/reports/BCC2008/BCC2008.pdf) for the Sierra Nevada as its framework for analyzing effects to migratory birds. Of this list of eleven (11) birds, project level reports (e.g. BA/BE, MIS) address nine (9) of the species either directly or by using an existing Management Indicator Species or Forest Service Sensitive species that utilize the same or similar habitat attributes. The following table highlights how and where these nine migratory birds are addressed directly or by using an existing MIS or Sensitive species.

Table 56. Analysis of Migratory Birds for the Moonlight Wheeler project.

Birds of Conservation Concern (Sierra Nevada - BCR 15)	**Forest Service Sensitive Species (S) or Management Indicator Species (MIS)**	**Project Level Report (BA/BE or MIS)**	**Critical Habitat component or threat as defined by Sierra Nevada Bird Conservation Plan (PIF)**
Bald Eagle	Bald Eagle (S)	BA/BE	Designated as a non-land bird by DeSante
Flammulated Owl	Mule Deer Hairy Woodpecker	MIS MIS	Depends critically on oaks or oak woodlands, Loss of Snags
California Spotted Owl	California Spotted Owl (S)	BA/BE	Depends critically on old growth
Calliope Hummingbird	Sooty (Blue) Grouse Yellow Warbler Willow Flycatcher (S)	MIS MIS BA/BE	Open Forested habitats, and moist habitats on the East Slope
Lewis' Woodpecker	Hairy Woodpecker	MIS	Loss of Snags
Williamson's Sapsucker	Hairy Woodpecker	MIS	Loss of Snags
Olive-sided Flycatcher	California Spotted Owl (S) Hairy Woodpecker	BA/BE MIS	Utilize late successional/old growth forest, but does not depend on it critically, Loss of Snags
Willow Flycatcher	Willow Flycatcher (S)	BA/BE	Depends critically on Montane Meadow habitat
Cassin's Finch	California Spotted Owl (S)	BA/BE	Depends critically on old growth

The remaining two species, the Peregrine Falcon and Black Swift, occur in known established sites or have habitats that are very localized and limited in extent on the Plumas NF.

Peregrine Falcon: PNF biologists have reviewed habitat for the Peregrine Falcon on the Plumas NF extensively since the early 1980's. Habitat for the Peregrine consists of three rock cliff sites on the Forest, located at Bald Rock, Canyon Dam and Pulga. Disturbance to these habitats is limited, as most activities do not impact these rock cliff sites. Projects with an analysis area that falls within a ½ mile vicinity of these three sites would analyze impacts to Peregrine Falcon, whereas projects with an analysis area outside of a ½ mile vicinity of these sites would not require further analysis.

Black Swift: Based on surveys and work by the Plumas County Audubon Society (C. Dillingham, pers comm.) the Black Swift is a rare spring and fall migrant across the PNF and has not been confirmed as a resident on the PNF. However suitable wet cliff/waterfall habitat does occur at selected sites on the Forest. Two sites appear to be suitable for Black Swifts, Feather Falls on the Feather River District and Frazier Falls on the Beckwourth District. Both sites fall within recreation areas or recreation sites, and do not receive ground disturbing activities that would modify or alter habitat values for the Black Swift. Projects with an analysis area that falls within a ½ mile vicinity of these two sites would analyze impacts to Black Swift habitat, whereas projects with an analysis area outside of a ½ mile vicinity of these sites would not require further analysis.

It appears the habitat conversion that occurred as a result of the Moonlight and Wheeler wildfires resulted in an overall decrease in habitat suitability for the ten BCC species. Stand replacing fire within predominantly Sierra Mixed Conifer (SMC) and other forested types resulted in a large increase (37,685 acres) of early seral shrub (MCP) habitat conditions throughout the analysis area. The olive sided flycatcher has been associated with early post-fire conditions, increasing in relative abundance in burned sites (Smucker et al, 2005), especially in regards to using standing dead trees as foraging perches in open areas (Hutto, 1995) and using edges of mature live trees and open burned forest (Kotliar et al, 2002). Thus some short term increase in habitat suitability could be realized for this species, although burned habitat is not identified as a habitat component required for this species (Zeiner et al, 1990; CDFG, 2005). Due to its strong association with burned forest in the Sierra Nevada (Kotliar et al 2002, Siegel and Wilkerson 2004), the Olive-sided Flycatcher is the species of focus in this RFEIS. Please see the Moonlight and Wheeler Migratory Landbird Supplemental Report (USDA 2009h: Chris Collins, June 2009) for additional account of the affected environment and environmental consequences to selected migratory bird species.

3.5.2 Environmental Consequences

3.5.2.1 Alternative A (Proposed Action) – Direct, Indirect, and Cumulative Effects

3.5.2.1.1 USDA Forest Service R5 Sensitive Species

The implementation of the project may affect individuals of the following USDA Forest Service R5 sensitive wildlife species listed: Mountain yellow-legged frog (MYLF), bald eagle, California spotted owl, Northern goshawk, American marten, pallid bat, and

Western red bat; the proposed project would not result in a trend toward federal listing, or result in a loss of viability, for any of these species. All other Forest Service R5 sensitive wildlife species resulted in a "Will Not Affect" (WNA) determination. A WNA determination was made based on: 1) lack of species presence within the area, and/or; 2) lack of habitat in the analysis area, and/or; 3) no impact to habitat as a result of treatments within high and moderate severity burn areas. Additional species accounts and rationale for these determinations can be found in the Moonlight and Wheeler Fires Recovery and Restoration Project Biological Assessment/Biological Evaluation, Chris Collins, January 2009) (USDA 2009h). Table 57 shows the USDA Forest Service R5 sensitive species affects determinations.

Table 57. USDA Forest Service R5 Sensitive Wildlife Species Affects Determination.

Scientific Name	Common Name	Suitable Habitat Present	Observed in Project Area (Y/N)	Finding
Determination: May Affect Individuals, but is not likely to result in a trend toward Federal listing or loss of viability.				
Rana sierrae	Mountain Yellow-legged Frog	Yes	Yes	MAI
Haliaeetus leucocephalus	Bald Eagle	Yes	Yes	MAI
Strix occidentalis occidentalis	California Spotted Owl	Yes	Yes	MAI
Accipiter gentilis	Northern Goshawk	Yes	Yes	MAI
Martes americana	American Marten	Yes	No	MAI
Antrozous pallidus	Pallid Bat	Yes	No	MAI
Lasiurus blossevilli	Western Red Bat	Yes	No	MAI
Determination: Will Not Affect Individuals				
Mylopharodon conocephalus	Hardhead Minnow	No	No	WNA
Rana boylii	Foothill Yellow-legged Frog	Yes	No	WNA
Rana pipiens	Northern Leopard Frog	No	No	WNA
Clemmys marmorata	Pond Turtle	No	No	WNA
Empidonax traillii	Willow Flycatcher	Yes	No	WNA
Strix nebulosa	Great Gray Owl	Yes	No	WNA
Buteo swainsonii	Swainson's Hawk	No	No	WNA
Grus Canadensis	Greater Sandhill	No	No	WNA

Scientific Name	Common Name	Suitable Habitat Present	Observed in Project Area (Y/N)	Finding
labida	Crane			
Martes pennanti	Pacific Fisher	Yes	No	WNA
Gulo gulo luteus	California Wolverine	No	No	WNA
Vulpes vulpes necator	Sierra Nevada Red Fox	Yes	No	WNA
Corynorhinus townsendii	Townsend's Big-eared Bat	Yes	No	WNA

3.5.2.1.1.1 Mountain Yellow-legged Frog

Potential direct effects from the proposed project include impacts to individual frogs during activities. Possible direct effects from the proposed actions on Forest Service R5 aquatic sensitive species include crushing of individuals if they are present during project activities. The use of a fellerbuncher within RHCAs has the potential of directly injuring or killing frogs. Although helicopter and skyline logging is considered to have minimal ground disturbing effects, falling of trees can result in crushing, injuring, or killing of animals that occur where trees fall. The potential for direct impacts to individuals is greatest during wet periods and in early fall, when frogs are most likely to disperse from aquatic habitats.

There are three watersheds that have known MYLF populations. Approximately 790 RHCA acres under alternative A would be treated in these watersheds for fire-killed tree removal. Table 58 displays the treatment acres within watersheds with known MYLF populations. Treatments within these RHCAs would increase the potential for direct effects, as frogs are put at risk of being killed/injured with falling and yarding activities.

Table 58. Treatment acres under Alternative A within watersheds with known MYLF populations.

Watersheds with MYLF Populations	Watershed Acres Treated	Acres treated in RHCA	RHCA Acres Treated by Logging System	
			Helicopter/Skyline	Tractor
L. Lone Rock C.	735	196	93	103
Pierce C.	319	105	0	105
West Branch Lights C.	2448	489	227	262
	Total	790	320	470

A possible indirect effect in helicopter and skyline cable units, because of the lop and scatter of limbs and tops, and the leaving of trees under 16 inches dbh, would be that the resultant ground cover within RHCAs immediately post harvest is likely to be higher than in untreated RHCAs outside of units. The same is not true for ground-based units which would transport most of the standing fire-killed material out. There would be some amount of breakage that would be left on the ground but this volume is not easily quantifiable.

Sheltering habitat for MYLFs also includes landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs. A reduction in fire-killed wood would result in a lack of connectivity and cover for frogs that could possibly move out of Lone Rock Creek and into the floodplain, the RHCAs, and upland habitats. Possible indirect effects to frogs using the RHCA for dispersal, and over wintering may include a reduction in cover provided by woody debris, warmer and drier microclimate conditions due to removal of fire-killed trees in RHCA areas, and reduction in connectivity provided by woody debris between aquatic habitats, RHCAs, and uplands. Cover for aquatic-dependent species and effective soil cover in this post-fire environment are very important for the proper functioning of aquatic and riparian habitats. As vegetation reestablishes, the role of the standing fire-killed and downed wood would be reduced.

The PNF conducted a 3-year telemetry study on the MYLF to determine the degree of overland movements into RHCA in order to minimize impacts from fuel reduction efforts across the forest (Wengert 2008). The 3-year study found that MYLF have very limited movements into upland habitats or adjacent riparian areas. For example, during the 3-year study, only one movement greater than 1 meter occurred away from the wetted stream channel into riparian or upland habitat. This movement by 1 MYLF was recorded at 77 feet away from the wetted stream channel. The study concluded that off-stream channel movements were very rare and that in-stream movements within and up and down the wetted stream channel were common and frequent traits of MYLF behavior. Therefore, the project design features and mitigations which include RHCA equipment restriction zones, Best Management Practices (BMPs) to prevent water quality degradation (Appendix C, Table C-1) and Riparian Management Objectives standards (in project record) should provide adequate protection to minimize impacts to the MYLF within riparian or upland habitats.

Cumulative Effects: The following discussion on watershed conditions within the analysis area is drawn from the Moonlight and Wheeler Fires Recovery and Restoration Project Watershed Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Two of the three watersheds with known MYLF populations, Lower Lone Rock Creek and West Branch Light Creek, currently are above the Threshold of Concern (TOC). Table 59 displays the cumulative conditions of watersheds with known/suspected MYLF populations for alternative A. These two watersheds are susceptible to very high cumulative effects risk, such as erosion and large movement of sediment into streams. Lower Indian Creek watershed, suspected of having MYLF but with no detections to date, is also over TOC and at very high risk. Pierce Creek watershed exists below TOC but the risk of cumulative effects is still considered high.

Table 59. Cumulative condition of watersheds with known/suspected MYLF populations.

Watersheds	ERA % TOC	ERA (% of the TOC)*	
		Existing	Alt A
Lower Lone Rock	13	118%	128%

Creek			
Pierce Creek	12	80%	86%
West Branch Lights C.	13	163%	190%
Lower Indian Creek	12	132%	145%

*ERA is shown as the percent of the TOC for each watershed. For example, a watershed that is above the TOC will have a total value greater than 100. Total ERA contributions less than 100 are below the TOC. As disturbance approaches and exceeds the TOC, the risk of detrimental watershed effects increases.

As Table 59 shows Alternative A of the Moonlight and Wheeler Project would increase the percentage of TOC from existing conditions for all four watersheds. The cumulative risk assessment in all four of these watersheds is not expected to change from what exists currently. The West Branch Lights Creek watershed has the highest existing post-project cumulative risk. The bulk of the harvest, particularly by tractor, is concentrated in the tributary headwaters of Lights Creek drainage, which confluence in a single locale at the top of the Middle Lights Creek sub-watershed and therefore greater adverse effects are expected.

There are over 19,000 acres of private land within the analysis area. Cumulative effects from private land use (timber and gravel extraction, fire salvage harvest, livestock grazing, and urbanization) would continue to create water quality problems, including sedimentation and bank cutting. Of particular concern is the heavy logging on Sierra Pacific lands within the Lights Creek and Lone Rock drainages, which have known MYLF populations. The additive impact from private land logging on these and other drainages in the analysis area have been incorporated into the cumulative watershed effects analysis and is reflected in the high ERA values.

The analysis area occurs within the boundaries of nine active livestock grazing allotments, the majority of which is composed of the Clarks Creek, Lights Creek, and Lone Rock allotments. Grazing capacity within allotments is based on the primary range (meadow systems) and not on secondary or transitory range. At this time there are no plans to increase livestock stocking rates or use due to the increase in transitory range created by the fire. Based on the existing stocking rates and current range conditions, the season of use, the distribution of primary range across the project area, as well as no increased stocking due to increase in transitory range, there should be no change in livestock effects to habitat conditions over the long term (5+ years).

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed, which supports a well distributed population of MYLFs on Forest Service land, is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing riparian vegetation and streambanks to recover.

Determination: Application of BMPs will be used to lower incidence of surface erosion on the hill slope and prevent sediment delivery to the valley bottoms. Since 1992, the Plumas NF has conducted over 600 evaluations of BMP effectiveness per the approved R5 protocol. The most recent summary of this monitoring was produced following the 2007 field season (USDA 2008a). That summary listed 441 evaluations of BMPs for the type of activities proposed under the action alternatives. BMPs were rated as effective for 79.8% of those evaluations. When effects from roads already in use are separated from activity areas, BMP effectiveness is over 90%. Based on predicted hill slope erosion rates for skyline and tractor yarding in the first year after harvest (reported in watershed section), and considered along with observed recovery of riparian buffers and incorporation of BMPs, it is expected that actual rates of delivery to the valley bottom would be near the background rate for burned areas that are not harvested.

Significant vegetative recovery of riparian zones has occurred since the fire (based on 2009 surveys, see watershed section). These same surveys revealed that these riparian zones provided effective buffers for sediment deposition. In the three watersheds suveyed, Hungry, Lights and Moonlight Creeks, effectiveness of riparian area in mitigating rilling from upslope sources was estimated at about 80%, 60% and 90%, respectively. In each watershed pre-fire vegetation, and post-fire re-growth, along with litter cast, had developed ground cover to levels as high, or better, than the upslope condition. Typically, riparian vegetation, and associated breaks in slope at the valley bottom and near channel floodplain largely dissipate flow energy and induce deposition of transported fines. BMP effectiveness monitoring results for project-applicable activities on the forest are about the 90% level. Therefore sediment delivery to a channel buffer from an activity area is expected to be very slight and further degradation of water quality due to sediment delivery from harvested areas is not expected. The slight amounts of sediment generated from activity areas during a high runoff event would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

The watershed report (USDA 2009f) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including mountain yellow-legged frog suitable and occupied habitat.

The Moonlight and Wheeler Project “May affect, but is not likely to adversely affect or result in a loss of viability or a trend toward federal listing.” This determination is based on project design features and mitigations that will lessen and minimize impacts to the MYLF which include; 1) Incorporation of RHCA equipment restriction zones, 2) Implementation of Best Management Practices, and 3) Implementation of soil and water mitigation standards (RMOs). These design features and mitigations combined with results from the PNF’s 3-year telemetry study indicate that impacts to the MYLF are not expected to result in adverse effects or loss of viability.

3.5.2.1.1.2 Bald Eagle

Table 60 indicates that approximately 442 acres assigned to an eagle territory are present within the analysis area. The only Moonlight and Wheeler project activities proposed within the Bald Eagle Management Area (BEMA) are roadside hazard treatments totaling approximately 44 acres. There are no roadside hazard or salvage treatment units proposed within either active nesting territory at Antelope Lake. The potential haul of salvage material could occur on roads 29N43 (Forest Service Road 172), 28N03 and 27N42 and logging truck activity could be disruptive during the nesting season, depending on number of trucks per hour. Historically the activity on paved roads within these territories has not caused any nesting failures or territory abandonment. To limit disturbance to nesting eagles, Standard Management Requirements would be utilized for this project (listed in appendix C of this document).

Table 60. Acres within individual bald eagle territories burnt by Antelope Complex.

Territory	Mgt Zone*	Total Acres within Territory	Acres within Burn & Project Area	% in burn
Antelope I	Primary/Secondary	321	9	2.8%
Antelope III	Primary	345	153	44%
Antelope III	Secondary	296	280	95%
	TOTAL	962	442	46%

*Zones described in the 2006 Antelope Lake Bald Eagle Management Plan.

Cumulative Effects: The Stream fire burned a total of 3,600 acres in 2001, with approximately 1,379 acres within the Antelope BEMA, including at the time both designated Antelope Lake nesting territories. Shortly after the fire, a third nesting territory was established on the south side of Antelope Lake, which later was determined to be the pair that occupied Antelope II territory. Portions of the fire were salvage logged in 2003/2004. This included removal of hazard trees, merchantable sawlogs, and subsequently reforestation in all three nesting territories.

In 2006 the Boulder fire burned approximately 3,000 acres, of which 2,389 were located in the BEMA, including 508 acres within the Antelope II territory. Approximately 249 acres, including portions of Antelope II Territory were logged to remove hazardous trees from the recreational use areas. Since both Stream and Boulder fire/salvage has occurred, the birds at Antelope Lake have produced a total of 11 young between 2002 and 2007, including four in 2007. Thus fire and salvage logging cumulatively have not resulted in a decrease in nest occupancy or production.

Thus between 2001 – 2007, approximately 6,195 land acres within the BEMA, or 85 percent, have experienced wildfire, including stand replacement wildfire. These fires have created conditions that, within the next 25 years, as residual, fire stressed trees die and snags fall, the reduction in the amount and distribution of available habitat supporting nest trees could increase competition between the two nesting pairs for territorial space, which could reduce the number of nesting pairs from two to one. Approximately 48 percent of existing land acres within the BEMA support live green habitat in size classes capable of providing nesting habitat. Fire-killed tree removal in the proposed treatment areas would not occur within the BEMA and would not exacerbate this eventual habitat loss within the BEMA.

The Antelope Complex Roadside Hazard Tree Removal (Antelope RSHTR) project was completed in 2008, with some portions implemented within the BEMA, Antelope I territory, and Antelope III territory. Table 61 indicates the maximum potential acres within each territory treated under that project. Total amount of suitable habitat within each nesting territory was not changed within either management zone as a result of hazard tree removal. (USDA 2007a, USDA 2008i).

Table 61. Maximum potential hazard tree removal acres in bald eagle territories.

Territory	Road #	Primary Mgt. Zone		Secondary Mgt. Zone	
		Miles	Acres	Miles	Acres
Antelope I	29N43 (NFS 172)	0.75	36	0	0
Antelope III	28N03	1.0	48	0.25	12
	27N42	0.75	36	0.5	24
	Total	2.5	120	0.75	36

Within the entire Antelope Lake BEMA, when combined with the one mile of roadside hazard tree removal proposed under the Moonlight and Wheeler project and the 14.5 miles treated under the Antelope RSHTR project, approximately 15.5 miles, totaling approximately 735 acres would be treated for hazard tree reduction, shown in Table 62. This is approximately 10 percent of the entire 7,280 land acres within the BEMA.

Table 62. Maximum potential Acres of Hazard Tree Removal in Antelope Lake Bald Eagle Management Area (BEMA).

Road #	Miles	Acres
From Table 61	3.25	156
28N03	2.63	122
28N00	0.06	4
27N07C	0.35	14
26N54	0.5	24
27N60	1.5	77
27N41	2.5	121
27N41B	1.0	48
27N41D	0.25	12
27N41E	0.25	12
27N62	2.75	133
27N59	0.25	12
TOTAL	15.5	735

The BA/BEs for the Moonlight and Antelope hazard tree removal projects (USDA 2007a, USDA 2008i) concluded that the direct, indirect and cumulative effects of the action would not result in any change in population trends to meet the identified PNF LRMP goal for nesting pairs.

Approximately 630 acres of reforestation are planned to occur within the BEMA, with 25 acres located within the secondary zone of the Antelope III territory. Reforestation efforts should hasten restoration of large tree forest conditions, especially in establishment of preferred nest tree species such as ponderosa, Jeffrey and sugar pine.

Approximately 80 acres within the BEMA is private land. This land is primarily residential with 5-10 structures (cabins and trailers) and supports meadow, open shrub and open forest. This land was burned by the Antelope Complex, although no structures were lost. At this time there is no plan put forward to remove any fire-killed trees from this land.

Alternative A, with implementation of LOPs that have proved effective in the past for salvage and restoration projects (Stream and Boulder fires) within nesting territories at Antelope Lake, would not have any additional cumulative effects on habitat within the BEMA, individual nesting territories or cause any change in population distribution across the PNF or the Sierra Nevada range.

Determination: Alternative A may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the bald eagle.

3.5.2.1.1.3 California Spotted Owl

Under Alternative A, fire-killed or hazard tree removal would occur on 14,755 acres using helicopter, skyline, and tractor logging systems. Two PACs within the PNF PAC network would be minimally treated (8 acres total) for roadside hazard tree removal only under these actions. Outside of PACs, there would be no removal of fire-killed trees from non-burned parcels or areas burnt at low severity (less than 50 percent basal area mortality). No fire-killed tree removal would occur within currently suitable spotted owl habitat (as defined in the Affected Environment section of this revised final EIS). Removal of fire-killed or roadside hazard trees in non-suitable habitat would not change the existing condition of the amount of suitable habitat. Narrow corridors of dispersal (live-green forested) habitat within the analysis area, would not be treated for fire-killed or roadside hazard tree removal.

Table 63. Accounting of acres under alternative A treated for fire-killed or roadside hazard tree removal in areas formerly known as spotted owl PACs.

PAC #	Former Land Designation	ALT A proposed acres	PAC #	Former Land Designation	ALT A proposed acres
PL005	PAC	131	PL126	PAC	304
	HRCA	211		HRCA	113
	TOTAL	343		TOTAL	417
PL006	PAC	252	PL198	PAC	0
	HRCA	175		HRCA	0
	TOTAL	427		TOTAL	0
PL041	PAC	81	PL199	PAC	75
	HRCA	73		HRCA	454
	TOTAL	154		TOTAL	529
PL042	PAC	293	PL201	PAC	59
	HRCA	149		HRCA	169
	TOTAL	442		TOTAL	228
PL043	PAC	260	PL229	PAC	23
	HRCA	440		HRCA	549
	TOTAL	701		TOTAL	572
PL044	PAC	297	PL253	PAC	142
	HRCA	221		HRCA	44
	TOTAL	518		TOTAL	185
PL106	PAC	180	PL262	PAC	277
	HRCA	5		HRCA	310
	TOTAL	186		TOTAL	587
PL122	PAC	134	PL263	PAC	215
	HRCA	258		HRCA	306
	TOTAL	391		TOTAL	522
PL123	PAC	169	PL284	PAC	141
	HRCA	289		HRCA	341
	TOTAL	457		TOTAL	482
PL125	PAC	186	PL303	PAC	0
	HRCA	215		HRCA	9
	TOTAL	401		TOTAL	9

Under alternative A approximately 3,218 acres of fire-killed or hazard tree removal would occur in areas formerly known as PACs and approximately 4,331 acres would occur in what was formerly designated as HRCAs. This is displayed in Table 63. This combined 7,550 acres proposed for treatment is not suitable owl habitat due to the effects from moderately high and high severity fire, and the PAC numbers listed in Table 63 have been removed from the PNF spotted owl network of PACs.

Table 64 shows treatments that are proposed under alternative A that fall within the eight remaining PACs and associated HRCAs. The acres within PACs PL071 (1 acre) and PL286 (7 acres) are proposed for roadside hazard removal treatment only. All acres summarized in Table 64 reflect areas where fire killed trees or roadside hazard trees are planned for removal. No suitable owl habitat (CWHR 4M, 4D, 5M, 5D) would be entered or altered by the proposed actions.

Table 64. Proposed treatment acres under alternative A in remaining PACs and HRCAs within analysis area.

PAC #		ALT A	PAC #		ALT A
PL071	PAC	1	PL167	PAC	0
	HRCA	19		HRCA	132
	TOTAL	20		TOTAL	132
PL073	PAC	0	PL230	PAC	0
	HRCA	248		HRCA	0
	TOTAL	248		TOTAL	0
PL107	PAC	0	PL286	PAC	7
	HRCA	62		HRCA	135
	TOTAL	62		TOTAL	142
PL109	PAC	0	PL287	PAC	0
	HRCA	41		HRCA	315
	TOTAL	41		TOTAL	315

Under alternative A there would be no new system road construction so no long-term increases in human activities are expected as a result of this action. There would be approximately 13 miles of temporary road constructed under Alternative A to accommodate logging systems. Temporary roads constructed under this alternative would be decommissioned upon completion of the project. Road density would remain the same within the analysis area as pre-fire conditions, which is 2.62 miles of open road/square mile.

Cumulative Effects: The Stream fire burned a total of 3,600 acres in 2001. Prior to the burn the Stream fire area supported 2,428 acres of suitable spotted owl nesting and foraging habitat; after the fire there was 129 acres of suitable habitat located across the fire landscape in five isolated stands. Three spotted owl PACS were impacted by the Stream fire: PL073, PL106 and PL126. In 2002, PACs and HRCAs for these three PACs impacted by fire were re-drawn. Re-drawing these PACs was based on availability of suitable habitat around the fire perimeters and 2002 owl detections (BA/BE Stream Fire Restoration Project, January 21, 2003). Thus there was no net loss of PACs from the PNF owl network. As described earlier, PL073 has been re-mapped and PL106 and PL126 have now been rendered unsuitable as PACs as the result of the Moonlight and Antelope Complex fires.

In 2006 the Hungry fire burned 547 acres within the Middle Creek drainage; approximately 325 acres burned at low severity, 113 acres of moderate severity and 109 acres of high severity. A total of 170 acres of suitable habitat (5M and 4M) was rendered unsuitable habitat as a result of the fire. The Hungry fire burned within PAC PL167 and its associated HRCA. Approximately 114 acres of the 386 acre PAC (30 percent) was

burnt, the entire 114 acres was composed of CWHR 5M. Approximately 25 acres burnt at high/moderate severity, and 89 acres at low severity. The high severity was stand replacing and converted the existing habitat to CWHR type 1 and 2, while the low severity did not change the CWHR type. Therefore 25 acres were changed from CWHR 5M to CWHR 2 and 89 acres did not change. Approximately 47 acres of the 686 acre HRCA (7 percent) burnt, with 33 acres at high/moderate severity, and 14 acres burnt at low severity; the high severity was stand replacement and converted the existing habitat to CWHR type 1 and 2, while the low severity did not change the CWHR type.

PL167 was re-configured based on fire severity and field reconnaissance. Habitat created unsuitable in the PAC and HRCA was excluded from these areas. In addition, habitat that was isolated as a result of the fire was also removed. Approximately 7 acres of HRCA was excluded. After reconfiguration, PAC PL167 contains over 300 acres of the best available habitat. This habitat contains the known nest stand which is located at the south end of the PAC along Middle Creek. Overall, the PAC/HRCA contains 1007 acres (Hungry Fire Salvage Project BA/BE, 3-06-07).

In 2007 the Hungry fire salvage project removed fire-killed trees from 75 acres. All 75 acres were high burn severity acres and were analyzed as 75 acres of CWHR 1 and 2 (early seral grass/forb/brush). No suitable owl habitat was impacted by this project, and no fire-killed tree removal occurred within the PAC. The Hungry Fire Salvage Project did not result in any additional unsuitable spotted owl habitat.

Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough Ranger District and Dry Flat on the Beckwourth Ranger District) were implemented in 2008. These two projects removed hazard trees from approximately 3,330 acres. The Antelope Complex project was the only project of these two to enter and treat an existing HRCA for roadside hazard tree removal. This occurred in the HRCA for PL167 and approximately 13 acres were treated.

The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract and ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area. In addition to these public land projects, approximately 11,454 acres of the 19,238 acres of private land within the analysis area has been or is planned for salvage logging.

Table 65 shows all acres of proposed or current treatments from fire-killed or hazard tree removal actions within the analysis area for alternative A. Approximately 29,980 acres on public and private land (35 percent) is proposed for fire-killed or hazard tree removal

within the analysis area under alternative A. On public land, approximately 18,526 acres of fire-killed or hazard tree removal would occur under alternative A. This is 27 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 49,882 acres (73%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 11.7 snags/acre. Fire-killed tree removal would not result in any additional unsuitable spotted owl habitat above what was changed due to wildfire.

Table 65. Acres of proposed and current post-fire treatments in the wildlife analysis area – Alternatives A.

	Alt A acres proposed for fire-killed/hazard tree removal	% of analysis area	% on public lands
Moonlight and Wheeler Project	14,755	17%	22%
Antelope RSHTR Project	2,036	2%	3%
Dry Flat RSHTR Project	1,294	1%	2%
Camp 14 Project	249	0%	0%
North Moonlight Project	192	0%	0%
Private Land salvage	11,454	13%	n/a
Total on public land	18,526	21%	27%
Total: public and private land	29,980	35%	n/a

As was acknowledged in the Affected Environment section and documented in post-fire survey results, spotted owls can and do utilize unlogged severely burned forests. The cumulative removal of fire-killed or roadside hazard trees on approximately 18,527 acres of public land under this alternative does contribute to overall habitat degradation due to the removal of fire-killed structures supporting habitat. These actions could potentially adversely affect spotted owls if any are present in these areas due to disturbance and loss of foraging habitat.

Based on the latest spotted owl survey information, which will be conducted again in 2009 by PLAS owl crews, implementation of fire-killed tree removal could be subject to a LOP that would restrict tree removal during the nesting season (March 1 to August 15). Based on known information and as-needed implementation of a LOP, the fire-killed tree removal should not disturb known nesting pairs, and would not alter the current distribution of owl PACs across the PNF. The cumulative removal of fire-killed or hazard trees from 27 percent of public land would modify burned habitat with fire-killed tree structure removal, but would not reduce spotted owl PAC/HRCA occupancy, distribution, or the spotted owl population on the PNF above that resulting from the wildfire. Fire-killed tree removal within the analysis area would not impact either habitat or population trends on the PNF.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster

planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Barred owls (*Strix varia*) continue to have an apparent increase in distribution and numbers in the northern Sierra Nevada and may become an increasing risk factor to spotted owl (California Spotted Owl Module: 2007 Annual Report, 10 January 2008).The Plumas Lassen Administrative Study synthesis of barred-sparred owl records through 2007 indicates that there are a minimum of 41 individual site records across the northern Sierra Nevada. None of these detections have been located within either the Antelope Complex Fire or Moonlight Fire areas. It is uncertain as to what the long term impacts of wildfire and forest succession may have on barred owl abundance and distribution; in the short-term, suitable nesting and foraging habitat for this species, as inferred by barred owl habitat use during detections on the PNF, has been rendered unsuitable by wildfire.

Bioregional Habitat Status and Trend: (The following information is drawn from the MIS Report for this project. Please refer to this report for further analysis to Late Seral Closed Canopy Forests, of which this MIS species is associated). There are currently 994,000 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on public land in the Sierra Nevada (USDA 2008a). The trend is slightly increasing (from 7 to 9 percent within the last decade on public land).

The Moonlight and Antelope Complex fires resulted in the removal of 20 PACs on the PNF; thus currently there are 276 PACs across the PNF. It is expected that the spotted owl population on the PNF may decline in response to the loss of PACs and suitable nesting and foraging habitat to moderately high to high severity fire. The large scale fragmentation created by these stand replacement fires across 80,000 acres immediately reduced the spotted owl carrying capacity on the PNF that would not recover and support owl habitat for numerous decades. This large gap may also create a potential bottleneck impeding owl dispersion in the eastern most range of the species. The removal of fire-killed trees in unsuitable habitat would not cumulatively add to this potential population distribution decline. Restoration, in terms of accelerating the availability of mature conifer stands through reforestation as well as natural establishment, could eventually improve conditions for spotted owl re-occupancy.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, as well as incorporation of LOPs to reduce disturbance during critical periods if needed, alternative A of the Moonlight and Wheeler

Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the California spotted owl.

The proposed action would reduce long-term hazardous surface fuels on 14,755 acres that would accumulate over time if nothing was done. This fuel reduction would have a beneficial affect on future fire behaviors, including decreased fire intensity and rate of spread that could enhance suppression capabilities and firefighter safety. This could allow for increased protection of the developing stands, resulting from reforestation efforts, which could provide forested habitat suitable for owls (CWHR 4P to 4M) in approximately 90 years.

3.5.2.1.1.4 Northern Goshawk

There would be no direct effects to individuals or goshawk habitat. The greatest impact to the goshawk and goshawk habitat was the Moonlight and Antelope Complex fires. Within the analysis area (burn perimeter), prior to the fires, there was 45,660 acres of public land of suitable goshawk nesting/high quality foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 4,055 acres of public land that are suitable goshawk nesting/high quality foraging habitat located across the fire landscape within the analysis area

Alternative A would remove fire-killed or hazard trees from high and moderate severity burned areas, up to 14,755 acres, which do not support habitat considered suitable for goshawk. This action would not reduce live tree canopy cover, or degrade any nesting and foraging habitat for goshawk. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no post fire goshawk habitat would be logged, degraded and/or rendered unsuitable by the proposed action.

Table 66. Acres treated for fire-killed or hazard tree removal in areas formerly known as Northern goshawk PACs.

PAC #	ACRES PROPOSED FOR FIRE-KILLED TREE REMOVAL ALTERNATIVE A
T07	74
T08	38
T09	103
T13	122
T14	16
T24	14
T36	0
Total	366

Table 66 shows the acres treated in areas formerly known as Northern goshawks PACs. Approximately 366 acres of fire-killed tree removal would occur in areas formerly known as PACs. This fire-killed tree removal acreage is not suitable goshawk habitat due to fire effects. Table 66 is provided for information and for future acre accountability.

Removal of fire-killed trees that could be available for additional prey species if left on site may incrementally impose a decrease in habitat suitability for goshawks from pre and post treatment conditions. No suitable nesting or foraging habitat would be directly

affected by fire-killed tree removal, as only fire-killed trees within moderately high and high severity burn areas would be removed.

Cumulative Effects: The Stream fire burned a total of 3,600 acres in 2001. Prior to the burn the Stream fire areas supported 2,428 acres of suitable goshawk nesting habitat; after the fire there was 129 acres of suitable goshawk nesting habitat located across the fire landscape in five isolated stands. The Stream fire burnt approximately 89 acres of a 270 acre PAC (T08) at high fire severity (suitable habitat no longer suitable) and 29 acres at low severity, maintaining suitable foraging habitat conditions). Thus approximately 181 acres of this PAC was still intact. No goshawk nesting activity has been documented in this PAC since 1983. This PAC did not burn with the Antelope Complex.

In 2006 the Hungry fire burned 547 acres within the Middle Creek drainage; approximately 325 acres burned at low severity, 113 acres of moderate severity and 109 acres of high severity. Approximately 109 acres of suitable habitat (5M/4M) was converted to unsuitable nesting/foraging habitat while 61 acres was converted to more open foraging habitat (4P/5P). No goshawk PACs were impacted by the Hungry fire and none were impacted by the 75 acre Hungry Salvage Project in 2007. The Hungry Fire Salvage Project did not result in any additional unsuitable goshawk habitat.

Thus stand replacing wildfires (Moonlight, Antelope Complex, Stream, and Hungry fires) have resulted in a reduction of suitable goshawk nesting and foraging habitat of approximately 41,605 acres.

Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough R.D. and Dry Flat on the Beckwourth R.D.) were implemented in 2008. These two projects removed hazard trees from approximately 3,330 acres. None of these treatments enter the seven goshawk PACs that were removed from the PAC network.

Approximately 29,980 acres on public and private land (35 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative A. On public land, approximately 18,526 acres of fire-killed or hazard tree removal would occur under alternative A. This is 27 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 49,882 acres (73%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 11.7 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable northern goshawk habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity,

unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

The proposed action would reduce long-term hazardous surface fuels on 14,755 acres that would accumulate over time if nothing was done. This fuel reduction would have a beneficial affect on future fire behaviors, including decreased fire intensity and rate of spread that could enhance suppression capabilities and firefighter safety. This could allow for increased protection of the developing stands, resulting from reforestation efforts, which could provide forested habitat suitable for goshawks (CWHR 4P to 4M) in approximately 90 years.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative A of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Northern goshawk.

3.5.2.1.1.5 American Marten

Alternative A would remove fire-killed or roadside hazard trees from high and moderate severity burned areas (up to 14,755 acres) that do not support habitat considered suitable for marten. This action would not reduce live tree canopy cover, or degrade any denning, resting, and foraging habitat for marten. There would be no fire-killed tree removal from CWHR types still classified as 4M, 4D, 5M, 5D. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no marten habitat would be logged or rendered unsuitable by the proposed actions. There may be instances where individual live trees may be cut for safety purposes or to facilitate access to harvest fire-killed trees. These instances are expected to be rare and impacts to existing live tree stands minimal.

Treatments are proposed within the PNF draft carnivore network. Under alternative A, this project would treat 5,283 acres for fire-killed (or salvage) tree removal and 1,616 acres for roadside hazard tree removal, for a total of 6,899 treated acres within the carnivore network. As stated previously, little to no live trees would be removed or impacted by the project’s actions and there is expected to be no change in present CWHR types. The remaining CWHR 4M/4D/5M/5D stands, which provide suitable habitat and connectivity for the marten and other mesocarnivores, would not be treated and only minimally affected by this project (due to incidental removal of live trees for operability, which would be of minimal size and scale, and highly dispersed, and would have negligible effects on stand structure). .

The open road density within the project area is 2.62 miles of open road/square mile. Open road density would remain the same with this alternative. According to early habitat models (Freel 1991) this road density provides low-no habitat capability for the marten and other forest carnivores.

Cumulative Effects: The cumulative effects on marten are essentially the same described for spotted owl. See cumulative effects discussion for spotted owl elsewhere in this document.

Approximately 29,980 acres on public and private land (35 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative A. On public land, approximately 18,526 acres of fire-killed or hazard tree removal would occur under alternative A. This is 27 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 49,882 acres (73%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 11.7 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable marten habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Determination: Based on past survey work, it is likely that marten do not occur in the analysis area. Fire-killed or roadside tree removal under alternative A of the Moonlight and Wheeler Fires Recovery and Restoration Project would not impact either marten habitat or population trends on the PNF. Considering the rare chance that individuals are present in the analysis area, alternative A may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American marten.

3.5.2.1.1.6 Pallid Bat

Direct effects from the proposed actions are possible if this species occurs in the analysis area. Destruction of active roosts through felling or removal of fire-killed trees with hollows could displace or harm individual bats. Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment resulting in lowered reproductive success. These effects would be most severe during the breeding season (May 20 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. Activities conducted during the winter months can potentially disturb hibernacula sites (winter shelters), causing species arousal and use of crucial energy reserves.

There would be no habitat disruption or modification to rock outcrops, caves and mining adits. No man-made structures that could provide habitat for bats are planned for removal or modification, other than roads and culverts, both of which do not provide habitat. Fire-killed and hazard tree removal under this alternative proposes to treat 27% of FS lands in the analysis area, which leaves the majority of the burn area untreated and available for this species to utilize.

Cumulative Effects: Both the Hungry and Boulder Fires in 2006 created abundant fire-killed tree habitat. Both fires combined to burn a total of around 3,547 acres; approximately 324 acres of fire-killed tree removal occurred on these burned acres (9 percent). The availability of fire-killed trees for bat use in the Antelope Lake area is abundant.

Habitat attributes like large fire-killed trees would be removed or modified by the proposed action, which could result in direct mortality of bat species that may be roosting within the fire-killed tree. Cumulatively, approximately 29,980 acres on public and private land (35 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative A. On public land, approximately 18,526 acres of fire-killed or hazard tree removal would occur under alternative A. This is 27 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 49,882 acres (73%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 11.7 snags/acre. In the long-term, fire-killed or roadside hazard tree removal would not result in any additional unsuitable pallid bat habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed trees supporting habitat.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative A of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the pallid bat.

3.5.2.1.1.7Western Red Bat

Effects are similar as described for pallid bat except that impacts for this analysis are tied directly to impacts on cottonwood trees. Mature cottonwood trees suitable for red bat roosts are located along many stretches of perennial streams within the analysis area. Many of these large cottonwoods died as a result of fire. No cottonwood or other hardwood trees would be removed within salvage treatment units. Cottonwood tree removal in roadside hazard treatment units is possible if any are deemed hazardous but this is expected to be very limited (may even be non-existent). Therefore, it is possible there could be a minimal direct loss of habitat for this species. It is unknown as to what extent fire-killed trees, especially preferred riparian trees such as cottonwoods, are used by red bats, but if bats are using cottonwoods that are felled, direct mortality could occur.

Downstream of the fire, some cottonwood exists that could replace those consumed by fire and potentially removed as hazards.

Cumulative Effects: Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Determination: This species is relatively rare on the PNF but its presence in isolated areas, as well as the presence of cottonwood in the project area, warrants a determination that alternative A of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Western red bat.

3.5.2.1.2 USDA Forest Service R5 Management Indicator Species

3.5.2.1.2.1 Black-backed Woodpecker (BBWO)

With alternative A, 73 percent of the public land within the analysis area has no fire-killed or roadside hazard tree removal planned. Maintaining 73 percent of public land within the analysis area in an unsalvaged condition can benefit species closely tied to early post-fire conditions, including the BBWO (Kotliar et al. 2002).

In addition, one hundred and two snag retention areas, ranging in size from 7 to 27 acres, were designated over approximately ten percent (1,060 acres) of salvage treatment areas. Fire-killed tree removal is not proposed within these snag retention areas. Primary selection criteria for snag retention areas were: 1) areas formerly identified as Spotted Owl PACs; 2) along treatment unit boundaries adjacent to non-burned and low severity areas; 3) within RHCAs; and 4) in stands that supported a minimum of 40 percent canopy cover pre-fire.

Within salvage treatment units, the proposed action calls for the removal of fire-killed trees 14 inches or 16 inches dbh and larger. Within helicopter and skyline units this would result in the retention of smaller fire-killed trees (less than 15.9 inches dbh) scattered and clumped across all 6,219 acres of helicopter and skyline units. Small fire-killed tree density within these units would be around 32 fire-killed trees/acre between 10 inches and 14.9 inches dbh. In the 8,536 acres of tractor units under this alternative, (4,147 acres within salvage units, 4,389 acres within roadside hazard tree units) as a result of both

sawlog and biomass proposed for harvest, there would be no small fire-killed tree availability, except in snag retention areas and RHCA equipment restriction zones.

Snags would be retained to meet Riparian Management Objectives (RMOs) for down woody debris recruitment. Snags greater than 15 inches dbh would be retained at 4 snags/acres in all treated RHCAs. RHCAs have been incorporated into the 10 acre (average) snag retention areas where appropriate.

Black-backed woodpecker chicks that are present within the treatment units and have not yet fledged by July 30, 2009, the scheduled start of implementation, could be directly killed due to removal of occupied nest trees. Possible direct mortality of chicks could occur in 2010 as well if harvest units remain and are scheduled to be treated during the nestling stage.

Cumulative Effects: Prior to the Antelope Complex fires, there was approximately 1,488 acres of habitat classified as snags in burned forest within the analysis area (created from the 2001 Stream Fire). Within this portion of the Stream Fire area, approximately 221 acres in nine units were salvage logged in 2003. On average snags were distributed across the salvage units at 4-6 snags/acre. The remaining 1,267 acres of the Stream Fire area within the analysis area were not salvage logged (did not have fire-killed tree removal) and now are burnt forest habitat supporting a high density of medium and large snags/acre; this habitat is seven to eight years old. Due to its age, habitat in the Stream Fire has probably declined in habitat suitability for BBWO.

Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough Ranger District and Dry Flat on the Beckwourth Ranger District) were implemented in 2008. These two projects removed roadside hazard trees from approximately 3,330 acres.

The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract and ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area. In addition to these public land projects, approximately 11,454 acres of the 19,238 acres of private land within the analysis area was salvage logged in 2007 and 2008.

Table 67. Cumulative amount of BBWO suitable habitat remaining post treatments (public land).

Alternative A (proposed action) Cumulative				
CWHR Type (pre-fires)	Created BBWO Habitat in Analysis Area	Cumulative Acres (all projects) BBWO Habitat Planned for Fire-killed or Roadside Hazard Tree Removal under Alt A	Post Moonlight and Wheeler Project Habitat Available for BBWO	
			Acres Remaining	% Remaining
CWHR 4M/4D	17,896	6,234	11,662	65%
CWHR 5M/5D	14,673	6,163	8,510	58%
Total	32,569	12,397	20,172	62%

Approximately 32,569 acres of public land within the analysis area is considered suitable BBWO habitat as a result of high to moderately high severity fire burning through pre-fire 4M, 4D, 5M, and 5D. Table 67 shows the cumulative amount of BBWO habitat remaining on public land. All proposed or ongoing fire-killed tree removal project acreage within the analysis area (this project, two roadside hazard projects, and two smaller salvage projects) are accounted for in Table 67. Approximately 12,397 of these acres under alternative A would become unsuitable after post fire-killed or roadside hazard tree treatments, leaving 20,172 cumulative acres of suitable BBWO habitat.

Table 68. Cumulative amount of moderately high to high (>50 BAM) severity salvaged and unsalvaged in the wildlife analysis area (public land).

Total Acres Mod-High Severity in Analysis Area	Moonlight and Wheeler Project Acres Proposed for Dead or Hazard Tree Removal	Acres Proposed for Salvage (all other projects)	Acres Un-salvaged	% of Mod-High Severity Unsalvaged
	Alt A			
47,825	13,295	1,894	32,636	68%

Table 68 indicates that, under alternative A, 68 percent of the analysis area classified as high severity to moderately high severity burn would not be salvage logged. Areas untreated would continue to be available as BBWO habitat somewhere between 5 and 7 years. After this time period, the quality of foraging habitat declines because the fire-killed wood habitat no longer supports prey species that BBWOs consume.

Snag density estimations post treatment on public land within the analysis area has been done. Snag numbers reflect cumulative effects, that is, all Forest Service projects ongoing or proposed that are/would remove fire-killed trees, and are averaged across the landscape (public land within the analysis area – 68,408 acres).

Implementation of all projects under alternative A results in an estimated post harvest snag density (greater than 15 inches dbh) across the 68,408 acres of public land of 11.7 snags/acre. The cumulative amount of snags 10 inches to 14.9 inches dbh post harvest under this alternative is estimated to be 26 snags/acre.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Private timberlands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the summer of 2008 fire salvage harvest has been occurring on these lands. Over 11,400 acres have been salvage harvested to date and, although additional salvage may take place, future salvaged acres on private land is expected to be minimal. Private fire salvage projects have occurred mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees within these private parcels. It is reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Implementation of fire-killed or roadside hazard tree removal on 14,755 acres of 68,408 acres of public land as designed, in combination with past, present and reasonably foreseeable future actions would result in a decline in BBWO habitat availability and distribution across the PNF. That being said, there would still be short term population increase resulting from the suitable habitat remaining after the proposed project.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Black-Backed Woodpecker Trend. In 2008, a pilot study for black-backed woodpecker monitoring was conducted in the Sierra Nevada (Siegel et al. 2008). Black-backed woodpeckers were detected at 68 of 371 survey stations, in 10 of the 19 fire areas. Occupied sites were well distributed across the Sierra Nevada national forests, ranging from the Lassen NF to the Sequoia NF. This included two sites surveyed in or adjacent to the Moonlight and Wheeler Project analysis area: the Moonlight Fire (due west of Antelope Lake – 16 of 24 stations with BBWO detections and the Boulder Complex Fire (north of Antelope Lake) – 11 of 22 stations with BBWO detections. Detections occurred in every major pre-fire CWHR habitat type surveyed; occupied fire areas ranged in size from small (170 ha, 420 ac) to very large (26,159 ha, 64,639 ac) and ranged from 1 year post-fire to 7 years post-fire. Detections occurred at stations in all three fire severity classes, but more severely burned forest stands were more likely to be occupied (7.8% of the low-severity stations, 17.2% of the moderate-severity stations, and 25.2% of the high-severity stations). BBWOs still occupied fires 7 years old (3 of the 4 seven-years post-fire sites surveyed were occupied). The two sites surveyed where only 1 year had elapsed since fire were

occupied, which supports other studies regarding the ability of this species to quickly find and colonize new habitat patches.

The pilot study results indicate that the black-backed woodpecker is "widely distributed across recently burned forest stands in the 10 Sierra Nevada national forests." Black-backed woodpeckers were detected at numerous fire areas where at least some degree of post-fire logging had occurred (e.g., Boulder Complex Fire, Bassetts Fire) or was in process. Most of these sites had nearby patches of unlogged habitat. However, in two of the fires surveyed (Kibbie and Vista), black-backed woodpeckers were abundant in areas that had not been salvage logged, but absent from the areas that clearly had been salvaged logged.

A query of wildfires between 2000 and 2008 that burned in and around the Tahoe, Plumas, Lassen, and Modoc National Forests and were greater than 1,000 acres was done to obtain a ballpark figure of how much potential habitat is available in the northeast California region (Yasuda, pers. comm. 2009). Of the 51 fires queried, 107,566 acres on forested National Forest lands burned at high severity (i.e. fires which burned at a composite Burn Index value of 4 defined in Miller and Safford (2008) as "Areas where high to total mortality of the vegetation occurred"). The Forest Service Activity Tracking System (FACTS) showed that 9,050 acres were salvaged in these fire areas, leaving 98,516 acres (92%) in an unsalvaged state. After the estimated BBWO suitable acreage to be removed under Alternative A (12,397) is deducted, 86,119 acres (80%) of forested (conifer) areas in this region which burned at high severity between 2000 and 2008 would still support potential BBWO suitable habitat.

The cumulative effect of the Moonlight and Wheeler Project in terms of changes in medium-sized and large-sized snags per acre within burned forest habitat would change from the existing condition. With implementation of the Moonlight and Wheeler Project, there would be a reduction in burned forest habitat supporting snags thus potentially reducing habitat that could support BBWO. Thus the potential for the analysis area to support BBWO declines post project implementation. But overall, post-project, the analysis area still leaves untreated the majority of suitable habitat created by the two fires. Alternative A would not alter the existing trend in the ecosystem component, nor would it lead to a change in the distribution of black-backed woodpecker across the Sierra Nevada bioregion."

Conclusion: All action alternatives, combined with ongoing and planned fire-killed tree removal projects, leave more area unharvested than harvested within the analysis area. The cumulative amount under alternative A (18,526 total estimated acres treated, would leave about 73 percent of public land unharvested. Hutto (2006) recommends as a management priority retention of some burned forest 0-5 years after a fire because that is the narrow window of time during which the biologically unique early postfire conditions become established and persist. Leaving the majority of the burn in an unharvested condition maintains an important component of biological diversity identified by Hutto (2006): "all the unique plants and animals that depend on those first few years of natural (postfire) succession. This includes the BBWO.

Prior to the Moonlight and Antelope Complex fires, there was approximately 1,267 acres of burned snag habitat within the analysis area (from the 2001 Stream Fire). Assuming BBWO densities @ 3.2/40 ha in burned forest (1 pair/32 acres) (Bock and Lynch 1970)

or 1 pair/500 acres) (Raphael and White 1984 in NatureServe 2007), this habitat (snags in burned forest) potentially supported between 2 and 39 pair of BBWOs between 2002 to 2007.

In 2007, the Moonlight and Antelope Complex fires combined burnt over 87,000 acres. Within the 87,647 acre analysis area (the two fire perimeters), approximately 32,659 acres of suitable BBWO habitat was created by high severity fire. This provides enough habitat (snags in burned forest) to theoretically support an additional 65 to 1,020 pairs. Thus the Moonlight and Antelope Complex fires created an upward trend in BBWO habitat from existing conditions that could have increased the short term trends in woodpeckers in the analysis area.

3.5.2.1.2.2 Benthic Macroinvertebrates

Project design as described above describes the large areas of public land within the analysis area where coarse woody debris would be maintained and recruited. Table 69 shows the indicator measures for coarse woody debris.

Table 69. Measures for coarse woody debris amounts and recruitment

	Alternative A
Avg. Tons/Ac of Coarse Woody Debris (short-term: Post-harvest)	0.5 – 4.3
Avg. Tons/Ac of Coarse Woody Debris (long-term: 30 years)	0.8 – 12.4
Avg. number of snags > 15” available for large woody debris recruitment to streams(Short-term: Post-harvest)	4-6 of the largest snags per acre in treated RHCAs
Percent of Acres in RHCAs planted	100%

Treatments in alternative A include snag retention areas and snag recruitment within RHCAs both of which retain snags that would serve as recruitment for coarse woody debris. Within RHCAs of tractor, helicopter and skyline units, generally four to six of the largest snags per acre would be retained, preferably within falling distance of the channel where available, to provide for large down woody debris recruitment to best meet riparian management objectives. Within ground-based salvage harvesting treatments, snag retention in RHCAs would be most preferable and efficient within equipment exclusion zones where snags would be within reasonable falling distance of the channel for coarse woody debris recruitment and harvesting safety issues would be minimized due to equipment exclusion. Fire killed trees will be harvested within the RHCAs, reducing the potential LWD recruitment into perennial and intermittent streams as well as reducing shade provided by these trunks; all green trees and four to six of the largest snags per acre would be retained in the RHCAs which would continue to contribute both LWD recruitment and shade.

Post-fire mortality of fire-injured trees, particularly within Moderate and High vegetation burn severity areas, would occur in the first three to five years immediately following the fire event. Snag recruitment and coarse woody debris recruitment would continue to occur within these areas as well.

Because all standing dead under 16 inches dbh are left in the helicopter and skyline cable units in Alternative A, recruitment for LWD is greatest (Watershed Report, table 8). Because of biomass removal of standing dead below 16 inch dbh, and harvest of standing dead above 16 inch dbh, LWD amounts in tractor units are estimated to decrease in time from 7.3 tons per acre on the average to 5.6 tons per acre on the average 30 years after the fire. There will be some recruitment from those fire damaged trees that will die 3 to 5 years after the fire. In treated areas of tractor units, there are wildlife snag retention stands to meet minimum snag standards (LRMP as amended). There will be some recruitment from retention of four to six of the largest snags per acre within falling distance of perennial and intermittent streams.

The wildfire consumed both riparian and conifer vegetation that provide surface water shade. Thus up to 100 percent of existing vegetation providing shade has been removed. No live vegetation currently providing minimal shade would be removed by the action alternatives, thus no immediate change in water surface shade is expected. Fire-killed trees provide a minor amount of shade, thus some structural shade would be removed, but amount of shade provided by fire-killed trees is much less than prior to the fire and probably not very influential in terms of water temperatures. There would be some loss of large diameter snags adjacent to the perennial streams within helicopter units, yet the retention of four to six of the largest snags per acres within these RHCAs would minimize this effect. Large woody retention/recruitment within RHCAs of perennial and intermittent streams would result in a large flush of woody material over the next 10 years and then no recruitment for the next 50+ years. Vegetative response post fire by riparian species would help recover surface water shade within two-five years (USDA 2009d).

Water temperature has the potential to warm up slightly within the helicopter and skyline units due to removal of large diameter trees that provide some shading to the stream. This effect would be indirect and should be minimal. In addition within the tractor units; areas outside of the snag retention zones and RHCAs would be devoid of all snags greater than 14 inches dbh and thus any shade larger diameter snags provide would be lost. There is the potential for increased temperatures due to lack of forested or “snag” cover in the short term, and increased conifer cover in the long term (10-15 years) with the growth of the planted conifers throughout the units harvested. The potential for a short term increase in temperature could affect the timing of life histories of sensitive aquatic macroinvertebrates.

Changes in stream flow, above the levels that may have increased due to vegetative removal by fire, are not expected to increase with removal of fire-killed trees. Therefore direct affects of tree removal of fire-killed trees, reforestation and minor road construction would not impact perennial or intermittent stream flows.

Cumulative Effects: Sediment delivery to streams is related to the cumulative watershed effects analysis (USDA 2009f), and findings are that there is little difference between the action alternatives and the no action alternatives due to the adverse effect of the wildfire. The impacts of all action alternatives would not be higher than that of the wildfire, though the salvage activities would prolong natural recovery from 2 to 5 years (ibid). The steep slopes, though more erosive, would return to natural fire recovery within two years, while the shallow slopes where ground based systems are used would return fire recovery

within 3-5 years. Slope restrictions for ground based harvest under 25 percent slope would lower erosion potential on 2,196 acres under alternative A.

Flow changes depending on the water year. The overwhelming effect to hydrologic function, in any of the alternatives, is that of cover loss and potential for widespread overland flow. With a high water event there would be potential for a debris flow to occur within the stream courses in those watersheds. “Overland flow can be initiated when surface infiltration capacity is drastically reduced. The effect of wildfire in the event of high intensity rainfall is comparably much higher than roads or harvest” (USDA 2009f). There is a minimal change in the TOC/ERA values with the implantation of alternative A and the greatest effect to flow would be within those seventeen watersheds analyzed that are currently over threshold prior to the implementation of action alternatives and would remain over threshold. The existing flow condition should remain the same post project unless large water event occurs thus impacting the existing macroinvertebrate habitat.

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use.

Conclusion: The direct/indirect and cumulative effect of dead tree removal, roadside hazard tree removal, and reforestation would not change the existing amount of riverine or lacustrine habitat, would not change the amount of montane riparian habitat present in the project area, would not result in any reduction in deciduous canopy closure, or result in a change in size class of existing riparian vegetation. No live trees (deciduous or coniferous) would be removed. Thus the amount of total live tree canopy cover would not be reduced. Grazing should have little impact on riparian vegetation and meadow recovery. Changes in flow and water surface shade will be too small to be measured. Sedimentation is expected to increase as a result of vegetative removal caused by the wildfire. With Alternatives A some short term increase of sedimentation is expected from soil disturbance with tractor logging. This action may extend the timeline for habitat recovery and pre-fire macroinvertebrate community.

The watershed report (USDA 2009f) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including habitat occupied by macroinvertebrates.

Population Status and Trend Summary for the Sierra Nevada National Forests. Current data from the Sierra Nevada indicate that status and trend for benthic macroinvertebrates based on River Invertebrate Prediction and Classification System scores is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Aquatic Macroinvertebrates Habitat Trend. The responses to the key factors identified for macroinvertebrate habitat would be affected by wildfire. As with numerous studies (included in Roby & Azuma 1995, and in Minshall, 2003), it is expected that stream temperatures, stream flows and nutrient levels will all increase in the short term, and that long term increase in sediment production and deposition will occur. The response of the macroinvertebrate community will also follow similar findings: partial recovery will occur quickly (1-5 years), species diversity will be higher than pre-fire but species richness would be lower, and long term recovery of the macroinvertebrate community may take 10-50+ years. With salvage logging, the timeframes for recovery may be extended. Recovery of stream ecosystems from the effects of fire is likely to be slower, more sporadic, and potentially incomplete in cases where natural process is impaired (Minshall, 2003). Rapid recovery of stream macroinvertebrates is associated with the more rapid recovery of the riparian vegetation (Ibid).

Based on the direct/indirect and cumulative effects of the action alternatives as well as the no action alternative, the status and trend of in-stream habitat and the macroinvertebrate community would be negatively impacted for the short term, but long term restoration and recovery would occur 10-50 years out. This impact could occur in approximately 10.5 miles of perennial streams within the project area. These short term impacts at the project level are too small to have any affect at the larger scale and thus will not alter the existing trend in the habitat or aquatic macroinvertebrates across the Sierra Nevada bioregion.

3.5.2.2 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

3.5.2.2.1 USDA Forest Service R5 Sensitive Species

3.5.2.2.1.1 Mountain Yellow-legged Frog

Degraded conditions within watersheds as a result of the fires would continue. Post-fire (0-5 years) sediment loading to aquatic habitats would be higher than pre-fire levels because of the decrease in ground cover and bank stability provided by live vegetation and the resulting increase in soil movement. Sediment inputs should decrease over time as groundcover increases, vegetation re-establishes, and stream banks stabilize.

Two of the three watersheds with known MYLF populations, Lower Lone Rock Creek and West Branch Light Creek, currently exist above TOC (Table 104). These two watersheds are susceptible to very high cumulative effects risk, such as erosion and large movement of sediment into streams. Lower Indian Creek watershed, suspected of having MYLF but with no detections to date, is also over TOC and at very high risk. Pierce Creek watershed exists below TOC but the risk of cumulative effects is still considered high.

Cumulative Effects: There is over 19,000 acres of private land within the analysis area. Cumulative effects from private land use (timber and gravel extraction, fire salvage harvest, livestock grazing, and urbanization) would continue to create water quality problems, including sedimentation and bank cutting.

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed, which supports a well distributed population of MYLFs on Forest Service land, is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing riparian vegetation and streambanks to recover.

Determination: Alternative B may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the mountain yellow-legged frog.

3.5.2.2.1.2 Bald Eagle

There would be no direct or indirect effects on individual bald eagles or bald eagle habitat, similar to the action alternatives, as no action would occur within the BEMA or within territories. There would be no “out of normal” road use, thus no need for LOPs. The cumulative effects mirror those described above with the action alternatives.

Determination: Alternative B would not affect individual bald eagles or bald eagle habitat.

3.5.2.2.1.3 California Spotted Owl

There would be no direct effects to individuals or owl habitat. The greatest impact to the spotted owl and spotted owl habitat was the Moonlight and Antelope fires. Within the analysis area (burn perimeter for both fires), pre-fire, there was 44,483 acres of public land that was suitable spotted owl nesting/foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is approximately 3,646, acres of suitable spotted owl nesting/foraging habitat located across the analysis area fire landscape.

Twenty five spotted owl PACs (and twenty-eight HRCAs)were present within the project area prior to the Moonlight and Antelope Complex fires and effects to habitat as a result of the fire are displayed in Table 63. Of these PACs twenty are determined to no longer function as intended due to loss of habitat and have been removed from the PNF PAC network.

The majority of the burn area is considered unsuitable habitat for spotted owl, and probably would remain unsuitable nesting habitat for 125+ years. Intraspecific competition for quality nesting and foraging habitat outside the burn may increase between owls that used the project area prior to the fire. Within the analysis area, there could be increased intra specific competition for nesting and foraging habitat as a result of a loss of 40,837 acres (public land) of owl habitat in the landscape, forcing owls to share less habitat acres. Elimination or modification of habitat may cause a shift in owl PAC/home range use. Owls may move out of the area affected and seek unoccupied suitable habitat elsewhere. When this shift occurs, displaced owls could be entering

another pair's home range. Increasing the density of owls could result in an additional net loss of owl pairs in the area.

The Montane Chaparral type that would persist with the no action alternative provides unsuitable owl habitat. Prey species preferred by spotted owls (woodrats and flying squirrels) would likely avoid the recent burn area. As the MCP or SMC1-2 habitat matures, woodrats may re-colonize as they are known to utilize earlier successional habitats, especially along edges of shrub fields and conifer/oak stands (Mayer and Laudenslayer, 1990 and personal observation). Flying squirrels would likely be absent in high intensity burn areas until mature conifer habitat develops. The edges between unburned forest or low severity burned patches along the fire perimeter could provide habitat for these prey species. The small patches of forested habitat within the burn that burned at low severity are isolated by large expanses of unsuitable habitat; these patches may be marginal for foraging spotted owls due to the isolation from the forest interior.

Table 70. Cumulative acres of proposed and current post-fire treatments in the wildlife analysis area – Alternative B (no action).

	Acres proposed for fire-killed/hazard tree removal under Alt B (no action)	% of analysis area	% on public lands
Moonlight and Wheeler Project	0	0%	0%
Antelope RSHTR Project	2,036	2%	3%
Dry Flat RSHTR Project	1,294	1%	2%
Camp 14 Project	249	0%	0%
North Moonlight Project	192	0%	0%
Private Land salvage	11,454	13%	n/a
Total on public land	3,771	4%	6%
Total: public and private land	15,225	18%	n/a

Table 70 shows that, under the no action alternative, cumulatively, 3,771 acres of public land have been or would be treated for fire-killed tree removal or roadside hazard tree removal. This is approximately 6% of public land in the analysis area. The remaining untreated acreage (96% of public land), especially dense, forested stands which burned at high intensity, would experience a significant amount of long-term surface fuel loading accumulating over time. In such untreated areas there would be increased risk associated with future fire behaviors, including increased fire severity and rate of spread that could reduce suppression capabilities. This could allow for increased risk to habitat recovery by burning up any reforested (naturally or artificially) stands. Thus the no action alternative does not provide for accelerated recovery and restoration of owl habitat. This alternative may affect, but not likely to lead to federal listing or loss of viability, of the California spotted owl.

3.5.2.2.1.4 Northern Goshawk

There would be no direct effects to individuals or goshawk habitat. The greatest impact to the goshawk and goshawk habitat was the Moonlight and Antelope Complex Fires. Within the analysis area (burn perimeter), prior to the Moonlight and Antelope fires, there was 45,660 acres of public land are suitable goshawk nesting/high quality foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 4,055 acres of public land that are suitable goshawk nesting/foraging habitat located across the fire landscape within the analysis area.

The majority of the burn area is considered unsuitable habitat for goshawks, and probably would remain unsuitable nesting habitat for 125+ years. Intraspecific competition for quality nesting and foraging habitat outside the burn may increase between goshawks that may have used the project area prior to the fire.

The Montane Chaparral type that would persist with the no action alternative provides some low suitability foraging habitat in all seral stages for goshawks (CWHR Version 8.0). Goshawks prey on small mammals as well as catch birds on the wing. They then perch on plucking posts to feed. These plucking posts are usually located within forested stands, providing an element of security cover for feeding goshawks. The edges between unburned forest or low intensity burned patches within the interior of the burn are attractive edges to a variety of prey species for goshawk (jays, flickers, golden mantled ground squirrel). The small patches of forested habitat within the burn that burned at low intensity can serve as areas for plucking posts and where goshawks can perch and work the edges for foraging.

Please refer to the spotted owl no action cumulative effects section previously and Table 70 for a summary and discussion of cumulative post-fire treatments within the analysis area.

The no action alternative does not provide for accelerated recovery and restoration of goshawk habitat. This alternative may affect, but not likely to lead to federal listing or loss of viability, of the northern goshawk.

3.5.2.2.1.5 American Marten

There would be no direct effects to individuals or marten habitat. The greatest impact to the marten and marten habitat was the Moonlight and Antelope Complex Fires. Within the analysis area (burn perimeter), prior to the Moonlight and Antelope fires, there was 544,055 acres of public land that are suitable marten denning/foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 3,874 acres of public land that are suitable marten nesting/foraging habitat located across the fire landscape within the analysis area.

The majority of the burn area is considered unsuitable habitat for marten, and probably would remain unsuitable nesting habitat for 125+ years. The Montane Chaparral type that would persist with the no action alternative does not provide any suitable habitat in all seral stages for marten. Since this species avoids areas of open canopy cover, if individuals are present they would likely avoid large areas of the Moonlight and Antelope Complex fires until a dense conifer overstory develops. This would include the 3,874 acres of public land remaining suitable within the analysis area since they are largely in a discontinuous arrangement and isolated by large expanses of unsuitable habitat.

The open road density within the project area is 2.62 miles of open road/square mile. Open road density would remain the same with this alternative. According to early habitat models (Freel 1991) this road density provides low-no habitat capability for the marten and other forest carnivores.

Please refer to the spotted owl no action cumulative effects section previously and Table 70 for a summary and discussion of cumulative post-fire treatments within the analysis area.

The no action alternative does not provide for accelerated recovery and restoration of goshawk habitat. This alternative may affect, but not likely to lead to federal listing or loss of viability, of the American marten.

3.5.2.2.1.6 Pallid Bat

The Moonlight and Antelope Complex fires created open habitats and large snags which are used by pallid bat. Insects invading fire-killed trees in the fire area would provide prey for this species in the area. As the montane chaparral matures and forms dense brush fields, foraging habitat quality would decline for pallid bats since they capture prey on the ground. The large snags would provide roosting habitat for pallids; the small amount of black oak (live and fire-killed) would be retained. Snag densities (greater than 15 inches dbh) with the no action alternative would be higher across the landscape than with the action alternatives (16.8 snags/acre with no actions versus 11.7 to 13.3 snags/acre with cumulative actions). The no action alternative would not affect the pallid bat.

3.5.2.2.1.7 Western Red Bat

There would be no reduction in fire-killed trees across the landscape or within RHCAs. The large cottonwoods along riparian corridors that survived the fires would provide for red bat roosts. The multiple edges produced by the mosaic burn pattern, as well as the fire perimeter, create habitat preferred by red bats. This alternative would not affect the Western red bat.

3.5.2.2.2 USDA Forest Service R5 Management Indicator Species

3.5.2.2.2.1 Black-backed Woodpecker (BBWO)

No fire-killed tree removal would occur with this alternative. Snag densities (greater than 15 inches dbh) averaged across the analysis area with the no action alternative would be approximately 16.8 snags/acre.

Cumulative Effects: Cumulatively the only fire-killed trees removed from the analysis area would be those within the two roadside hazard tree projects (3,330 acres) and the two salvage sales (441 acres). Table 71 indicates that, under the no action alternative, cumulative post-fire treatments would remove fire-killed trees from 1,246 suitable BBWO acres, with 96% suitable acres left untreated. It was estimated that snag densities post hazard removal would average about 2 snags greater than 15 inches dbh/acre within the hazard tree zones, as not all fire-killed trees created by fire would be deemed hazards. No fire-killed trees greater than 15 inches dbh is expected to remain within the 441 acres treated under the two salvage projects. This leaves a total of 64,637 public land acres untreated that would support all fire-killed trees created by the two fires.

Table 71. Cumulative amount of BBWO suitable habitat remaining post treatments under the no action alternative (public land).

		Alternative B (no action) Cumulative		
CWHR Type (pre-fires)	Created BBWO Habitat in Analysis Area	Cumulative Acres (all projects) BBWO Habitat Planned for Fire-killed or Roadside Hazard Tree Removal under Alt B	Post Moonlight and Wheeler Project Habitat Available for BBWO	
			Acres Remaining	% Remaining
CWHR 4M/4D	17,896	888	17,008	95%
CWHR 5M/5D	14,673	358	14,315	98%
Total	32,569	1,246	31,323	96%

Private timberlands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the summer of 2008 fire salvage harvest has been occurring on these lands. Over 11,400 acres have been salvage harvested to date and, although additional salvage may take place, future salvaged acres on private land is expected to be minimal. Private fire salvage projects have occurred mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees within these private parcels. It is reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

3.5.2.2.2.2 Benthic Macroinvertebrates

As salvage logging may extend the timeframes for in-stream habitat recovery and restoration of the macroinvertebrate community, the no action alternative, may reduce the timeframe for this recovery. There would be no short-term reduction in macroinvertebrate habitat above that affected by wildfire. Flows and sedimentation would still increase, and surface water shading would still be minimal, due to lack of vegetation caused by wildfire.

In the long term, no fuels treatment would leave habitat vulnerable to high severity wildfire in the future, increasing the risk of a large downstream hydrologic event reducing the quality of habitat for macroinvertebrates.

Streams within the Moonlight and Wheeler project aquatic analysis area are not expected to change flow due to the no action alternative. For example all twenty-four perennial streams within the aquatic analysis area are expected to remain perennial, all intermittent streams are expected to remain intermittent and the same for ephemeral streams. Due to vegetation removal by wildfire, it is expected that there could be some short term increases in flow, depending on the water year. "The wildfire left the landscape in a very risky condition for flooding and slope erosion within the next two to three years as slopes revegetate." (USDA 2009g). There would be no change in the Threshold of Concern/Equivalent Roaded Acres (TOC/ERA) values by the implementation of alternative B and the greatest effect to flow will be within those seventeen of the twenty-six watersheds analyzed that are currently over threshold post fire and will remain over threshold. With a high water event there would be potential for a debris flow to occur within the stream courses in those watersheds. Table 72 shows the indicator measures for coarse woody debris.

Table 72. Measures for coarse woody debris amounts and recruitment

	Alternative B
Avg. Tons/Ac of Coarse Woody Debris (short-term: Post-harvest)	0.5
Avg. Tons/Ac of Coarse Woody Debris (long-term: 30 years)	12.4
Avg. number of snags > 15" available for large woody debris recruitment to streams(Short-term: Post-harvest)	>15.6 snags per acre
Percent of Acres in RHCAs planted	0%

Snag recruitment and coarse woody debris recruitment would continue to occur within the project area. There would be a greater number of snags into the future without the implementation of the actions alternatives. Fuel loading would be very high and increase the potential for a catastrophic wildfire without any treatment or fuel removal within the project boundary.

Natural recovery would occur. Snags provide structure and some cover into the future, yet recovery of the conifers and the associated shade they provide within the RHCA would be delayed into the future.

Stream temperature would remain the same as the existing post fire condition. With the high fuel loading there would be a greater potential of another catastrophic wildfire within these perennial and intermittent drainages, thus with a future potential of affecting the timing of life history activities of sensitive taxa.

Sedimentation rates into the perennial and intermittent drainages will remain the same post fire condition. TOC values will remain the same. The River Invertebrate Prediction

and Classification System score should remain the same, unless a high water event or rain on snow event occurs within the sensitive watersheds.

Cumulative Effects: Other hazard tree removal projects, private salvage operations, mining, livestock grazing, as described above under Alternatives A cumulative effects section would continue. Changes in flow, water surface shade will be too small to be measured. Sedimentation is expected to increase as a result of vegetative removal caused by the wildfire. There would be no logging thus the risk of additional sediment delivery to the riverine systems is minimal.

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use.

Changes in flow, water surface shade will be too small to be measured. Sedimentation is expected to increase as a result of vegetative removal caused by the wildfire. Timeframes for recovery of in-stream habitat may be reduced compared to action alternatives.

The watershed report (USDA 2009f) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including habitat occupied by macroinvertebrates.

Population Status and Trend Summary for the Sierra Nevada National Forests. Current data from the Sierra Nevada indicate that status and trend for benthic macroinvertebrates based on River Invertebrate Prediction and Classification System scores is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Aquatic Macroinvertebrates Habitat Trend. The responses to the key factors identified for macroinvertebrate habitat would be affected by wildfire. As with numerous studies (included in Roby & Azuma 1995, and in Minshall, 2003), it is expected that stream temperatures, stream flows and nutrient levels will all increase in the short term, and that long term increase in sediment production and deposition will occur. The response of the macroinvertebrate community will also follow similar findings: partial recovery will occur quickly (1-5 years), species diversity will be higher than pre-fire but species richness would be lower, and long term recovery of the macroinvertebrate community may take 10-50+ years.

Summary of Aquatic Macroinvertebrate Status and Trend at the Bioregional Scale: The status and trend at the bioregional scale would remain stable.

3.5.2.3 Alternative C – Direct, Indirect, and Cumulative Effects

3.5.2.3.1 USDA Forest Service R5 Sensitive Species

3.5.2.3.1.1 Mountain Yellow-legged Frog (MYLF)

Potential direct effects from the proposed project include impacts to individual frogs during activities. Possible direct effects from alternative C on Forest Service R5 aquatic sensitive species include crushing of individuals if they are present during project activities. The use of a fellerbuncher within the RHCA has the potential of directly injuring or killing frogs. The potential for direct impacts to individuals is greatest during wet periods and in early fall, when frogs are most likely to disperse from aquatic habitats.

There are three watersheds that have known MYLF populations. Approximately 470 RHCA acres under alternative C would be treated in these watersheds for fire-killed tree removal, Table 73. Treatments within these RHCAs would increase the potential for direct effects, as frogs are put at risk of being killed/injured with falling and yarding activities.

Table 73. Treatment acres under Alternative C within watersheds with known MYLF populations.

Watersheds with MYLF Populations	Watershed Acres Treated	Acres treated in RHCA
L. Lone Rock C.	349	103
Pierce C.	319	105
West Branch Lights C.	1520	262
	Total	470

Sheltering habitat for MYLFs also includes landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs. A reduction in fire-killed wood would result in a lack of connectivity and cover for frogs that could possibly move out of Lone Rock Creek and into the floodplain, the RHCAs, and upland habitats. Possible indirect effects to frogs using the RHCA for dispersal, and over wintering may include a reduction in cover provided by woody debris, warmer and drier microclimate conditions due to removal of fire-killed trees in RHCA areas, and reduction in connectivity provided by woody debris between aquatic habitats, RHCAs, and uplands. Cover for aquatic-dependent species and effective soil cover in this post-fire environment are very important for the proper functioning of aquatic and riparian habitats until vegetation can reestablish and provide these habitat elements (5-30+ years). As vegetation reestablishes, the role of the standing fire-killed and downed wood would be reduced.

The PNF conducted a 3-year telemetry study on the MYLF to determine the degree of overland movements into RHCA in order to minimize impacts from fuel reduction efforts across the forest (Wengert 2008). The 3-year study found that MYLF have very limited movements into upland habitats or adjacent riparian areas. For example, during the 3-year study, only one movement greater than 1 meter occurred away from the wetted stream

channel into riparian or upland habitat. This movement by 1 MYLF was recorded at 77 feet away from the wetted stream channel. The study concluded that off-stream channel movements were very rare and that in-stream movements within and up and down the wetted stream channel were common and frequent traits of MYLF behavior. Therefore, the project design features and mitigations which include RHCA equipment restriction zones, Best Management Practices (BMPs) to prevent water quality degradation (Appendix C, Table C-1) and Riparian Management Objectives standards (in project record) should provide adequate protection to minimize impacts to the MYLF within riparian or upland habitats.

Cumulative Effects: The following discussion on watershed conditions within the analysis area is drawn from the Moonlight and Wheeler Fires Recovery and Restoration Project Watershed Report (USDA Forest Service 2008).

Two of the three watersheds with known MYLF populations, Lower Lone Rock Creek and West Branch Light Creek, currently exist well above TOC (Table 104). These two watersheds are susceptible to very high cumulative effects risk, such as erosion and large movement of sediment into streams. Lower Indian Creek watershed, suspected of having MYLF but with no detections to date, is also over TOC and at very high risk. Pierce Creek watershed exists below TOC but the risk of cumulative effects is still considered high.

Table 74. Cumulative condition of watersheds with known/suspected MYLF populations.

Watersheds	ERA % TOC	ERA (% of the TOC)*	
		Existing	Alt C
Lower Lone Rock Creek	13	118%	126%
Pierce Creek	12	80%	87%
West Branch Lights C.	13	163%	184%
Lower Indian Creek	12	132%	145%

*ERA is shown as the percent of the TOC for each watershed. For example, a watershed that is above the TOC will have a total value greater than 100. Total ERA contributions less than 100 are below the TOC. As disturbance approaches and exceeds the TOC, the risk of detrimental watershed effects increases.

As Table 74 shows Alternative C of the Moonlight and Wheeler Project would increase the percentage of TOC from existing conditions for all four watersheds. The cumulative risk assessment in all four of these watersheds is not expected to change from what exists currently. The West Branch Lights Creek watershed has the highest existing post-project cumulative risk under Alternative C this remains extreme. The bulk of the harvest, particularly by tractor is concentrated in the tributary headwaters of Lights Creek drainage, which confluence in a single locale at the top of the Middle Lights Creek sub-watershed. An additional and significant proportion of proposed harvest is in the Moonlight Creek drainage, which confluences with Lights Creek at the bottom end of the Middle Lights Creek sub-watershed. Further, the Middle Lights Creek is an epicenter of sorts for high burn severity. These factors in themselves would create high expectations of runoff increase downstream and within the Middle Lights Creek sub-watershed.

There are over 19,000 acres of private land within the analysis area. Cumulative effects from private land use (timber and gravel extraction, fire salvage harvest, livestock

grazing, and urbanization) would continue to create water quality problems, including sedimentation and bank cutting. The additive impact from private land logging on these and other drainages in the analysis area have been incorporated into the cumulative watershed effects analysis and is reflected in the high ERA values

The analysis area occurs within the boundaries of nine active livestock grazing allotments, the majority of which is composed of the Clarks Creek, Lights Creek, and Lone Rock allotments. Grazing capacity within allotments is based on the primary range (meadow systems) and not on secondary or transitory range. At this time there are no plans to increase livestock stocking rates or use due to the increase in transitory range created by the fire. Based on the existing stocking rates and current range conditions, the season of use, the distribution of primary range across the project area, as well as no increased stocking due to increase in transitory range, there should be no change in livestock effects to habitat conditions over the long term (5+ years).

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed, which supports a well distributed population of MYLFs on Forest Service land, is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing riparian vegetation and streambanks to recover.

Determination: Application of BMPs will be used to lower incidence of surface erosion on the hill slope and prevent sediment delivery to the valley bottoms. Since 1992, the Plumas NF has conducted over 600 evaluations of BMP effectiveness per the approved R5 protocol. The most recent summary of this monitoring was produced following the 2007 field season (USDA 2008a). That summary listed 441 evaluations of BMPs for the type of activities proposed under the action alternatives. BMPs were rated as effective for 79.8% of those evaluations. When effects from roads already in use are separated from activity areas, BMP effectiveness is over 90%. Based on predicted hill slope erosion rates for skyline and tractor yarding in the first year after harvest (reported in watershed section), and considered along with observed recovery of riparian buffers and incorporation of BMPs, it is expected that actual rates of delivery to the valley bottom would be near the background rate for burned areas that are not harvested.

Significant vegetative recovery of riparian zones has occurred since the fire (based on 2009 surveys, see watershed section). These same surveys revealed that these riparian zones provided effective buffers for sediment deposition. In the three watersheds suveyed, Hungry, Lights and Moonlight Creeks, effectiveness of riparian area in mitigating rilling from upslope sources was estimated at about 80%, 60% and 90%, respectively. In each watershed pre-fire vegetation, and post-fire re-growth, along with

litter cast, had developed ground cover to levels as high, or better, than the upslope condition. Typically, riparian vegetation, and associated breaks in slope at the valley bottom and near channel floodplain largely dissipate flow energy and induce deposition of transported fines. BMP effectiveness monitoring results for project-applicable activities on the forest are about the 90% level. Therefore sediment delivery to a channel buffer from an activity area is expected to be very slight and further degradation of water quality due to sediment delivery from harvested areas is not expected. The slight amounts of sediment generated from activity areas during a high runoff event would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

The watershed report (2009) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including mountain yellow-legged frog suitable and occupied habitat.

The Moonlight Wheeler Fire Restoration project "May affect, but is not likely to adversely affect or result in a loss of viability or a trend toward federal listing." This determination is based on project design features and mitigations that will lessen and minimize impacts to the MYLF which include; 1) Incorporation of RHCA equipment restriction zones, 2) Implementation of Best Management Practices, and 3) Implementation of soil and water mitigation standards (RMOs). These design features and mitigations combined with results from the PNF's 3-year telemetry study indicate that impacts to the MYLF are not expected to result in adverse effects or loss of viability.

3.5.2.3.1.2 Bald Eagle

The direct, indirect, and cumulative effects to the bald eagle in the analysis area under this alternative are essentially the same as that presented under Alternative A. To avoid repetition, please refer to that discussion.

Alternative C, with implementation of LOPs that have proved effective in the past for salvage and restoration projects (Stream and Boulder fires) within nesting territories at Antelope Lake, would not have any additional cumulative effects on habitat within the BEMA, individual nesting territories or cause any change in population distribution across the PNF or the Sierra Nevada range.

Determination: Alternative C may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the bald eagle.

3.5.2.3.1.3 California Spotted Owl

Under Alternative C, fire-killed or hazard tree removal would occur on 8,536 acres using only tractor logging systems. Two PACs within the PNF PAC network would be minimally treated (8 acres total) for roadside hazard tree removal only under these actions. Outside of PACs, there would be no removal of fire-killed trees from non-burned parcels or areas burnt at low severity (less than 50 percent basal area mortality). No fire-

killed tree removal would occur within currently suitable spotted owl habitat (as defined in the Affected Environment section of this RFEIS). Removal of fire-killed or roadside hazard trees in non-suitable habitat would not change the existing condition of the amount of suitable habitat. Narrow corridors of dispersal (live-green forested) habitat within the analysis area, would not be treated for fire-killed or roadside hazard tree removal.

Under this alternative approximately 1,354 acres of fire-killed or hazard tree removal would occur in areas formerly known as PACs and approximately 2,121 acres would occur in what was formerly designated as HRCAs. This combined 3,475 acres proposed for treatment is not suitable owl habitat due to the effects from moderately high and high severity fire, and the PAC numbers have been removed from the PNF spotted owl network of PACs.

Table 70 shows treatments that are proposed under alternative C that fall within the eight remaining PACs and associated HRCAs. The acres within PACs PL071(1 acre) and PL286 (7 acres) are proposed for roadside hazard removal treatment only. All acres summarized in table 70 reflect areas where fire killed trees or roadside hazard trees are planned for removal. No suitable owl habitat (CWHR 4M, 4D, 5M, 5D) would be entered or altered by the proposed actions.

Table 75. Proposed treatment acres under alternative C in remaining PACs and HRCAs within analysis area.

PAC #		ALT C	PAC #		ALT C
PL071	PAC	1	PL167	PAC	0
	HRCA	19		HRCA	5
	TOTAL	20		TOTAL	5
PL073	PAC	0	PL230	PAC	0
	HRCA	36		HRCA	0
	TOTAL	36		TOTAL	0
PL107	PAC	0	PL286	PAC	7
	HRCA	2		HRCA	52
	TOTAL	2		TOTAL	59
PL109	PAC	0	PL287	PAC	0
	HRCA	41		HRCA	259
	TOTAL	41		TOTAL	259

Under alternative C there would be no new system road construction so no long-term increases in human activities are expected as a result of this action. There would be approximately 18 miles of temporary road constructed under Alternative C to accommodate logging systems. Temporary roads constructed under this alternative would be decommissioned upon completion of the project. Road density would remain the same within the analysis area as pre-fire conditions, which is 2.62 miles of open road/square mile.

Cumulative Effects: Please refer to the cumulative effects section for the spotted owl under Alternative A, which is essentially the same for this alternative except for the discussion on cumulative post-fire treatments, which is provided below.

Table 71 shows all acres of proposed or current treatments from fire-killed or hazard tree removal actions within the analysis area for alternative C. Approximately 23,761 acres on public and private land (27 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative C. On public land, approximately 12,307 acres of fire-killed or hazard tree removal would occur under alternative C. This is 18 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 56,101 acres (82%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. Fire-killed tree removal would not result in any additional unsuitable spotted owl habitat above what was changed due to wildfire.

Table 76. Acres of proposed and current post-fire treatments in the wildlife analysis area – Alternative C.

	Alt C acres proposed for fire-killed/hazard tree removal	% of analysis area	% on public land
Moonlight and Wheeler Project	8,536	10%	12%
Antelope RSHTR Project	2,036	2%	3%
Dry Flat RSHTR Project	1,294	1%	2%
Camp 14 Project	249	0%	0%
North Moonlight Project	192	0%	0%
Private Land salvage	11,454	13%	n/a
Total on public land	12,307	14%	18%
Total: public and private land	23,761	27%	n/a

As was acknowledged in the Affected Environment section and documented in post-fire survey results, spotted owls can and do utilize unlogged severely burned forests. The cumulative removal of fire-killed or roadside hazard trees on approximately 12,307 acres of public land under this alternative does contribute to overall habitat degradation due to the removal of fire-killed structures supporting habitat. These actions could potentially adversely affect spotted owls if any are present in these areas due to disturbance and loss of foraging habitat.

Based on spotted owl survey information, implementation of fire-killed or hazard tree removal could be subject to a LOP that would restrict tree removal during the nesting season (March 1 to August 15). Based on known information and as-needed implementation of a LOP, fire-killed or hazard tree removal should not disturb known nesting pairs, and would not alter the current distribution of owl PACs across the PNF. The cumulative removal of fire-killed or hazard trees from 18 percent of public land under this alternative would modify burned habitat with fire-killed tree structure removal, but would not reduce spotted owl PAC/HRCA occupancy, distribution, or the spotted owl population on the PNF above that resulting from the wildfire. Fire-killed or hazard tree removal within the analysis area would not impact either habitat or population trends on the PNF.

Determination: This alternative would reduce long-term hazardous surface fuels on 8,536 acres that would accumulate over time if nothing was done. This fuel reduction would have a beneficial affect on future fire behaviors, including decreased fire intensity and rate of spread that could enhance suppression capabilities and firefighter safety. This could allow for increased protection of the developing stands, resulting from reforestation efforts, which could provide forested habitat suitable for owls (CWHR 4P to 4M) in approximately 90 years.

Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, as well as incorporation of LOPs to reduce disturbance during critical periods if needed, Alternative C of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the California spotted owl.

3.5.2.3.1.4 Northern Goshawk

There would be no direct effects to individuals or goshawk habitat. The greatest impact to the goshawk and goshawk habitat was the Moonlight and Antelope Complex fires. Within the analysis area, prior to the fires, there was 45,660 acres of public land of suitable goshawk nesting/high quality foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 4,055 acres of public land that are suitable goshawk nesting/high quality foraging habitat located across the fire landscape within the analysis area

Alternative C would remove, using tractor logging systems, fire-killed or hazard trees from high and moderate severity burned areas, up to 8,536 acres, which do not support habitat considered suitable for goshawk. This action would not reduce live tree canopy cover, or degrade any nesting and foraging habitat for goshawk. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no post fire goshawk habitat would be logged, degraded and/or rendered unsuitable by the proposed action.

Table 77. Acres treated under Alternative C for fire-killed or hazard tree removal in areas formerly known as Northern goshawk PACs.

PAC #	ACRES PROPOSED FOR FIRE-KILLED OR HAZARD TREE REMOVAL ALTERNATIVE C
T07	63
T08	29
T09	28
T13	0
T14	16
T24	14
T36	0
Total	150

Approximately 150 acres of fire-killed tree removal would occur in areas formerly known as PACs, displayed in table 72. This fire-killed tree removal acreage is not suitable goshawk habitat due to fire effects. Table 72 is provided for information and for future acre accountability.

Removal of fire-killed or roadside hazard trees that could be available for additional prey species if left on site may incrementally impose a decrease in habitat suitability for goshawks from pre and post treatment conditions. No suitable nesting or foraging habitat would be directly affected by fire-killed tree removal, as only fire-killed trees within moderately high and high severity burn areas would be removed.

Cumulative Effects: The cumulative effects on the northern Goshawk are essentially the same as for the spotted owl under this alternative. Please refer to that discussion elsewhere in this document.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, Alternative C of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Northern goshawk.

3.5.2.3.1.5 American Marten

Alternative C would remove using tractor logging systems fire-killed or roadside hazard trees from high and moderate severity burned areas (up to 8,536 acres) that do not support habitat considered suitable for marten. This action would not reduce live tree canopy cover, or degrade any denning, resting, and foraging habitat for marten. There would be no fire-killed tree removal from CWHR types still classified as 4M, 4D, 5M, 5D. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no marten habitat would be logged or rendered unsuitable by the proposed actions. There may be instances where individual live trees may be cut for safety purposes or to facilitate access to harvest fire-killed trees. These instances are expected to be rare and impacts to existing live tree stands minimal.

Treatments are proposed within the PNF draft carnivore network. Under alternative C, this project would treat 1,558 acres for fire-killed (or salvage) tree removal and 1,616 acres for roadside hazard tree removal, for a total of 3,174 treated acres within the

carnivore network. As stated previously, little to no live trees would be removed or impacted by the project's actions and there is expected to be no change in present CWHR types. The remaining CWHR 4M/4D/5M/5D stands, which provide suitable habitat and connectivity for the marten and other mesocarnivores, would not be treated and only minimally affected by this project (due to incidental removal of live trees for operability, which would be of minimal size and scale, and highly dispersed, and would have negligible effects on stand structure).

The open road density within the project area is 2.62 miles of open road/square mile. Open road density would remain the same with this alternative. According to early habitat models (Freel 1991) this road density provides low-no habitat capability for the marten and other forest carnivores.

Cumulative Effects: The cumulative effects on the marten under this alternative are essentially the same as for the spotted owl. Please refer to that discussion elsewhere in this document.

Determination: Based on past survey work, it is likely that marten do not occur in the analysis area. Fire-killed or roadside tree removal under alternative C of the Moonlight and Wheeler Fires Recovery and Restoration Project would not impact either marten habitat or population trends on the PNF. Considering the rare chance that individuals are present in the analysis area, alternative C may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American marten.

3.5.2.3.1.6 Pallid Bat

Direct effects from the proposed actions are possible if this species occurs in the analysis area. Destruction of active roosts through felling or removal of fire-killed trees with hollows could displace or harm individual bats. Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment resulting in lowered reproductive success. These effects would be most severe during the breeding season (May 20 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. Activities conducted during the winter months can potentially disturb hibernacula sites (winter shelters), causing species arousal and use of crucial energy reserves.

Cumulative Effects: Both the Hungry and Boulder Fires in 2006 created abundant fire-killed tree habitat. Both fires combined to burn a total of around 3,547 acres; approximately 324 acres of fire-killed tree removal occurred on these burned acres (9 percent). The availability of fire-killed trees for bat use in the Antelope Lake area is abundant.

Habitat attributes like large fire-killed trees would be removed or modified by the proposed action, which could result in direct mortality of bat species that may be roosting within the fire-killed tree. Approximately 23,761 acres on public and private land (27 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative C. On public land, approximately 12,307 acres of fire-killed or hazard tree removal would occur under alternative C. This is 18 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 56,101 acres (82%) of the fire land base located on public land would not be treated for fire-killed or

hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable spotted owl habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

There would be no habitat disruption or modification to rock outcrops, caves and mining adits. No man-made structures that could provide habitat for bats are planned for removal or modification, other than roads and culverts, both of which do not provide habitat.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative C of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the pallid bat.

3.5.2.3.1.7 Western Red Bat

Effects are similar as described for pallid bat except that impacts for this analysis are tied directly to impacts on cottonwood trees. Mature cottonwood trees suitable for red bat roosts are located along many stretches of perennial streams within the analysis area. Many of these large cottonwoods died as a result of fire. No cottonwood or other hardwood trees would be removed within salvage treatment units. Cottonwood tree removal in roadside hazard treatment units is possible if any are deemed hazardous but this is expected to be very limited (may even be non-existent). Therefore, it is possible there could be a minimal direct loss of habitat for this species. It is unknown as to what extent fire-killed trees, especially preferred riparian trees such as cottonwoods, are used by red bats, but if bats are using cottonwoods that are felled, direct mortality could occur. Downstream of the fire, some cottonwood exists that could replace those consumed by fire and potentially removed as hazards.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced

planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Determination: This species is relatively rare on the PNF but its presence in isolated areas, as well as the presence of cottonwood in the project area, warrants a determination that alternative C of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Western red bat.

3.5.2.3.2 USDA Forest Service R5 Management Indicator Species

3.5.2.3.2.1 Black-backed Woodpecker (BBWO)

With alternative C, approximately 82 percent of the public land within the analysis area has no fire-killed or roadside hazard tree removal planned. Maintaining 82 percent (56,101 acres) of public land within the analysis area in an unsalvaged condition can benefit species closely tied to early post-fire conditions, including the BBWO (Kotliar et al. 2002).

In addition, fifty-five snag retention areas, ranging in size from 7 to 27 acres, were designated over approximately 14 percent (580 acres) of salvage treatment areas. Fire-killed tree removal is not proposed within these snag retention areas. Primary selection criteria for snag retention areas were: 1) areas formerly identified as Spotted Owl PACs; 2) along treatment unit boundaries adjacent to non-burned and low severity areas; 3) within RHCAs; and 4) in stands that supported a minimum of 40 percent canopy cover pre-fire.

Within salvage treatment units and roadside hazard treatment units, alternative C proposes the removal of fire-killed trees greater than 14 inches for sawlog product and trees less than 14 inches for biomass product. In the 8,536 acres proposed under this alternative 4,147 acres are within salvage units and 4,389 acres are within roadside hazard tree units. As a result of both sawlog and biomass proposed for harvest within these units, there would be no small fire-killed tree availability, except in snag retention areas and RHCA equipment restriction zones.

Snags would be retained to meet Riparian Management Objectives (RMOs) for down woody debris recruitment. Snags greater than 15 inches dbh would be retained at 4 snags/acres in all treated RHCAs. RHCAs have been incorporated into the 10 acre (average) snag retention areas where appropriate.

Black-backed woodpecker chicks that are present within the treatment units and have not yet fledged by July 30, 2009, the scheduled start of implementation, could be directly killed due to removal of occupied nest trees. Possible direct mortality of chicks could occur in 2010 as well if harvest units remain and are scheduled to be treated during the nestling stage.

Cumulative Effects: Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough Ranger District and Dry Flat on the Beckwourth Ranger District) were implemented in 2008. These two projects removed roadside hazard trees from approximately 3,330 acres.

The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract and ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area. In addition to these public land projects, approximately 11,454 acres of the 19,238 acres of private land within the analysis area was salvage logged in 2007 and 2008.

Table 78. Cumulative amount of BBWO suitable habitat remaining post treatments (public land).

		Alternative C Cumulative		
CWHR Type (pre-fires)	Created BBWO Habitat in Analysis Area	Cumulative Acres (all projects) BBWO Habitat Planned for Fire-killed or Roadside Hazard Tree Removal under Alt C	Post Moonlight and Wheeler Project Habitat Available for BBWO	
			Acres Remaining	% Remaining
CWHR 4M/4D	17,896	3,895	14,001	78%
CWHR 5M/5D	14,673	3,260	11,413	78%
Total	32,569	7155	25,414	78%

Approximately 32,569 acres of public land within the analysis area is considered suitable BBWO habitat as a result of high to moderately high severity fire burning through pre-fire 4M, 4D, 5M, and 5D. Table 73 shows the cumulative amount of BBWO habitat remaining on public land. All proposed or ongoing fire-killed tree removal project acreage within the analysis area (this project, two roadside hazard projects, and two smaller salvage projects) are accounted for in table 73. Approximately 7,155 of these acres under alternative C would become unsuitable after post fire-killed or roadside hazard tree treatments, leaving 25,414 cumulative acres of suitable BBWO habitat.

Table 79. Cumulative amount of moderately high to high (>50 BAM) severity salvaged and unsalvaged in the wildlife analysis area (public land).

Total Acres Mod-High Severity in Analysis Area	Moonlight and Wheeler Project Acres Proposed for Dead or Hazard Tree Removal	Acres Proposed for Salvage (all other projects)	Acres Un-salvaged	% of Mod-High Severity Unsalvaged
	Alt C			
47,825	7,140	1,894	38,790	81%

Table 74 indicates that, under alternative C, 81 percent of the analysis area classified as high severity to moderately high severity burn would not be salvage logged. Areas untreated would continue to be available as BBWO habitat somewhere between 5 and 7 years. After this time period, the quality of foraging habitat declines because the fire-killed wood habitat no longer supports prey species that BBWOs consume.

Snag density estimations post treatment on public land within the analysis area has been done. Snag numbers reflect cumulative effects, that is, all Forest Service projects ongoing or proposed that are/would remove fire-killed trees, and are averaged across the landscape (public land within the analysis area – 68,408 acres).

Implementation of all projects under alternative C results in an estimated post harvest snag density (greater than 15 inches dbh) across the 68,408 acres of public land of 13.3 snags/acre. The cumulative amount of snags 10 inches-14.9 inches dbh post harvest under this alternative is estimated to be 26 snags/acre.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Private timberlands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the summer of 2008 fire salvage harvest has been occurring on these lands. Over 11,400 acres have been salvage harvested to date and, although additional salvage may take place, future salvaged acres on private land is expected to be minimal. Private fire salvage projects have occurred mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees within these private parcels. It is

reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Implementation of fire-killed or roadside hazard tree removal on 8,536 acres of 68,408 acres of public land as designed, in combination with past, present and reasonably foreseeable future actions would result in a decline in BBWO habitat availability and distribution across the PNF. That being said, there would still be short term population increase resulting from the suitable habitat remaining after the proposed project.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Black-Backed Woodpecker Trend. In 2008, a pilot study for black-backed woodpecker monitoring was conducted in the Sierra Nevada (Siegel et al. 2008). Black-backed woodpeckers were detected at 68 of 371 survey stations, in 10 of the 19 fire areas. Occupied sites were well distributed across the Sierra Nevada national forests, ranging from the Lassen NF to the Sequoia NF. This included two sites surveyed in or adjacent to the Moonlight and Wheeler Project analysis area: the Moonlight Fire (due west of Antelope Lake – 16 of 24 stations with BBWO detections and the Boulder Complex Fire (north of Antelope Lake) – 11 of 22 stations with BBWO detections. Detections occurred in every major pre-fire CWHR habitat type surveyed; occupied fire areas ranged in size from small (170 ha, 420 ac) to very large (26,159 ha, 64,639 ac) and ranged from 1 year post-fire to 7 years post-fire. Detections occurred at stations in all three fire severity classes, but more severely burned forest stands were more likely to be occupied (7.8% of the low-severity stations, 17.2% of the moderate-severity stations, and 25.2% of the high-severity stations). BBWOs still occupied fires 7 years old (3 of the 4 seven-years post-fire sites surveyed were occupied). The two sites surveyed where only 1 year had elapsed since fire were occupied, which supports other studies regarding the ability of this species to quickly find and colonize new habitat patches.

The pilot study results indicate that the black-backed woodpecker is “widely distributed across recently burned forest stands in the 10 Sierra Nevada national forests.” Black-backed woodpeckers were detected at numerous fire areas where at least some degree of post-fire logging had occurred (e.g., Boulder Complex Fire, Bassetts Fire) or was in process. Most of these sites had nearby patches of unlogged habitat. However, in two of the fires surveyed (Kibbie and Vista), black-backed woodpeckers were abundant in areas that had not been salvage logged, but absent from the areas that clearly had been salvaged logged.

A query of wildfires between 2000 and 2008 that burned in and around the Tahoe, Plumas, Lassen, and Modoc National Forests and were greater than 1,000 acres was done to obtain a ballpark figure of how much potential habitat is available in the northeast California region (Yasuda, pers. comm. 2009). Of the 51 fires queried, 107,566 acres on forested National Forest lands burned at high severity. The Forest Service Activity Tracking System (FACTS) showed that 9,050 acres were salvaged in these fire areas, leaving 98,516 acres (92%) in an unsalvaged state. After the estimated BBWO suitable acreage to be removed under Alternative C (7,155) is deducted, 91,361 acres (85%) of forested (conifer) areas in this region which burned at high severity between 2000 and 2008 would still support potential BBWO suitable habitat.

The cumulative effect of the Moonlight and Wheeler Project in terms of changes in medium-sized and large-sized snags per acre within burned forest habitat would change

from the existing condition. With implementation of the Moonlight and Wheeler Project, there would be a reduction in burned forest habitat supporting snags thus potentially reducing habitat that could support BBWO. Thus the potential for the analysis area to support BBWO declines post project implementation. But overall, post-project, the analysis area still leaves untreated the majority of suitable habitat created by the two fires. Alternative C would not alter the existing trend in the ecosystem component, nor would it lead to a change in the distribution of black-backed woodpecker across the Sierra Nevada bioregion."

The cumulative amount under alternative C (12,307 total estimated acres treated, would leave about 82 percent of public land unharvested. Hutto (2006) recommends as a management priority retention of some burned forest 0-5 years after a fire because that is the narrow window of time during which the biologically unique early postfire conditions become established and persist. Leaving the majority of the burn in an unharvested condition maintains an important component of biological diversity identified by Hutto (2006): "all the unique plants and animals that depend on those first few years of natural (postfire) succession. This includes the BBWO.

Prior to the Moonlight and Antelope Complex fires, there was approximately 1,267 acres of burned snag habitat within the analysis area (from the 2001 Stream Fire). Assuming BBWO densities @ 3.2/40 ha in burned forest (1 pair/32 acres) (Bock and Lynch 1970) or 1 pair/500 acres) (Raphael and White 1984 in NatureServe 2007), this habitat (snags in burned forest) potentially supported between 2 and 39 pair of BBWOs between 2002 to 2007.

In 2007, the Moonlight and Antelope Complex fires combined burnt over 87,000 acres. Within the 87,647 acre analysis area (the two fire perimeters), approximately 32,659 acres of suitable BBWO habitat was created by high severity fire. This provides enough habitat (snags in burned forest) to theoretically support an additional 65 to 1,020 pairs. Thus the Moonlight and Antelope Complex fires created an upward trend in BBWO habitat from existing conditions that could have increased the short term trends in woodpeckers in the analysis area.

3.5.2.3.2.2 Benthic Macroinvertebrates

Project design describes the large areas of public land within the analysis area where coarse woody debris would be maintained and recruited. Table 75 shows the indicator measures for coarse woody debris.

Table 80. Measures for coarse woody debris amounts and recruitment

	Alternative C
Avg. Tons/Ac of Coarse Woody Debris (short-term: Post-harvest)	0.5 – 4.3
Avg. Tons/Ac of Coarse Woody Debris (long-term: 30 years)	0.8 – 12.4
Avg. number of snags > 15" available for large woody debris recruitment to streams(Short-term: Post-harvest)	4-6 of the largest snags per acre in treated RHCAs
Percent of Acres in RHCAs	100%

planted	

Treatments under alternative C include snag retention areas and snag recruitment within RHCAs both of which retain snags that would serve as recruitment for coarse woody debris. Within Riparian Habitat Conservation Areas (RHCAs) of tractor, helicopter and skyline units, generally four to six of the largest snags per acre would be retained, preferably within falling distance of the channel where available, to provide for large woody debris (LWD) recruitment to best meet riparian management objectives. Within ground-based salvage harvesting treatments, snag retention in RHCAs would be most preferable and efficient within equipment exclusion zones where snags would be within reasonable falling distance of the channel for coarse woody debris recruitment and harvesting safety issues would be minimized due to equipment exclusion. Fire killed trees will be harvested within the RHCAs, reducing the potential LWD recruitment into perennial and intermittent streams as well as reducing shade provided by these trunks; all green trees and four to six of the largest snags per acre would be retained in the RHCAs which would continue to contribute both LWD recruitment and shade.

Post-fire mortality of fire-injured trees, particularly within Moderate and High vegetation burn severity areas, would occur in the first three to five years immediately following the fire event. Snag recruitment and coarse woody debris recruitment would continue to occur within these areas as well.

Because of biomass removal of standing dead below 14 inch dbh, and harvest of standing dead above 14 inch dbh within up to 8,536 acres under this alternative, LWD amounts in tractor units are estimated to decrease in time from 7.3 tons per acre on the average (estimated present condition) to 5.6 tons per acre on the average 30 years after the fire. There will be some recruitment from those fire damaged trees that will die 3 to 5 years after the fire. In treated areas of tractor units, there are wildlife snag retention stands to meet minimum snag standards (USDA 2004b). There will be some recruitment from retention of four to six of the largest snags per acre within falling distance of RHCAs.

The wildfire consumed both riparian and conifer vegetation that provide surface water shade. Thus up to 100 percent of existing vegetation providing shade has been removed. No live vegetation currently providing minimal shade would be removed by the action alternatives, thus no immediate change in water surface shade is expected. Fire-killed trees provide a minor amount of shade, thus some structural shade would be removed, but amount of shade provided by fire-killed trees is much less than prior to the fire and probably not very influential in terms of water temperatures. There would be some loss of large diameter snags adjacent to the perennial streams within helicopter units, yet the retention of four to six of the largest snags per acres within these RHCAs would minimize this effect. Large woody retention/recruitment within RHCAs of perennial and intermittent streams would result in a large flush of woody material over the next 10 years and then no recruitment for the next 50+ years. Vegetative response post fire by riparian species would help recover surface water shade within two-five years (USDA 2008d).

Water temperature has the potential to warm up slightly within the helicopter and skyline units due to removal of large diameter trees that provide some shading to the stream. This effect would be indirect and should be minimal. In addition within the tractor units; areas outside of the snag retention zones and RHCAs would be devoid of all snags greater than

14 inches dbh and thus any shade larger diameter snags provide would be lost. There is the potential for increased temperatures due to lack of forested or "snag" cover in the short term, and increased conifer cover in the long term (10-15 years) with the growth of the planted conifers throughout the units harvested. The potential for a short term increase in temperature could affect the timing of life histories of sensitive aquatic macroinvertebrates.

Changes in stream flow, above the levels that may have increased due to vegetative removal by fire, are not expected to increase with removal of fire-killed trees. Therefore direct affects of tree removal of fire-killed trees, reforestation and temporary road construction would not impact perennial or intermittent stream flows.

Cumulative Effects: Sediment delivery to streams is related to the cumulative watershed effects analysis (USDA 2009f), and findings are that there is little difference between the action alternatives and the no action alternatives due to the adverse effect of the wildfire. The impacts of alternative C would not be higher than that of the wildfire, though the salvage activities would prolong natural recovery from 2 to 5 years (ibid). The steep slopes, though more erosive, would return to natural fire recovery within two years, while the shallow slopes where ground based systems are used would return fire recovery within 3-5 years. Slope restrictions for ground based harvest under 25 percent slope would lower erosion potential on 2,196 acres under Alternative C.

Flow changes depending on the water year. The overwhelming effect to hydrologic function, under alternative C is that of cover loss and potential for widespread overland flow. With a high water event there would be potential for a debris flow to occur within the stream courses in those watersheds. "Overland flow can be initiated when surface infiltration capacity is drastically reduced. The effect of wildfire in the event of high intensity rainfall is comparably much higher than roads or harvest" (USDA 2009f). There is a minimal change in the TOC/ERA values with the implementation of alternative C and the greatest effect to flow would be within those seventeen watersheds analyzed that are currently over threshold prior to the implementation of action alternatives and would remain over threshold. The existing flow condition should remain the same post fire unless large water event occurs thus impacting the existing macroinvertebrate habitat.

The watershed report (USDA 2009f) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including habitat occupied by macroinvertebrates.

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long

term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use.

The direct/indirect and cumulative effect of dead tree removal, roadside hazard tree removal, and reforestation would not change the existing amount of riverine or lacustrine habitat, would not change the amount of montane riparian habitat present in the project area, would not result in any reduction in deciduous canopy closure, or result in a change in size class of existing riparian vegetation. No live trees (deciduous or coniferous) would be removed. Thus the amount of total live tree canopy cover would not be reduced. Grazing should have little impact on riparian vegetation and meadow recovery. Changes in flow and water surface shade will be too small to be measured. Sedimentation is expected to increase as a result of vegetative removal caused by the wildfire. With Alternatives C some short term increase of sedimentation is expected from soil disturbance with tractor logging. This action may extend the timeline for habitat recovery and pre-fire macroinvertebrate community.

Population Status and Trend Summary for the Sierra Nevada National Forests. Same as alternative A. Please refer to that discussion.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Aquatic Macroinvertebrates Habitat Trend. Same as alternative A. Please refer to that discussion.

3.5.2.4 Alternative D – Direct, Indirect, and Cumulative Effects

3.5.2.4.1 USDA Forest Service R5 Sensitive Species

3.5.2.4.1.1 Mountain Yellow-legged Frog (MLYF)

Potential direct effects from the proposed project include impacts to individual MYLF during activities. Possible direct effects from the proposed actions on Forest Service R5 aquatic sensitive species include crushing of individuals if they are present during project activities. The use of a fellerbuncher within the RHCA has the potential of directly injuring or killing frogs. The potential for direct impacts to individuals is greatest during wet periods and in early fall, when frogs are most likely to disperse from aquatic habitats.

There are three watersheds that have known MYLF populations. Approximately 356 RHCA acres under alternative D would be treated in these watersheds for fire-killed tree removal (table 76). Treatments within these RHCAs would increase the potential for direct effects, as frogs are put at risk of being killed/injured with falling and yarding activities.

Table 81. Treatment acres under Alternative D within watersheds with known MYLF populations.

Watersheds with MYLF Populations	Watershed Acres Treated	Acres treated in RHCA
L. Lone Rock C.	296	95
Pierce C.	319	105
West Branch Lights	656	156

C.		
	Total	356

Sheltering habitat for MYLFs also includes landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs. A reduction in fire-killed wood would result in a lack of connectivity and cover for frogs that could possibly move out of Lone Rock Creek and into the floodplain, the RHCAs, and upland habitats. Possible indirect effects to frogs using the RHCA for dispersal, and over wintering may include a reduction in cover provided by woody debris, warmer and drier microclimate conditions due to removal of fire-killed trees in RHCA areas, and reduction in connectivity provided by woody debris between aquatic habitats, RHCAs, and uplands. Cover for aquatic-dependent species and effective soil cover in this post-fire environment are very important for the proper functioning of aquatic and riparian habitats until vegetation can reestablish and provide these habitat elements (5-30+ years). As vegetation reestablishes, the role of the standing fire-killed and downed wood would be reduced.

The PNF conducted a 3-year telemetry study on the MYLF to determine the degree of overland movements into RHCA in order to minimize impacts from fuel reduction efforts across the forest (Wengert 2008). The 3-year study found that MYLF have very limited movements into upland habitats or adjacent riparian areas. For example, during the 3-year study, only one movement greater than 1 meter occurred away from the wetted stream channel into riparian or upland habitat. This movement by 1 MYLF was recorded at 77 feet away from the wetted stream channel. The study concluded that off-stream channel movements were very rare and that in-stream movements within and up and down the wetted stream channel were common and frequent traits of MYLF behavior. Therefore, the project design features and mitigations which include RHCA equipment restriction zones, Best Management Practices (BMPs) to prevent water quality degradation (Appendix C, Table C-1) and Riparian Management Objectives standards (in project record) should provide adequate protection to minimize impacts to the MYLF within riparian or upland habitats.

Cumulative Effects: The following discussion on watershed conditions within the analysis area is drawn from the Moonlight and Wheeler Fires Recovery and Restoration Project Watershed Report (USDA 2009f).

Two of the three watersheds with known MYLF populations, Lower Lone Rock Creek and West Branch Light Creek, currently exist above TOC (table 98). These two watersheds are susceptible to very high cumulative effects risk, such as erosion and large movement of sediment into streams. Lower Indian Creek watershed, suspected of having MYLF but with no detections to date, is also over TOC and at very high risk. Pierce Creek watershed exists below TOC but the risk of cumulative effects is still considered high.

Table 82. Cumulative condition of watersheds with known/suspected MYLF populations.

Watersheds	ERA % TOC	ERA (% of the TOC)*	
		Existing	Alt D

Lower Lone Rock Creek	13	118%	125%
Pierce Creek	12	80%	87%
West Branch Lights C.	13	163%	172%
Lower Indian Creek	12	132%	145%

*ERA is shown as the percent of the TOC for each watershed. For example, a watershed that is above the TOC will have a total value greater than 100. Total ERA contributions less than 100 are below the TOC. As disturbance approaches and exceeds the TOC, the risk of detrimental watershed effects increases.

As table 77 shows, alternative D of the Moonlight and Wheeler Project would increase the percentage of the Threshold of Concern (TOC) from existing conditions for all four watersheds. The cumulative risk assessment in all four of these watersheds is not expected to change from what exists currently. The West Branch Lights Creek watershed has the highest existing cumulative risk and under Alternative D this remains extreme. The bulk of the Moonlight and Wheeler Project's harvest activities, particularly by tractor, are concentrated in this watershed, and therefore greater adverse effects are expected.

There are over 19,000 acres of private land within the analysis area. Cumulative effects from private land use (timber and gravel extraction, fire salvage harvest, livestock grazing, and urbanization) would continue to create water quality problems, including sedimentation and bank cutting. The additive impact from private land logging on these and other drainages in the analysis area have been incorporated into the cumulative watershed effects analysis and is reflected in the high ERA values

The analysis area occurs within the boundaries of nine active livestock grazing allotments, the majority of which is composed of the Clarks Creek, Lights Creek, and Lone Rock allotments. Grazing capacity within allotments is based on the primary range (meadow systems) and not on secondary or transitory range. At this time there are no plans to increase livestock stocking rates or use due to the increase in transitory range created by the fire. Based on the existing stocking rates and current range conditions, the season of use, the distribution of primary range across the project area, as well as no increased stocking due to increase in transitory range, there should be no change in livestock effects to habitat conditions over the long term (5+ years).

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed, which supports a well distributed population of MYLFs on Forest Service land, is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing riparian vegetation and streambanks to recover.

Determination: Application of BMPs will be used to lower incidence of surface erosion on the hill slope and prevent sediment delivery to the valley bottoms. Since 1992, the

Plumas NF has conducted over 600 evaluations of BMP effectiveness per the approved R5 protocol. The most recent summary of this monitoring was produced following the 2007 field season (USDA 2008a). That summary listed 441 evaluations of BMPs for the type of activities proposed under the action alternatives. BMPs were rated as effective for 79.8% of those evaluations. When effects from roads already in use are separated from activity areas, BMP effectiveness is over 90%. Based on predicted hill slope erosion rates for skyline and tractor yarding in the first year after harvest (reported in watershed section), and considered along with observed recovery of riparian buffers and incorporation of BMPs, it is expected that actual rates of delivery to the valley bottom would be near the background rate for burned areas that are not harvested.

Significant vegetative recovery of riparian zones has occurred since the fire (based on 2009 surveys, see watershed section). These same surveys revealed that these riparian zones provided effective buffers for sediment deposition. In the three watersheds suveyed, Hungry, Lights and Moonlight Creeks, effectiveness of riparian area in mitigating rilling from upslope sources was estimated at about 80%, 60% and 90%, respectively. In each watershed pre-fire vegetation, and post-fire re-growth, along with litter cast, had developed ground cover to levels as high, or better, than the upslope condition. Typically, riparian vegetation, and associated breaks in slope at the valley bottom and near channel floodplain largely dissipate flow energy and induce deposition of transported fines. BMP effectiveness monitoring results for project-applicable activities on the forest are about the 90% level. Therefore sediment delivery to a channel buffer from an activity area is expected to be very slight and further degradation of water quality due to sediment delivery from harvested areas is not expected. The slight amounts of sediment generated from activity areas during a high runoff event would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

The watershed report (2009) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including mountain yellow-legged frog suitable and occupied habitat.

The Moonlight Wheeler Fire Restoration project “May affect, but is not likely to adversely affect or result in a loss of viability or a trend toward federal listing.” This determination is based on project design features and mitigations that will lessen and minimize impacts to the MYLF which include; 1) Incorporation of RHCA equipment restriction zones, 2) Implementation of Best Management Practices, and 3) Implementation of soil and water mitigation standards (RMOs). These design features and mitigations combined with results from the PNF’s 3-year telemetry study indicate that impacts to the MYLF are not expected to result in adverse effects or loss of viability.

3.5.2.4.1.2 Bald Eagle

The direct, indirect, and cumulative effects to the bald eagle in the analysis area under this alternative are essentially the same as presented under Alternative A. To avoid repetition, please refer to that discussion elsewhere in this document.

Alternative D, with implementation of LOPs that have proved effective in the past for salvage and restoration projects (Stream and Boulder fires) within nesting territories at Antelope Lake, would not have any additional cumulative effects on habitat within the BEMA, individual nesting territories or cause any change in population distribution across the PNF or the Sierra Nevada range.

Determination: Alternative D may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the bald eagle.

3.5.2.4.1.3 California Spotted Owl

Under Alternative D, fire-killed or hazard tree removal would occur on 5,656 acres using only tractor logging systems. Two PACs within the PNF PAC network would be minimally treated (8 acres total) for roadside hazard tree removal only under these actions. Outside of PACs, there would be no removal of fire-killed trees from non-burned parcels or areas burnt at low severity (less than 50 percent basal area mortality). No fire-killed tree removal would occur within currently suitable spotted owl habitat (as defined in the Affected Environment section of this RFEIS). Removal of fire-killed or roadside hazard trees in non-suitable habitat would not change the existing condition of the amount of suitable habitat. Narrow corridors of dispersal (live-green forested) habitat within the analysis area, would not be treated for fire-killed or roadside hazard tree removal. Under this alternative approximately 436 acres of fire-killed or hazard tree removal would occur in areas formerly known as PACs and approximately 920 acres would occur in what was formerly designated as HRCAs. This combined 1,356 acres proposed for treatment is not suitable owl habitat due to the effects from moderately high and high severity fire, and the PAC numbers have been removed from the PNF spotted owl network of PACs.

Table 78 shows treatments that are proposed under alternative D that fall within the eight remaining PACs and associated HRCAs. The acres within PACs PL071 (1 acre) and PL286 (7 acres) are proposed for roadside hazard removal treatment only. All acres summarized in table 78 reflect areas where fire killed trees or roadside hazard trees are planned for removal. No suitable owl habitat (CWHR 4M, 4D, 5M, 5D) would be entered or altered by the proposed actions.

Table 83. Proposed treatment acres under alternative D in remaining PACs and HRCAs within analysis area.

PAC #		ALT D	PAC #		ALT D
PL071	PAC	1	PL167	PAC	0
	HRCA	19		HRCA	0
	TOTAL	20		TOTAL	0
PL073	PAC	0	PL230	PAC	0
	HRCA	5		HRCA	0
	TOTAL	5		TOTAL	0
PL107	PAC	0	PL286	PAC	7

	HRCA	2		HRCA	13
	TOTAL	2		TOTAL	20
PL109	PAC	0	PL287	PAC	0
	HRCA	41		HRCA	111
	TOTAL	41		TOTAL	111

Under alternative D there would be no new system road construction so no long-term increases in human activities are expected as a result of this action. There would be approximately 13 miles of temporary road constructed under Alternative D to accommodate logging systems. Temporary roads constructed under this alternative would be decommissioned upon completion of the project. Road density would remain the same within the analysis area as pre-fire conditions, which is 2.62 miles of open road/square mile.

Cumulative Effects: Please refer to the cumulative effects section for the spotted owl under Alternative A, which is essentially the same for this alternative except for the discussion on cumulative post-fire treatments, which is provided below

Table 78 shows all acres of proposed or current treatments from fire-killed or hazard tree removal actions within the analysis area for alternative D. Approximately 20,881 acres on public and private land (24 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative D. On public land, approximately 9,427 acres of fire-killed or hazard tree removal would occur under alternative D. This is 14 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 58,981 acres (86%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable spotted owl habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Table 84. Acres of proposed and current post-fire treatments in the wildlife analysis area – Alternatives D.

	Alt D acres proposed for fire-killed/hazard tree removal	% of analysis area	% on public land
Moonlight and Wheeler Project	5,656	6%	8%
Antelope RSHTR Project	2,036	2%	3%
Dry Flat RSHTR Project	1,294	1%	2%
Camp 14 Project	249	0%	0%
North Moonlight Project	192	0%	0%
Private Land salvage	11,454	13%	n/a
Total on public land	9,427	11%	14%
Total: public and private land	20,881	24%	n/a

As was acknowledged in the Affected Environment section and documented in post-fire survey results, spotted owls can and do utilize unlogged severely burned forests. The cumulative removal of fire-killed or roadside hazard trees on approximately 9,427 acres of public land under this alternative does contribute to overall habitat degradation due to the removal of fire-killed structures supporting habitat. These actions could potentially adversely affect spotted owls if any are present in these areas due to disturbance and loss of foraging habitat.

Based on spotted owl survey information, implementation of fire-killed or hazard tree removal could be subject to a LOP that would restrict tree removal during the nesting season (March 1 to August 15). Based on known information and as-needed implementation of a LOP, fire-killed or hazard tree removal should not disturb known nesting pairs, and would not alter the current distribution of owl PACs across the PNF. The cumulative removal of fire-killed or hazard trees from 14 percent of public land under this alternative would modify burned habitat with fire-killed tree structure removal, but would not reduce spotted owl PAC/HRCA occupancy, distribution, or the spotted owl population on the PNF above that resulting from the wildfire. Fire-killed tree removal within the analysis area would not impact either habitat or population trends on the PNF.

Determination: This alternative would reduce long-term hazardous surface fuels on 5,656 acres that would accumulate over time if nothing was done. This fuel reduction would have a beneficial affect on future fire behaviors, including decreased fire intensity and rate of spread that could enhance suppression capabilities and firefighter safety. This could allow for increased protection of the developing stands, resulting from reforestation efforts, which could provide forested habitat suitable for owls (CWHR 4P to 4M) in approximately 90 years.

Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, as well as incorporation of LOPs to reduce disturbance during critical periods if needed, alternative D of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the California spotted owl.

3.5.2.4.1.4 Northern Goshawk

There would be no direct effects to individuals or goshawk habitat. The greatest impact to the goshawk and goshawk habitat was the Moonlight and Antelope Complex fires. Within the analysis area (burn perimeter), prior to the fires, there was 45,660 acres of public land of suitable goshawk nesting/high quality foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 4,055 acres of public land that are suitable goshawk nesting/high quality foraging habitat located across the fire landscape within the analysis area

Alternative D would remove, using tractor logging systems, fire-killed or hazard trees from high and moderate severity burned areas, up to 5,656 acres, which do not support habitat considered suitable for goshawk. This action would not reduce live tree canopy cover, or degrade any nesting and foraging habitat for goshawk. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no post fire goshawk habitat would be logged, degraded and/or rendered unsuitable by the proposed action.

Table 85. Acres treated under Alternative D for fire-killed or hazard tree removal in areas formerly known as Northern goshawk PACs.

PAC #	ACRES PROPOSED FOR FIRE-KILLED OR HAZARD TREE REMOVAL ALTERNATIVE D
T07	36
T08	29
T09	28
T13	0
T14	16
T24	14
T36	0
Total	123

Approximately 123 acres of fire-killed tree removal would occur in areas formerly known as PACs, displayed in table 80. This fire-killed tree removal acreage is not suitable goshawk habitat due to fire effects. Table 80 is provided for information and for future acre accountability.

Removal of fire-killed or roadside hazard trees that could be available for additional prey species if left on site may incrementally impose a decrease in habitat suitability for goshawks from pre and post treatment conditions. No suitable nesting or foraging habitat would be directly affected by fire-killed tree removal, as only fire-killed trees within moderately high and high severity burn areas would be removed.

Cumulative Effects. The cumulative effects on the northern Goshawk are essentially the same as for the spotted owl under this alternative. Please refer to that discussion elsewhere in this document.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative D of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Northern goshawk.

3.5.2.4.1.5 American Marten

Alternative D would remove using tractor logging systems fire-killed or roadside hazard trees from high and moderate severity burned areas (up to 5,656 acres) that do not support habitat considered suitable for marten. This action would not reduce live tree canopy cover, or degrade any denning, resting, and foraging habitat for marten. There would be no fire-killed tree removal from CWHR types still classified as 4M, 4D, 5M, 5D. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no marten habitat would be logged or rendered unsuitable by the proposed actions. There may be instances where individual live trees may be cut for safety purposes or to facilitate access to harvest fire-killed trees. These instances are expected to be rare and impacts to existing live tree stands minimal.

Treatments are proposed within the PNF draft carnivore network. Under alternative D, this project would treat 136 acres for fire-killed (or salvage) tree removal and 1,616 acres for roadside hazard tree removal, for a total of 1,752 treated acres within the carnivore network. As stated previously, little to no live trees would be removed or impacted by the

project's actions and there is expected to be no change in present CWHR types. The remaining CWHR 4M/4D/5M/5D stands, which provide suitable habitat and connectivity for the marten and other mesocarnivores, would not be treated and only minimally affected by this project (due to incidental removal of live trees for operability, which would be of minimal size and scale, and highly dispersed, and would have negligible effects on stand structure).

The open road density within the project area is 2.62 miles of open road/square mile. Open road density would remain the same with this alternative. According to early habitat models (Freel 1991) this road density provides low-no habitat capability for the marten and other forest carnivores.

Cumulative Effects: The cumulative effects on the marten are essentially the same as for the spotted owl under this alternative. Please refer to that discussion elsewhere in this document.

Determination: Based on past survey work, it is likely that marten do not occur in the analysis area. Fire-killed or roadside tree removal under alternative D of the Moonlight and Wheeler Fires Recovery and Restoration Project would not impact either marten habitat or population trends on the PNF. Considering the rare chance that individuals are present in the analysis area, alternative D may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American marten.

3.5.2.4.1.6 Pallid Bat

Direct effects from the proposed actions are possible if this species occurs in the analysis area. Destruction of active roosts through felling or removal of fire-killed trees with hollows could displace or harm individual bats. Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment resulting in lowered reproductive success. These effects would be most severe during the breeding season (May 20 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. Activities conducted during the winter months can potentially disturb hibernacula sites (winter shelters), causing species arousal and use of crucial energy reserves.

Cumulative Effects: Both the Hungry and Boulder Fires in 2006 created abundant fire-killed tree habitat. Both fires combined to burn a total of around 3,547 acres; approximately 324 acres of fire-killed tree removal occurred on these burned acres (9 percent). The availability of fire-killed trees for bat use in the Antelope Lake area is abundant.

Habitat attributes like large fire-killed trees would be removed or modified by the proposed action, which could result in direct mortality of bat species that may be roosting within the fire-killed tree. Approximately 20,881 acres on public and private land (24 percent) is proposed for fire-killed or hazard tree removal within the analysis area under alternative D. On public land, approximately 9,427 acres of fire-killed or hazard tree removal would occur under alternative D. This is 14 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 58,981 acres (86%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed

trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable pallid habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

There would be no habitat disruption or modification to rock outcrops, caves and mining adits. No man-made structures that could provide habitat for bats are planned for removal or modification, other than roads and culverts, both of which do not provide habitat.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative D of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the pallid bat.

3.5.2.4.1.7 Western Red Bat

Effects are similar as described for pallid bat except that impacts for this analysis are tied directly to impacts on cottonwood trees. Mature cottonwood trees suitable for red bat roosts are located along many stretches of perennial streams within the analysis area but primarily along Indian Creek, south of Antelope Lake. Many of these large cottonwoods died as a result of fire. No cottonwood or other hardwood trees would be removed within salvage treatment units. Cottonwood tree removal in roadside hazard treatment units is possible if any are deemed hazardous but this is expected to be very limited (may even be non-existent). Therefore, it is possible there could be a minimal direct loss of habitat for this species. It is unknown as to what extent fire-killed trees, especially preferred riparian trees such as cottonwoods, are used by red bats, but if bats are using cottonwoods that are felled, direct mortality could occur. Downstream of the fire, some cottonwood exists that could replace those consumed by fire and potentially removed as hazards.

Cumulative Effects: Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire

severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Determination: This species is relatively rare on the PNF but its presence in isolated areas, as well as the presence of cottonwood in the project area, warrants a determination that alternative D of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Western red bat.

3.5.2.4.2 USDA Forest Service R5 Management Indicator Species

3.5.2.4.2.1 Black-backed Woodpecker (BBWO)

With alternative D, approximately 86 percent of the public land within the analysis area has no fire-killed or roadside hazard tree removal planned. Maintaining 86 percent (58,981 acres) of public land within the analysis area in an unsalvaged condition can benefit species closely tied to early post-fire conditions, including the BBWO (Kotliar et al. 2002).

In addition, nineteen snag retention areas, ranging in size from 7 to 27 acres, were designated over approximately 13 percent (174 acres) of salvage treatment areas. Fire-killed tree removal is not proposed within these snag retention areas. Primary selection criteria for snag retention areas were: 1) areas formerly identified as Spotted Owl PACs; 2) along treatment unit boundaries adjacent to non-burned and low severity areas; 3) within RHCAs; and 4) in stands that supported a minimum of 40 percent canopy cover pre-fire.

Within salvage treatment units and roadside hazard treatment units, alternative D proposes the removal of fire-killed trees greater than 14 inches for sawlog product and trees less than 14 inches for biomass product. In the 5,656 acres proposed under this alternative 1,267 acres are within salvage units and 4,389 acres are within roadside hazard tree units. As a result of both sawlog and biomass proposed for harvest within these units, there would be no small fire-killed tree availability, except in snag retention areas and RHCA equipment restriction zones.

Snags would be retained to meet Riparian Management Objectives (RMOs) for down woody debris recruitment. Snags greater than 15 inches dbh would be retained at 4 snags/acres in all treated RHCAs. RHCAs have been incorporated into the 10 acre (average) snag retention areas where appropriate.

Black-backed woodpecker chicks that are present within the treatment units and have not yet fledged by July 30, 2009, the scheduled start of implementation, could be directly

killed due to removal of occupied nest trees. Possible direct mortality of chicks could occur in 2010 as well if harvest units remain and are scheduled to be treated during the nestling stage.

Cumulative Effects: Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough Ranger District. and Dry Flat on the Beckwourth Ranger District) were implemented in 2008. These two projects removed roadside hazard trees from approximately 3,330 acres.

The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract and ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area. In addition to these public land projects, approximately 11,454 acres of the 19,238 acres of private land within the analysis area was salvage logged in 2007 and 2008.

Table 86. Cumulative amount of BBWO suitable habitat remaining post treatments (public land).

		Alternative D Cumulative		
CWHR Type (pre-fires)	Created BBWO Habitat in Analysis Area	Cumulative Acres (all projects) BBWO Habitat Planned for Fire-killed or Roadside Hazard Tree Removal under Alt D	Post Moonlight and Wheeler Project Habitat Available for BBWO	
			Acres Remaining	% Remaining
CWHR 4M/4D	17,896	2,710	15,186	85%
CWHR 5M/5D	14,673	1,888	12,785	87%
Total	32,569	4,598	27,971	86%

Approximately 32,569 acres of public land within the analysis area is considered suitable BBWO habitat as a result of high to moderately high severity fire burning through pre-fire 4M, 4D, 5M, and 5D. Table 81 shows the cumulative amount of BBWO habitat remaining on public land. All proposed or ongoing fire-killed tree removal project acreage within the analysis area (this project, two roadside hazard projects, and two smaller salvage projects) are accounted for in table 81. Approximately 4,598 of these acres under alternative D would become unsuitable after post fire-killed or roadside hazard tree treatments, leaving 27,971 cumulative acres of suitable BBWO habitat.

Table 87. Cumulative amount of moderately high to high (>50 BAM) severity salvaged and unsalvaged in the wildlife analysis area (public land).

Total Acres Mod-High Severity in Analysis Area	Moonlight and Wheeler Acres Proposed for Dead or Hazard Tree Removal	Acres Proposed for Salvage (all other projects)	Acres Un-salvaged	% of Mod-High Severity Unsalvaged
	Alt D			
47,825	4,278	1,894	41,652	87%

Table 82 indicates that, under alternative E, 87 percent of the analysis area classified as high severity to moderately high severity burn would not be salvage logged. Areas untreated would continue to be available as BBWO habitat somewhere between 5 and 7 years. After this time period, the quality of foraging habitat declines because the fire-killed wood habitat no longer supports prey species that BBWOs consume.

Snag density estimations post treatment on public land within the analysis area has been done. Snag numbers reflect cumulative effects, that is, all Forest Service projects ongoing or proposed that are/would remove fire-killed trees, and are averaged across the landscape (public land within the analysis area – 68,408 acres).

Implementation of all projects under alternative D results in an estimated post harvest snag density (greater than 15 inches dbh) across the 68,408 acres of public lands of 13.3 snags/acre. The cumulative amount of snags 10 inches- 14.9 inches dbh post harvest under this alternative is estimated to be 26 snags/acre.

Cumulative Effects: Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Private timberlands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the summer of 2008 fire salvage harvest has been occurring on these lands. Over 11,400 acres have been salvage harvested to date and, although additional salvage may take place, future salvaged acres on private land is expected to be minimal. Private fire salvage projects have occurred mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees within these private parcels. It is

reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Implementation of fire-killed or roadside hazard tree removal on 5,656 acres of 68,408 acres of public land as designed, in combination with past, present and reasonably foreseeable future actions would result in a decline in BBWO habitat availability and distribution across the PNF. That being said, there would still be short term population increase resulting from the suitable habitat remaining after the proposed project.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Black-Backed Woodpecker Trend. In 2008, a pilot study for black-backed woodpecker monitoring was conducted in the Sierra Nevada (Siegel et al. 2008). Black-backed woodpeckers were detected at 68 of 371 survey stations, in 10 of the 19 fire areas. Occupied sites were well distributed across the Sierra Nevada national forests, ranging from the Lassen NF to the Sequoia NF. This included two sites surveyed in or adjacent to the Moonlight and Wheeler Project analysis area: the Moonlight Fire (due west of Antelope Lake – 16 of 24 stations with BBWO detections and the Boulder Complex Fire (north of Antelope Lake) – 11 of 22 stations with BBWO detections. Detections occurred in every major pre-fire CWHR habitat type surveyed; occupied fire areas ranged in size from small (170 ha, 420 ac) to very large (26,159 ha, 64,639 ac) and ranged from 1 year post-fire to 7 years post-fire. Detections occurred at stations in all three fire severity classes, but more severely burned forest stands were more likely to be occupied (7.8% of the low-severity stations, 17.2% of the moderate-severity stations, and 25.2% of the high-severity stations). BBWOs still occupied fires 7 years old (3 of the 4 seven-years post-fire sites surveyed were occupied). The two sites surveyed where only 1 year had elapsed since fire were occupied, which supports other studies regarding the ability of this species to quickly find and colonize new habitat patches.

The pilot study results indicate that the black-backed woodpecker is “widely distributed across recently burned forest stands in the 10 Sierra Nevada national forests.” Black-backed woodpeckers were detected at numerous fire areas where at least some degree of post-fire logging had occurred (e.g., Boulder Complex Fire, Bassetts Fire) or was in process. Most of these sites had nearby patches of unlogged habitat. However, in two of the fires surveyed (Kibbie and Vista), black-backed woodpeckers were abundant in areas that had not been salvage logged, but absent from the areas that clearly had been salvaged logged.

A query of wildfires between 2000 and 2008 that burned in and around the Tahoe, Plumas, Lassen, and Modoc National Forests and were greater than 1,000 acres was done to obtain a ballpark figure of how much potential habitat is available in the northeast California region (Yasuda, pers. comm. 2009). Of the 51 fires queried, 107,566 acres on forested National Forest lands burned at high severity. The Forest Service Activity Tracking System (FACTS) showed that 9,050 acres were salvaged in these fire areas, leaving 98,516 acres (92%) in an unsalvaged state. After the estimated BBWO suitable acreage to be removed under Alternative D (4,598) is deducted, 93,918 acres (87%) of forested (conifer) areas in this region which burned at high severity between 2000 and 2008 would still support potential BBWO suitable habitat.

The cumulative effect of the Moonlight and Wheeler Project in terms of changes in medium-sized and large-sized snags per acre within burned forest habitat would change

from the existing condition. With implementation of the Moonlight and Wheeler Project, there would be a reduction in burned forest habitat supporting snags thus potentially reducing habitat that could support BBWO. Thus the potential for the analysis area to support BBWO declines post project implementation. But overall, post-project, the analysis area still leaves untreated the majority of suitable habitat created by the two fires. Alternative D would not alter the existing trend in the ecosystem component, nor would it lead to a change in the distribution of black-backed woodpecker across the Sierra Nevada bioregion."

The cumulative amount under alternative D (9,427 total estimated acres treated, would leave about 86 percent of public land unharvested. Hutto (2006) recommends as a management priority retention of some burned forest 0-5 years after a fire because that is the narrow window of time during which the biologically unique early postfire conditions become established and persist. Leaving the majority of the burn in an unharvested condition maintains an important component of biological diversity identified by Hutto (2006): "all the unique plants and animals that depend on those first few years of natural (postfire) succession. This includes the BBWO.

Prior to the Moonlight and Antelope Complex fires, there was approximately 1,267 acres of burned snag habitat within the analysis area (from the 2001 Stream Fire). Assuming BBWO densities @ 3.2/40 ha in burned forest (1 pair/32 acres) (Bock and Lynch 1970) or 1 pair/500 acres) (Raphael and White 1984 in NatureServe 2007), this habitat (snags in burned forest) potentially supported between 2 and 39 pair of BBWOs between 2002 to 2007.

In 2007, the Moonlight and Antelope Complex fires combined burnt over 87,000 acres. Within the 87,647 acre analysis area (the two fire perimeters), approximately 32,659 acres of suitable BBWO habitat was created by high severity fire. This provides enough habitat (snags in burned forest) to theoretically support an additional 65 to 1,020 pairs. Thus the Moonlight and Antelope Complex fires created an upward trend in BBWO habitat from existing conditions that could have increased the short term trends in woodpeckers in the analysis area.

3.5.2.4.2.2 Benthic Macroinvertebrates

Project design as described above describes the large areas of public land within the analysis area where coarse woody debris would be maintained and recruited. Table 85 shows the indicator measures for coarse woody debris.

Table 88. Measures for coarse woody debris amounts and recruitment

	Alternative D
Avg. Tons/Ac of Coarse Woody Debris (short-term: Post-harvest)	0.5 – 4.3
Avg. Tons/Ac of Coarse Woody Debris (long-term: 30 years)	0.8 – 12.4
Avg. number of snags > 15" available for large woody debris recruitment to streams(Short-term: Post-harvest)	4-6 of the largest snags per acre in treated RHCAs
Percent of Acres in RHCAs planted	100%

Treatments under alternative D within RHCAs both of which retain snags that would serve as recruitment for coarse woody debris. Within RHCAs generally four to six of the largest snags per acre would be retained, preferably within falling distance of the channel where available, to provide for large woody debris recruitment to best meet riparian management objectives. Within ground-based salvage harvesting treatments, snag retention in RHCAs would be most preferable and efficient within equipment exclusion zones where snags would be within reasonable falling distance of the channel for coarse woody debris recruitment and harvesting safety issues would be minimized due to equipment exclusion. Fire killed trees will be harvested within the RHCAs, reducing the potential LWD recruitment into perennial and intermittent streams as well as reducing shade provided by these trunks; all green trees and four to six of the largest snags per acre would be retained in the RHCAs which would continue to contribute both LWD recruitment and shade.

Post-fire mortality of fire-injured trees, particularly within Moderate and High vegetation burn severity areas, would occur in the first three to five years immediately following the fire event. Snag recruitment and coarse woody debris recruitment would continue to occur within these areas as well.

Because of biomass removal of standing dead below 14 inch dbh, and harvest of standing dead above 14 inch dbh within up to 8,536 acres under this alternative, LWD amounts in tractor units are estimated to decrease in time from 7.3 tons per acre on the average (estimated present condition) to 5.6 tons per acre on the average 30 years after the fire. There will be some recruitment from those fire damaged trees that will die 3 to 5 years after the fire. In treated areas of tractor units, there are wildlife snag retention stands to meet minimum snag standards (USDA 2004b). There will be some recruitment from retention of four to six of the largest snags per acre within falling distance of perennial and intermittent streams.

The wildfire consumed both riparian and conifer vegetation that provide surface water shade. Thus up to 100 percent of existing vegetation providing shade has been removed. No live vegetation currently providing minimal shade would be removed by alternative D, thus no immediate change in water surface shade is expected. Fire-killed trees provide a minor amount of shade, thus some structural shade would be removed, but amount of shade provided by fire-killed trees is much less than prior to the fire and probably not very influential in terms of water temperatures. Large woody retention/recruitment within RHCAs of perennial and intermittent streams would result in a large flush of woody material over the next 10 years and then no recruitment for the next 50+ years. Vegetative response post fire by riparian species would help recover surface water shade within two-five years (USDA 2008d).

Within the tractor units; areas outside of the snag retention zones would be devoid of all snags greater than 14 inches dbh and thus any shade larger diameter snags provide would be lost. There is the potential for increased temperatures due to lack of forested or “snag” cover in the short term, and increased conifer cover in the long term (10-15 years) with the growth of the planted conifers throughout the units harvested. The potential for a short term increase in temperature could affect the timing of life histories of sensitive aquatic macroinvertebrates.

The impacts of alternative D would not be higher than that of the wildfire, though the salvage activities would prolong natural recovery from 2 to 5 years (ibid). The steep slopes, though more erosive, would return to natural fire recovery within two years, while the shallow slopes where ground based systems are used would return fire recovery within 3-5 years. Slope restrictions for ground based harvest under 25 percent slope would lower erosion potential on 858 acres under alternative D.

Changes in stream flow, above the levels that may have increased due to vegetative removal by fire, are not expected to increase with removal of fire-killed trees. Therefore direct affects of tree removal of fire-killed trees, reforestation and minor road construction would not impact perennial or intermittent stream flows.

Flow changes depending on the water year. The overwhelming effect to hydrologic function, in any of the alternatives, is that of cover loss and potential for widespread overland flow. With a high water event there would be potential for a debris flow to occur within the stream courses in those watersheds. “Overland flow can be initiated when surface infiltration capacity is drastically reduced. The effect of wildfire in the event of high intensity rainfall is comparably much higher than roads or harvest” (USDA 2009f). There is a minimal change in the TOC/ERA values with the implementation of alternative D and the greatest effect to flow would be within those seventeen watersheds analyzed that are currently over threshold prior to the implementation of action alternatives and would remain over threshold. The existing flow condition should remain the same post fire unless large water event occurs thus impacting the existing macroinvertebrate habitat.

The watershed report (USDA 2009f) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including habitat occupied by macroinvertebrates.

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use.

The direct/indirect and cumulative effect of dead tree removal, roadside hazard tree removal, and reforestation would not change the existing amount of riverine or lacustrine habitat, would not change the amount of montane riparian habitat present in the project area, would not result in any reduction in deciduous canopy closure, or result in a change in size class of existing riparian vegetation. No live trees (deciduous or coniferous) would be removed. Thus the amount of total live tree canopy cover would not be reduced. Grazing should have little impact on riparian vegetation and meadow recovery. Changes in flow and water surface shade will be too small to be measured. Sedimentation is

expected to increase as a result of vegetative removal caused by the wildfire. With alternative D some short term increase of sedimentation is expected from soil disturbance with tractor logging. This action may extend the timeline for habitat recovery and pre-fire macroinvertebrate community.

Population Status and Trend Summary for the Sierra Nevada National Forests. Same as alternative A. Please refer to that discussion.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Aquatic Macroinvertebrates Habitat Trend. Same as alternative A. Please refer to that discussion.

3.5.2.5 Alternative E – Direct, Indirect, and Cumulative Effects

3.5.2.5.1 USDA Forest Service R5 Sensitive Species

3.5.2.5.1.1 Mountain Yellow-legged Frog (MLYF)

Sheltering habitat for MYLFs also includes landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs. A reduction in fire-killed wood would result in a lack of connectivity and cover for frogs that could possibly move out of Lone Rock Creek and into the floodplain, the Riparian Habitat Conservation Areas (RHCAs), and upland habitats. Possible indirect effects to frogs using the RHCA for dispersal, and over wintering may include a reduction in cover provided by woody debris, warmer and drier microclimate conditions due to removal of fire-killed trees in RHCA areas, and reduction in connectivity provided by woody debris between aquatic habitats, RHCAs, and uplands. Cover for aquatic-dependent species and effective soil cover in this post-fire environment are very important for the proper functioning of aquatic and riparian habitats until vegetation can reestablish and provide these habitat elements (5-30+ years). As vegetation reestablishes, the role of the standing fire-killed and downed wood would be reduced.

The PNF conducted a 3-year telemetry study on the MYLF to determine the degree of overland movements into RHCA in order to minimize impacts from fuel reduction efforts across the forest (Wengert 2008). The 3-year study found that MYLF have very limited movements into upland habitats or adjacent riparian areas. For example, during the 3-year study, only one movement greater than 1 meter occurred away from the wetted stream channel into riparian or upland habitat. This movement by 1 MYLF was recorded at 77 feet away from the wetted stream channel. The study concluded that off-stream channel movements were very rare and that in-stream movements within and up and down the wetted stream channel were common and frequent traits of MYLF behavior. Therefore, the project design features and mitigations which include RHCA equipment restriction zones, Best Management Practices (BMPs) to prevent water quality degradation (Appendix C, Table C-1) and Riparian Management Objectives standards (in project record) should provide adequate protection to minimize impacts to the MYLF within riparian or upland habitats.

Cumulative Effects: The following discussion on watershed conditions within the analysis area is drawn from the Moonlight and Wheeler Fires Recovery and Restoration Project Watershed Report (USDA Forest Service 2008).

Two of the three watersheds with known MYLF populations, Lower Lone Rock Creek and West Branch Light Creek, currently exist well above TOC (table 98). These two watersheds are susceptible to very high cumulative effects risk, such as erosion and large movement of sediment into streams. Lower Indian Creek watershed, suspected of having MYLF but with no detections to date, is also over TOC and at very high risk. Pierce Creek watershed exists below TOC but the risk of cumulative effects is still considered high.

Table 89. Cumulative condition of watersheds with known/suspected MYLF populations.

Watersheds	ERA % TOC	ERA (% of the TOC)*	
		Existing	Alt E
Lower Lone Rock Creek	13	118%	122%
Pierce Creek	12	80%	85%
West Branch Lights C.	13	163%	172%
Lower Indian Creek	12	132%	142%

*ERA is shown as the percent of the TOC for each watershed. For example, a watershed that is above the TOC will have a total value greater than 100. Total ERA contributions less than 100 are below the TOC. As disturbance approaches and exceeds the TOC, the risk of detrimental watershed effects increases.

As table 84 shows Alternative E of the Moonlight and Wheeler Project would increase the percentage of TOC from existing conditions for all four watersheds. The cumulative risk assessment in all four of these watersheds is not expected to change from what exists currently. The West Branch Lights Creek watershed has the highest existing cumulative risk and under Alternative C this remains extreme. The bulk of the Moonlight and Wheeler Project's harvest activities, particularly by tractor, are concentrated in this watershed, and therefore greater adverse effects are expected.

There are over 19,000 acres of private land within the analysis area. Cumulative effects from private land use (timber and gravel extraction, fire salvage harvest, livestock grazing, and urbanization) would continue to create water quality problems, including sedimentation and bank cutting. The additive impact from private land logging on these and other drainages in the analysis area have been incorporated into the cumulative watershed effects analysis and is reflected in the high ERA values.

The analysis area occurs within the boundaries of nine active livestock grazing allotments, the majority of which is composed of the Clarks Creek, Lights Creek, and Lone Rock allotments. Grazing capacity within allotments is based on the primary range (meadow systems) and not on secondary or transitory range. At this time there are no plans to increase livestock stocking rates or use due to the increase in transitory range created by the fire. Based on the existing stocking rates and current range conditions, the season of use, the distribution of primary range across the project area, as well as no

increased stocking due to increase in transitory range, there should be no change in livestock effects to habitat conditions over the long term (5+ years).

Within the nine active grazing allotments in the fire perimeters there is expected to be minimal impacts to critical riparian areas due to the following reasons: 1) cows did not graze burned areas in 2008, the season after the wildfires, therefore riparian vegetation have had a full year of rest to resprout, 2) the increase in transitory (upland) range 2-5 years after the fires may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable, and 3) long term recovery will be unimpeded through strict adherence to use standards which are: 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture when any one of these triggers are reached. In addition, the Lower Lone Rock Creek watershed, which supports a well distributed population of MYLFs on Forest Service land, is scheduled to have a 1.5 mile temporary electric fence constructed in spring, 2009, before the cattle are turned out, which will prevent grazing in that reach of the watershed, further allowing riparian vegetation and streambanks to recover.

Determination: Application of BMPs will be used to lower incidence of surface erosion on the hill slope and prevent sediment delivery to the valley bottoms. Since 1992, the Plumas NF has conducted over 600 evaluations of BMP effectiveness per the approved R5 protocol. The most recent summary of this monitoring was produced following the 2007 field season (USDA 2008a). That summary listed 441 evaluations of BMPs for the type of activities proposed under the action alternatives. BMPs were rated as effective for 79.8% of those evaluations. When effects from roads already in use are separated from activity areas, BMP effectiveness is over 90%. Based on predicted hill slope erosion rates for skyline and tractor yarding in the first year after harvest (reported in watershed section), and considered along with observed recovery of riparian buffers and incorporation of BMPs, it is expected that actual rates of delivery to the valley bottom would be near the background rate for burned areas that are not harvested.

Significant vegetative recovery of riparian zones has occurred since the fire (based on 2009 surveys, see watershed section). These same surveys revealed that these riparian zones provided effective buffers for sediment deposition. In the three watersheds suveyed, Hungry, Lights and Moonlight Creeks, effectiveness of riparian area in mitigating rilling from upslope sources was estimated at about 80%, 60% and 90%, respectively. In each watershed pre-fire vegetation, and post-fire re-growth, along with litter cast, had developed ground cover to levels as high, or better, than the upslope condition. Typically, riparian vegetation, and associated breaks in slope at the valley bottom and near channel floodplain largely dissipate flow energy and induce deposition of transported fines. BMP effectiveness monitoring results for project-applicable activities on the forest are about the 90% level. Therefore sediment delivery to a channel buffer from an activity area is expected to be very slight and further degradation of water quality due to sediment delivery from harvested areas is not expected. The slight amounts of sediment generated from activity areas during a high runoff event would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

The watershed report (2009) concluded that given implementation of erosion control features in activity areas, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of precipitation that induces overland flow in the burned watersheds. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses, including mountain yellow-legged frog suitable and occupied habitat.

The Moonlight Wheeler Fire Restoration project "May affect, but is not likely to adversely affect or result in a loss of viability or a trend toward federal listing." This determination is based on project design features and mitigations that will lessen and minimize impacts to the MYLF which include; 1) Incorporation of RHCA equipment restriction zones, 2) Implementation of Best Management Practices, and 3) Implementation of soil and water mitigation standards (RMOs). These design features and mitigations combined with results from the PNF's 3-year telemetry study indicate that impacts to the MYLF are not expected to result in adverse effects or loss of viability.

3.5.2.5.1.2 Bald Eagle

The direct, indirect, and cumulative effects to the bald eagle in the analysis area under this alternative are essentially the same as presented under Alternative A. To avoid repetition, please refer to that discussion elsewhere in this document.

Alternative E, with implementation of LOPs that have proved effective in the past for salvage and restoration projects (Stream and Boulder fires) within nesting territories at Antelope Lake, would not have any additional cumulative effects on habitat within the BEMA, individual nesting territories or cause any change in population distribution across the PNF or the Sierra Nevada range.

Determination: Alternative E may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the bald eagle.

3.5.2.5.1.3 California Spotted Owl

Under Alternative E, roadside hazard tree removal treatments would occur on 4,389 acres using only tractor logging systems. Two PACs within the PNF PAC network would be minimally treated (8 acres total) under these actions. Removal of roadside hazard trees would not change the existing condition of the amount of suitable habitat. Narrow corridors of dispersal (live-green forested) habitat existing within the analysis area would remain after roadside hazard tree removal treatments.

Under this alternative approximately 436 acres of roadside hazard tree removal would occur in areas formerly known as PACs and approximately 920 acres would occur in what was formerly designated as HRCAs. This combined 1,356 acres proposed for treatment is not suitable owl habitat due to the effects from moderately high and high severity fire, and the PAC numbers have been removed from the PNF spotted owl network of PACs.

Table 85 shows treatments that are proposed under alternative E that fall within the eight remaining PACs and associated HRCAs. The acres within PACs PL071 (1 acre) and PL286 (7 acres) are proposed for roadside hazard removal treatment only. All acres

summarized in table 85 reflect areas where fire killed trees or roadside hazard trees are planned for removal. No suitable owl habitat (CWHR 4M, 4D, 5M, 5D) would be entered or altered by the proposed actions.

Table 90. Proposed treatment acres under alternative E in remaining PACs and HRCAs within analysis area.

PAC #		ALT E	PAC #		ALT E
PL071	PAC	1	PL167	PAC	0
	HRCA	19		HRCA	0
	TOTAL	20		TOTAL	0
PL073	PAC	0	PL230	PAC	0
	HRCA	5		HRCA	0
	TOTAL	5		TOTAL	0
PL107	PAC	0	PL286	PAC	7
	HRCA	2		HRCA	13
	TOTAL	2		TOTAL	20
PL109	PAC	0	PL287	PAC	0
	HRCA	41		HRCA	111
	TOTAL	41		TOTAL	111

Under alternative E there would be no new system road construction so no long-term increases in human activities are expected as a result of this action. Temporary roads constructed under this alternative would be decommissioned upon completion of the project. Road density would remain the same within the analysis area as pre-fire conditions, which is 2.62 miles of open road/square mile.

Cumulative Effects: Please refer to the cumulative effects section for the spotted owl under Alternative A, which is essentially the same for this alternative except for the discussion on cumulative post-fire treatments, which is provided below

Table 86 shows all acres of proposed or current treatments from fire-killed or hazard tree removal actions within the analysis area for alternative E. Approximately 19,877 acres on public and private land (23 percent) is proposed for fire-killed or roadside hazard tree removal within the analysis area under alternative E. On public land, approximately 8,160 acres of fire-killed or hazard tree removal would occur under alternative E. This is 12 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 60,248 acres (88%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable spotted owl habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Table 91. Acres of proposed and current post-fire treatments in the wildlife analysis area – Alternative E

	Alt E acres	% of	% on

	proposed for fire-killed/hazard tree removal	analysis area	public land
Moonlight and Wheeler Project	4,389	5%	6%
Antelope RSHTR Project	2,036	2%	3%
Dry Flat RSHTR Project	1,294	1%	2%
Camp 14 Project	249	0%	0%
North Moonlight Project	192	0%	0%
Private Land salvage	11,454	13%	n/a
Total on public land	8,160	9%	12%
Total: public and private land	19,877	23%	n/a

As was acknowledged in the Affected Environment section and documented in post-fire survey results, spotted owls can and do utilize unlogged severely burned forests. The cumulative removal of fire-killed or roadside hazard trees on approximately 8,160 acres of public land under this alternative does contribute to overall habitat degradation due to the removal of fire-killed structures supporting habitat. These actions could potentially adversely affect spotted owls if any are present in these areas due to disturbance and loss of foraging habitat.

Based on spotted owl survey information, implementation of fire-killed or hazard tree removal could be subject to a LOP that would restrict tree removal during the nesting season (March 1 to August 15). Based on known information and as-needed implementation of a LOP, fire-killed or hazard tree removal should not disturb known nesting pairs, and would not alter the current distribution of owl PACs across the PNF. The cumulative removal of fire-killed or hazard trees from 18 percent of public land under this alternative would modify burned habitat with fire-killed tree structure removal, but would not reduce spotted owl PAC/HRCA occupancy, distribution, or the spotted owl population on the PNF above that resulting from the wildfire. Fire-killed tree removal within the analysis area would not impact either habitat or population trends on the PNF.

Determination: This alternative would reduce long-term hazardous surface fuels on 4,389 acres that would accumulate over time if nothing was done. This fuel reduction would have a beneficial affect on future fire behaviors, including decreased fire intensity and rate of spread that could enhance suppression capabilities and firefighter safety. This could allow for increased protection of the developing stands, resulting from reforestation efforts, which could provide forested habitat suitable for owls (CWHR 4P to 4M) in approximately 90 years.

Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, as well as incorporation of LOPs to reduce disturbance during critical periods if needed, alternative E of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the California spotted owl.

3.5.2.5.1.4 Northern Goshawk

There would be no direct effects to individuals or goshawk habitat. The greatest impact to goshawks and goshawk habitat was the Moonlight and Antelope Complex fires. Within the analysis area (burn perimeter), prior to the fires, there was 45,660 acres of public land of suitable goshawk nesting/high quality foraging habitat (CWHR 5D, 5M, 4D, and 4M); after the fire there is currently approximately 4,055 acres of public land that are suitable goshawk nesting/high quality foraging habitat located across the fire landscape within the analysis area

Alternative E would remove, using tractor logging systems, roadside hazard trees from, up to 4,389 acres that do not support habitat considered suitable for goshawk. This action would not reduce live tree canopy cover, or degrade any nesting and foraging habitat for goshawk. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no post fire goshawk habitat would be logged, degraded and/or rendered unsuitable by the proposed action.

Approximately 123 acres of fire-killed tree removal would occur in areas formerly known as PACs (same as under alternative D – see table 80) This fire-killed tree removal acreage is not suitable goshawk habitat due to fire effects and is provided for information and for future acre accountability.

Removal of fire-killed or roadside hazard trees that could be available for additional prey species if left on site may incrementally impose a decrease in habitat suitability for goshawks from pre and post treatment conditions. No suitable nesting or foraging habitat would be directly affected by fire-killed tree removal, as only fire-killed trees within moderately high and high severity burn areas would be removed.

Cumulative Effects: The cumulative effects on the northern Goshawk are essentially the same as for the spotted owl under this alternative. Please refer to that discussion elsewhere in this document.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative E of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Northern goshawk.

3.5.2.5.1.5 American Marten

Alternative E would remove using tractor logging systems roadside hazard trees from burned areas (up to 4,389 acres) that do not support habitat considered suitable for marten. This action would not reduce live tree canopy cover, or degrade any denning, resting, and foraging habitat for marten. The present condition of late-successional forest habitat within the analysis area would not change from the existing condition created by the wildfire. Thus no marten habitat would be logged or rendered unsuitable by the proposed actions. There may be instances where individual live trees may be cut for safety purposes or to facilitate access to harvest fire-killed trees. These instances are expected to be rare and impacts to existing live tree stands minimal.

Treatments are proposed within the PNF draft carnivore network. Under alternative E, this project would treat 1,616 acres for roadside hazard tree removal. As stated previously, little to no live trees would be removed or impacted by the project's actions and there is expected to be no change in present CWHR types. The remaining CWHR

4M/4D/5M/5D stands, which provide suitable habitat and connectivity for the marten and other mesocarnivores, would not be treated and only minimally affected by this project.

The open road density within the project area is 2.62 miles of open road/square mile. Open road density would remain the same with this alternative. According to early habitat models (Freel 1991) this road density provides low-no habitat capability for the marten and other forest carnivores.

Cumulative Effects: The cumulative effects on the marten are essentially the same as for the spotted owl under this alternative. Please refer to that discussion elsewhere in this document.

Determination: Based on past survey work, it is likely that marten do not occur in the analysis area. Fire-killed or roadside tree removal under alternative E of the Moonlight and Wheeler Fires Recovery and Restoration Project would not impact either marten habitat or population trends on the PNF. Considering the rare chance that individuals are present in the analysis area, alternative E may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American marten.

3.5.2.5.1.6 Pallid Bat

Direct effects from the proposed actions are possible if this species occurs in the analysis area. Destruction of active roosts through felling or removal of fire-killed trees with hollows could displace or harm individual bats. Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment resulting in lowered reproductive success. These effects would be most severe during the breeding season (May 20 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. Activities conducted during the winter months can potentially disturb hibernacula sites (winter shelters), causing species arousal and use of crucial energy reserves.

Cumulative Effects: Both the Hungry and Boulder Fires in 2006 created abundant fire-killed tree habitat. Both fires combined to burn a total of around 3,547 acres; approximately 324 acres of fire-killed tree removal occurred on these burned acres (9 percent). The availability of fire-killed trees for bat use in the Antelope Lake area is abundant.

Habitat attributes like large fire-killed trees would be removed or modified by the proposed action, which could result in direct mortality of bat species that may be roosting within the fire-killed tree. Approximately 19,877 acres on public and private land (23 percent) is proposed for fire-killed or roadside hazard tree removal within the analysis area under alternative E. On public land, approximately 8,160 acres of fire-killed or hazard tree removal would occur under alternative E. This is 9 percent of the 68,408 public land acres within the analysis area. Thus, under this alternative, approximately 60,248 acres (91%) of the fire land base located on public land would not be treated for fire-killed or hazard tree removal. This land base would be supporting various densities of fire-killed trees with the overall snag density (15”dbh or greater) estimated at 13.3 snags/acre. In the long-term, fire-killed tree removal would not result in any additional unsuitable pallid bat habitat above what was changed due to wildfire; but it does in the short term (one to two years) contribute cumulatively to overall habitat degradation when

added to the conditions created by wildfire, primarily due to the removal of fire-killed structures supporting habitat.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

There would be no habitat disruption or modification to rock outcrops, caves and mining adits. No man-made structures that could provide habitat for bats are planned for removal or modification, other than roads and culverts, both of which do not provide habitat.

Determination: Based on the changes to habitat expected from the fire-killed tree removal and subsequent reforestation, alternative E of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the pallid bat.

3.5.2.5.1.7 Western Red Bat

Effects are similar as described for pallid bat except that impacts for this analysis are tied directly to impacts on cottonwood trees. Mature cottonwood trees suitable for red bat roosts are located along many stretches of perennial streams within the analysis area. Many of these large cottonwoods died as a result of fire. No cottonwood or other hardwood trees would be removed within salvage treatment units. Cottonwood tree removal in roadside hazard treatment units is possible if any are deemed hazardous but this is expected to be very limited (may even be non-existent). Therefore, it is possible there could be a minimal direct loss of habitat for this species. It is unknown as to what extent fire-killed trees, especially preferred riparian trees such as cottonwoods, are used by red bats, but if bats are using cottonwoods that are felled, direct mortality could occur. Downstream of the fire, some cottonwood exists that could replace those consumed by fire and potentially removed as hazards.

Cumulative Effects: Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately

10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Determination: This species is relatively rare on the PNF but its presence in isolated areas, as well as the presence of cottonwood in the project area, warrants a determination that alternative E of the Moonlight and Wheeler Fires Recovery and Restoration Project may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the Western red bat.

3.5.2.5.2 USDA Forest Service R5 Management Indicator Species

3.5.2.5.2.1 Black-backed Woodpecker (BBWO)

Alternative E calls for the removal of roadside hazard trees greater than 14 inches for sawlog product and roadside hazard trees less than 14 inches for biomass product on up to 4,389 acres.

With alternative E, approximately 91 percent of the public land within the analysis area has no roadside hazard tree removal planned. Maintaining 91 percent (60,248 acres) of public land within the analysis area in an unsalvaged condition can benefit species closely tied to early post-fire conditions, including the BBWO (Kotliar et al. 2002).

Snags would be retained to meet Riparian Management Objectives (RMOs) for down woody debris recruitment. Snags greater than 15 inches dbh would be retained at 4 snags/acres in all treated RHCAs.

Black-backed woodpecker chicks that are present within the treatment units and have not yet fledged by July 30, 2009, the scheduled start of implementation, could be directly killed due to removal of occupied nest trees. Possible direct mortality of chicks could occur in 2010 as well if harvest units remain and are scheduled to be treated during the nestling stage.

Cumulative Effects: Two roadside safety and hazard tree removal projects (Antelope Complex on the Mt. Hough Ranger District and Dry Flat on the Beckwourth Ranger District) were implemented in 2008. These two projects removed roadside hazard trees from approximately 3,330 acres.

The Camp 14 and North Moonlight projects are fire salvage projects proposed by the Beckwourth Ranger District, Plumas National Forest, and the Eagle Lake Ranger District, Lassen National Forest, respectively. The Camp 14 project is completed while the North Moonlight project is currently under contract and ongoing. These fire salvage projects are limited to less than 250 acres in size, and occur in separate watersheds. Both of these projects include harvesting fire-injured trees in the interest of capturing the value of those trees which were substantially injured by the fire and likely to die in the near future; however, since these projects also primarily target areas of high to moderate burn severity where greater than 50 percent of the basal area was killed, most trees harvested would be dead, fire-killed trees. The contributions of these two projects to cumulative effects

include a localized reduction in snags, in snag recruitment from fire-injured trees, and in high burn severity forest structure. Due to the size, scale, and, in the case of Camp 14, the dispersal of such activities, these localized effects would be minimal when considering the extent of the analysis area. In addition to these public land projects, approximately 11,454 acres of the 19,238 acres of private land within the analysis area was salvage logged in 2007 and 2008.

Table 92. Cumulative amount of BBWO suitable habitat remaining post treatments (public land).

		Alternative E Cumulative		
CWHR Type (pre-fires)	Created BBWO Habitat in Analysis Area	Cumulative Acres (all projects) BBWO Habitat Planned for Fire-killed or Roadside Hazard Tree Removal under Alt E	Post Moonlight and Wheeler Project Habitat Available for BBWO	
			Acres Remaining	% Remaining
CWHR 4M/4D	17,896	2,058	15,838	89%
CWHR 5M/5D	14,673	1,398	13,275	91%
Total	32,569	3,456	29,113	89%

Approximately 32,569 acres of public land within the analysis area is considered suitable BBWO habitat as a result of high to moderately high severity fire burning through pre-fire 4M, 4D, 5M, and 5D. Table 87 shows the cumulative amount of BBWO habitat remaining on public land. All proposed or ongoing fire-killed tree removal project acreage within the analysis area (this project, two roadside hazard projects, and two smaller salvage projects) are accounted for in table 87. Approximately 3,456 of these acres under alternative E would become unsuitable after all post fire-killed or roadside hazard tree treatments, leaving 29,113 cumulative acres of suitable BBWO habitat.

Table 93. Cumulative amount of moderately high to high (>50 BAM) severity salvaged and unsalvaged in the wildlife analysis area (public land).

Total Acres Mod-High Severity in Analysis Area	**Moonlight and Wheeler Acres Proposed for Dead or Hazard Tree Removal**	**Acres Proposed for Salvage (all other projects)**	**Acres Un-salvaged**	**% of Mod-High Severity Unsalvaged**
	Alt E			
47,825	3,013	1,894	42,918	90%

Table 88 indicates that, under alternative E, 90 percent of the analysis area classified as high severity to moderately high severity burn would not be roadside hazard-tree logged. Areas untreated would continue to be available as BBWO habitat somewhere between 5 and 7 years. After this time period, the quality of foraging habitat declines because the fire-killed wood habitat no longer supports prey species that BBWOs consume.

Snag density estimations post treatment on public land within the analysis area has been done. Snag numbers reflect cumulative effects, that is, all Forest Service projects ongoing

or proposed that are/would remove fire-killed trees, and are averaged across the landscape (public land within the analysis area – 68,408 acres).

Implementation of all projects under alternative E results in an estimated post harvest snag density (greater than 15 inches dbh) across the 68,408 acres of public land of 13.3 snags/acre. The cumulative amount of snags 10 inches- 14.9 inches dbh post harvest under this alternative is estimated to be 26 snags/acre.

Reforestation of national forest lands where no salvage harvest is proposed began within the analysis area in spring 2008. A combination of low density wide spaced cluster planting in the Antelope Lake and Babcock Peak areas and low density square-spaced planting in the Camp 14 area occurred within areas of high fire severity accounting for a total of approximately 838 acres planted in 2008. During the summer of 2008, the Frazier Cabin Reforestation Project included 141 acres of mechanical site preparation which accounts for 0.16 percent of the analysis area and consequently results in a negligible contribution to cumulative effects. Approximately 10,500 acres of high severity, unsalvaged areas were planted in Spring 2009 across the Mt. Hough and Beckwourth Ranger District portions of the Moonlight and Antelope Complex fires utilizing a combination of low density planting arrangements. These additional acres of reforestation occurred in unsalvaged areas of the fire including old plantations and natural stands. Manual release treatments would occur within one to two years following planting. The net cumulative effect would be the enhanced establishment of conifer seedlings across the analysis area in order to re-establish forested conditions.

Private timberlands account for over 19,000 acres or approximately 22 percent of the analysis area. Since fall 2007 through the summer of 2008 fire salvage harvest has been occurring on these lands. Over 11,400 acres have been salvage harvested to date and, although additional salvage may take place, future salvaged acres on private land is expected to be minimal. Private fire salvage projects have occurred mostly on productive, well-stocked stands that burned with moderate to high burn severity resulting in a notable reduction in densities of fire-killed and fire-injured trees within these private parcels. It is reasonably assumed based on state forest practice regulations and private timber practices that these areas would be re-planted and managed for maximizing tree growth.

Implementation of fire-killed or roadside hazard tree removal on 4,389 acres of 68,408 acres of public land as designed, in combination with past, present and reasonably foreseeable future actions would result in a decline in BBWO habitat availability and distribution across the PNF. That being said, there would still be short term population increase resulting from the suitable habitat remaining after the proposed project.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Black-Backed Woodpecker Trend. In 2008, a pilot study for black-backed woodpecker monitoring was conducted in the Sierra Nevada (Siegel et al. 2008). Black-backed woodpeckers were detected at 68 of 371 survey stations, in 10 of the 19 fire areas. Occupied sites were well distributed across the Sierra Nevada national forests, ranging from the Lassen NF to the Sequoia NF. This included two sites surveyed in or adjacent to the Moonlight and Wheeler Project analysis area: the Moonlight Fire (due west of Antelope Lake – 16 of 24 stations with BBWO detections and the Boulder Complex Fire (north of Antelope Lake) – 11 of 22 stations with BBWO detections. Detections occurred in every major pre-fire CWHR habitat type surveyed; occupied fire areas ranged in size from small (170 ha, 420

ac) to very large (26,159 ha, 64,639 ac) and ranged from 1 year post-fire to 7 years post-fire. Detections occurred at stations in all three fire severity classes, but more severely burned forest stands were more likely to be occupied (7.8% of the low-severity stations, 17.2% of the moderate-severity stations, and 25.2% of the high-severity stations). BBWOs still occupied fires 7 years old (3 of the 4 seven-years post-fire sites surveyed were occupied). The two sites surveyed where only 1 year had elapsed since fire were occupied, which supports other studies regarding the ability of this species to quickly find and colonize new habitat patches.

The pilot study results indicate that the black-backed woodpecker is "widely distributed across recently burned forest stands in the 10 Sierra Nevada national forests." Black-backed woodpeckers were detected at numerous fire areas where at least some degree of post-fire logging had occurred (e.g., Boulder Complex Fire, Bassetts Fire) or was in process. Most of these sites had nearby patches of unlogged habitat. However, in two of the fires surveyed (Kibbie and Vista), black-backed woodpeckers were abundant in areas that had not been salvage logged, but absent from the areas that clearly had been salvaged logged.

A query of wildfires between 2000 and 2008 that burned in and around the Tahoe, Plumas, Lassen, and Modoc National Forests and were greater than 1,000 acres was done to obtain a ballpark figure of how much potential habitat is available in the northeast California region (Yasuda, pers. comm. 2009). Of the 51 fires queried, 107,566 acres on forested National Forest lands burned at high severity. The Forest Service Activity Tracking System (FACTS) showed that 9,050 acres were salvaged in these fire areas, leaving 98,516 acres (92%) in an unsalvaged state. After the estimated BBWO suitable acreage to be removed under Alternative E (3,456) is deducted, 95,060 acres (88%) of forested (conifer) areas in this region which burned at high severity between 2000 and 2008 would still support potential BBWO suitable habitat.

The cumulative effect of the Moonlight and Wheeler Project in terms of changes in medium-sized and large-sized snags per acre within burned forest habitat would change from the existing condition. With implementation of the Moonlight and Wheeler Project, there would be a reduction in burned forest habitat supporting snags thus potentially reducing habitat that could support BBWO. Thus the potential for the analysis area to support BBWO declines post project implementation. But overall, post-project, the analysis area still leaves untreated the majority of suitable habitat created by the two fires. Alternative E would not alter the existing trend in the ecosystem component, nor would it lead to a change in the distribution of black-backed woodpecker across the Sierra Nevada bioregion.

The cumulative amount under alternative E (8,160 total estimated acres treated) would leave about 88 percent of public land unharvested. Hutto (2006) recommends as a management priority retention of some burned forest 0-5 years after a fire because that is the narrow window of time during which the biologically unique early postfire conditions become established and persist. Leaving the majority of the burn in an unharvested condition maintains an important component of biological diversity identified by Hutto (2006): "all the unique plants and animals that depend on those first few years of natural (postfire) succession. This includes the BBWO.

Prior to the Moonlight and Antelope Complex fires, there was approximately 1,267 acres of burned snag habitat within the analysis area (from the 2001 Stream Fire). Assuming BBWO densities @ 3.2/40 ha in burned forest (1 pair/32 acres) (Bock and Lynch 1970) or 1 pair/500 acres) (Raphael and White 1984 in NatureServe 2007), this habitat (snags in burned forest) potentially supported between 2 and 39 pair of BBWOs between 2002 to 2007.

In 2007, the Moonlight and Antelope Complex fires combined burnt over 87,000 acres. Within the 87,647 acre analysis area (the two fire perimeters), approximately 32,659 acres of suitable BBWO habitat was created by high severity fire. This provides enough habitat (snags in burned forest) to theoretically support an additional 65 to 1,020 pairs. Thus the Moonlight and Antelope Complex fires created an upward trend in BBWO habitat from existing conditions that could have increased the short term trends in woodpeckers in the analysis area.

3.5.2.5.2.2 Benthic Macroinvertebrates

Project design as described above in describes the large areas of public land within the analysis area where coarse woody debris would be maintained and recruited. Table 89 shows the indicator measures for coarse woody debris.

Table 94. Measures for coarse woody debris amounts and recruitment

	Alternative E
Avg. Tons/Ac of Coarse Woody Debris (short-term: Post-harvest)	0.5 – 4.3
Avg. Tons/Ac of Coarse Woody Debris (long-term: 30 years)	0.8 – 12.4
Avg. number of snags > 15” available for large woody debris recruitment to streams(Short-term: Post-harvest)	4-6 of the largest snags per acre in treated RHCAs
Percent of Acres in RHCAs planted	100%

Post-fire mortality of fire-injured trees, particularly within Moderate and High vegetation burn severity areas, would occur in the first three to five years immediately following the fire event. Snag recruitment and coarse woody debris recruitment would continue to occur within these areas as well.

Because of biomass removal of standing dead hazard trees below 14 inch dbh, and harvest of standing dead hazard trees above 14 inch dbh within up to 4,389 acres under this alternative, LWD amounts along roadside corridors are estimated to decrease in time from 7.3 tons per acre on the average (estimated present condition) to 5.6 tons per acre on the average 30 years after the fire. There will be some recruitment from those fire damaged trees that will die 3 to 5 years after the fire. There will be some recruitment from retention of four to six of the largest snags per acre within falling distance of perennial and intermittent streams.

The wildfire consumed both riparian and conifer vegetation that provide surface water shade. Thus up to 100 percent of existing vegetation providing shade has been removed. No live vegetation currently providing minimal shade would be removed by alternative

E, thus no immediate change in water surface shade is expected. Fire-killed trees provide a minor amount of shade, thus some structural shade would be removed, but amount of shade provided by fire-killed trees is much less than prior to the fire and probably not very influential in terms of water temperatures. Large woody retention/recruitment from fire-killed trees not deemed as hazard trees and therefore left standing within RHCAs of perennial and intermittent streams would result in a large flush of woody material over the next 10 years and then no recruitment for the next 50+ years. Vegetative response post fire by riparian species would help recover surface water shade within two-five years (USDA 2008d).

There is the potential for increased temperatures due to lack of forested or “snag” cover in the short term, and increased conifer cover in the long term (10-15 years) with the growth of the planted conifers throughout the units harvested. The potential for a short term increase in temperature could affect the timing of life histories of sensitive aquatic macroinvertebrates.

Flow changes depending on the water year. The overwhelming effect to hydrologic function, in any of the alternatives, is that of cover loss and potential for widespread overland flow. With a high water event there would be potential for a debris flow to occur within the stream courses in those watersheds. “Overland flow can be initiated when surface infiltration capacity is drastically reduced. The effect of wildfire in the event of high intensity rainfall is comparably much higher than roads or harvest” (USDA 2009f). There is a minimal change in the TOC/ERA values with the implementation of alternative E and the greatest effect to flow would be within those seventeen watersheds analyzed that are currently over threshold prior to the implementation of action alternatives and would remain over threshold. The existing flow condition should remain the same post fire unless large water event occurs thus impacting the existing macroinvertebrate habitat.

The direct/indirect and cumulative effect of dead tree removal, roadside hazard tree removal, and reforestation would not change the existing amount of riverine or lacustrine habitat, would not change the amount of montane riparian habitat present in the project area, would not result in any reduction in deciduous canopy closure, or result in a change in size class of existing riparian vegetation. No live trees (deciduous or coniferous) would be removed. Thus the amount of total live tree canopy cover would not be reduced. Grazing should have little impact on riparian vegetation and meadow recovery. Changes in flow and water surface shade will be too small to be measured. Sedimentation is expected to increase as a result of vegetative removal caused by the wildfire. With alternative E some short term increase of sedimentation is expected from soil disturbance with tractor logging. This action may extend the timeline for habitat recovery and pre-fire macroinvertebrate community.

Population Status and Trend Summary for the Sierra Nevada National Forests. Same as alternative A. Please refer to that discussion.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Aquatic Macroinvertebrates Habitat Trend. Same as alternative A. Please refer to that discussion.

3.5.2.5.3 Migratory Landbirds

Most of the bird species associated with moderate to dense mature forests and dense forests of all ages would not use forests modified by stand-replacing wildfire in the short term, while some bird species would use areas created by stand replacing fire. Early post-fire specialists (wood drillers and aerial insectivores) appear to prefer unsalvaged burns, responding primarily to the changes in structural characteristics (increased availability of snags, decrease in canopy cover, increases or changes in insect prey) brought about by burning (Kotliar et al 2002). Allowing succession to proceed naturally in unsalvaged burns may benefit the most species (Ibid).

On the other hand these same researchers provide evidence that partial salvage of a burn, that is leaving portions unharvested, can result in no net loss in the number of cavity nesting species (Kotliar 2002). Hutto (1995) stated that it may be an appropriate strategy to take trees from one part of the burn and leave another part of the burned area untouched, but the amount to leave is an unknown (Hutto 2006). He concludes that "it may be difficult to retain the ecological integrity of a burned forest in the face of most kinds of postfire salvage logging" (Hutto & Gallo, 2006).

Direct/Indirect/Cumulative Effects – Action Alternatives (A, C, D, E): All action alternatives leave more area unharvested than harvested within the analysis area. Table 95 shows the cumulative amount of dead or hazard tree removal (i.e. combined acres of proposed or current treatments from salvage or roadside hazard tree removal) within the 87,647 acre analysis area), on all lands (public and private) within the analysis area and on just Forest Service lands.

Table 95. Cumulative salvage or roadside hazard treatments in the wildlife analysis area.

	Alternative A	Alternative C	Alternative D	Alternative E	Alt B (no action)
Public/Private	29,980 (35%)	23,761 (27%)	20,881 (24%)	19,877 (23%)	15,225 (18%)
FS Lands only	18,526 (27%)	12,307 (18%)	9,427 (14%)	8,160 (12%)	3,771 (6%)

Thus, from 49,882 to 60,248 acres (Alt A and Alt E, respectively) of the 68,408 acre fire land base located on Forest Service land would not be treated for dead tree removal. Hutto (2006) recommends as a management priority retention of some burned forest 0-5 years after a fire because that is the narrow window of time during which the biologically unique early postfire conditions become established and persist. Leaving the majority of the burn within the project area in an unharvested condition maintains an important component of biological diversity identified by Hutto (2006): "all the unique plants and animals that depend on those first few years of natural (postfire) succession".

Cumulatively, approximately 68 percent of FS land in the analysis area classified as moderately-high to high severity burn (50 percent or greater basal area mortality) would not be salvage or roadside hazard logged with alternative A. The other action alternatives would leave the same severity burn areas untreated at 81 % (Alt C), 87% (Alt D), and 90% (Alt E).

Migratory species that would utilize dead trees for some habitat use, such as perches for territorial singing, hawking/foraging, and nesting, within the early seral MCP habitat

created by fire, such as the olive-sided flycatcher, would have a potential decline in habitat suitability on the acres treated for dead tree removal. Under Alternative A, cumulatively, approximately 73 percent of FS land within the analysis area would not be treated for dead tree removal, leaving within these untreated areas approximately 11.7 snags/acre greater than 15 inch dbh. The other action alternatives would leave the following percentage of FS lands untreated: Alternative C - 82 percent, Alternative D - 86 percent, and Alternative E - 88 percent with an estimated snag density of 13.3 snags/acre greater than 15 inch dbh.

Converting MCP to SMC1 and eventually SMC 2 through reforestation, has apparent short term increases in habitat suitability for the olive-sided flycatcher and long term increases in habitat suitability (as plantations grow into forested habitat) for all of the ten BCC species. While reforestation activities would enhance the re-establishment of open canopy forested conditions, it is reasonably expected that these plantations would continue to have substantial shrub components, particularly in the first twenty to thirty years of growth. Cumulatively, alternative A proposes to reforest approximately 29% of FS lands. Alternatives D and E propose to reforest the same amount. Alternative C proposes to reforest approximately 19%.

Alternative B (No Action) There would be no removal of fire-killed or roadside hazard trees, thus no decline from existing condition in habitat suitability for those species utilizing dead trees in early seral habitat. The average snag density (greater than 15 inches dbh) remaining across the analysis area under this alternative is estimated at 16.8 snags/acre.

The short and long term increases in habitat suitability for forest species from reforestation described under the action alternatives would not occur. This alternative would solely rely on natural regeneration to re-establish forested conditions. Under alternative B approximately 12 percent of public lands would be reforested under other current or proposed reforestation projects accounting for 18 percent of all public lands that burned with high severity (approximately 12 square miles). This would solely rely on natural regeneration to reforest 82 percent of public lands that burned with high severity, an equivalent of approximately 53 square miles. Allowing areas to naturally regenerate would ensure that shrub habitat would remain on the landscape longer than with intensive regeneration efforts.

3.6 Soil and Hydrology

3.6.1 Affected Environment

3.6.1.1 Regulatory Framework

Management direction is from the PNF LRMP (USDA 1988) as amended by Herger-Feinstein Quincy Library Group (HFQLG) Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA 1999a, 1999b, 2003b, 2003c), and the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, 2004b). This changes management direction in the PNF LRMP and directs the Forest to adhere to these guidelines in the following resource area:

3.6.1.1.1 Riparian Habitat Conservation Areas (RHCAs)

Apply Scientific Analysis Team (SAT) guidelines. These include the following interim widths for these types of RHCAs: 300 feet (perennial fish bearing streams and lakes; 150 feet (perennial non-fish bearing streams, ponds, wetlands greater than 1 acre, and lakes); 100 feet (intermittent and ephemeral streams, wetlands less than 1 acre, and landslides).

Other features in RHCA determinations include: Top of inner gorge, 100-year floodplain, outer edge of riparian vegetation, or a distance equal to one or two tree heights (depending on stream type).

3.6.1.1.2 Soil Standards

The soil standards and guidelines presented in the PNF LRMP, as amended by the FSEISs and RODs for the Herger-Feinstein Quincy Library Group and the Sierra Nevada Forest Plan Amendment, provide the relevant substantive standards for Forest activities to comply with the National Forest Management Act. The quantitative PNF LRMP standards and guidelines for the maintenance and improvement of soil resources are:

Determine adequate ground cover for disturbed sites outside of streamside management zones during project planning on a case-by-case basis, based on specialist evaluation, using the following table as a guide (a table relating suggested minimum effective ground cover to erosion hazard rating is presented on page 4-44 of the PNF LRMP).

To avoid land base productivity loss due to soil compaction, dedicate no more than 15% of timber stands to landings and permanent skid trails.

Determine retention levels of down woody material on an individual project basis. Suggested retention levels in the SNFPA ROD are 10-15 tons of large down wood per acre for westside vegetation types and 3 large down logs per acre for eastside vegetation types.

The regional soil quality analysis standards presented in FSH 2509.18 of the Forest Service Handbook are not a set of mandatory standards or requirements. Those analysis standards are a set of threshold values that indicate when changes in soil properties and soil conditions would potentially result in significant impairment of the soil productivity potential. They are intended to be used during analysis or evaluation of soil condition. Among the thresholds specific to soil productivity are:

- Use of Erosion Hazard Rating (EHR) to determine necessary soil cover to prevent accelerated erosion.
- Retaining at least 50 percent cover in an activity area of fine organics (less than 3 inches in diameter).
- Retain a minimum amount of large woody debris required to maintain microbial habitat and soil moisture for long term productivity. The amount depends on local ecological type and should be determined by the Forest.
- Retention of at least 90 percent of soil porosity found under natural conditions, determined by sampling of activity areas.

- Determine extent of detrimental soil disturbance that affects soil hydrologic function by using Region 5 Cumulative Watershed Effects Analysis, EHR, or Water Erosion Prediction Project (WEPP).

3.6.1.2 Methods

Proposed ground harvest units were surveyed in November, 2007, and again a smaller subset in June, 2009. In the 2007 survey, selected units were evaluated using Forest protocol for assessing soil condition and hydrology function. The 2009 was a simpler rapid assessment concentrating on soil cover, amounts of Large Woody Debris (LWD) and RHCA cover effectiveness. Literature reviews, field notes, Forest monitoring reports, Geographical Information System (GIS) data, and professional judgment were used to support report conclusions. Burn Area Emergency Response (BAER) reports for hydrology and soils were primary sources of information on current conditions. Given that the vast bulk of the project treatment is within the Moonlight Fire perimeter, unless otherwise noted references to BAER reports are to the Moonlight Fire BAER. Soil survey data, survey protocol, and field notes are in the project record. Sediment delivery from ground disturbed by proposed activities was modeled using the Forest Service interface for the Water Erosion Prediction Program (WEPP) and the USFS Region 5 soil erosion model. Relative runoff was evaluated using the R5 Equivalent Roaded Acre (ERA) method.

The WEPP modules, Erosion Risk Management Tool (ERMiT) and Disturbed WEPP provide estimates of soil erosion using site specific variables for climate, soil texture, slope distance, and groundcover. The ERMiT module was used to characterize storm intensity and runoff with erosion. Disturbed WEPP was used to investigate erosion potential according to hillslope attributes. Accuracy is highly variable, +/- 50 percent for Disturbed WEPP hillslopes, though improves when averaging erosion across a broad area (Larson and MacDonald 2006; Spigel and Robichaud 2007). Both ERMiT and Disturbed WEPP tend to over predict low sediment yields and under predict high sediment yields (MacDonald and Robichaud 2007).

Cumulative impacts are addressed using the ERA methodology outlined in the Forest Service Region 5 Water and Soil Conservation Handbook (1990). The soils analysis uses the timber harvest units as the reference for effects determinations. Long term productivity is assured if at least 85 percent of the timber unit area has soil indicators not in a detrimental condition. Soils cumulative effects are considered using the ERA analysis detailed in the hydrology section. Analysis boundaries are watersheds used for ERA method and are presented in Figure 3. The watersheds delineated for analysis encompass that portion of the Moonlight Fire and Antelope Complex perimeter within which actions are proposed and/or cumulative effects of fire and past harvest with the proposed action are significant. The base GIS layer used to create the project level watersheds was the CalWater 2.2.1 GIS layer from the state of California. The base layer was selected over the PNF corporate layer for two reasons; it is more up to date and it contains the watershed numbering system that the Regional Water Quality boards use (common language).

CalWater 2.2.1 GIS layer was modified to create subdivisions (the project analysis watersheds) based on R5 ERA protocols (watersheds optimally are to be between 2000

and 6000 acres). The analysis area includes complete drainage for all proposed treatment units. Total acreage for the analysis sub watersheds is 87,240.

3.6.1.3 Project Design Features

Design features are used to comply with the PNF LRMP as amended by the Sierra Nevada Framework. A further standard level of protection is provided from use of applicable Best Management Practices. Project design features are:

- Ground-based equipment would be restricted to slopes less than 35 percent except on decomposed granitic soils where equipment would be restricted to slopes less than 25 percent.
- Subsoiling to 18 inches minimum depth of temporary roads and landings within same year as harvest.
- In ground based logging units, trees greater than 24 inches dbh would be topped and limbed with tops and limbs lopped and scattered to a depth of less than 18 inches. In skyline and helicopter units, limbs and tops would be lopped and scattered to a depth of less than 18 inches.
- For alternatives A and C, generally retain an average of 5 to 15 tons of down woody material per acre. Emphasize retention of wood that is in the earliest stages of decay. For alternative D, retain 10 to 20 tons of large down wood per acre over the treatment unit.

The following equipment restriction zones would be established for ground-based logging in RHCAs based on stream type and slope class:

Table 96. RHCA equipment restrictions

Stream Type	Slope Class		
	0–15% (feet)	15%–25% (feet)	Greater Than 25%
Perennial	100	150	No mechanical
Intermittent	50	100	No mechanical
Ephemeral	25	50	No mechanical
Meadows and Wetlands	25	50	No mechanical

Extend the equipment restriction zones to 25 feet beyond the outer or upslope extent of the “green line” (actual or potential extent of riparian vegetation) or the inner channel slope break, where these features are present and these widths would exceed the above-listed widths. Also, exclude equipment from unstable slopes (landslide-prone areas or unstable mined lands) outside the riparian equipment restriction zones.

The following project design elements are to further ensure compliance with PNF LRMP and Sierra Nevada Framework and address concerns that arose during the analysis process:

- Tractor limitations listed above in design features apply to excavators and fellerbuncher harvesters in addition to skidders and forwarders.

- Harvesting and removal of products within equipment restriction zones would require direction felling and end-lining.
- Allow low ground pressure equipment to travel into the outer RHCA (outside of the equipment restriction zone) to retrieve harvest trees and bring them to skid trails.
- Locate skid trails at angles acute or perpendicular to stream channels to minimize erosion into the channel and allow skidders to enter the outer RHCA on these skid trails.
- Space trails at no less than 50 feet. Though larger spacing is typically recommended, the 50 foot spacing may actually reduce off trail harvest traffic.
- To minimize soil displacement, no equipment would be permitted to turn around while off a skid trail in RHCAs.
- Limit tractor operation to either dry season or frozen/snow covered soils to lessen compaction risk. Though most landforms are well drained and rocky sloped, the riparian bottoms have high wet soil and thus compaction risk.

3.6.1.4 Monitoring

The PNF LRMP sets out objectives and protocols for monitoring of plan standards and guidelines, BMP compliance and effectiveness, and soil productivity parameters. Random sampling of project units will be performed as part of the Forest's annual monitoring for BMP implementation and effectiveness. For analysis watersheds that exceed the ERA threshold of concern and that have project activity, forensic monitoring shall be performed annually as required by the CA Regional Water Quality Control Board, Central Valley Region Resolution #R-5-2005-0052, "Conditional Waiver of Waste Discharge Requirements for Discharges Related to Timber Harvest Activities." This monitoring requires at least two inspections over the first winter after timber operations to monitor the condition of erosion control measures and to ascertain whether sediment discharges have resulted from failed management measures or general timber harvest activities. At least two inspections are required after November 15, both occurring within 12 hours following a 24-hour storm event of at least 2 inches, with one inspection occurring after the precipitation season has produced a total of 5 inches of precipitation and another inspection after a total of 15 inches has been produced. Additional photo-point monitoring is required if a noticeable significant discharge of sediment is observed at any time in any Class I or Class II watercourse.

In-channel monitoring following Stream Condition Inventory (SCI) protocols (USDA Forest Service, 2002) provides a second tier of evaluation, the first being monitoring of BMP compliance and effectiveness described above. The purpose of SCI monitoring of beneficial uses is to determine whether BMPs collectively are effective in protecting water quality at the watershed scale. Effectiveness will be assessed by monitoring trends in channel characteristics that affect beneficial uses. Two SCI sites would be located, one below a treated (salvage log) watershed and one below a burned but untreated watershed. Sites will be selected on basis of similar valley segment and stream reach characteristics.

3.6.1.5 Climate

The analysis area ranges from 3,600 feet to 7,800 feet in elevation. Annual precipitation occurs mostly between the months of October and May, although late summer thunderstorms can produce localized high rainfall intensities. Total annual precipitation

varies from about 40 inches in the western side of the project to 24 inches on the east. The winter snow line occurs in late December above 6500 feet. Generally from the end of October to mid/late-November most storms occur as rain. Below 6,500 feet elevation precipitation may occur as rain or snow (Faust 2007).

3.6.1.6 Geology

The project area is underlain by various rock types that are in the main (71 percent of the total area) Cretaceous granitics, and Jurassic meta-volcanics and meta-sedimentaries. Most of the remainder of the area (23 percent of the total) is tertiary volcanics that are pyroclastic andesites and rhyolites. Some 6 percent of the total area is sedimentary, either tertiary or younger gravel deposits, including the Auriferous river channel deposits of the Eocene or Pliocene/Pleistocene, and Pleistocene to Holocene slump debris (Wopat 2007).

3.6.1.7 Watershed Sensitivity

Project area watersheds are rated as moderately sensitive by Forest staff when evaluated for use of the ERA method. Rating variables include erosion potential, slope steepness, amount of alluvial channels, risk of rain-on-snow and/or thunderstorm events, and re-vegetation potential. Using these ratings, a Threshold of Concern (TOC) value is assigned for each watershed in order to assess risk from proposed activities. The project watersheds have moderate risk ratings of 12 through 14 percent ERA. Most of the project area watersheds are above TOC because of wildfire effects, recent salvage removal on private lands, and past management on Forest lands.

3.6.1.8 Beneficial Uses

Existing beneficial uses of surface waters in the project area are found in the Central Valley Region Water Quality Control Plan (California Central Valley Regional Water Quality Control Board 2007). The project area drains to the North Fork Feather River. The North Fork Feather watershed comprises 55% of the approximately 2.2 million acre basin that feeds Lake Oroville, the primary reservoir for the California State Water Project. Existing beneficial uses include municipal and domestic supply, hydropower generation, recreation, freshwater habitat, habitat suitable for fish reproduction and early development, and wildlife habitat. Specific uses of water in the vicinity of the fire are irrigation (Indian Valley and North Arm of Indian Valley), cold water fisheries (Management Indicator Species Report, Chris Collins and Kristina Van Stone Hopkins, May 2008), and Antelope Lake reservoir for storage, domestic supply, and recreation (Faust 2007). There are, however, no specific monitoring data of these water bodies to support any conclusions regarding compliance with state regulatory criteria on beneficial uses.

On May 5, 2009, following heavy rainfall in the project area (1.9 inches 5/1/09-05/04/09 at Greenville weather station; California Department of Water Resources website: http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=TAY), technicians from Feather River Coordinated Resource Management (unpublished data, 2009) took grab samples of flow in Indian and Lights Creek in Indian Valley below the project area. Values of Nephelometric Turbidity Units (NTU) were 222 and 98 for Lights and Indian Creek, respectively. Specific NTU values for North Fork Feather River tributaries are not provided in state water quality standards (California Central Valley Regional Water Quality Control Board 2007), but general guidelines for natural waters given suggest

values for Lights Creek, for example, are 2-30 times above thresholds for turbidity due to controllable factors.

3.6.1.9 Stream Channel Conditions

There are 790 miles of channel in the project area, including 604 miles of ephemeral, 80 miles of intermittent, and 106 miles of perennial according to Forest GIS records. The fact that listed perennial miles are greater than intermittent probably points more to the difficulties in determining flow regime than in actuality.

About 27 miles of channel, mostly ephemeral and intermittent in nature, have been surveyed previously by Forest staff for indication of flow regime and function, such as bank stability and amounts of LWD. Most of the survey reaches are in Pierce and Upper Indian creeks drainages with minor amounts in Cold Stream, Middle Lights Middle Creek, Moonlight, and Moonlight Valley (Forest GIS records). About 6 percent of the total surveyed reaches or 1.6 miles had prevalent or extensive bank instability, primarily in Upper Indian Creek, and almost entirely within ephemeral and intermittent channels. About 1.4 miles of channel, all intermittent or ephemeral in nature were listed in the survey as having poor, inadequate amounts of LWD in terms of habitat structure. All these reaches were in Middle and Upper Indian creek drainages.

Moonlight Creek received an overall condition rating of good. Both the percentage of sediment in pool tails and the percentage of unstable banks were low, and these were also rated as good. Shade was also rated as good, with conditions of 96 percent. Hungry Creek was rated as good overall, with both shade and unstable banks rating as good. Sediment in pool tails however, was more than 15 percent, and rated as poor. Pierce Creek at Wheeler Sheep Camp and Boulder Creek at Hallett Meadow rated at moderate to poor. Sediment in pool tail fines was high in both reaches, which rated at very poor and poor, respectively. Historic grazing activity has occurred around both reaches, and has contributed to bank instability.

Fire likely burned out the LWD in most channels, particularly first and second order streams. Sediment previously stored by LWD may be released, as well as new deliveries of sediment including ash may be freer to transport downstream (Faust 2007). In the larger channels LWD was only partially consumed. Burned trees on the banks have fallen into streams creating flow deflector that will divert water into stream banks creating more erosion as well as destabilizing the banks themselves (Rosel et al. 2007). Observation during field visits for this report was that those reaches within meadow areas were relatively untouched, and the burn was light on the meadow floodplain. Reaches in gorges such as lower Lights Creek with large areas of out cropping were also only lightly burned. Amounts of LWD in RHCAs in tons per acre are measurement indicator for stream morphology and aquatic habitat.

Mining in or near the streambeds of Cooks, Moonlight, Lights, and Indian Creeks has disturbed riparian areas and channels creating over-steepened and unstable stream banks.

There is a confluence of many streams to form the main stem of Lights Creek: West Branch Lights Creek, upper Lights Creek, Bear Valley Creek, Morton Creek, Smith Creek, Fant Creek and East Branch Lights Creek. The channels in this area are broad and mobile with cobble/boulder dominate beds. Channels upslope of the confluence are steep with unstable banks. Prominent terraces have developed along Morton Creek immediately upstream of its confluence with East Branch Lights Creek. These features

indicate that accelerated post-fire erosion and sedimentation is likely to increase channel instability and bank erosion in this area. The main channel of Lights Creek is likewise unstable with high sediment loading and a braided cobble-dominated channel for approximately one mile downstream of the confluence area. Abundant mine tailings and debris are present on the banks and in the channel. Channel form and instability, as well as large bed particles may be the result as well from a very wide range of annual peak flows in area streams (USGS records, http://waterdata.usgs.gov/nwis/sw). The tributary channels of Upper Lights Creek watersheds by contrast are steep and dominated by cobbles and boulders and appear to be stable. Mastication and mulching treatments were proposed in the hydrology report for the Moonlight Fire BAER to moderate the expected increase in sediment delivery to the streams (Faust 2007).

The Willow Creek channel and its tributary channels appear to be stable, armored as they are by large substrate or vegetation. Similarly, the main channel and tributaries of Pierce Creek, and Indian Creek are composed mostly of cobbles and boulders and appear stable. The channels of Moonlight Creek and its tributaries were fairly stable, though some areas of Moonlight Valley appear degraded. Middle Lights Creek is dominated by placer mining activity and the channels are degraded, and tailing piles cover banks and floodplains (Faust 2007).

3.6.1.10 Soil condition

The defining soil characteristic is the current condition after the fire. In the first year after the fire, much of the burned area had sparse groundcover and LWD. The BAER team found that the Moonlight and Antelope Complex fires burned mostly at moderate and high burn severity (Rosel et al 2007). The sparse "moonscape" conditions together with highly erodible soils, in particular the granitics, create a high hazard for soil erosion. The worst area is at the confluence of Middle Lights Creek with several lower order watersheds, including East Branch Lights Creek, Smith Creek-Fant Creek, Morton Creek, and West Branch Lights Creek. These areas had large contiguous areas of high and very high burn severity on highly erodible soils. In addition, the burned area has a high probability for a warm mid-winter wind and rain event that could trigger flooding if coincident with heavy snowpack. The implication for soil productivity would be soil losses from debris flows and mudflows. Though these mass wasting events are not documented for the project area, at least some level of risk has stemmed from a post burn environment where substantial storm events could occur. Erosion risk was predicted to last for at least 2 years after the fire while hill slopes revegetate, then reduce quickly during years 3 through 5 (Rosel et al. 2007). Recent surveys indicate that revegetation has occurred more quickly than predicted in the BAER report (see below).

The project area soils have moderate productivity with ample moisture of 24 to 40 inches annual precipitation. Soils are differentiated based on geology. Soils on granitics are thin, have sandy loam textures and marginal productivity. The granitics are classically infertile with risk to erosion from sheetwash and dry ravel (Megahan 1992), though resistant to compaction because of a lack of clay (Gomez et al. 2002). These soils are textbook examples of decomposed granite "DG" soils with excessively drained conditions. Figure 3 shows the proximity of these granitic soils on which roughly a third of the proposed units occur.

Another indicator of productivity is potential wood volume mapped as the forest survey site class (FSSC). Forest survey site class (FSSC) is a measure of site productivity in

cubic feet of wood per acre per year. Site class 1 is the most productive, while FSSC 7 is the least. Site class 7 lands are considered non-productive, and occur largely along ridge tops and steep rocky slopes. Both site class 5 and 6 lands are interpreted as having low productivity (USDA Forest Service 1999). Using this indicator, the project area has low potential for wood volume with mostly site classes 5 and 6 classes mapped.

All other project soils developed in either metamorphic rocks or volcanic parent material. These soils are very rocky, with very gravelly loam soil textures. Drainage is less than the granitics though appreciable. Productivity is higher with moderate soil development. Erosion risk is reduced from the high amounts of surface rock that break up erosive overland flows. Toe slopes and old landslide features will have deeper soils with higher clay content.

Burn severity for the Moonlight and Antelope Complex fires perimeter was 38 percent high severity, 37 percent moderate, 18 percent low and 7 percent unburned (Rosel et al. 2007). Ground observations of the high burn severity areas found soils still have good structure and intact fine roots, but soil cover and canopy was completely consumed. In limited areas hydrophobicity was found at 2 to 6 inches depth. Degraded root structure was also found in the top soil (Rosel et al. 2007).

Fire severity directly relates to burn residency time and is tied to the amount and condition of cover, depth of hydrophobic conditions that can interfere with soil drainage, and changes to soil structure and overall hydrologic function. In contrast, fire intensity translates to vegetation canopy burned. Not all high intensity burns typical of crown fires burn with high severity since flames sweep across the forest without downward radiant heating (Hartford and Fransden 1992). High severity burns can be long-term impairments to productivity from the excessive heating eliminating all surface organics and burning vegetative seed source in the upper horizons (DeBano et al. 1998). The bared soil is subject to erosion, though this is site specific and particularly tied to the risk for high intensity rainfall (Spigel and Robichaud 2007).

The high severity conditions observed by the BAER team are due to the complete removal of vegetation cover. Hydrophobic layers only developed on metamorphic and volcanic soils and were from 2 to 6 inches deep (Rosel et al. 2007). However, hydrophobicity is a temporary condition lasting 1 to 2 years (Shakesby et al. 2000). Proposed project activities would occur approximately 2 years after the fire. Hydrophobicity is not a substantial issue for soil drainage, especially on the prominently rocky metamorphic soils that are more robust to erosion. The extent of hydrophobic soils was estimated to be 797 acres on the 64,991 acre Moonlight Fire (less than 2%) and 7% of the Antelope Complex.

Recovery potential depends on erosion after wildfire as groundcover re-establishes with vegetation growth. Erosion risk reduces dramatically as groundcover returns, estimated at 3 to 5 years in the Moonlight BAER report (Rosel et al. 2007). Two complicating factors cited in the BAER report were limited natural regrowth within the high severity burned areas and the high chance for flooding events, mainly warm rain on wind events during January and February (Hydrology section below). Though rainfall intensity is a primary driver for erosion, especially in a burned area landscape (Spigel and Robichaud 2006), the saturated conditions are likely to produce shallow surface movement of soil. Delayed regrowth was observed in adjacent areas burned in years prior to the Moonlight Fire

(Rosel et al. 2007). However, recent survey data from 2009 indicates groundcover has recovered more quickly than predicted in the BAER report (see below).

Reported rates of soil erosion in the BAER soils report were based on high burn severity slopes and a yearly precipitation amount with a 10-year return interval. The BAER report found an average of 46 tons/acre following the wildfire compared to natural rates of 1-2 tons/acre (Rosel et al. 2007). Modeling used Water Erosion Project (ERMiT) to estimate soil erosion (Ibid). Generally, WEPP modeling has +/-50 percent accuracy.

Given the setting for heightened erosion risk after the fire, erosion risk was mapped to illustrate the most problematic areas. Mapping used the ERA model and followed the logic of the Moonlight BAER team post fire assessment (Rosel et al. 2007). The model uses soil survey information together with climate, slope metrics, and groundcover data. Figure 3 gives a general overview of the erosion risk in relation to the proposed harvest units. Table 97 shows the split of erosion risk within proposed units. Erosion risk is greatest on the steep sloped areas that had high burn severity; most notably on granitic soils. Other soils that are mapped as very high soil erosion risk include Rock Outcrop-Deadwood-Clallam families complex with 70-100 percent slopes and the Wapi-Chaix families complex with 50-85 percent slopes (darker areas in figure 3 outside granitic soils). Risk may be overstated in these areas since these steep rocky slopes do not have as much sediment available to lose.

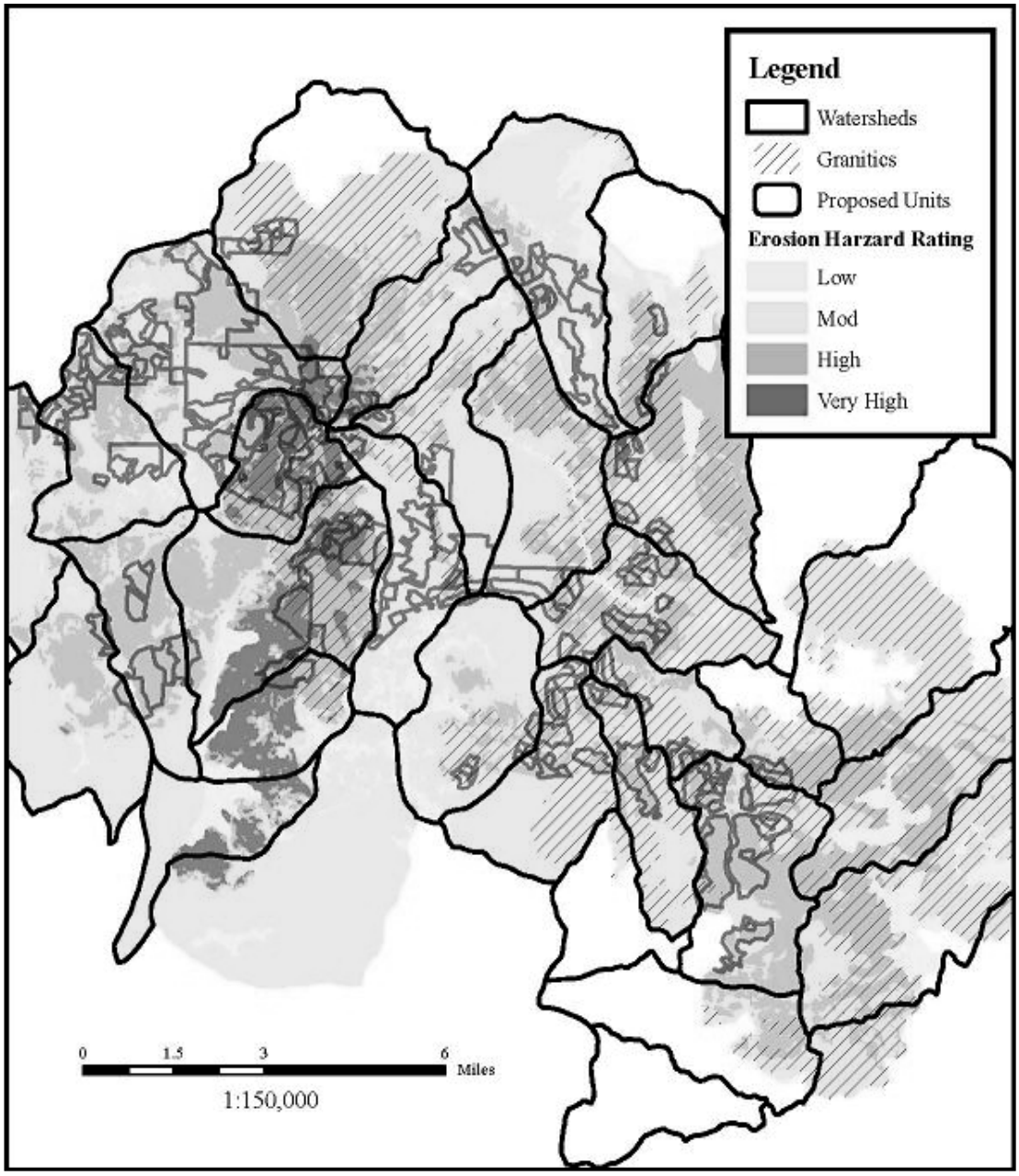


Figure 3. Granitic soils within the project area.

Table 97. Erosion risk across the project units for the Moonlight and Wheeler Fires project treatment units using the Erosion Hazard Rating System. Values shown are acres.

Erosion Hazard Rating				
Alternative	**Low**	**Moderate**	**High**	**Very High**
A	558	5878	6749	1758
C	515	5019	2737	264
D	515	3306	1754	169
E	508	2455	1265	157

Despite the high risk for erosion as indicated by the mapping, signs of erosion during the fall 2007 reconnaissance for this report were very rare. Overt signs of either overland flow or rilling was observed in very small portions (<<1 percent in extent of unit area) in 3 units (8, 67 and 76b), of the 30 units surveyed for soil disturbance in November, 2007. The lack of observed erosion is likely because of the well drained soils that limit erosive overland water flow.

The 2007-2008 precipitation season was well below normal and no significant storm events occurred over that winter. Little or no overland erosion was expected to have occurred within the burned areas because winter and spring runoff was dominated by slow, steady snowmelt that did not have much erosive power. This expectation was verified on a limited scale by a two-day monitoring reconnaissance in June 2008 of BAER treatments and areas proposed for further treatment within the Moonlight Fire, performed by five R5 hydrologists and soil scientists. Of the half dozen sites without treatment visited, all within DG soils, none exhibited evidence of accelerated surface erosion over the winter (Hoffman 2008).

Prior to the issuance of the FEIS, in June 2009, a survey of units within the watersheds most affected by the fire was conducted (Table 99). This survey found several instances of surface erosion from burned slopes, likely due to short but high-intensity spring rainstorms that did not occur in 2008. However, the rilling observed from burned slopes was limited in scope and did not typically reach streamside buffer areas. Also, much greater than anticipated re-growth was measured both in the upland hill slopes, and also in the riparian zones, and was largely composed of brush species (white thorn and willow). The LWD component had also significantly changed, with an average of 13 large logs (> 12” dbh) on the ground from previous standing dead. This is a loading, conservatively estimated, at about 10 tons/acre.

3.6.1.10.1 Effective soil cover

Soil cover was removed from the wildfire and ranged from 0 to 60 percent for the surveyed units (Table 98) in November 2007. Most of the units in high burn severity areas had sparse groundcover in the 2007 survey. Only one unit, unit 15, had adequate amounts of ground cover. Ground cover was provided mostly by rock fragments greater than 3 inches on the intermediate axis, with minor amounts of basal vegetation. Those units with ground cover ≥ 20 percent in the November, 2007 survey were underlain by Jurassic metamorphic and Tertiary volcanic rocks, which are more resistant to mechanical weathering than the granites, had large extents of outcrops, and are stony. The remaining units in question were mostly in Cretaceous granites which weather

relatively quickly into sandy textured, highly erodible soils. Recent surveys indicate that soil cover has recovered dramatically since November 2007 and more quickly than predicted in the BAER report (see below). Effective ground cover overall in the re-surveyed (2009) watersheds ranges from 52 to 70%, and averaged 65% on an unit basis.

PNF LRMP standards and guidelines direct that adequate ground cover for disturbed sites is to be determined for each Plumas NF project on a case-by-case basis. The PNF LRMP offers suggested guides for effective ground cover that vary by the soil erosion hazard rating (EHR). Effective ground cover should be maintained at 60 percent for soils with a high EHR, and 50 percent for soils with a moderate EHR. Given that 65 percent of the treatment area soils have EHR of high or very high (Table 99), effective ground cover should be considered no less than 60 percent in all units. The PNF ground cover standard for this project is to utilize project materials, such as scattered top and limb slash material, to improve existing ground cover where possible until basal vegetation can be re-established.

3.6.1.10.2 Soil compaction

Residual harvest accounts for 6679 acres within the preferred alternative, whereby roughly half is slated for tractor based harvest. Region 5 soil analysis standards have a threshold in soil porosity reduction of 10 percent, at which point it is assumed detrimental compaction may occur, but this guideline does not in itself consider extent of compaction. A threshold of 15 percent extent of detrimental effects to soil productivity, over an activity area, is recommended. Table 98 shows that of the field reconnaissance proposed units, of which roughly half had signs of past harvest, no indication of past harvest impacts exceeding threshold for detrimental disturbance were found. The area of detrimentally compacted ground found during the survey was almost exclusively skid trails and landings, although not all skids and landings were deemed detrimentally compacted. The lack of residual harvest effects was surprising given the level of past harvest activities within the planned fire area. This component was not included in the June, 2009 survey as no significant change was expected.

3.6.1.10.3 Down woody material

The PNF LRMP as amended states that down woody material retention should be determined on individual project basis. For this project, retention levels for down woody material (where available) will be 5-10 tons per acre of large woody debris greater than 3 inches in diameter and a minimum of 3 logs greater than 12 inches diameter per acre. Regional soil analysis standards suggest that forest specific guidelines be according to local ecological type. The forest type in the analysis area is east side or within the transition zone from west side vegetation type to east side, favoring the east side (Tompkins 2008). Recommended levels for east side vegetation types should be an average of 3 large down logs per acre a minimum of 12 inches diameter at mid point (USDA 2004a, page 69). The average number of large down logs per acre in the 2007 survey treatment units as might be expected was very low (Table 98). LWD in units of tons per acre are a measurement indicator for soil productivity. Recommended numbers and diameter of down logs works out to about 1 ton per acre for ponderosa pine and Douglas fir types, using conversion factors found in Brown et al. (2003).

In fire salvage and green timber harvest areas, much attention has focused on large woody debris as a viable indicator for ensuring soil productivity (Harvey et al. 1989; Graham et al. 1994). The coarse wood debris creates microsites that moderates soil moisture, temperature and biota. Graham et al. (1994) recommends retention of 5-10 tons per acre of LWD (defined as greater than 3 inches in diameter) on dry ponderosa pine types (Brown et al. 2003).

Decaying material needed to support organisms and return nutrients to the soil will be formed as standing dead trees fall in the project area and come into contact with the ground. As the downed wood decays, the old logs become sites for biological activity with mineral nutrients and higher moisture. The ecto and endomycorrhizae that take advantage of downed wood as substrate are important for vegetation including shrub, forb, and grass species. The moisture content in adjoining soils will also remain at elevated levels and provide areas of accelerated vegetative recovery**.** Burned logs that where charred may not function readily as nutrient sinks per se, though the charcoal can moderate mineral nitrogen abundance in the long term by alleviating inhibitory compounds that interfere with nitrification (DeLuca et al. 2006).

Current estimates for LWD in re-surveyed units (June 2009) are about 10 tons/acre. Given the delay in anticipated project start and the fall of dead trees in the interval period, this measure is greater than estimates provided elsewhere in this document (fuel, fire and forestry sections).

3.6.1.11 Fine organic matter

The Region 5 guidance provides a threshold for surface fine organic matter, recommending retention of 50 percent cover in all stands. Organic cover helps maintain site fertility and prevent soil loss from erosion. Fine organic matter consists of plant litter, duff, and woody material less than three inches in diameter. None of the units surveyed had any appreciable fine organics. There were significant areas in many units with a thin ash layer, on order of a few millimeters thickness. Although in some cases partially burned litter and duff existed, ash, when dried, may not present a sufficient buffer to rainfall and was not counted as effective cover. Recent June, 2009 surveys were of effective soil cover against erosion. The changes over earlier surveys were in mainly the form of live re-growth, and down LWD. Fine organics may still be below recommended levels throughout most of the proposed treatment area.

Table 98. Results of November, 2007 disturbance survey

Unit #	Soil Cover %	Detrimental Compaction %	Down Logs per Acre	Canopy Cover %
11	28	0	<<1*	21
5a, 55b`	16	0	<1	15
15	60	5	<<1	19
16	38	0	~1	23
113c	50	0	<<1	20
113e	40	0	<1	11
22	25	5	~1	20
24	20	0	~1	6
26, 26f	12	6	~2	4

Unit #	Soil Cover %	Detrimental Compaction %	Down Logs per Acre	Canopy Cover %
28	10	7	<1	13
26i	45	5	<1	24
31, 31c	5	5	<1	26
38a	0	0	<<1	3
76b	25	3	<1	11
52	5	0	<<1	8
54, 134	20	0	<1	28
59, 59b	0	0	<<1	9
96, 61a, 61b	5	0	<1	14
8	3	0	<1	21
79b, 92a	10	0	<<1	19
67	20	0	<<1	14
69	5	5	<<1	49

*--no downed wood within sample transects.

Table 99. Results of June 2009 disturbance survey

Watershed	Units in Survey	Average % Soil Cover	Average Down Logs per Acre	Effective Stream Buffer %
Hungry Creek	54, 59, 61a & b	52	12	80
Lights Creek	26, 26f, 31, 38	60	8.5	60
Moonlight Creek	11a & b, 16	70	20	90

3.6.2 Environmental Consequences

3.6.2.1 Alternative A (Proposed Action), C, D, and E

Alternative C is inclusive of all tractor harvest in proposed Alternative A. It also retains 92% of the temporary road construction (12 of 13 miles). It drops from Alternative A the helicopter and skyline cable logging, as well as the need to construct 11 helicopter landings.

Alternative D is inclusive of the roadside hazard tree removal and 31% of the tractor harvest, those units or sub-units of tractor harvest which essentially requires no temporary road construction. Only 3 miles of temporary roads are proposed with Alternative D. As with Alternative C, D drops the helicopter and skyline cable units.

Alternative E is inclusive of the roadside hazard tree removal component of Alternative A. No temporary roads or landings are proposed with this alternative. Amount of harvest in RHCA is not substantially different than the other alternatives (Table 100). This simply points up that most of the RHCA harvest entries are along already existing forest roads.

Table 100. Comparison of actions in project alternatives.

Type Action*	Alternatives

	A	B	C	D	E
Temp Road*	19	0	18	3	0
Ground-based Harvest	8,536	0	8,536	5,656	4,389
Skyline Harvest	872	0	0	0	0
Helicopter Harvest	5,347	0	0	0	0
Roadside Hazard	4,389	0	4,389	4,389	4,389
Reforestation	16,006	0	9,306	16,006	16,006
Snags Retention	1,060	0	580	174	0

*--temporary road values are miles, all others are acres.

These reductions in project activities in Alternatives C, D and E, from Alternative A, do not alter substantially the condition for any of the analyzed watersheds (Table 104). The amount of harvest within RHCAs in Alternatives C, D and E are similar and not substantively different from Alternative A, considering the much larger disturbance impacts of ground-base harvest methods.

The wildfire left the landscape in a very risky condition for flooding and slope erosion within the first year or two after the fire as slopes continue to revegetate. The effects of the action alternatives are difficult to measure compared to the larger issue of recovery after the wildfire. The main effect will be delayed recovery for 1 to 3 years from soil disturbance associated with tractor yarding activities. Long-term effects to soil productivity are less certain, particularly on the 8,536 acres where biomass removal is planned. Granitic soils are the most at risk for long term impairments to productivity because they are relatively infertile. There are 2,425 acres of biomass removal planned on granitic soils. No piling or burning of slash or biomass will occur in the tractor harvest units.

Reforestation activities, while beneficial for timber recruitment, will not alleviate the disturbance hazard of tractor harvest activities. The highest risk is in the Lights Creek valley. Soils on the main stem stream and major contributing streams are naturally highly erodible and were predominately burned at a high severity.

The confluence of similar third order watersheds at the top of the Middle Lights Creek project watershed creates in itself a heightened risk for flooding on and downstream of this watershed. An aggravating circumstance is the heavy logging on Sierra Pacific lands in the headwaters of Upper Lights, West and East Branch Lights, and Smith Creeks, the principle contributors to Lights Creek. Altogether these factors create a "perfect storm" condition for flooding during the occurrence of a warm southwester in mid winter that brings heavy rains and warm winds on a thick blanket of snow.

3.6.2.1.1 Direct and Indirect Effects

3.6.2.1.1.1 Soil Erosion and Detrimental Disturbance

Using WEPP, predicted rates of hill slope erosion for the first year after the fire were well above natural erosion rates of between 1 and 2 tons/acre cited in the BAER reort. Erosion potential was upwards of 60 tons/acre the first year following fire using the same basis as the soil BAER report of a precipitation year with a 10-year recurrence interval (figure 4). The impact of all action alternatives would be lessened by the significant vegetative recovery that has occurred since 2007 and would not be higher than that of the wildfire, though the salvage activities would prolong complete natural recovery from 2 to 3 years on ground disturbed by harvest activities. The steep slopes, though more erosive, would return to erosion rates similar to wildfire recovery within 1 to 2 years (figure 4). These steep slopes would be unaffected under alternatives C, D and E., The shallow slopes where ground-based systems are used would also return to natural fire recovery within 2 years (figure 4). Slope restrictions for ground based harvest under 25 percent slope, which include areas within granitic soils, RHCA, and roadside hazard removal, would variously lower erosion potential for all action alternatives. Difference in erosion potential from steep (>35%) and shallow slopes are shown in figure 4 below.

Detrimental disturbances within helicopter yarding treatment units are incidental to hand falling of trees and insignificant in extent.

Use of heavy equipment in ground base units for felling and yarding will compact and displace topsoil, particularly along principle trails and landings. The degree of soil compaction depends on the number of passes by heavy equipment, and also the texture of soil (Powers 2002). Coarser, sandy soils typically resist compaction better than finer grain soils (Gomez et al. 2002), but most soil compaction occurs within the first three or four passes (Williamson and Neilson 2002). In general, project soils are resistant to compaction due to sandy granitic soils in a third of the tractor units and otherwise from the high rock content. However, the additional tractor use from biomass removal of unmerchantable trees increases ground based traffic.

Further effects of ground base yarding are decreased infiltration capacity, either because of the removal of the organic ground cover and exposure to high intensity rainfall, or reduced porosity through compaction. The former condition is the most probable because of heightened risk for surface erosion by sheet wash and rilling. Theoretically, tractor yarding would have the greatest impact with removal of cover from 15 to 30 percent across treatment units due to machine travel. Further loss, albeit small, would be through removal of trees with some needles left. Needlecast on the burn slopes is an important first component to soil cover recovery. On severe burn areas, loss of cover would be smaller intense burn of the canopy. Steep areas would have groundcover reductions of 3 to 10 percent depending on the harvest system. Helicopter yarding usually leads to less than 3 percent detrimental disturbance and skyline yarding averages 10 percent detrimental disturbance (McIver and Starr 2000).

Results of WEPP analysis on an acre of disturbed ground under average conditions of slope gradient, length, etc. are shown in figure 4 below. Slope lengths were assumed to be 300 feet for shallow slopes less than 35 percent, and 500 feet for steep slopes averaging 50 percent. Though erosion on granitics is problematic, the WEPP software shows markedly lower rates of erosion on these hillslopes conflicting with typically cited field observations and soils mapping risk interpretations. Thus, soils on metasedimentary rocks were used to contrast erosion rates between wildfire and wildfire with salvage harvest.

The modeling illustrates the very high erosion potential in the first year following wildfire. Hill slope erosion rates under conditions of the design storm could have been as high as 60 tons/acre on steep slopes. Rosel et al. (2007) reported an average predicted rate of 46.2 tons per acre for all watersheds 1 year after the fire. Modeling following re-surveys of ground cover in June 2009, show a 94 % decrease in potential erosion (from 33 tons/acre to 2 tons per acre) within two years of the fire.

Using skyline yarding system, treated acreage in the third year after the fire (the assumed first year after the proposed project activities) would have double the erosion potential due to relatively small reductions in groundcover. However, within two years, burned area and skyline treatment areas would have similar risk for erosion potential, essentially at nautral post-fire background rates.

Using tractor yarding systems, the third precipitation season after the fire would be 2.5 times the erosion over the normal recovery after the wildfire. Though disturbance levels are higher with tractor yarding, that factor is predominantly offset by the much shallower slopes, resulting in an erosion rate increase similar to skyline method

The skyline curve starts with higher erosion rates in the first year after the fire because of the steep slopes associated with this method. Slope gradient is a strong driver of erosion and a dominant factor, along with slope length, in WEPP analysis.

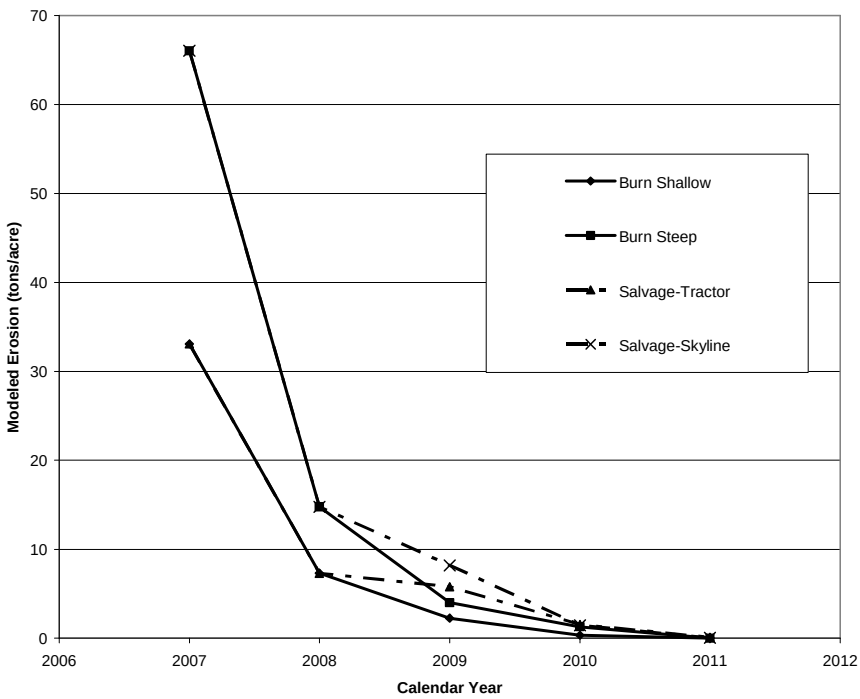


Figure 4. Potential erosion in time for burned slopes versus planned skyline and tractor salvage. Modeling assumes salvage harvest is completed during year 2009.

Biomass harvest could also impact the erosion rates. All of the planned tractor units have biomass removal. Trees over 24” dbh in the tractor units would be limbed and topped. This debris would then be lopped and scattered. All trees harvested in the helicopter and skyline units would be limbed and topped and the debris scattered. It is expected that the

resultant ground cover would be approximately 10% from lop and scatter alone. Skyline and helicopter salvage harvest would leave all non-merchantable material within the units. Though mixed results are found with contour logging effectiveness (Robichaud et al. 2000), leaving this material would intuitively provide some level of protection. Table 101 below shows that LWD component of cover will increase many times over across the helicopter and skyline units. Some soil cover gained since the fire, due to vegetative recovery however, would be lost by disturbance during harvest. Also, in monitoring of downed wood debris after harvest, data from the Rocky Mountain Research Station indicates roughly 13-56 tons/acre material after salvage harvest using tractor systems (Page-Dumroese 2008, personal communication).

It is important to point out that these hill slope erosion rates are based on occurrence of yearly precipitation with a 10-year return interval, or a 10% probability of occurrence. Similarly, localized thunderstorms are common, but the real risk for flooding is from the heavy mid winter rain associated with warm windy conditions. While it is reasonable to assume there is some observable effect of activities on burned slopes, in the event of a storm sufficient to initiate overland flow, those effects would be relatively localized and in terms of delivery of sediment to channels it would be difficult if not impossible to differentiate from the sediment load derived from the rest of the watershed's burned, but untreated slopes. The main effect is the prolonged exposure of 2 to 3 years where natural recovery would be delayed from the salvage harvest activities.This effect is limited to areas disturbed by harvest and its magnitude is described in figure 4.

Application of BMPs will be used to lower incidence of surface erosion on the hill slope and prevent sediment delivery to the valley bottoms. Since 1992, the Plumas NF has conducted over 600 evaluations of BMP effectiveness per the approved R5 protocol. The most recent summary of this monitoring was produced following the 2008 field season (USDA 2008a). That summary included 245 evaluations of BMPs for the type of timber activities proposed under the action alternatives. BMPs were rated as effective for over 87% of those evaluations but effectiveness has improved, as USFS sale asministration has improved, to 97% for the 63 evaluations conducted over the past two years.

The increased hill slope erosion rates depicted in figure 4 apply only to ground disturbed within the harvest units, which is expected to be up to 30% in tractor units and 10% in skyline units. When these ratios are applied to hill slope erosion rates for skyline and tractor yarding in the first year after harvest (8.2 and 5.8 tons per acre, respectively), and considered along with observed recovery of riparian buffers and incorporation of BMPs, it is expected that actual rates of delivery to the valley bottom would not be significantly different from background rates for burned areas that are not harvested.

Other sources for soil erosion are from temporary road construction where native surfaces are exposed to rainfall. Within units, these areas will likely have short-term increases of soil erosion above the recommended 2 tons/acre. Effects will decrease as roads are obliterated immediately following project completion by subsoiling, which will break up compaction and increase infiltration capacity. Erosion risk is for less than 10 years as groundcover returns to 50 percent or over.

3.6.2.1.1.2 Soil Organic Matter and Large Woody Debris

Regional standards are to maintain organic matter both of fine and large size in amounts sufficient to prevent significant short or long-term nutrient deficits.

Fine surface organic matter includes plant litter, duff, and woody material less than three inches in diameter that occurs over at least 50 percent of the activity area. This condition is not met in very high and high burn severity areas, nor would it be for up to 3 years or more after the fire.

Limbs and tops used for lop and scatter in helicopter and skyline units, breakage during harvest in all units, and scattering of tops and limbs of trees over 24” dbh in ground-based units would contribute to total LWD greater than 3 inches diameter in the immediate post-harvest condition. It is expected that the resultant ground cover from lop and scatter alone would be approximately 10%. Results from June, 2009 soil cover survey indicate present ground cover from LWD may be in excess of 1% as an average condition.

Fire ecology models (USDA 2009c) give estimates of over 7 tons per acre of LWD loading on average immediately after harvest, however the recent survey shows that these estimates may already be exceeded by fallen dead trees. Further increases would also be due to fire-damaged trees dying within 3 to 5 years of the fire. Other areas that will contribute LWD, outside of treated ground but within the treatment units, are snag retention areas for wildlife and equipment exclusion zones within RHCAs.

Table 101. LWD values in tons per acre average in treatment units—summarized from fire ecology modeling and stand exam data (USDA 2009c)

Term	All Action Alternatives	All Action Alternatives	Alt. A Only	RHCAs	
	Tractor and/or Roadside Hazard Units LWD > 3" diameter	Tractor and/or Roadside Hazard Units, LWD > 12" diameter	Helicopter and Skyline Units LWD > 3" diameter	Tractor and/or Roadside Hazard Units LWD > 3" diameter	Helicopter and Skyline Units LWD > 3" diameter
Post-Harvest	7.3	1.1	7.3	7.8	10.4
10 years after harvest	6.7	1.0	14.7	12.4	17.3
20 years after harvest	6.2	0.9	18.8	12.8	23.1
30 years after harvest	5.6	0.8	18.5	11.8	22.8

Because all standing dead trees under 16 inches dbh are left in the helicopter and skyline cable units in alternative A, recruitment for LWD is greatest, and in the long term (10-30 years) LWD is estimated to be from about 15 to 19 tons per acre in those units.

Because of biomass removal of standing dead trees below 16 inched dbh, and harvest of standing dead trees above 16 inches dbh, LWD amounts in tractor units are estimated to decrease in time from 7.3 tons per acre on average to 5.6 tons per acre on average 30 years after the fire. The reason is that removal of most standing dead trees from the treatment units eliminates LWD recruitment. There will be some recruitment from those fire damaged trees that will die 3 to 5 years after the fire.

According to the fire ecology modeling for alternative A presented in Table 101, in the treated areas of tractor units, aside from wildlife snag retention stands and equipment exclusion zones in RHCAs, total LWD amounts greater than 3 inches dbh would be on low side of range of 5 to 10 tons per acre recommended for long term soil productivity (Graham et al., 1994; Brown et al., 2003). Project design elements require retention of 5 to 15 tons of down woody material per acre for alternatives A and C and 10 to 20 tons of large down wood per acre for alternative D.

Converting east side eco-type standards for 3 large logs a minimum of 12 inches dbh into tons per acre gives about 1.0 tons for ponderosa and Douglas fir type cover, using conversion factors from Brown et al. (2003). Therefore total tonnage of LWD greater than 12 inches dbh in the tractor units would be marginal or below levels set by standards (Table 101). However, since implementation of any action alternative would occur in

2009, nearly 2 years after the fire events, a substantial amount of cull logs greater than 12 inches dbh will be left in the units, generally raising the log mass per acre well over 1.0 ton.

All units will be hand planted with conifer seedlings. Preparation for planting is hand scalping of ground cover, of approximately 5 feet in diameter. The density of planting will be between 100 and 200 seedlings per acre, depending on burn severity and plant association groups of burn area. The total disturbance from planting constitutes less than 7 percent of the planted area. These totals are not considered to be a significant detriment to the eventual recovery of ground cover, nor are the treatment plots large enough to be considered as detrimentally disturbed ground (USDA Forest Service 1998).

In time, organic matter will gradually accumulate from litter, woody debris, forbs, and grasses. Nutrients will gradually accumulate due to inputs (in precipitation, dry deposition, throughfall, weathering of parent material, and nitrogen fixation) and retention. These processes will take decades.

Salvage logging impacts soil recovery after wildfire by extracting remaining organic matter in form of tree boles. The greatest impacts are within high intensity burn areas. Where wildfire burned hot, forest floor is missing, and most of the trees are blackened. These areas are sensitive since live above-ground biomass is essentially removed. Site conditions are largely moderated with the remaining forest structure in the form of dead wood. Dead down and standing wood ameliorate site condition by forming micosites that shelter vegetation regrowth, harbor moisture, and augment soil temperature with shade (Harvey et al. 1987; Franklin et al. 2002). These attributes improve soil growth potential, especially in dry areas such as south facing slopes. As standing dead falls, this wood is further incorporated as brown cubicle rot that acts as a sponge for moisture.

3.6.2.1.1.3 Soil Biology

Impacts to micro-organisms and soil fauna, including endo- and ecto-mycorrhizae are not quantifiable. Impacts would be highest in high burn intensity areas. Ectomycorrhizae are most abundant in the organic soil components, including litter, humus, soil wood, charcoal, and organic enriched mineral horizons. Since the Moonlight and Wheeler fires reduced the soil organic component, it follows that the total number of ectomycorrhizae would be reduced. This occurs for a number of reasons including the reduction of habitat sites, chemical changes in the remaining organic matter, and the reduction of conifer needs for the added nutrient uptake capacity gained through ectomycorrhizal associations. Soil chemistry can change after fire, resulting in unfavorable conditions for some ectomycorrhizae species.

All action alternatives would theoretically have greater impact on ectomycorrhizae with the removal of wood products. Though likely immeasurable, the impacts would be greatest in the tractor based biomass and harvest removal units, where the most disturbances occurs with the least amount of organic material left. Alternatives A, C, D and E have similar level of these activities. Skyline and helicopter harvest units would likely not impact ectomycorrhizae with appreciable material left to ameliorate site conditions.

An indirect effect that can result in adverse effects to soil productivity is from introduction of noxious weed species. Noxious weed species are a threat where groundcover is sparse and soil resources are abundant. Typically, available nutrients

spike following fire and greatly reduce over the following two years (Choromanska and Deluca 2002). Noxious weeds invasion is a risk since these species are more adept than natives at exploiting abundant soil resources after fire.

Noxious weed invasion can impact soil productivity by shifting plant species composition. The shift in composition has biodiversity implications. The assumption is less diversity can lead to less productivity (Perry and Amaranthus 1997). Aggressive exotic invader species such as cheatgrass *(Bromus tectorum*) influence below-ground soil function by changing soil nutrient status and water dynamics, creating legacy effects that favor opportunistic species (Norton et al. 2004; Thorpe and Callaway 2006; Gundale et al. 2007). The risk is highest where noxious weeds establish and hinder native plant recolonization, especially where the fire burned the hottest.

3.6.2.1.1.4Roads

Proposed temporary road results in short term degradation of soil hydrology and long-term reduction in soil biological function. In this case the life-time of the road is the project implementation period of approximately 1 year. Obliteration and reclamation efforts improve soil hydrologic function over leaving roads in place. For the short term, reclamation improves soil infiltration adequately to address erosion potential, though reclaimed soil would have infiltration rates lower than natural forest rates (Luce 1997; Foltz and Maillard 2003). For the long term, infiltration rates improve over time as freeze/thaw and plant roots improve soil porosity though rates would likely remain lower than adjacent natural forest soil (Switalski et al. 2004). Soil biological function restores as forest floor and native plant communities returns. Moist areas in the lower to middle portion of the watershed have higher restoration potential. Also, most of the project area has a northeast aspect, and thus cool and wet conditions that promote vegetation growth. Degraded biological condition is predicted for greater than 20 years.

3.6.2.1.1.5Hydrology: Surface Flow and Water Quality

Road prisms intercept overland and subsurface flow, conveying this water across the relatively impermeable running surfaces in ditches. Skid trails and other temporary transport routes associated with treatment have a similar effect, though a lesser degree of compaction and total width, they are often on steeper gradients. Erosion from increased flow routing on trails is controlled with water bars, which dissipate water energy and allow water to infiltrate into the soil. Subsoiling of temporary roads and landings will improve infiltration and disrupt surface flow.

The effect of greater overland flow and routing by roads and trails may be great enough to accentuate surface flow peaks for small fall storms in the natural channels of small watersheds. Exacerbated flows, occurring with a frequency or duration that exceeds existing long-term conditions of flow, could affect channel stability by degrading beds and in turn undercut banks and valley side slopes in the confined channels. However, the project area’s channels and near-channel valley slopes are dominated by large alluvial/colluvial and bedrock outcropping. The generally good bank stability found in project surveys is an indication of the resiliency of the well armored mountain streams.

Temporary roads are to be constructed for the action alternatives, but will within the same year of harvest be closed and, along with landings subsoiled to a minimum depth of 18 inches. The overall effect of roads is expected to be similar to the long-term pre-fire condition. Maintenance of running surfaces and crossings may attenuate response to

storms insofar as concentration of flow in rutted roads, plugged or damage culverts would be corrected. Erosion treatment on skidding trails will reduce or eliminate the hydrologic connectedness of the skid trial system to Forest roads and its drainage, hence to project streams.

In the event of high intensity rainfall, over the short term of 3 years after the fire it is the effects of fire that are paramount, and runoff after implementation of the action alternatives would not be significantly or measurably increased above natural post-fire levels. The recovery rate of the fire -no action alternative-would likely be faster than the action alternatives where groundcover is reduced and soils are slightly to moderately compacted by timber extraction.

Runoff response to harvest, and incidental road building is overwhelming only for small (<<1 year recurrence interval) fall storms in dry antecedent conditions and well within the range of annual variability of peak flows (Beschta 1978; Ziemer 1998; Jones 2000). Incidents of significant effects of harvest to large peak flows can usually be correlated only with very high road density, or the placement of roads in close proximity to channels (Rice et al. 1973; Jones and Grant 1996; Jones 2000). This effect of harvest and roads is also most significant in small watersheds of under 1,000 acres and tends to decrease to insignificance with larger watersheds (Beschta et al. 2000). Analysis watersheds are between 1600 and 7600 acres, and average 3800 acres.

Sediment production from harvest is also mostly tied to construction of access roads with several fold increases (multiplicative factors of 2 and 3) measured from 1 to 5 years after completion of harvesting, before a return to near baseline or pre-activity condition (Krammes and Burns 1973; Rice et al. 1973; Beschta 1978; Keppeler and Ziemer 1990). Primary sources are running surfaces, cut banks, and fill slope failures, the latter which usually come a few years after road construction. No new permanent roads are proposed under any of the action alternatives.

Burned watersheds with significant ground cover loss diverge from their pre-burned conditions of peak flow and sediment production in response to high intensity rainfall, particularly in small headwater drainage areas (Neary et al. 2005). Most importantly, peakflow responses from wildfire are typically well out of range of responses produce by harvest and road building, with measurements from 1 to 3 orders of magnitude (multiplicative factors of 10 to 1,000) over pre-fire conditions (Tiedemann et al. 1979; Neary et al. 2005), because of the much larger proportions of a burned watershed in condition to generate overland flow. These runoff events are capable of initiating debris flow in headwater areas, drastically altering channel morphology of alluvial channels (USDA 2004b). Sedimentation following a wildfire is also typically 1 and often 2 orders of magnitude greater than pre-fire conditions (Tiedemann et al. 1979). A recent synthesis of 80 years of fire-related sediment yield data from literature (Moody and Martin, 2009) strongly indicates that the vast bulk of sediment transported from watersheds (>75%) over the long-term (10-100 years) is episodic, directly attributable to fire, and most importantly, derived from the channel area and connected floodplain, and not hill slopes. A particular function of mountain channels is to store sediment delivered by creep, ravel and rilling, but such material is typically only moved out of channel storage in the event of infrequent storms.

There is a remaining risk of impairment to water quality downstream of the project watersheds over at least the next year or two from the time of this writing mostly because

of the existing burned condition. This uncontrollable factor has already resulted in water quality objectives being exceeded. Recent water samples in Lights and Indian Creeks by Feather River Coordinated Resource Management (unpublished data, 2009,), following rainfall in the project area during May 1 through May 5, 2009, showed NTU measurement of turbidity many times over thresholds of state water quality standards (California Central Valley Regional Water Quality Control Board 2007). There is no available method to quantify effects of harvest on burned slopes, except to point out the obviously magnified effects it would have on a partially denuded slope compared to that of a typical green harvest.

Whatever the added effects of harvest on burned slopes, burned over stream buffers are obviously much less likely to dissipate and disperse overland flow and transported sediment before it reaches a channel. Nevertheless significant vegetative recovery of riparian zones has occurred since the fire. Another index of the June 2009 survey was observations of riparian buffer effectiveness (see photos in appendix E). In the three watersheds covered, Hungry, Lights and Moonlight Creeks, effectiveness of riparian area in mitigating rilling from upslope sources was estimated at about 80%, 60% and 90%, respectively. In each watershed pre-fire vegetation, and post-fire re-growth, along with litter cast, had developed ground cover to levels as high, or better, than the upslope condition. The incidence of up slope rilling was slight in Hungry Creek and Moonlight Creek watersheds. Moderate rilling in Lights Creek, particularly West Branch Lights Creek were caused primarily by historic logging skid trails/temporary roads.

WEPP modeling results given in above sections are for material eroded from a hill slope, and largely delivered to the foot of a slope, but not necessarily sediment delivered to a channel. Typically, riparian vegetation, and associated breaks in slope at the valley bottom and near channel floodplain largely dissipate flow energy and induce deposition of transported fines. BMP effectiveness monitoring results for project-applicable activities on the Forest are expected to be about 97%. Therefore sediment delivery to a channel buffer from an activity area is expected to be very slight and further degradation of water quality due to sediment delivery from harvested areas is not expected. The slight amounts of sediment generated from activity areas during a high runoff event would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

In project area streams that were surveyed either by the Moonlight Fire BAER effort or in stream surveys by Forest staff of channel conditions prior to the fire, channel condition was good overall. The proposed action calls for harvest of Riparian Habitat Conservation Areas (RHCAs) to the extent outlined in design features section and in Table 102 below. Values in the table are distance in feet from channels that harvest would occur and equipment can travel. On slopes greater than 25 percent there is no equipment travel. Where riparian conditions or valley slope break exists at slopes greater than 25 percent but at a distance that exceed those values given in Table 102, equipment will be allowed to operate an additional 25 feet. Equipment is restricted to slopes of 35 percent in all areas except those with granite parent material, or in an RHCA as described below.

Table 102. Riparian Habitat Conservation Area parameters for logging equipment use.

Stream Type	0-15% (feet)	15-25% (feet)	> 25% (feet)
Perennial	100	150	No mechanical
Intermittent	50	100	No mechanical
Ephemeral	25	50	No mechanical
Meadows and Wetlands	25	50	No mechanical

About 40% of the treatment acres in Alternative A will be helicopter or skyline yarding of all material except snags to the extent of 4 to 6 per acre, over 16 inches dbh, over a landscape basis. Limbs and tops will be lopped and scattered to a depth of 18 inches or less. The other half of the treated ground will use ground based equipment. Most of the standing dead will be removed, except for snag retention, as sawlogs or as biomass. This harvest scheme will persist in the RHCA areas to the extent outlined in Table 102. The substantive difference between Alternative A and C, D and E is the elimination of skyline and helicopter acres from those alternatives. Alternatives D and E further reduce acreage of tractor harvest from A and C.

The equipment exclusion zones within the RHCA retain sufficient quantities of standing dead trees for future recruitment and within 10 years predicted LWD is greater than 10 tons per acre.

Planting of conifer seedlings will take place throughout the burn perimeters. Between 100-200 tress will be planted per acre spaced in clusters. Site preparation for each tree would be hand grubbing of about a 5 foot circle. Total disturbance would be about 7 percent of the planted area, in widely spaced patches.

In the helicopter and skyline cable units, because of the lop and scatter of limbs and tops, and the leaving of trees under 16 inches dbh, the resultant ground cover immediately after harvest is likely to be better than the current, post-fire ground cover in any RHCA that these units may include. The same is not necessarily true for ground-based units which will transport most of the standing dead material out. Trees over 24” dbh in the tractor units would be limbed and topped and the debris then lopped and scattered. It is expected that the resultant ground cover from this treatment would be approximately 10%. Given levels of 65% already present, the benefit may be a total of a few percent effective ground cover. There will be some amount of breakage that will be left on the ground, but this volume would be far less and less predictive. In addition, because of biomass prescription, it is likely wheeled equipment would travel over most of a unit area. Table 103 shows that 53% of entries into RHCAs are in ground-base equipment tractor harvest or roadside hazard tree removal units. The substantive differences between the alternatives are those RHCA acres in Alternative A within helicopter and skyline cable units. Application of BMPs, such as water barring skidding trails, and project design features, such as lop and scatter of limbs to increase cover will mitigate some of the effects of harvest. The scope of the activity treatment area within the burned watersheds is between 5 and 18% (Alternative A through E). Detrimental ground disturbance, upwards of 30% in tractor base unit area and between 5 and 10% in helicopter and skyline units, would range between 1.6 and 3.6 % total for the project watershed’s area, depending on action alternative. Given implementation of erosion control features in activity area, and observations of stream buffer effectiveness, impacts to water quality from activity disturbed ground are not expected to be a significant factor in the event of

precipitation that induces overland flow in the burned watersheds. Such impacts would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses.

Table 103. RHCA acres in high/very high EHR soils.

Logging Systems	Alternatives							
	A		C		D		E	
	Int.*	Per.**	Int.	Per.	Int.	Per.	Int.	Per.
Helicopter	388	289	0	0	0	0	0	0
Skyline cable	67	186	0	0	0	0	0	0
Tractor/Roadside	406	635	406	635	358	586	297	565
Total	930	1041	406	635	358	586	297	565

*--Intermittent streams, **--Perennial streams

3.6.2.1.2 Cumulative Effects

3.6.2.1.2.1 Soils

An activity area is any impacted site feasible for sampling. Sale contract units are typically considered as individual activity areas for the purpose of soils monitoring (USDA Forest Service 1998). Current rates of compaction or detrimentally disturbed ground in units surveyed are low (Table 98).

Cumulative effects of the proposed harvest are best characterized in the context of recovery after the wildfire. Natural recovery would be set back from 2 to 3 years from an erosion standpoint but because vegetative recovery has already progressed significantly since the fire 2 years ago, the effects of the alternatives for this project will be greatly reduced from effects of similar activities under conditions prevailing immediately after the fire. Longer term effects are more difficult to discern with poor understanding of long term effects. Generally, over snow logging will have much less impact than summer logging (McIver and Starr 2001; Page-Dumroese et al. 2006a). However, implementation varies across forests and cover types with long term implications uncertain.

The Moonlight and Wheeler project area has moderately productive soils on metasediments and poor soils on granitics. Page-Dumroese (2006) alludes to poor productivity sites as having more critical needs for organic matter. Further, in an exhaustive catalogue of organic stores on sites throughout Idaho, Montana, and somewhat in Oregon, Page-Dumroese and Jurgensen (2006) found that surface organic matter on poor sites is a larger portion of the overall nutrient base and thus has implications for overall productivity. In regards to the proposed project, these findings

suggest that the biomass removal together with timber harvest on the granitics would hinder recovery. This effect would occur on 2425 acres, roughly a third of the planned tractor biomass acres for Alternatives A and C. Tractor biomass would occur on 2002 acres of granitic soils for Alternative D and 1384 acres of granitics for Alternative E, roughly one half and one third of the total acreage for the alternatives, respectively.

In tractor units, and outside of the RHCAs and wildlife snag retention areas, estimates of LWD greater than 12 inches in diameter for east side vegetation types would be marginal or slightly under standards over the long term (30 years), because of lack of recruitment. However, recent survey results (June 2009) indicate that LWD recruitment is stronger than predicted in the fuel modeling results.

The scientific community has conflicting viewpoints on the long term effects of fire salvage on soils. James McIver, a professor at Oregon State who has actively participated in describing effects, provides a great overview. In his Forest Service briefing paper, McIver suggests that viewpoints by Beschta et al. (2004) offers a protection approach in the face of uncertain effects on severely burned soils as opposed to a more utilitarian approach with economics as a factor. In a rebuttal to Beschta, Evers (2002) argues that salvage within the context of site specific conditions is reasonable. However, without specific long term monitoring of salvage harvest within this ecosystem, long term effects are still uncertain.

3.6.2.1.2.2 Hydrology

As Table 104 shows (Affected Environment, Hydrology) the largest effect to hydrologic function to hill slopes in the project are is from the wildfire itself. Although the ERA method is not quantitatively predictive it may be used to show relative effects of different sources to watershed runoff. For instance the fact that alternative C retains the ground base harvest, but drops the helicopter and skyline cable units has little effect on overall results, as ground base methods are by far the most disturbing to ground cover, which is the most important factor to hydrologic function of forested slopes. Figure 5 which classify project watersheds ERA percentage relative to TOC for alternative A would essentially be the same for alternative C, D and E as Table 104 shows.

Table 104. Summary of Equivalent Roaded Acre analysis for determining cumulative watershed effects.

Watershed	ERA% Alternative				Total ERA %				
	Alt. A	Alt. C	Alt. D	Alt. E	Existing*	Alt. A	Alt. C	Alt. D	Alt. E
Bear Valley	0.0	0.0	0.0	0.0	23.0	23.0	23.0	23.0	23.0
Cold Stream	1.1	0.9	0.3	0.3	13.6	14.7	14.5	13.9	13.9
East Branch Lights C.	3.0	2.9	1.9	1.8	16.6	19.5	19.4	18.4	18.4
Freds C.	0.2	0.0	0.0	0.0	12.5	12.7	12.5	12.5	12.5
Indian C. blw Antelope-Babcock	1.9	1.0	0.2	0.0	19.7	21.5	20.7	19.9	19.7
Indian C. blw Antelope-Dam	0.5	0.4	0.0	0.0	14.6	15.1	15.0	14.6	14.6
Lonesome Canyon	0.4	0.2	0.1	0.0	26.7	30.1	29.9	29.8	29.7
L. Cooks C.	0.3	0.3	0.2	0.2	5.9	6.2	6.2	6.1	6.1
L. Indian C.	1.6	1.6	1.6	1.2	15.8	17.4	17.4	17.4	17.0
L. Lights C.	0.6	0.1	0.1	0.1	17.4	18.0	17.5	17.5	17.5
L. Lone Rock C.	1.4	1.0	0.8	0.5	15.4	16.7	16.4	16.2	15.9
Middle C.	0.9	0.6	0.3	0.3	12.3	13.2	12.9	12.6	12.6
Mid. Hungry C.	1.1	1.0	0.6	0.4	8.8	9.9	9.8	9.4	9.2
Mid. Lights C.	3.0	1.5	1.0	0.9	19.9	22.9	21.3	20.9	20.8
Moonlight C.	1.2	0.7	0.6	0.6	14.5	15.7	15.2	15.1	15.1
Moonlight Pass	0.1	0.0	0.0	0.0	22.8	22.9	22.9	22.9	22.9
Moonlight Valley	1.9	1.7	1.4	0.8	18.0	19.9	19.8	19.5	18.8
Morton C.	1.0	0.9	0.6	0.4	21.8	22.8	22.8	22.5	22.3
North Arm Indian Valley	0.1	0.1	0.1	0.1	4.7	4.8	4.8	4.8	4.8
Pierce C.	0.8	0.8	0.8	0.6	9.6	10.3	10.4	10.4	10.2
Smith C.	1.4	1.3	0.9	0.3	25.3	26.7	26.6	26.2	25.6
Up. Hungry C.	1.4	1.4	1.3	1.3	12.2	13.6	13.6	13.5	13.5
Up. Indian C.	1.5	1.4	0.8	0.5	10.2	11.6	11.5	11.0	10.7
Up. Lights C.	0.3	0.1	0.1	0.1	14.1	14.3	14.2	14.2	14.2
Upper Peters Creek	0.5	0.5	0.5	0.5	10.5	11.1	11.1	11.1	11.1
West Branch Lights C.	3.5	2.7	1.2	1.1	21.2	24.7	23.9	22.4	22.3

*--assumes proposed harvest on private land, see Total ERA% Table 105below.

Roads, though a steady and non-diminishing source of runoff effect are a minor one in the project area, accounting for 1 to 2 percent ERA across the watersheds. The ERA method is not spatial, so the true effect of roads may be greater or less than the value given, relative to their position on the valley slopes. Roads on steep slopes, with high cuts, tend to capture a degree of ground interflow particularly during storm events. Conveyance of this water through drainage ditches to low order draws are the primary means by which forest roads advance the timing and/or increase runoff. Roads on the ridge lines obviously capture little except what precipitation falls directly on their running surfaces. Roads in the valley bottom may subsurface flow, but at locations close to natural discharge points. Roads at mid-slope, particularly if there are multiple segments across a slope have the greatest potential for capturing storm flow and conveying to natural surface channels. It is at these crossings of roads and natural channels where the most significant resource impacts occur, typically by scour and bank erosion downstream, where accelerated velocities caused by undersized crossing pipes and increased flow volume from the road conveyance degrade a channel. Alternative A proposes construction

of 13 miles of temporary roads, which would include 9 intrusions into RHCAs, 7 crossings on intermittent channels and 2 on perennial channels. Scour of channels from crossing culverts can be appreciated by simply noting that skin resistance of a typical corrugated pipe is about one half that of a mountain stream channel. Given this, and that during high flow typically the width of flow from the channel is constrained in a pipe so that depth increases, and velocities in a pipe crossings will usually be half again to twice that of the natural channel. Since kinetic energy varies as the square of velocity, the energy of flow is magnified exponentially at the outlet of the pipe anywhere between two and four times or more, than in the natural channel.

With the proposed Alternative A, 19 of 26 project area watersheds are over ERA% thresholds set by the Forest, for management impacts that affect runoff. All but four watersheds over threshold are due to the effects of the fire (Table 104). Two of the exceptions, Bear Valley and Moonlight Pass are due to fire salvage harvest on private land completed in 2008, or expected by the end of 2009. Salvage harvest in private lands is mostly upslope of Forest Service managed land, in the headwaters of analysis watersheds. The other two watersheds potentially over threshold are Middle Creek and Upper Hungry. Both watersheds are very near threshold conditions currently (Table 104) and given the proposed alternative Middle Creek could exceed thresholds by 0.2 ERA% points and Upper Hungry Creek by 0.6 ERA% points. Actually all action alternatives would result in an ERA% over threshold in Upper Hungry Creek, but only Alternative A would cause an over-threshold condition in Middle Creek. The increase ERA% of Alternative A is accounted entirely by ground-base and helicopter harvest. Eleven of the watersheds are in excess of 30 percent over TOC and it is reasonable to expect that under conditions of intense precipitation significant increases in runoff could occur in the event of a storm event with a 10-year recurrence as described in the BAER hydrology report. One more watershed, East Branch of Lights Creek, is 30% over TOC with this alternative compared with existing condition, see Table 104, which is due to the proposed action, although existing harvested land has actually a greater effect to runoff in most watersheds than the proposed action.

Potential erosion from harvest slopes is expected to be elevated over normal post-fire conditions because of reduced ground cover. But in the event of precipitation that initiates erosion, the overall lack of ground cover on burned slopes will be the greater source. Harvesting creates areas of compaction and displacement of soils that may lead to localized incidences of overland flow. However, project design measures and BMPs are expected to prevent erosion related to project activities from reaching stream channels in detectable amounts. The treatment units do not constitute the majority of slope area. Therefore actual harvest effects are a relatively minor proportion of the watershed, as shown in Table 104. The slight amounts of sediment generated from activity areas during a high runoff event over the burned landscape would not be measurable or detectable at the analysis watershed scale and would not affect identified downstream beneficial uses. This point is illustrated in Table 104which shows that between 4 and 18% of project watershed’s area are rendered comparable to forest road surface by fire effects (column ERA%). Compare that to values in Table 104 which shows that effected area by alternative to be between 0.0 and 3.5% of project watershed’s area.

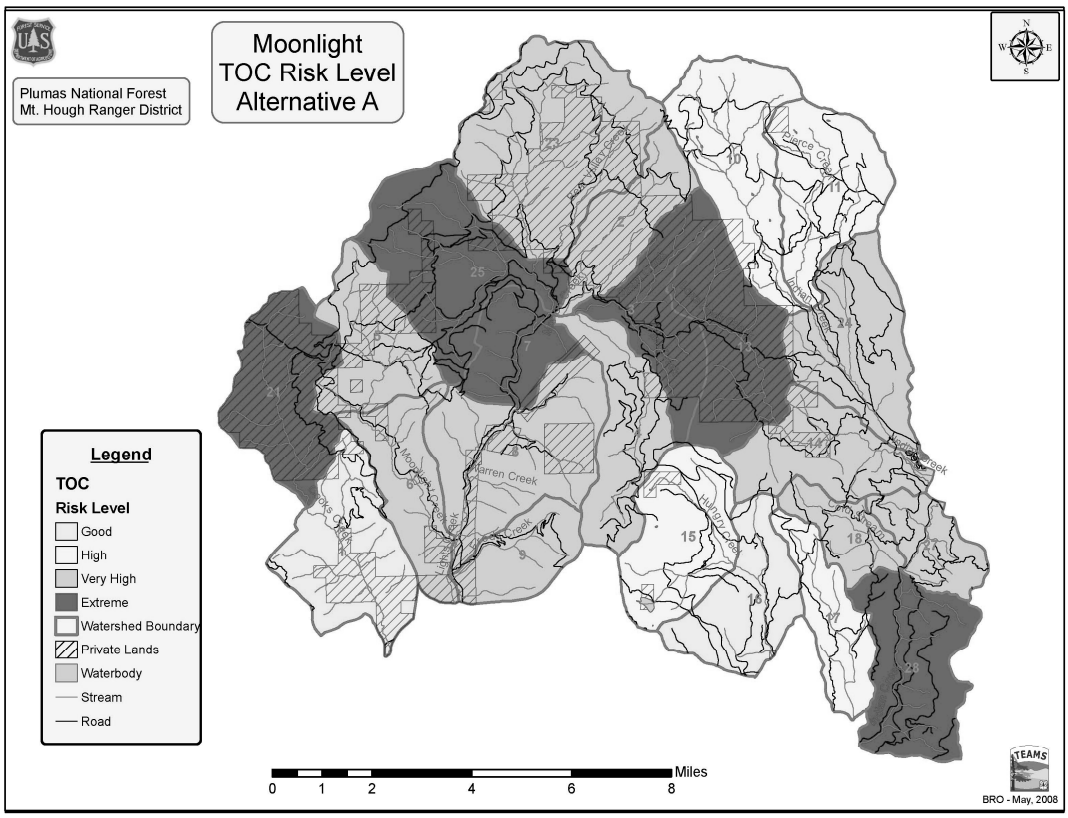
Effects of proposed actions would ameliorate fuel loading and potential fire behavior within the treatment units. However, given the limited scope of the treatment units it is

unlikely that the treatment would significantly alter the effect of future wildfire, in a given watershed, on hydrologic response or erosion. The action alternatives are designed to *exclude* harvest activities entirely from 78 percent (under alternative A) to 94 percent (under alternative E) of public lands within the analysis area (and 5 to 18% of project watershed's area). Consequently, large areas of unsalvaged and untreated areas would exist under all action alternatives. In addition, there are snag retention areas within salvage harvest units, equipment restriction zones, and further snag retention guidelines within RHCAs, all of which would reduce effectiveness of treatment.

There have been few recorded fires that extend across more than one of the analysis watersheds. The largest fire in the Lights Creek drainage was in 1959 of 1400 acres in the Morton and Smith Creeks watersheds. The next largest was 1100 acres in 1996 in the Cooks Creek watershed, a steam that confluences with Lights Creek well downstream of the project area. Therefore, a thoroughly unique situation exists in regards to runoff for Lights Creek, particularly within and below the Middle Lights Creek sub-watershed. Two of three important variables that could drive a very large runoff event occurred in the winter of 2007-2008. First, the fact of the fire and its most significant effect, the catastrophic loss of forest ground cover across virtually the entire landscape. Second, there was an early and heavy snowfall. The third factor would have been heavy rainfall in the mid winter months of January and February of 2008, a happenstance of 12 of 21 years during the period of record on the Indian Creek gage, which drove the 7 largest flood events recorded at the site. The occurrence of heavy rain and warm and breezy conditions in mid-winter is popularly referred to as the "pineapple express" because of the point of origin of these systems in the South Pacific Ocean near the Hawaiian Islands. These conditions can be present during El Nino episodes, but the latitude of the project area puts it between El Nino and La Nina influenced zones, and makes the correlation somewhat problematic (Barkhuff 2008, personal communication). Most importantly is the frequent occurrence of warm and moist tropical air from the southwest moving over the Sierra Nevada Mountains in mid-winter when a thick blanket of snow may be already present. The 2007-2008 precipitation season, in fact, proved to be well below normal and no significant rain-on-snow events occurred over that winter.

Therefore, over the next 2 years until further, sufficient ground cover is re-established, there remains a heightened risk of flooding downstream of the project area, particularly within the Lights Creek drainage. Because of reduced ground cover due to the fire, a flood could be potentially much larger than previous to the fire, with the same return interval of rainfall. It is the conclusion in this report (see Alternative B discussion below) that the Moonlight Fire BAER Hydrology Report very probably underestimated the magnitude of potential runoff from the fire area.

Figure 5. Action alternatives level of risk for exceeding watershed threshold of concern. Values listed in Table 104 above.



3.6.2.2 Alternative B – No Action

3.6.2.2.1 Direct and Indirect Effects

3.6.2.2.1.1 Soil Erosion and Detrimental Disturbance

Groundwater will be elevated in the burn area due to reduced evapo-transpiration and thereby elevating the risk of mass wasting. However, active or recent landslides were only observed in units 26a and 26b. They were low angle slumps from low ridges dissected with deep V-shape first order draws. Some draws had flow on the order of a few gallons per minute during time of field visit in November, 2007.

Typically in conditions of forest canopy and floor cover overland flow is a rare occurrence limited to areas of outcrops, or disturbance whether natural or due to activities. However, in the 30 units surveyed in 2007 soil cover ranged from 0 to 60 percent with an average of 20 percent, and canopy cover ranging from 3 to 49 percent (Table 99). By the June 2009 survey groundcover had dramatically increased due to vegetation re-growth. There was some observable rilling, slight in Hungry and Moonlight Creeks, higher in Lights Creek, though caused by historic roads.

Raindrop impact is a severe source of initial erosion on bare soil. Shear stress imparted by raindrops on bare soil has been measured as much as four times the critical shear stress of cohesive soils and 100 times the shear stress created by thin sheet wash (Julien

2002). Critical shear stress is the point of initiation of movement of a particle. Fine particles transported by raindrop impact or sheet wash can plug pores in the mineral soil surface and thereby reduce infiltration capacity (Biswell 1989; Powers 2002). Overland flow can be initiated when surface infiltration capacity is drastically reduced. The effect of wildfire in the event of high intensity rainfall is comparably much higher than roads or harvest, because of the much greater proportion of watershed area that is affected.

Aerial mulching to re-establish cover in high-vegetative burn severity areas was recommended in the Moonlight BAER hydrology report (Faust 2007). Mulch areas were approximately 700 acres in Middle Lights Creek, west of Forest Service road 28N36, within portions of sections 7, 8 and 18, Township 27 North, Range 11 East, and sections 12 and 13, Township 27 North and Range 10 East. An additional 40 to 80 acres were mulched in the Fred's Creek watershed over a portion of sections 29 and 30, Township 27 North and Range 11 East. Mulch areas were selected in order to protect a residence in Fred's Creek and water quality in the main stem Light's Creek.

3.6.2.2.1.2 Soil Organic Matter and Large Woody Debris

Dead and downed wood is well recognized as a critical element for soil productivity (Harvey et al. 1987; Graham et al. 1994). Recommendations for minimal coarse wood levels to sustain productivity are outlined in Graham et al. (1994), and are between 5 and 10 tons per acre for drier ponderosa pine forest cover. Preliminary data gathered in fall, 2007, in mostly high severity burn tractor units shows those units are well below the recommended range (Table 99). Estimates of LWD for the current condition are about 10 tons per acre on average across the treatment area.. In the long-term, because of recruitment from standing dead trees, LWD estimates range from 16 tons per acre 10 years after the fire to 27 tons per acre 30 years after the fire (Table 101).

Brown et al. (2003) postulates where coarse wood (greater than 3 inches in diameter) reach 30 tons/acre; high severity fire could result in the event of a reburn. The greatest risk is within 10 to 30 years where logs are in contact with the ground and have not experienced much decay. However, recent findings suggest that reburn in plantations following salvage is not lower than in naturally regenerated stands (Thompson et al. 2007). Factors that may increase fire severity in managed areas are the close tree spacing in plantations, higher abundance of fine fuels (Donato et al. 2006), and homogenous stand structure that promotes high severity fire (Odion et al. 2004). Also, sclerophyllus shrubs common in both managed and unmanaged regenerating stands can increase fire severity (Odion et al. 2004; Thompson et al. 2007). Given the uncertainties of reburn occurring and risk from the no-action and action alternatives, no difference can be construed in regards to fire severity.

Alternative B, the no action alternative, would have no adverse effects on soil microbes, including ectomycorrhizae. Recovery of soil microbial communities would occur gradually as vegetative communities return. Ectomycorrhizae are commonly associated with conifers and thus would follow their succession.

3.6.2.2.1.3 Hydrology: Surface Flow/Water Quality

The overwhelming effect to hydrologic function, in any of the alternatives, is that of cover loss and the potential for widespread overland flow. An indication of just this occurrence may be reflected in recent water samples collected in Lights and Indian

Creeks by Feather River Coordinated Resource Management (unpublished data, 2009,), following rainfall in the project area during May 1 through May 5, 2009. Turbidity measurements of water samples gave NTUs many times over thresholds of state water quality standards (California Central Valley Regional Water Quality Control Board 2007)

The design storm chosen for the runoff computations was a 10 year 24-hour frequency and duration (4.5 to 5.0 inches total of precipitation in project area) as the event most likely to create a damaging flood to downstream beneficial uses (Faust 2007). The calculated effects of the fire was that runoff from the design storm is equal to that of a 30 year storm under unburned conditions. The ratio of increased runoff of post-fire to pre-fire conditions ranged from 1.01 in Boulder Creek which had only a few percent of its area within the fire perimeter, to 2.33 in West Branch Lights Creek, which was entirely within the fire perimeter. The mean ratio for all watersheds affected by the fire was 1.60 (Faust 2007).

A U.S. Geological Survey stream gage was operated on Lights Creek (Station # 114013) for six years between 1958 through 1963 (Table 105). While this period of record is less than adequate for statistical treatment of annual peak flows the record was useful for comparison to Moonlight Fire BAER modeling outputs.

Table 105. Comparison of USGS gage peaks on Indian and Lights Creek for period of record on Lights Creek. Values in cubic feet per second (cfs).

Year	Instantaneous Peak Flow	
	Lights Creek Gage	*Indian Creek Gage*
1958	2120	14000
1959	261	1020
1960	1300	6180
1961	180	464
1962	463	3090
1963	2440	30200

The location of the Lights Creek gage corresponds to the downstream end of the Middle Lights Creek watershed used in this project and also in peak flow analysis in the Moonlight Fire BAER hydrology report (Faust 2007). Table 106 below shows post-fire predicted values for 2, 5 and 10 year recurrence interval peak flows (Q2, Q5, and Q10) calculated in the BAER hydrology report (Faust 2007) and those from regression equation between Indian Creek gage data and Lights Creek data.

Table 106. Comparison of BAER and station data estimates of peak flow for Lights Creek

Source of data for estimation of Lights Creek Peak Flows	Return Interval of Flow (cfs)		
	Q2	Q5	Q10
BAER report; Regional Equations	291	789	1,200
Regression Equation. With Indian C. Data	644	1198	1857

Three of the annual six peak flows from the Lights Creek USGS record exceed the calculated Q5 flow from the BAER report and two of these exceed the calculated Q10 flow. Correlation of Lights Creek gage record with the USGS gage on Indian Creek near

Taylorsville (Station # 114012), that has a period of record from 1958 to 1980, indicate that the years in question on Lights Creek are probably between the Q1.25 and Q20. The correlation was made by regression between the peak values of the two gage sites. This was considered reasonable since the peaks at both sites occurred on the same day in each year, obviously driven by the same storm event. The aspect and total relief of the watershed above the gages are similar. The R square value, a measurement of the degree correlation of the parameters used is high at 0.83, which indicates that those factors that combine to produce peak flow are similar in both drainages. Only Greenville climate records were available, but are at a location sufficiently close to clearly show the correlation between precipitation events and runoff at the gage site, and provide further evidence that the storms that drive the largest peaks are not localized to a single drainage.

While some of these flows were certainly channel forming events, or generally above the average set of yearly conditions that maintains active channel geometry, these flows are also well within long-term range of baseline conditions. It is important to note that at the Indian Creek gage with 21 years of record between 1956 and 1980, the range of peak flows is over three orders of magnitude (from 219 cubic feet per second (cfs) to 30,200 cfs). Streams with these kinds of variation in peaks are considered very flashy, with markedly high variability. Also 12 of the 21 peaks of record, including the top 7 occur in the months of December through February indicating most likely that warm wind and rain events with a present snowpack is a frequent occurrence. The greatest peak flow on record at the Lights Creek gage on 10/13/1962, was 2,440 cfs, and was driven by two days of rain (10/12 to 10/13/1962), recorded at the Greenville station (COOP #043621) as 5.77 and 5.11 inches. Each day of rain was close to the 10-year, 24-hour storm. The flow at the Indian Creek gage peaked at over 11,000 cfs. Had this storm occurred later in the season when soil moisture was higher the flow undoubtedly would have been very much higher. As it is 2,440 cfs produced at the Lights Creek gage was more than double the project runoff calculated in the Moonlight Fire BAER Hydrology report for similar rainfall.

The braided channel form noted in the BAER hydrology report, for Lights Creek, and other evidence of instability on the higher order streams can be placed in a context of high relief, and wide variation of annual peaks due to heavy rain or rain and snowmelt in early winter. Mining and grazing activities notwithstanding, a degree of channel instability, wide floodplain, and large substrate clast may be expected as natural conditions for these channels.

3.6.2.2.2 Cumulative Effects

The Forest uses the ERA method to assess cumulative effect of activities that alter hydrologic function and result primarily in alteration of runoff in project watersheds. The ERA method is essentially an accounting of the past, present, and future impacts. It is used to index land use intensity, rather than to predict effects. Judgment of the effect of proposed actions is made in consideration of current conditions, as determined by field observations, and those environmental parameters that are deemed relevant to the response of watershed hill slopes and channels in the project area. ERA is commonly expressed in percent of watershed area. ERA percentage for watershed is a measurement indicator to address soil disturbance, runoff, and sediment delivery concerns.

A degree of activity within a watershed, beyond which an adverse effect might be expected is the TOC described previously in this report in units of ERA percent. An appropriate range for TOCs is 10 to 20 percent ERA (USDA Forest Service 1990). The TOC for a watershed is calculated by a numeration of sensitive ground within that watershed. The closer the calculated ERA value for the watershed is to the threshold value the greater risk of overall detrimental impact to the watershed and its beneficial uses. The effect of activities decreases over time although the contribution of permanent roads to ERA does not change. Given the broad assumptions built in the ERA method, TOCs are not absolute determinations of adverse impacts, but a point at which it is reasonable to expect measurable effects. Given the degree that many of the project watersheds exceed their TOC, it is especially appropriate to use the value as a yardstick of detrimental change.

Seventeen of 26 analysis watersheds are over thresholds set by the Forest, for management impacts that affect runoff. All but two of the watersheds over threshold are due to the effects of the fire (Table 104). The two exceptions, Bear Valley and Moonlight Pass are due to fire salvage harvest on private land completed in 2008, or expected by 2009. Most of the salvage harvest on private lands is upslope of the Forest Service managed land, in the headwaters of the analysis watersheds. Ten of the watersheds are in excess of 30 percent over TOC and it is reasonable to expect that under conditions of intense precipitation events, that measurable increases in runoff response would occur.

Table 107. Current ERA in project area watersheds.

Watershed	ERA% NFS*	ERA% PVT*	ERA% Roads	ERA% Fire	ERA% PVT Proposed	Total ERA%	ERA% TOC
Bear Valley	0.1	5.8	1.2	11.2	4.6	23.0	13
Cold Stream	3.5	0.0	1.2	8.9	0.0	13.6	13
E.B. Lights	1.6	0.2	1.6	12.8	0.3	16.6	14
Freds	1.8	0.1	0.9	9.3	0.5	12.5	13
Indian blw Antelope, Babcock	1.7	0.0	1.4	16.6	0.0	19.7	13
Indian blw Antelope Dam	3.9	0.0	1.8	9.0	0.0	14.6	13
Lonesome Cyn	0.2	5.5	1.1	17.7	5.1	26.7	13
L. Cooks	0.5	0.0	0.8	4.5	0.1	5.9	12
L. Indian	2.5	0.0	1.8	11.2	0.3	15.8	12
L. Lights	0.0	2.0	0.9	13.0	1.5	17.4	14
L. Lone Rock	2.5	0.0	1.2	11.2	0.5	15.4	13
Mid. Creek	2.1	0.0	1.1	9.0	0.0	12.3	13
Mid. Hungry	1.7	0.1	1.5	5.6	0.0	8.8	13
Mid. Lights	0.2	0.8	1.3	17.6	0.0	19.9	14
Moonlight	0.4	.1	0.8	12.0	1.2	14.5	13
Moonlight Pass	1.4	12.8	1.1	6.2	1.4	22.8	14
Moonlight Valley	0.8	2.5	1.6	11.7	1.5	18.0	13
Morton	1.0	3.9	1.3	11.8	3.8	21.8	14
North Arm Indian Valley	.1	0.0	0.7	3.8	0.0	4.7	13
Pierce	3.5	0.0	1.4	4.7	0.1	9.6	12
Smith-Fant	0.5	1.85	1.4	15.8	5.7	25.3	14
Up. Hungry	2.2	0.2	1.3	8.4	0.1	12.2	13
Up. Indian	2.4	1.0	1.0	5.8	0.0	10.2	12
Up. Lights	0.9	3.5	1.2	7.7	0.8	14.1	13
Upper Peters Creek	5.4	0.0	3.8	1.4	0.0	10.5	14
W.B. Lights	0.6	0.5	1.5	17.2	1.3	21.2	13

*--NFS = NFS lands; PVT = private land

3.6.2.3 Alternative C – Direct, Indirect, and Cumulative Effects

Alternative C is inclusive of all tractor and roadside hazard elements within alternative A, already described above. Most temporary road construction (Table 100) including RHCA entries crossings are retained from Alternative A, so that on the basis of the analyzed watersheds there is little substantive difference in impacts to hydrology (Table 104) and detrimental disturbance for soils. Eighteen miles of temporary roads are proposed compared to 19 miles with Alternative A, with 7 RHCA entries and crossings of channels, including 1 with perennial flow.

Excepting the RHCA harvest areas, LWD > 3” will decrease over time, out to 30 years after harvest, because biomass removal will also remove future recruitment (Table 101). Predicted levels from fire ecology modeling indicate that LWD is expected to be on the low end of the range for sustaining adequate soil productivity. A project design element requires the general retention of 5 to 15 tons of down woody material per acre. Harvest

disturbance is expected to set back recovery (live and litter ground cover) 2 to 3 years at minimum.

Table 108. RHCA acres by alternative

Logging Systems	Alternatives							
	A		C		D		E	
	Int.*	Per.**	Int.	Per.	Int.	Per.	Int.	Per.
Helicopter	388	289	0	0	0	0	0	0
Skyline cable	67	186	0	0	0	0	0	0
Tractor/Roadside	406	635	406	635	358	586	297	565
Total	930	1041	406	635	358	586	297	565

*--Intermittent streams, **--Perennial streams

The only difference between Alternative A and C is the exclusion of skyline and helicopter logging in alternative C (Table 108). The steeper slopes associated with these latter harvest techniques have the greatest potential for erosion under the current conditions. That logging would not occur on these slopes under alternative C and therefore would not set back the timing of recovery, primarily of soil cover, substantially reducing potential erosion by a factor of two (see figure 4), on 6,219 acres (Table 100) when compared with Alternative A.

3.6.2.4 Alternative D – Direct, Indirect, and Cumulative Effects

Alternative D is inclusive of roadside hazard within Alternative A and a modified and decreased tractor harvest of 40 of the 187 units or sub-units, included in Alternative A, already described above (Table 100). Three miles of temporary roads are constructed for this alternative with a single channel crossing and entry into RHCA. The principle difference between ground base harvest of this alternative and those of Alternatives A and C is the eschewing of units not accessible by the existing forest road system. Regarding a watershed basis of runoff and detrimental soil impacts differences are not substantial between Alternative D and Alternatives A and C (Table 104). In terms of potential sediment delivery to channels, and given the greatly more disturbance associated with ground based harvest to other methods, and the degree of harvest within RHCAs (Table 108), this alternative again may not differ substantively from alternatives A and C.

Large woody debris component of the forest floor will decrease gradually out to thirty years, to marginal levels to maintain soil productivity. A project design element requires the general retention of 10 to 20 tons per acre of large down wood. Ground base harvest will set back recovery of forest floor by 2 to 3 years are a minimum.

3.6.2.5 Alternative E – Direct, Indirect, and Cumulative Effects

Alternative E is inclusive of the roadside hazard treatment element within Alternative A, already described above (Table 100). No temporary roads or landings are proposed with this alternative. These reductions, however, do not alter substantially the condition for any of the analyzed watersheds (Table 104). The amount of harvest within RHCAs is similar to tractor harvest in RHCAs in Alternatives C and D, and not substantively different from Alternative A (Table 108). This simply points up that most of the RHCA harvest entries are along already existing forest roads.

Over the next thirty years after harvest the LWD component of the forest floor will gradually decrease, due to lack of recruitment from proposed biomass removal, to levels that are marginal for soil productivity. It is expected that harvest will also set back recovery of the forest floor by 2 to 3 years.

3.7 Botany

This section summarizes the sensitive plant and noxious weed aspects of the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on sensitive plants and noxious weeds. The Moonlight and Wheeler Fires Recovery and Restoration Project Sensitive Plant Biological Evaluation and Noxious Weed Risk Assessment are incorporated by reference.

3.7.1 Affected Environment

The area analyzed in this document is referred to as the botany analysis area and encompasses approximately 90,585 acres and consists of all proposed treatment units, access roads to the treatment units, and the area within 1 mile of treatment unit boundaries. Proposed project treatment units are surveyed to determine known species for the effects analysis. Existing information based on current and past surveys conducted over the last 25 years and State records (CNDDB 2008) are used to determine species potentially affected in the analysis area outside of proposed treatment units. Surveys are considered current and valid for at least ten years. There is no Forest Service standard for the longevity of survey findings (USDA Forest Service 2007).

Species known from proposed treatment units or those known within the botany analysis area are considered to have the potential to be affected by project activities. All Threatened, Endangered, Candidate, and Sensitive species known in the botany analysis area are analyzed for potential effects from the project alternatives. (FSM 2672.43 Exhibit 01 Step 3) (USDA 2005). If a species is not known within the botany analysis area it is considered unlikely that project activities will impact the species and it is not analyzed in detail. Noxious weeds are surveyed for during rare plant surveys. A risk analysis is conducted for species known within the analysis area.

3.7.1.1 Threatened, Endangered, Candidate, and R5 Forest Service Sensitive Botanical Species

No Threatened, Endangered, or Candidate botanical species were located within the botany analysis area, during past or current surveys. One R5 Forest Service Sensitive botanical species, *Penstemon sudans* (Susanville beardtongue), is known from the area. Susanville beardtongue was discovered on the Plumas NF in 2004 and added to the

sensitive species list in 2006. Susanville beardtongue was located during 2005 and 2008 surveys.

Susanville beardtongue is known from 39 occurrences in California, most of which occur on land managed by the Bureau of Land Management in the vicinity of Susanville, California (CNDDB 2008 and PNF records). Three occurrences are known from the PNF. The number of plants at known occurrences varies from fewer than 50 to more than 1,000. Although often abundant where it occurs, Susanville beardtongue is restricted to a relatively small area in Lassen and Plumas counties, California, and adjacent Nevada. There are no known published scientific studies on the ecology or life history of *Penstemon sudans* (USDA 2008c) to aid in the management of this species.

Penstemon sudans is found on open sagebrush (Great Basin Scrub) or woodland dominated (pinyon / juniper woodland or lower coniferous forests) rocky slopes on volcanic or other igneous substrates, and sometimes roadsides (NatureServe 2008, CNPS 2008). Apparently, suitable habitat is widespread in northeastern California, and the factors restricting the range of Susanville beardtongue are unknown. Threats to this species include noxious weed spread, grazing, road construction, and logging (CNDDB 2008, USDA 2005b).

3.7.1.1.1 Noxious Weeds

The California Department of Food and Agriculture's noxious weed list (California Department of Food and Agriculture 2008) divides noxious weeds into categories A, B, and C. A-listed weeds are those for which eradication or containment is required at the state or county level. With B-listed weeds eradication or containment is at the discretion of the County Agricultural Commissioner. C-listed weeds require eradication or containment only when found in a nursery or at the discretion of the County Agricultural Commissioner.

There are 579 locations of priority weeds known within the botany analysis area. One A-rated weed, *Centaurea maculosa* (spotted knapweed), is known from seven locations. One B-rated weed, *Cirsium arvense* (Canada thistle) is known from 545 locations. Three C-rated weeds are known from the project area *Centaurea solstitialis* (yellow starthistle), *Taeniatherum caput-medusa* (medusahead), and *Cytisus scoparius* (Scotch broom). Yellow starthistle occurs at 8 locations, Medusahead at 13, and Scotch broom at 4 in the botany analysis area.

Of the 579 locations within the botany analysis area, 216 occur in alternative A proposed treatment units, 165 in alternative C proposed treatment units, 142 in Alternative D proposed treatment units, and 125 in Alternative E proposed treatment units.

There are 54 weed infested units in alternative A, 34 in alternative C, 24 in alternative D, and 12 in alternative E.

3.7.2 Environmental Consequences

The area analyzed in this document is referred to as the botany analysis area and encompasses approximately 78,615 acres and consists of all proposed treatment units, access roads to the treatment units, and the area within 1 mile of treatment unit boundaries. This area was chosen to capture all rare plants and noxious weed species that

occur (a) within the proposed treatment units or (b) have suitable habitat within the project area as well as a "source" (potential for seed dispersal) population located within close proximity to the proposed activities.

It is not known when the effects of the proposed treatments would no longer be altering the life history dynamics (such as germination, growth time necessary to reach sexual maturity, quantity of viable seed produced in a lifetime) of the rare species considered in this analysis. There is a lack of published scientific data on the life history or ecology of *Penstemon sudans* (USDA 2008c). One method to estimate duration of effects is to assume that the effects of the action alternatives last as long as they are, singly or in combination with other anticipated effects, distinguishable from the effects of the no-action alternative. Using this method is difficult for this project because of the intensity and scale of the Moonlight and Antelope Complex fires. Natural regeneration of stands after large fires is variable and unpredictable giving factors such as pockets of unburned stands, seed trees, chance seed dispersal, and potential for future fires. The fires of 2007 have permanently changed the vegetation pattern across the botany analysis area.

3.7.2.1 Alternative A – Direct, Indirect, and Cumulative Effects

3.7.2.1.1 R5 Forest Service Sensitive Botanical Species

No direct effects on Susanville beardtongue (*Penstemon sudans*) are anticipated because the known locations would be flagged for avoidance so project activities would not occur within these control areas. The indirect effects of the proposed action would likely be negligible to slightly beneficial. Since Susanville beardtongue is found in dry, naturally open areas with little or no canopy or vegetative cover the proposed action may increase the amount of suitable habitat for this species across the landscape by maintaining or enhancing natural openings through removal of dead trees.

There would likely be a low risk of cumulative effects because the direct and indirect effects on this species from alternative A would be negligible to slightly beneficial. A query of the Forest Service Activity Tracking System (FACTS) and subsequent overlay with Susanville beardtongue locations in proposed units reveals 6 past activities. Although there are no known specific and documented direct and indirect effects on this species from past activities they have likely had some negative effect to Susanville beardtongue because project activities were not mitigated. Existing grazing allotments may have some negative effects to sensitive plant populations. The impacts of grazing are not clearly established because long-term monitoring is not in place and there is a lack of published literature on the impacts of grazing on Susanville beardtongue.

No other projects in appendix B are likely to contribute to the direct, indirect, or cumulative effects of Penstemon sudans in the botany analysis area.

3.7.2.1.2 Noxious Weeds.

There are 216 known locations of noxious weeds within 54 units in alternative A. The risk of spreading of weed species will increase. The risk of introducing new weed species is minimized through Standard Management Requirements (SMRs) such as requirements for equipment cleaning (appendix C).

The project standard management requirements are designed to minimize risk of new weed introductions, minimize the spread of spotted knapweed, yellow starthistle, medusahead, and Scotch broom within and between units, and minimize likelihood of spread of Canada thistle from infested units to uninfested units. This project is likely to spread Canada thistle within already infested units.

Table 109. Summary of the weed risk assessment factors considered.

NON-PROPOSED ACTION DEPENDENT FACTORS		
Factors	**Variation**	**Risk**
1. Inventory	Complete	Low, baseline information is adequate.
2. Known Noxious Weeds	Priority species (spotted knapweed, yellow starthistle, medusahead, and Scotch broom) present, Canada thistle is abundant.	High priority to prevent spread from infested units to uninfested units; prevention of weed introductions is a high priority.
3. Habitat vulnerability	Mostly, burned vegetation in an early stage of recovery. High historical disturbance, high recent disturbance	High vulnerability.
4. Non-project dependent vectors	Moderate current vectors	Moderate risk.
PROPOSED ACTION DEPENDENT FACTORS		
5. Habitat alteration expected as a result of project.	Moderate to high ground disturbance due to logging and landing construction or reconstruction.	High risk
6. Increased vectors as a result of project implementation	Up to 13 miles of temporary roads, road maintenance, short-term traffic increase	High risk
7. Anticipated weed response to proposed action	All SMRs implemented	High risk of Canada thistle spread within infested units, low risk of new introductions, moderate risk of spotted knapweed, yellow starthistle, medusahead, and Scotch broom spread.

3.7.2.2 Alternative B – Direct, Indirect, and Cumulative Effects

3.7.2.2.1 R5 Forest Service Sensitive Botanical Species

No direct effects are anticipated because no project related activities would occur. The indirect effects of the no action would likely be negligible. Susanville beardtongue is found in dry, naturally open areas with little or no canopy or vegetative cover. The habitat near the known sites was minimally altered by the fires.

Because the direct and indirect effects of this alternative are expected to be negligible to minor, they would not substantially contribute to the effects from past, present, and future activities. The effects of other projects have been described under the proposed action above. The effects of those projects are the same for this alternative.

3.7.2.2.2 Noxious Weeds

There would be no project related actions so soil disturbance and compaction would not increase the risk of invasive plant introduction or spread.

Because there would be no project related activities, the risk of new weed introductions, spreading spotted knapweed, yellow starthistle, medusahead, and Scotch broom within and between units, and spreading Canada thistle from infested units to uninfested units is very low. Noxious weeds would continue to spread at their natural rate.

3.7.2.3 Alternative C – Direct, Indirect, and Cumulative Effects

3.7.2.3.1 R5 Forest Service Sensitive Botanical Species

No direct effects on Susanville beardtongue (*Penstemon sudans*) are anticipated because the known locations would be flagged for avoidance so project activities would not occur within these control areas. The indirect effects of the proposed action would likely be negligible to slightly beneficial. Since Susanville beardtongue is found in dry, naturally open areas with little or no canopy or vegetative cover the proposed action may increase the amount of suitable habitat for this species across the landscape by maintaining or enhancing natural openings through removal of dead trees.

Because the direct and indirect effects of this project are expected to be negligible to minor, they would not substantially contribute to the effects from past, present, and future activities. The effects of other projects have been described under the proposed action above. The effects of those projects are the same for this alternative.

3.7.2.3.1.1 Noxious Weeds

The effects of this alternative are somewhat reduced in comparison to alternative A because there are 51 fewer locations within treatment units and there are 20 fewer units with weed infestations.

There are 165 known locations of noxious weeds within 34 units in alternative C. The risk of spreading of weed species will increase. The risk of introducing new weed species is minimized through SMRs such as requirements for equipment cleaning.

The project standard management requirements are designed to minimize risk of new weed introductions, minimize the spread of spotted knapweed, yellow starthistle,

medusahead, and Scotch broom within and between units, and minimize likelihood of spread of Canada thistle from infested units to uninfested units. This project is likely to spread Canada thistle within already infested units.

3.7.2.4 Alternative D – Direct, Indirect, and Cumulative Effects

3.7.2.4.1 R5 Forest Service Sensitive Botanical Species

No direct effects on Susanville beardtongue (*Penstemon sudans*) are anticipated because the known locations would be flagged for avoidance so project activities would not occur within these control areas. The indirect effects of the proposed action would likely be negligible to slightly beneficial. Since Susanville beardtongue is found in dry, naturally open areas with little or no canopy or vegetative cover the proposed action may increase the amount of suitable habitat for this species across the landscape by maintaining or enhancing natural openings through removal of dead trees.

Because the direct and indirect effects of this project are expected to be negligible to minor, they would not substantially contribute to the effects from past, present, and future activities. The effects of other projects have been described under the proposed action above. The effects of those projects are the same for this alternative.

3.7.2.4.2 Noxious Weeds.

The effects of this alternative are somewhat reduced in comparison to alternative A because there are 74 fewer locations within treatment units and there are 30 fewer units with weed infestations.

There are 142 known locations of noxious weeds within 24 units in alternative D. The risk of spreading of weed species will increase. The risk of introducing new weed species is minimized through SMRs such as requirements for equipment cleaning.

The project standard management requirements are designed to minimize risk of new weed introductions, minimize the spread of spotted knapweed, yellow starthistle, medusahead, and Scotch broom within and between units, and minimize likelihood of spread of Canada thistle from infested units to uninfested units. This project is likely to spread Canada thistle within already infested units.

3.7.2.5 Alternatives E – Direct, Indirect, and Cumulative Effects

3.7.2.5.1 R5 Forest Service Sensitive Botanical Species

No direct effects on Susanville beardtongue (*Penstemon sudans*) are anticipated because the known locations would be flagged for avoidance so project activities would not occur within these control areas. The indirect effects of the proposed action would likely be negligible to slightly beneficial. Since Susanville beardtongue is found in dry, naturally open areas with little or no canopy or vegetative cover the proposed action may increase the amount of suitable habitat for this species across the landscape by maintaining or enhancing natural openings through removal of dead trees.

Because the direct and indirect effects of this project are expected to be negligible to minor, they would not substantially contribute to the effects from past, present, and future

activities. The effects of other projects have been described under the proposed action above. The effects of those projects are the same for this alternative.

3.7.2.5.2 Noxious Weeds.

The effects of this alternative are somewhat reduced in comparison to alternative A because there are 91 fewer locations within treatment units and there are 42 fewer units with weed infestations.

There are 125 known locations of noxious weeds within 12 units in alternative E. The risk of spreading of weed species will increase. The risk of introducing new weed species is minimized through SMRs such as requirements for equipment cleaning.

The project standard management requirements are designed to minimize risk of new weed introductions, minimize the spread of spotted knapweed, yellow starthistle, medusahead, and Scotch broom within and between units, and minimize likelihood of spread of Canada thistle from infested units to uninfested units. This project is likely to spread Canada thistle within already infested units.

3.8 Cultural Resources

3.8.1 Affected Environment

3.8.1.1 History of the Analysis Area

The following is a broad historical overview of the human or cultural mechanisms that have influenced the Moonlight and Wheeler Fires Recovery and Restoration Project. Ecosystem models based solely on biological and physical elements often disregard the complex interaction between humans and their environment. More than any other phenomenon, cultural landscapes provide a unique opportunity to interpret the history of the effects humans have had on the environment. Together, natural and cultural influences have shaped the overall character of the project vicinity.

3.8.1.2 Prehistory Period

Archaeological studies on the Mt. Hough Ranger District have primarily been limited to cultural resource inventories for proposed Forest Service activities. Because intensive archaeological research in the Moonlight and Wheeler Fires Recovery and Restoration Project sufficient to define prehistoric complexes and establish a reliable cultural chronology is not available, cultural assessments and interpretations for the treatment areas (including newly constructed and decommissioning of temporary roads, landings, and skid trials) rely upon extrapolations from several studies that were completed for lands adjacent to the treatment areas.

Archeological investigations at Plumas National Forest have revealed Native American occupation spanning at least 8,000 years. Cultural resources include flaked-stone artifact scatters, which reflect resource procurement activities and seasonal campsites, and habitation sites with midden deposits and, in some instances, housepits. Flaked-stone artifact scatters documented in the treatment areas consist of flaked-stone tools, debris, and occasionally groundstone artifacts that most likely resulted from one or more

occupational episodes. Obsidian sources north and east of the treatment areas account for the majority of the lithic material used in flaked-stone tool manufacturing, although locally available chert and igneous rock sources were also used. The distribution of Native American archeological sites in the treatment areas appear to have been influenced by the occurrence of perennial or reliable intermittent water sources, with most sites found in close proximity to these features.

Only a few projectile points have been identified within Plumas County that date to the *Paleo-Indian period* between 9000–6000 B.C. (Nilsson et al. 1996:8). Later assemblages are summarized under two comprehensive archaeological periods, the *Archaic Period* and *Emergent Period*. These two periods date between 6000 B.C.–A.D. 500 and A.D. 500–Historic Contact, respectively. The Archaic is also generally divided into Lower (6000–3000 B.C.), Middle (3000–1000 B.C.), and Upper (1000 B.C.–A.D. 500).

Prehistoric material culture in the northern Sierra region of California has been further categorized according to local chronologies that define technological, economic, social and ideological elements. This northern Sierra region includes the drainages of the upper Feather, Yuba, Bear, and American Rivers and Lake Tahoe. The Martis-Kings Beach chronological sequence was first developed by Heizer and Elsasser (1953) after an extensive survey of the Sierran area around Lake Tahoe. The sequence was revised later by Elsasser (1960), Elston (1971), Elston et al. (1977), Humpreys (1969), Ritter (1970), and Elsasser and Gortner 1991.

The Tahoe Reach chronological sequence by Elston et al. (1977) has been adopted and used by the majority of archaeologists working in the north central Sierran mountains and foothills, though questions have been raised about its validity (see, for example, Jackson et al. 1994:I.B.10). Some of these issues were examined recently by Basgall (2003). A second chronological scheme (Mesilla-Bidwell-Sweetwater-Oroville-Historic) was developed for the west slope of the Sierran foothills, summarized by Ritter (1970) based on work at Lake Oroville, and later by Kowta (1988) based on his work at Lake Almanor. Prehistoric influences from both the high Sierra and Great Basin to the east (Martis Complex) and from the Sacramento Valley to the west have been recognized within this western foothill sequence. Recently, for example, as a result of shoreline surveys at Lake Almanor, Compas (2003) identified Martis, Mesilla, Sweetwater, and Kings Beach assemblages, among others.

Although assemblages earlier than the Martis Complex (Spooner and Tahoe Reach phases) have been tentatively identified as part of the Tahoe Reach sequence (Elston et al. 1977), the Martis Complex is the earliest well-documented phase. The sequence attempted to show continuity in cultural development, using projectile point typologies, from the Martis and Kings Beach complexes through ethnographic times. Using this argument, the Kings Beach is taken to represent the Washoe, with ancestral Washoe represented by the Martis Complex (Elston et al. 1977; Kowta 1984). This assessment, however, is not universal (Moratto 1984:303). Elston and others also suggest that prehistoric occupation of the Sierras may have occurred as a result of the movement westward of peoples from the Great Basin. Kowta (1988) suggested Penutian-speaking peoples from the east displaced indigenous Sierran Hokan speakers about A.D. 1000.

The seven phases of the Tahoe Reach sequence (Elston et al. 1977:171), which spans most of the Holocene, are summarized in Table 110. The Martis and Kings Beach complexes account for five of the seven phases; these two complexes are detailed below.

Martis Complex (2000 B.C. – A.D. 500). This well-documented complex has been identified from the Lake Tahoe area, extending northward into Plumas and Lassen Counties, as well as southward into Alpine County (Elsasser 1960). Radiocarbon dates and obsidian hydration measurements indicate the complex was present from 2000 B.C. to A.D. 500 (Elsasser and Gortner 1991:361). Excavation of Martis Complex sites included the Chilcoot Rockshelter in Plumas County (CA-PLU-44) (Payen and Boyolan 1961). Characteristics of the Martis Complex include an emphasis on hunting and seed collecting. Projectile points were large, heavy, and roughly flaked; they also varied in form (although they resemble Great Basin forms, including the Elko series). An abundance of distinctive tool forms included finger-held drills or punches, large biface blades and cores, spokeshave-notched tools with a concave edge, and basalt pressure-retouched flake “scrapers.” For the manufacture of flaked tools, there was an apparent preference for using local basalt other than chert or obsidian. The milling equipment used to process seeds was predominantly grinding slabs and handstones.

Table 110. Cultural phases of the Tahoe Reach chronology.

Age	Phase	Characteristics	Climate
A.D. 1200–Historic Contact	Washo-Late Kings Beach	Desert Side-notched and Cottonwood Series points, chert cores, utilized flakes, and other small chert tools.	Neoglacial; wet and cool but with little summer precipitation
A.D. 1200–500	Early Kings Beach	Eastgate and Rose Spring series points, chert cores, utilized flakes, and other small chert tools.	Nonglacial; dry, trees growing in former bogs; Tahoe may often not overflow
A.D. 500–500 B.C.?	Late Martis	Corner-notched and eared points of the Martis and Elko series? Large side-notched points? Large basalt bifaces and other basalt tools.	Neoglacial; wet but not necessarily cooler, increased summer precipitation
500 B.C?–1500 B.C.	Middle Martis	Steamboat points, other types in Elko-Martis series? Large basalt bifaces and other basalt tools.	Possible warm, dry interval centered on 1500 B.C.
1500–2000 B.C.	Early Martis	Contracting stem points of the Elko-Martis series? Large basalt bifaces and other tools. Light-colored basalt artifacts?	Beginning of Meditherimal; Neoglacial, wet but not necessarily cooler, increased summer precipitation; Tahoe begins to overflow
2000–5000 B.C.	Spooner	Point in the Pinto and Humboldt series, light-colored basalt artifacts.	Altithermal; generally hot and dry; Tahoe does not overflow for long periods of time
6000 B.C.	Tahoe Reach	Parman points.	Anathermal; warming trend, climate similar to later Neoglacial intervals

There is a firmly dated association with unique “Central Sierra Abstract Style” or Style 7 rock art sites within the Middle Archaic Period, between 2000–500 B.C., which is equated with the Martis Complex (Elsasser and Gortner 1991:361; Foster et al. 2002). Payen (1966) initially defined the distinctive Style 7 or “High Sierra Abstract-Representation” petroglyphs. The panels, which contain a greater variety of design elements and are very complex, appear on bedrock surfaces in the higher elevations of the northern Sierra. Common design elements include wavy lines of varying complexity, tracks, concentric circles, simple circles elaborated by line elements, and anthromorphic-zoomorphic images.

Style 7 petroglyph sites are distributed within the drainages of the Feather, American, Bear, Truckee, and Yuba Rivers and occur within the counties of Nevada, Placer, Plumas, and Sierra. The sites range in elevation from 1,408–2,329 meters (4,620–7,640 feet) above sea level, usually on glaciated bedrock of various rock types, but in various natural settings along canyons, streams, and domes. At present, there is an ongoing inventory of

Style 7 sites being conducted by the California Department of Forestry and Fire Protection (Foster 1999). Recordation will ensure their protection during future logging operations in the region.

Kings Beach Complex (A.D. 1200. – A.D. 500). In contrast to the earlier Martis Complex, a fishing and gathering economy characterizes the succeeding Kings Beach Complex. Tools included the bow and arrow, as evidenced by the small, light projectile points. These smaller points resemble Desert Side-notched, Cottonwood, and Rosegate forms. Flaked tools were mainly manufactured from obsidian and chert instead of basalt. This may reflect a change in preference and/or availability of these raw material types, suggesting an increase in trade. The milling equipment used during this period was predominantly bedrock mortars, with pestles made from cobbles. This shift in milling technology may reflect a growing reliance on acorns as a dietary staple.

The Kings Beach Complex was initially dated to no earlier than 1,000 years ago, which left a gap between the end of this period and the beginning of the Martis Complex (Heizer and Elsasser 1953). There is no gap in the revised sequence developed by Elston et al. (1977:16, 171), who described a transitional phase between these two periods.

Recent data recovery excavations at a prehistoric archaeological site (CA-PLU-1485) located in the northern Sierra Valley, Plumas County, indicate that the site was apparently well known and occupied throughout the earlier Middle Archaic period (Waechter 2005). The site contains more than 50 rock-lined cooking basins, as well as a house floor and deep midden, and is located near two popular basalt quarries (Siegfried Canyon Ridge and Gold Lake). Radiocarbon dates from the cooking basins range from approximately A.D. 1000–1500. Ethnographic data suggests the rock-lined features were used to process camas roots (*Camassia quamash*), which appears to have intensified during the Medieval Climatic Anomaly (also known as the Medieval Warm Period) (approximately A.D. 900–750). The site is immediately south of the southern edge of Plumas National Forest.

3.8.1.3 Ethnographic Period

The Moonlight and Wheeler Fires Recovery and Restoration Project is in the ethnographic territory of the Maidu, also known as the Mountain or Northeastern Maidu (Dixon 1905:123-125; Kroeber 1925:391-392; Riddell 1978:370-371). The Maidu are a linguistic subfamily of the Maiduan family, Penutian stock (Shipley 1978:83). There are other two languages in the Maiduan family, Konkow (Concow, Northwestern Maidu) and Nisenan (Southern Maidu). Maidu dialects were probably spoken in four major areas, known as American Valley, Indian Valley, Big Meadows, and Susanville.

Maidu territory included the drainages of the Feather and Susan Rivers, in the high mountain meadows of the Sierra Nevada generally 1,219 meters (4,000 feet) above sea level or higher. This homeland was bounded by Lassen Peak to the north, the Sierra Buttes to the south, present-day Quincy on the west, and extending into the Great Basin to the east between Honey and Eagle Lakes. By the time of contact, however, the Maidu had withdrawn from the Honey Lake area, which was taken over by neighboring Paiute. Neighboring groups included the Konkow on the lower reaches of the Feather River to the west, Yana to the northwest, Atsugewi and Achumawi to the north, Nisenan to the southwest, with Northern Paiute and Washoe to the east.

The most important mountain valleys inhabited by the Maidu included American, Big Meadows (now under Lake Almanor), Butt, Genesee, Indian, Mountain Meadows, and Red Clover (Riddell 1978:370-372). One or more permanent villages were established in these valleys, winter weather permitting. Occupation was restricted to seasonal use in other valleys, including Sierra and Mohawk. The nearest recorded Maidu villages to the treatment areas would have been *Tse'lim-nah* and *Yow'-koo*, located in the North Arm of Indian Valley.

Political organization of the Maidu was limited to a settlement pattern of village communities (Kroeber 1925:397-398; Riddell 1978:373). A central village housed a circular, semi-subterranean ceremonial assembly structure and the home of the community spokesman. A community was composed of 3–5 villages, and the villages were apparently self-sufficient. Kroeber (1925:397) estimated village size as less than 200. Houses were either semi-subterranean or conical bark structures. Because of water discharge during the spring and summer snowmelt, villages were situated on the edges rather than the center of the valleys. Each village community owned and defended their common hunting and fishing grounds near these mountain valley settlements. Some fishing holes and deer fences were owned by individual families and inherited by male descendants.

The fundamental economy of the Maidu was one of subsistence hunting, fishing, and collecting plant foods in an area where abundant natural resources varied seasonally (Riddell 1978:373-374). Acorns were a dietary staple, and were collected from oak groves at lower elevations. Oak varieties in the area included the black oak (*Quercus kelloggii*), canyon or golden oak (*Q. chrysolepis*), and interior live oak (*Q. wislizenii*). The Maidu gathered nuts from the sugar pine and yellow pine and ate them raw or cooked into a soup or patties. In the northeastern part of their territory near Susanville, nuts from the huckleberry oak (*Q. vaccinifolia*) and bush chinquapin (*Chrysolepis sempervirens*) were also collected. Other vegetal resources included hazelnuts, buckeye nuts, wild nutmeg, grass seeds, berries, and underground roots and bulbs. Roots included camas, Indian root, cattail root, and tule root. Camas roots were harvested early in the summer and roasted in rock-lined cooking basins (Waechter 2005). Salmon, eel, birds, waterfowl, grasshoppers and other insects, as well as large and small mammals, were also consumed. Large animals included deer, elk, and grizzly bears.

A wide variety of tools, implements, and enclosures were employed by the Maidu to gather and collect food resources. These included the bow and arrow, traps, nets, slings, snares, clubs, and blinds for hunting land mammals and birds; salmon gigs, traps, and nets for fish. During communal drives, deer were driven over cliffs or shot by concealed hunters. Woven tools, including seed beaters, burden baskets, and carrying nets, as well as sharpened digging sticks, were used to collect plant resources. Snowshoes were used for winter travel, and dugout canoes or log rafts for navigating or crossing the mountain waterways (Riddell 1978:373-379).

The Maidu processed food resources with a variety of tools, including portable stone mortars, bedrock mortars and pestles, anvils, woven strainers and winnowers, leaching baskets and bowls, storage baskets, woven parching trays, wooden mortars, and knives. Baskets were either coiled or twined. They also traded between neighboring Konkow for

various resources and implements, and with the Achumawi for beads, obsidian, money beads, and green pigment dye.

Log drums, rattles, flutes and whistles accompanied Maidu ceremonial dances. Mortuary practices among the Maidu included extended burials, generally facing east, that were accompanied by grave offerings (Riddell 1978:381-384).

Prior to the discovery of gold in 1848, at Sutter's Mill near Coloma on the American River, Maidu lifeways were little affected by exploration into mainly Konkow territory by Spanish explorers and American trappers. With the tens of thousands of gold seekers came the mass introduction and concentration of diseases, and a great epidemic that swept the Sacramento Valley in 1833 also decimated the Konkow Maidu. Even the remote, traditional lands of the Maidu were overrun in the early 1850s with explorers and miners. The results were devastating and included the loss of land and territory, including traditional hunting and gathering locales, violence, malnutrition, and starvation. The Maidu then worked for miners for very low wages. By 1910, estimates indicate the Maidu population had been reduced to only 200 individuals from perhaps 2,500 prior to contact (Kroeber 1925; Riddell 1978:385-386).

Today, approximately 2,500 Maiduan people live on seven rancherias (Auburn, Berry Creek, Chico, Enterprise, Greenville, Mooretown, and Susanville) and the Round Valley Reservation, located in Plumas and Butte Counties (Alliance of California Tribes 2005). The Konkow Maidu were forcibly marched to the Round Valley Reservation in 1863, with few provisions or water over a long, hot dry trail. The Greenville Rancheria was originally called the Indian Mission, which was allotted several parcels of land. The Rancheria was restored to federal recognition in 1983, and three or four of the original land allotments were also restored to its members. Nearly 200 members are serviced today by this federally recognized group in Greenville, Plumas County.

3.8.1.4 Historic Period

The majority of the current treatment areas are within Plumas County, with minor acreage to the north extending into Lassen County. When Plumas County was formed in 1854 from portions of Butte County and named for the river that flows through it, the Spanish name for the river, "Plumas," was employed. Around this time, "El Rio de las Plumas" was also anglicized and became known as the Feather River. Some territory was transferred from Plumas to Lassen County in 1864. Quincy was later named the county seat (Plumas 2005).

The National Forest System was established in March 1905 by President Theodore Roosevelt (Plumas National Forest 2005). At that time, as the importance of minerals to the regional economy decreased and the value of timber and agriculture increased, President Roosevelt recognized the value of the area's forests as national resources. The boundaries of the extensive terrain within this forest roughly include the branches of the Feather River. Lassen National Forest borders Plumas National Forest to the north, with Tahoe National Forest on the south. Today, Plumas National Forest is best described as a multiple-use area. The lands provide recreational opportunities, wildlife habitat, and sustainable timber supplies (Plumas National Forest 2005).

The following history of Plumas County and the treatment areas is divided into three major themes: gold and copper mining, ranching and farming, and timber industry. Reference is made to a few of the previously recorded archaeological sites pertaining to the history within the Moonlight and Wheeler Fires Recovery and Restoration Project. Today, the county remains rural in character, with a population density of eight people per square mile, only one incorporated city in the entire county (Portola), and only two stoplights (in Quincy) The county boasts 1,000 miles of rivers and streams, more than 100 lakes, and over a million acres of national forest (Plumas National Forest 2005).

Gold and Copper Mining. The history of Plumas County is firmly entwined with the Gold Rush and the elusive search for "Gold Lake" by Thomas Stoddard and other miners. In the fall of 1849, Stoddard and his partner discovered a lake with large gold nuggets somewhere in the vicinity of Sierra Valley and Downieville. After losing his way and reaching the gold camps in the Downieville-Nevada City region, Stoddard's tale encouraged thousands of miners to search for the lake in the mountains that would become Plumas and Sierra Counties (Young 2003:20-24).

Although "Gold Lake" was never relocated, its quest started the Plumas County gold rush of 1850. Numerous rich placer diggings were discovered at Nelson Creek, Hopkins Creek, and Butte Bar, among others, as well as five mining bars on the East Branch of the North Fork of the Feather River. These included French Bar, Indian Bar, Junction Bar, Rich Bar, and Smith Bar. Rich Bar, for example, became a famous placer mining camp, and by 1852, boasted a population of 2,500 and the prominent Empire Hotel (Young 2003:25-30). James Beckwourth's discovery in 1850 of the lowest pass (Beckwourth Pass) across the Sierra Nevada Mountains permitted a steady flow of immigrants and miners who came searching for gold. The trail over the pass left present-day Reno across the pass to the American Valley (near Quincy), onward to the Sacramento Valley.

Placer mining and prospecting in the 1850s and 1860s included the current treatment areas within the Lights Creek drainage system. Although not very rich, claims were filed for gold and silver, as well as copper. A number of placer ditches were mined in the treatment areas, including China Gulch, Fant Ditch (see site record FS 05115200177) and Ruffa Ditch (see site record FS 05115200344/CA-PLU-2107-H) and the slopes of Moonlight Valley (Foote 1991:15).

In the 1860s, quartz mining was introduced to the region. In the Greenville area to the west of the current Moonlight and Wheeler Project treatment areas, for example, 15 mines and a total of 314 stamps to crush gold-bearing quartz were operating between 1860 and 1880 (Young 2003:35). With the advent of hydraulic mining in the early 1870s, gravels were worked on the Feather River near Seneca to the west of the current treatment areas (Foote 1991:13). A few years later, these destructive mining practices were outlawed.

There was a brief "copper boom" in 1862–1863 in Plumas and other counties in California. At nearby Genesee, the first important discovery was made at the Cosmopolitan (now Reward) Mine in what was later known as the Plumas Copper Belt. James Ford may have discovered the rich copper deposits along Lights Creek, within the current treatment areas, as early as 1865 (Foote 1991:12). This early boom ended by 1868 when easily available, high-grade copper was mined out.

James Ford was also responsible for the construction of a wagon road between Susanville and Taylorsville, which was financed by both Lassen and Plumas Counties in the 1860s. The route, still in use today, traverses Diamond Mountain and runs along Lights Creek through the North Arm of Indian Valley (Torrey 1945:28). It was the main route to Indian Valley from the north until at least 1908 (Aubrey 1908:178-179). To travel westward, people and goods traversed from Indian Valley to Greenville via Wolf Creek to the Feather and Sacramento Rivers.

A second "copper boom" occurred between 1915 and 1930. Three major mines opened and operated in Plumas County, near the northern and southern ends of the 18-mile-long Plumas Copper Belt (Foote 1991:13-14; Smith 1970:56). The Engels and Superior Mines, on Lights Creek north of the North Arm of Indian Valley, were at the north end of the Copper Belt; Walker Mine was at the southern end, south of Genesee Valley. Of these three major operations, the Engels and Superior Mines are within the current treatment areas.

Henry A. Engels and his family arrived in the area in 1880 and, shortly thereafter, established copper claims in China Gulch and Superior Ridge. After 20 years of prospecting, the Engels Copper Mining Company was founded in 1901 in order to gain the capital needed to develop mining on a large scale. Although other mining corporations were founded about this time between Lights Creek and Moonlight Valley, only the Engels Mine successfully developed into a major concern, with access to large quantities of high-grade copper (Foote 1991:15-16; Smith 1970:63; Young 2003:43-45).

By 1911, the Engels Copper Mining Company built a smelter in China Gulch. Shortly thereafter, however, the Forest Service prohibited its operation (MacBoyle 1918:57; Foote 1991:16). Next, a flotation mill, used to concentrate the ore, was constructed at Upper Camp after the price of copper increased in 1914. Upper Camp was located at the headwaters of China Gulch. The mill operated for five years, during which time sacks of the concentrated ore were loaded onto a 7,000-foot aerial tramway that descended to Indian Valley. A second tramway, about 2 miles long, transported crushed ore from a crusher on the level 6 adit to an ore bin at the Superior Mill, which operated from 1917 to 1930. The mill was located immediately south of the junction of the Superior Ravine with Lights Creek.

From the Superior Mill and Indian Valley, the ore was hauled or trucked to Keddie (8 miles northeast of Quincy) and then shipped via the Western Pacific Railroad to Garfield, Utah, for smelting. The Western Pacific had become the nation's sixth transcontinental railroad in 1903. With the Western Pacific, the Engels Copper Mining Company also invested in the construction of a broad gauge short line, used to haul freight and passengers. Completed in 1917, the Indian Valley Railroad ran daily from Lower Camp to a junction at Paxton with the Western Pacific (Young 2003:44, 72-75).

By 1923, a 2.5-mile, mostly underground, electric railroad was used to haul the ore from the level 10 adit to the Superior Mill. The level 10 adit was extensive, with an 8.5 by 8-foot portal that was 2 feet higher than the ore bin at the mill. A 12-inch diameter redwood flume was completed in 1922, connecting the water ditch in the level 10 adit, which drained the higher levels of the mine to the processing plant at Superior.

The townsite of "Engelmine" was gridded and graded in 1918 near Lower Camp on Lights Creek north of the Superior Mill, between the junctures of Lights Creek with

China Gulch and Superior Ravine. The planned townsite included a dining hall, recreation hall, hospital, school, post office, store/hotel, large dormitories, and family housing. When the level 10 adit was completed in 1923, housing at the Upper Camp was moved down to the Engelmine townsite, the level 6 aerial tram was closed, and Upper Camp abandoned (Foote 1991:17-18). Additional dormitories and family housing were constructed at the townsite near Lower Camp a year later. Utilities included sewer, power, and water. Two additional portions of the town, “Hollywood” and “Tijuana,” were located north of the townsite. At its peak during the 1920s, the population of the townsite was approximately 1,200.

Copper production emerged as Plumas County’s economic giant in the 1920s and 1930s, although gold mining also continued into the 19th century on a smaller scale in various areas. The Engels Mine on Lights Creek was the largest copper mine in the state of California and yielded some 117 million pounds of copper over its lifetime. At least $25 million in copper was produced at that mine in northern Indian Valley and some $23 million at the Walker Mine 15 miles to the south (Young 2003:43-45).

Although it also produced some gold and silver, the Engels Copper Mining Company closed in 1930 when the price of copper was too low to maintain a profit. In 1936, it merged with the California Copper Corporation to form the California-Engels Mining Company. People continued to live at the Engelmine townsite, and operations continued on the Indian Valley Railroad until 1940. At the end of this period, all the equipment and metal was sold, the railroad right-of-way abandoned, and the town dismantled. A new paved road was built on the railroad right-of-way, and includes part of Highway 89 and Plumas County Road 214. Houses were moved to Greenville, Quincy, Portola, Taylorsville, and other nearby towns. The last cabin was removed in the 1960s (Foote 1991:18).

During the 1850s to 1900, particularly during the 1880s, Chinese miners comprised a significant portion of the population in Plumas County. Typically, they worked abandoned placer gold diggings. China Gulch, the location of the Upper Camp operated by the Engels Mine, may be named for a placer stream that had been worked by Chinese miners (Young 2003:43). Evidence of Chinese culture has been identified within the current treatment areas at the Engel Mine Townsite. Commercial, cultural, and social centers, known as Chinatowns, were established in a number of towns, including Greenville and Taylorsville to the west of the current treatment areas. The largest Chinese community in the county was located at Silver Creek (Young 2003:46-51).

Placer miners continued to work the gold diggings in Lights Creek, particularly during the 1930s depression. There was also a short-lived dredging operation established in 1940 near the confluence of the East and West Branches of the creek. Although gold was found, the operation was not economical and had to be abandoned. There are still active placer mining claims on Lights Creek, but companies like the California-Engels Mining Company await an increase in the price of copper before beginning to mine the remaining disseminated, though extensive, deposits (Foote 1991:18).

Ranching and Farming. The growth of ranching and farming in the region was a direct effect of the Gold Rush and the demands for food and transport (mules and horses). Ranching in the fertile valleys of Plumas County has roots as early as 1850 when miners were rented grasslands for their mules. Adjacent to the current treatment areas, hay and

oats were grown in Indian Valley. The first gristmill in Indian Valley was constructed in 1856, with 8,000 tons of hay cut in 1876. The valley was also famous for its horses and the quality and quantity of its butter. By 1880, the valley had a large population approaching 2,000 individuals. Ranching in the area grew to include raising beef and dairy cattle, sheep, and hogs; farmers grew hay, oats, barley, potatoes, vegetables, and fruit orchards. The Taylorsville Creamery sold butter, cheese, and milk. A store and stage stop was established around 1880 in the Genesee Valley at the southern terminus of the current treatment areas (Young 2003:52-55).

During this period, particularly in the eastern portion of Plumas County, flocks of sheep and their Basque sheepherders became a routine, seasonal presence (Young 2003:58). Originally from the Pyrenees Mountains in Spain and France, Basques immigrated to the United States initially as part of the European influx during the Gold Rush. Particularly after completion of the transcontinental railroad in 1869, Basques started to arrive in the sheep country of the western states (Zubiri 1998). There was also a large influx of Basque sheepherders between 1900 to 1930 in concert with a high demand for lamb and wool.

Basque tenders and herders dominated the western sheep industry, a position they maintained from the 1890s to the 1970s. Tenders, who lived in summer “sheep camps,” brought food and supplies up to the sheepherders who stayed at the higher elevations grazing the sheep during the summer months. Basque sheep camps typically included hand-built traditional outdoor ovens for baking bread. Today, these structures are rare in California (Tahoe National Forest 2005).

The Basques were well known in the greater Sierra Nevada region, including the treatment areas, for their unique tree carvings, referred to as “arborglyphs” or “dendroglyphs.” Carvings were typically made on aspen trees and included names, dates, images, and inscriptions in different languages (Basque, Spanish, or French; rarely English). The images frequently had sexual themes, and sometimes included drawings of animals or zoomorphs. Since all the herders were young men, the glyphs reflect the absence of women and indicated a desire for female companionship (Nevada Historical Society 2005). As one consequence, the carvings have been viewed as curiosities and little more than pornography (Crawford 2005:26).

With the growth of Basque studies in this country (for example, the Center for Basque Studies at the University of Nevada Reno, http://basque.unr.edu) and scholarship by Basque-Americans, translations and new interpretations of the carvings have become available. In addition to names and dates, carvings include the name of the carver’s birthplace, patriotic statements about France and Spain, evidence of ethnic rivalries and conflicts between the herders from the Basque provinces of France or Spain, support for an independent Basque homeland, and support for Basque guerillas (ETA or Euskdita Askatasuna) fighting in Spain, as well as the loneliness and everyday life in the mountains (Mallea-Olaetxe 1992). The isolation is reflected in thousands of textual messages longing for women and also numerous portrayals of nude women in erotic poses. The drawings of animals included sheep, deer, antelope, and cougars, among others.

In addition to depicting the culture of the Basque sheepherders, recent research by an archaeologist with the Tahoe National Forest demonstrates that the dendroglyphs also preserve a general idea of land capacity and use (Crawford 2005). The carvings preserve

the seasonal rounds of specific historic bands of sheep and the length of time sheep foraged in a given area.

Timber. The initial growth of the timber industry in the region is another result of the Gold Rush and the mining industry. The first sawmill in Plumas County was erected circa 1850 at Rich Bar on the Middle Fork of the Feather River. Other mills were erected in 1852 at Rich Bar on the East Branch of the North Fork of the Feather River. By 1855, there was a mill in Indian Valley, which was powered by diverting the water from Indian Creek. Initially hauled by oxen, mules, or horses to the mills, much of the wood was used to shore up the expanding mine tunnels and then as supports for hydraulic mining (Young 2003:79-80).

Timber was also used to build flumes or skid roads to transport the lumber down from the mountains and the mills. As early as 1856, timber was floated from the western areas of the county all the way to Sacramento to meet the housing needs for the burgeoning population in the valley. Economical V-shaped logging flumes were introduced to the county in 1870. Some of the flumes, owned by large lumber companies, such as the Sierra Flume and Lumber Company and the Red River Lumber Company based in Big Meadows, reached lengths of nearly 50 miles (Young 2003:81-83).

The growth of the Western Pacific Railroad, beginning in 1903 and completed in 1909, gave an economic boost to Plumas County's timber industry. As many as nine standard- or narrow-gauge rail lines were built and snaked from the sawmills into the forests. By 1912, motorized trucks were being used to haul logs and had nearly supplanted the shortlines by the end of World War II. The industry was revolutionized again by the introduction of caterpillar trucks in the 1920s. About this same time, chainsaws replaced the hand axes and two-man saws (Young 2003:88-93).

In July 1968, the first skyline timber sale from the Plumas National Forest occurred 17 miles southeast of Greenville. The sale included 17.3 million board feet. The freshly cut logs were transported via overhead cable to a landing site for transport by trucks to a mill. In 1971, Plumas National Forest chose Lights Creek Canyon as the location for the nation's first helicopter timber sale. The use of helicopters to harvest the timber helped preserve the habitat and prevent erosion on the steep slopes. Helicopters were used at Happy Valley and Baloney over the next 15 years where economically feasible. Today, with changing environmental policies and a changing economy, only two sawmills remain in operation in Plumas County, and timber production is at an all-time low. Over half a century of unregulated logging, followed by three-quarters of a century of intensely regulated logging, have left visible marks in the timber areas (Young 2003:94-96).

3.8.2 Environmental Consequences

Cultural resources have been considered in all aspects of the Moonlight and Wheeler Fires Recovery and Restoration Project, including all alternatives analyzed in this document.

3.8.2.1 Introduction

Archaeological sites, historic buildings and structures, landscapes, and objects are the fabric of our national heritage. Collectively known as cultural resources, they are our

tangible links with the past. The Plumas National Forest is responsible for, and committed to, protecting and managing these important resources in a spirit of stewardship for future generations to understand and enjoy.

Consultation with the tribes and local Native American communities and/or interested parties was initiated in accordance with the *First Amended Regional Programmatic Agreement Among the USDA Forest Service , Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region (RPA)*(March, 2001), National Historic Preservation Act, and other laws and regulations.

The Forest Service acknowledges that contemporary Native American interests include traditional cultural properties (sites associated with cultural practices or beliefs that are rooted in history and important in maintaining cultural identity) and plant gathering sites for basket materials, medicines, and food resources. To date, the tribes have not identified any traditional cultural properties within the Moonlight and Wheeler Fires Recovery and Restoration Project boundaries.

Cultural properties identified during literature reviews, inventories, or surveys were assessed to determine potential effects associated with implementation of the project. Results of the analysis are discussed below.

Cultural resource inventories resulted in the identification of 80 previously recorded sites. Of these previously recorded sites, 75 are historic sites (94%) and 4 are prehistoric sites (5%) and 1 is multi-component (1%). The historic sites, dating between the 1850s and the early 1950s, consist of mining complexes, Basque arborglyph (aspen carving) sites, artifact scatters, cabins and trails. The prehistoric sites consist of artifact scatters and the multi-component site consists of a historic mining complex and a lithic concentration.

An additional 600 acres were inventoried for cultural resources during field season 2008 under ARR #02-09-2008 for the Moonlight Roadside Hazard Tree Removal Project by Matthew Padilla and Cristina Weinberg. Pedestrian transect spacing was a maximum of 20 meters (Complete inventory intensity). Four new historic sites were recorded consisting of sites associated with historic mining activities. All but 3 of the 48 sites were monitored since they were located outside of the project area.

An additional 2,500 acres were inventoried for cultural resources during field season 2008 under ARR #02-40-2008 by John W. Jones of Native X, Inc. 1,171 acres was inventoried using maximum pedestrian transect spacing of 20 meters (Complete Survey). 1, 059 acres was inventoried using between 20 meter and 40 meter pedestrian transect spacing (General Survey). 175 acres was inventoried between 40 meter and 80 meter pedestrian transect spacing (Cursory Survey). 99 acres was deemed “Non-Surveyable” (too steep and hazardous to survey with very low probability of locating new cultural resources). The Final Report was provided October 13, 2008. Results of the 2008 inventory are as follows: Thirteen new historic sites were recorded consisting of historic artifact scatters, ditches and reservoirs. Thirteen isolated finds were recorded consisting of isolated historic artifacts (cans, bottles, misery whip half) and isolated aspen tree carvings (arborglyphs). All but two of the 32 previously recorded sites were monitored. One of these sites could not be relocated after several attempts, and monitoring of the other site posed a safety hazard.

One new site was recorded within the project area in 2009 that had been mapped using a Global Positioning System (GPS) unit in 2006. This site consists of a water conveyance ditch.

With the 2008 cultural resource inventories and previous inventories, 100% of the project area has been inventoried. Between the 2008 and 2009 field seasons, 18 new sites were recorded within the project area.

Below is a table listing all sites recorded in the project area under all Action Alternatives. Those sites listed not listed under the Action Alternatives are located within the Analysis Area.

Table 111. All cultural site records within the Moonlight and Wheeler project area for all action alternatives.

FS Site #	Alt. A Present Y/N	Alt. C Present Y/N	Alt. D Present Y/N	Alt. E Present Y/N	Not present in any Action Alternatives, but present in analysis area	Mitigation (RPA SRPMs=Flag for Avoidance)
05115200011	N	N	N	N	X	Y
05115200020	Y	Y	Y	N		Y
05115200060	N	N	N	N	X	Y
05115200084	Y	Y	Y	Y		Y
05115200085	Y	Y	Y	Y		Y
05115200086	N	N	N	N	X	Y
05115200087	N	N	N	N	X	Y
05115200088	Y	N	N	N		Y
05115200089	N	Y	Y	Y		Y
05115200090	N	N	N	N		Y
05115200091	Y	Y	N	N		Y
05115200095	N	N	N	N	X	Y
05115200117	Y	N	Y	Y		Y
05115200126	N	N	N	N		Y
05115200130	N	Y	N	N		Y
05115200132	Y	Y	Y	Y		Y
05115200133	N	Y	Y	Y		Y
05115200135	Y	Y	Y	Y		Y
05115200140	Y	Y	Y	Y		Y
05115200149	N	N	N	N		Y
05115200152	Y	Y	Y	Y		Y
05115200153	Y	Y	Y	Y		Y
05115200154	Y	Y	Y	Y		Y
05115200165	Y	N	Y	Y		Y
05115200177	Y	Y	Y	Y		Y
05115200187	Y	Y	Y	Y		Y
05115200188	N	N	N	N	X	Y
05115200243	Y	Y	N	N		Y
05115200248	N	N	N	N	X	Y
05115200255	Y	Y	Y	Y		Y
05115200265	N	N	N	N	X	Y

05115200270	N	N	N	N	X	Y
05115200278	Y	Y	Y	Y		Y
05115200287	N	N	N	N		Y
05115200288	Y	Y	N	N		Y
05115200289	N	N	N	N	X	Y
05115200290	N	N	N	N		Y
05115200292	N	N	N	N		Y
05115200295	N	Y	Y	Y		Y
05115200315	Y	N	N	N		Y
05115200318	Y	Y	Y	Y		Y
05115200321	Y	N	Y	Y		Y
05115200322	N	N	N	N		Y
05115200333	N	N	N	N	X	Y
05115200334	Y	Y	N	N		Y
05115200335	N	N	Y	Y		Y
05115200340	N	N	Y	N		Y
05115200343	N	N	N	N		Y
05115200344	N	N	Y	Y		Y
05115200348	Y	Y	Y	Y		Y
05115200349	N	N	N	N	X	Y
05115200353	N	N	N	N		Y
05115200354	N	Y	Y	Y		Y
05115200355	Y	Y	Y	Y		Y
05115200381	N	N	N	N		Y
05115200383	Y	N	Y	Y		Y
05115200385	N	N	N	N	X	Y
05115200386	N	N	N	N	X	Y
05115200392	Y	Y	N	N		Y
05115200395	Y	Y	Y	Y		Y
05115200401	N	N	N	N		Y
05115200404	N	N	Y	Y		Y
05115200419	N	Y	Y	Y		Y
05115200449	Y	N	Y	Y		Y
05115200453	Y	Y	Y	Y		Y
05115200454	N	N	N	N		Y
05115200460	Y	Y	Y	Y		Y
05115200461	Y	Y	Y	Y		Y
05115200464	Y	Y	Y	Y		Y
05115200481	Y	N	Y	Y		Y
05115200497	N	N	N	N	X	Y
05115200511	Y	Y	Y	Y		Y
05115200540	Y	Y	Y	Y		Y
05115200541	N	N	N	N		Y
05115200542	N	N	N	N		Y
05115200543	Y	N	N	N		Y
05115200544	N	N	N	N		Y
05115200545	N	N	Y	Y		Y
05115200546	N	N	N	N		Y
05115200547	N	N	N	N		Y
05115200548	N	N	Y	Y		Y

05115200549	N	N	N	N		Y
05115200554	N	N	N	N	X	Y
05115200567	N	N	N	N		Y
05115200575	Y	Y	Y	Y		Y
05115200577	Y	Y	Y	Y		Y
05115200593	Y	Y	Y	Y		Y
05115200594	N	N	N	N	X	Y
05115200621	Y	Y	Y	Y		Y
05115200655	Y	Y	Y	Y		Y
05115200656	Y	N	Y	Y		Y
05115600657	N	N	N	N	X	Y
05115200659	N	N	N	N		Y
05115200661	Y	Y	Y	Y		Y
05115200664	Y	Y	Y	Y		Y
05115200673	Y	Y	Y	N		Y

3.8.2.2 Guiding Regulations

Section 110 of the *National Historic Preservation Act* (NHPA) requires the federal government to preserve important historic, cultural, and natural aspects of our national heritage. To accomplish this, federal agencies use the NHPA's Section 106 process. Passed by Congress three years before NEPA, Section 106 of the NHPA sets forth a framework for identifying and evaluating historic properties and assessing effects on these properties. This process has been codified in 36 *Code of Federal Regulations* (CFR) 800 Subpart B. The coordination or linkage between the Section 106 process of the NHPA and the mandate to preserve our national heritage under NEPA is well understood and is formally established in 36 CFR 800.3b and 800.8.

NEPA includes reference to ". . . important historic, cultural, and natural aspects of our national heritage." This terminology includes those resources defined as "historic properties" under the NHPA (36 CFR 800.16(l) (1)). Therefore, agencies use the NHPA Section 106 process to consider, manage, and protect historic properties during the planning and implementation stages of federal projects. The Plumas National Forest uses the *First Amended Regional Programmatic Agreement (RPA* (March, 2001) to implement the Section 106 process.

3.8.2.3 Methodology for Assessing Impacts on Cultural Resources

3.8.2.3.1 Geographic Area Evaluated for Impacts on Cultural Resources

The analysis area used for cultural resources consists of the Moonlight and Wheeler Fire Recovery and Restoration Project treatment areas.

3.8.2.3.2 Scope of the Analysis

Three levels of analyses were completed to understand the significant themes and extent of cultural resources associated with the Moonlight and Wheeler Fires Recovery and Restoration Project. First, research into the greater history of the treatment areas was

conducted to understand historic themes or events that have transpired in time and space (refer to the "Cultural Resources" section in chapter 3). Second, a cultural resource survey was conducted for the treatment areas to identify cultural properties associated with these themes. Lastly, cultural properties were assessed to determine potential effects associated with implementation of the project. The results and relevant rationale for each of these analyses are presented below.

3.8.2.3.3 Analysis Methods

Cultural resource data for the Moonlight and Wheeler Fires Recovery and Restoration Project is based on information available in the cultural resource files at the Mt. Hough Ranger District. The cultural resource files include literature pertaining to prehistory and history, site records, and atlases that show recorded site locations, previously surveyed areas, and other cultural resource data. *First Amended Regional Programmatic Agreement* (March, 2001).

3.8.2.4 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative Effects

The treatments proposed under the action alternatives would have no direct or indirect effects on cultural resources, since all cultural resource sites would be protected using Standard Resource Protection Measures.

3.8.2.5 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

No project treatment activities would occur under the no-action alternative; hence, there would be no effects on cultural resources.

3.8.3 NHPA Section 106 Assessment

The effects of the project on cultural resource sites were assessed in compliance with Section 106 of the *National Historic Preservation Act*.

No effects are anticipated, since the following Standard Resource Protection Measures (SRPMs) (*RPA:* March, 2001; Appendix B) would be implemented, as appropriate, for all cultural resources within the treatment areas that could potentially be affected by project implementation. Application of the following SRPMs would result in the project having "no effect" or "no adverse effect" on cultural resources:

- All proposed activities, facilities, improvements, and disturbances shall avoid cultural resource sites. Avoidance means that no activities associated with the project that may affect cultural resource sites shall occur within a site's boundaries, including any defined buffer zones. Portions of the project may require modification, redesign, or elimination to properly avoid cultural resource sites.

- All cultural resource sites within the area of potential effect shall be clearly delineated prior to implementing any associated activities that have the potential to affect cultural resource sites.

- Buffer zones may be established to ensure added protection where the Forest or District Archaeologist determines that they are necessary. The use of buffer zones in conjunction with other avoidance measures are particularly applicable where setting contributes to the property's eligibility under 36 CFR 60.4, or where it may be an important attribute of some types of cultural resource sites (e.g., historic buildings or structures; historic or cultural properties important to Native Americans). The size of buffer zones needs to be determined by the Forest or District Archaeologist on a case-by-case basis.

- When any changes in proposed activities are necessary to avoid cultural resource sites (e.g., project modifications), these changes shall be completed prior to initiating any activities.

- Monitoring during project implementation, in conjunction with other measures, may be used to enhance the effectiveness of protection measures.

3.8.4 Past, Present, and Reasonably Foreseeable Future Actions

3.8.4.1 Past Conditions

As indicated in the general history discussion for the Moonlight and Wheeler Fires Recovery and Restoration Project treatment areas (refer to the Cultural Resources" section in chapter 3), there are numerous archaeological sites and features. Prehistoric sites generally date from 150 to 7,500+ years before present. There are remains of prehistoric habitation sites, camps, and artifact scatters.

Since the landscape is never static, it is difficult to predict the impact Native Americans had on the land. Current studies on fire ecology suggest that Native Americans used fire as a tool to control vegetation. Based on ethnographic data, these studies are suggesting that vegetation control occurred primarily within close proximity to larger villages and was used to reduce brush, control insects, and enhance certain desirable species of plants. A local example of this is the burning of beargrass to enhance the plant's qualities for basket weaving. Based only on ethnographic data, it is impossible to know the true extent of vegetative control measures used.

Historic land uses did have major impacts on the landscape during the gold rush, the settlement and industry of post gold rush, and the impact of logging and ranching. Evidence of the magnitude of European settlement is found in numerous mining features such as ditches, reservoirs, and hydraulic pits. Early photographs of historic town sites provide a glimpse of landscapes almost completely barren of trees. All trees were removed for building house, town sites, heat sources, and the shoring of mining adits (tunnels).

Logging mills were built in the treatment areas during the 1850s, and by the 1890s, the denuding of timbered land on the East Coast brought lumber companies west. These companies bought up millions of acres of timbered lands. As the easily accessed trees were cut, logging railroads were built to acquire more timber. Archaeological sites and

features associated with lumbering include logging camps, lumber mills, railroad grades, and artifacts.

The first archaeological reconnaissance reports date to the mid-1970s. At that time, there were few protection measures for archaeological resources. In fact, digging and collecting in archaeological sites was a common practice. By the early 1980s, cultural resource surveys and site protection measures were in place. Today, all archaeological sites are protected from any project activities.

3.8.4.2 Present Conditions

Some of the cultural resource sites that were monitored during project survey show damage as a result of natural deterioration over time, vandalism, and from inadvertent effects from previous projects and activities.

3.8.4.3 Future Conditions

The Forest Service will continue to protect cultural resource sites from project activities in the future. But, as more and more people are drawn to National Forests to recreate, and with the ever -increasing use of motorized vehicles, it becomes a difficult challenge to protect archaeological resources. The Forest Service is in the process of designating off-highway vehicle (OHV) routes in order to control use and avoid impacts on all resources. OHV routes would not be designated through known archaeological sites. The likelihood and extent of illegal off-road use and the looting of archaeological sites is unpredictable.

Future impacts on cultural resource sites may increase due to increased access to the Forest, although the likelihood and intensity of the impacts are unknown. The Moonlight and Wheeler Fires Recovery and Restoration Project itself would not impact archaeologist sites because the sites would be protected from project activities by flagging for avoidance.

The protection of cultural resource sites involves more than merely flagging and avoidance, as is the standard prior to project activities. Educating the public about the fragile, finite nature of cultural resource sites is paramount to site protection. Public education can be accomplished by the development of interpretative signs, lectures, and brochures that provide information on the history of the sites, as well as cultural resource site protection measures.

3.8.5 Summary of Cumulative Effects

Cultural resource sites will be protected using Standard Resource Protection Measures as outlined in the Forest Service *First Amended Regional Programmatic Agreement (*March, 2001) therefore, no cumulative effects on cultural resources are expected.

3.8.5.1 Native American Consultation

Consultation was initiated with the following tribes: Honorable Kyle Self, (Chairman, Greenville Indian Rancheria), Honorable Stacy Dixon (Chairman, Susanville Indian Rancheria), Honorable Glenda Nelson (Chairwoman, Estom Yumeka Tribe of Enterprise Rancheria), Honorable Jim Edwards (Chairman, Tyme Maidu Tribe of Berry Creek Rancheria), Honorable Gary Archuleta (Chairman, Concow Maidu Tribe of Mooretown Rancheria), Honorable Dennis Ramirez (Chairman, Mechoopda Indian Tribe of Chico Rancheria), and Honorable Waldo Walker (Chairman, Washoe Tribe of California and Nevada). In addition, consultation was also initiated with Honorable Lorena Gorbet (Chairwoman, Maidu Cultural and Development Group).

3.9 Scenery

3.9.1 Affected Environment

The landscape in the Moonlight and Antelope Complex fire areas ranges from the flat areas near North Arm and Genesee Valley, to moderately and extremely steep slopes. The forests are primarily pine-dominated mixed conifer and red fir forest types; red and white fir-dominated forests exist at higher elevations. However, a large portion of these forests burned under moderate to high vegetation burn severity drastically changing the forest vegetation type in a large portion of the area and consequently, heavily influencing the existing landscape character of the area.

Impacts of the Moonlight and Antelope Complex fires vary greatly. Visual effects of the fires were most obvious directly after the fire occurred. Changes to vegetation patterns in the area have created stark contrasts to the surrounding forest character that negatively affects the setting and recreation experience. Charred, fire-killed skeletons of trees and shrubs now dominate areas that burned under high severity. In these areas, the forest floor is covered by ash with little to no vegetative ground cover. Portions of the fires that burned under moderate severity include areas where trees survived, but were injured by the fire. Within these areas, post-fire mortality is expected to occur due to damage of tree crowns and cambium layers. In these areas, much of the low growing vegetation and ground cover have burned. Throughout portions of the fires areas, the fires burned with low severity where trees and islands of ground cover and brush remain intact.

Scenic resources include views of naturally appearing landscapes such as landforms, rock formations, and water features and are important to forest visitors who may enjoy views from places like Antelope Lake Recreation Area. Viewpoint opportunities are also important along forests roads such as the Janesville-Antelope-Taylorsville Road (NFS Road 172), the Lights Creek Road (County Road 213), and the Diamond Mountain Motorway (Forest Service Road 28N02).

The Visual Quality Objectives (VQOs) contained in the PNF LRMP (USDA 1988) are used to identify and classify scenic resources in the Moonlight and Antelope Complex fires area.

The VQOs were mapped as part of the forest planning process using Agriculture Handbook 462 – Visual Management System, volume 2, chapter 1 (USDA 1974). The VQOs describe different degrees of acceptable alteration of the natural and characteristic

landscape. The objectives are considered the measurable standards for the management of the "seen" aspects of the land. The following VQO definitions apply to the landscape:

Retention—activities are not to be evident to the casual forest visitor.

Partial Retention—activities may be evident but must remain subordinate to the characteristic landscape.

Modification—activities may dominate the characteristic landscape but must, at the same time, use naturally established form, line, color, and texture. Activities should appear as a natural occurrence when viewed in the Foreground or Middle ground.

The majority of the analysis area has a VQO of modification. However, there are areas where VQOs are classified as retention and partial retention:

Road to the Antelope Lake Recreation Area. This is a high-use recreation area with a VQO of "Retention" of which, only a portion is included within the analysis area. Management direction is to provide visual resources with a naturally appearing landscape where management and other activities are generally not evident to the casual forest visitor. No management activities are prohibited in these areas. (USDA 1988, page 4-95). In the past decade, four major fires, all 3,000 acres and greater, have altered the landscape, all four of which can be seen from the recreation area.

Diamond Mountain Motorway and Wildcat Ridge. This is a native surface road (Forest Service road 28N02) that provides access from Antelope Lake to Wheeler Sheep Camp and towards Red Rock Lookout. These areas are classified as a VQO of "Partial Retention", but only a portion of which falls within the analysis area. These areas are generally seen as middleground and background from major recreation areas and are of primary or secondary importance. No management activities are prohibited in these areas. (USDA 1988, page 4-105)

3.9.2 Environmental Consequences

3.9.2.1 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative Effects

The geographic area analyzed for effects on scenic resources, the analysis Area, is the Moonlight and Antelope Complex fire perimeters. The analysis area was bounded in this manner in order to incorporate scenic views from campgrounds, lakes, and forest roads that were affected by the fires. This boundary also includes portions of the Antelope Lake Recreation Area and Janesville-Antelope-Taylorsville Road.

The timeframe considered for cumulative effects is based on past and present vegetation management activities and wildfires. As discussed in section 3.4.1, past management activities, but most importantly, the recent Moonlight and Antelope Complex fires have contributed to the existing scenic landscape. Future activities were considered (appendix

B) in this analysis but only until the time that project implementation has been completed. Unanticipated future wildfires and other treatments could occur prior to completion of the Moonlight and Wheeler Project, which could affect the scenic character.

Salvage harvesting and reforestation activities would result in noticeable impacts to scenic integrity and landscape character under all action alternatives; however, snag retention areas and remaining snags within Riparian Habitat Conservation Areas (RHCAs), as well as untreated areas within the analysis area would contribute to breaking up the continuity of such activities. It may be reasonably expected that management activities would generally exceed the PNF LRMP VQOs in the short term (0 to 5 years) and that the treatment units would be best classified as VQO of modification 5 to 30 years post harvest. Within areas that burned with high severity, the majority of the fire-killed trees would be harvested and the area would appear barren until grasses, brush, and newly planted trees become established. Stumps would be visible along the immediate foreground of roads while such areas would appear as barren patches of various sizes in middle ground views from roads. Snag retention areas and snags within RHCAs as well as untreated areas within the analysis area would provide an important vertical element that may break up the continuity of barren patches within the middle ground views. Areas that burned with low to moderate severity would retain trees that survived the fire and would enhance views of the surrounding landscape.

In the long term (5 to 30 years and beyond), assigned VQOs would be achieved as reforestation occurs and the effects of management becomes less apparent. Scenery resources would be characterized by established and developing young plantations where removal of fire-killed trees and competing vegetation would enhance the establishment, growth, and development of planted tree seedlings. Variable survival in cluster plantations would contribute to the heterogeneity of planted stands, mimic the “feel” of natural stands, and should not be apparent to the forest visitor. Standing snags would remain within snag retention areas and untreated areas and would provide vertical elements to landscape views dominated by green textures of an intermixture of brush and trees. As plantations develop into pole size trees, harvested and planted areas would appear as natural green textures that would blend with middle ground and background views of the surrounding forest landscape.

Table 112. Percent of acres for each visual quality objective classification that would be affected by completed, current, or proposed post-fire harvest treatments within the Moonlight and Antelope Complex fire perimeters.

Visual Quality Objectives			
Alternative	Modification	Partial Retention	Retention
A	39%	20%	45%
B (No Action)	21%	8%	30%

C	33%	13%	31%
D	29%	11%	31%
E	27%	10%	31%

Table 112 shows the percent of each visual quality objective for each alternative. The primary harvest treatments occurring within the “Retention” VQOs are those roadside hazard removal harvest treatments along the road to the Antelope Lake Recreation area. Additional treatments occurring under alternative A within the “Retention” VQO are helicopter salvage harvest treatments where 1) harvest would be restricted to the fewer larger trees per acre, 2) a greater number of smaller standing snags per acre would be retained and 3) harvest treatments would not be as apparent to the forest visitor. Under alternatives C, D, and E, treatments within “Retention” areas would have a negligible increase of 1 percent over that of the no-action alternative.

Under the action alternatives, an increase in treatments would occur in areas classified as “Modification” and “Partial Retention”. This is largely due to salvage harvest treatments, which would retain scenic character through retention of snags within riparian habitat conservation areas and designated snag retention areas.

Under alternative A greater acreage would be affected by salvage treatments resulting in the greatest short-term modification of scenery. Alternative E would have the smallest short-term modification of scenery, as salvage harvest treatments would be limited to roadside hazard. All action alternatives would expedite long-term re-establishment of forested conditions through reforestation treatments. Under alternatives C and D, salvage treatments and corresponding effects would be limited relative to alternative A due to the reduced acreage of salvage treatments, but short-term modification of scenery would be greater than those effects under alternative E due to the inclusion of salvage treatments.

Past activities and wildfire events, most importantly the Moonlight and Antelope Complex fires have cumulatively shaped the scenic landscape character of the analysis area. Current and proposed projects such as the roadside hazard tree removal projects and other salvage projects listed in appendix B of the final EIS would contribute to adverse short-term effects to foreground and middle ground views. Reforestation activities associated with the action alternatives and additional reforestation projects listed in appendix B would result in enhancing VQOs by providing for green textures and landscapes as newly planted trees are established and develop into pole-size trees. This would contribute to tempering the longevity and duration of the short-term effects to scenic integrity and landscape character by promoting forested stand conditions that would blend in with the surrounding forest landscape. Other activities listed in appendix B would not have noticeable or measurable effects to foreground, middle ground, and background scenery, scenic integrity, or landscape character.

3.9.2.2 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

Management activities (salvage harvesting and reforestation) would not occur and therefore no visible changes beyond natural processes would result from this alternative.

Alternative B would result in the least visible change from the natural appearance of the existing burned landscape. Human caused changes would not be evident and VQOs would be achieved. In the short term (0 to 10 years), areas that burned with high severity would continue to appear as blackened hillsides with tree skeletons. These areas would be dominated by weathering snags mixed with a variety of brush as evidenced in recent past fires such as the unmanaged areas of the Storrie fire (2000), Stream fire (2001), and Boulder fire (2006). Areas that burned with lower severity would be dominated by views of individual and groups of live trees and brush species.

In the long term (10 to 30 years and beyond), the area would still achieve the PNF LRMP VQOs, but visual quality would be reduced as snags fall to the ground. Areas that burned with high vegetation burn severity would be dominated by an intermix of jack-strawed fallen snags and brush. The vertical element of standing snags would not be apparent resulting in large continuous brushfields. Scenery resources would take longer to recover to previous forest character than with action alternatives as brush dominance of the site may slow and/or hinder the establishment and development of natural regeneration.

Under the no-action alternative, approximately 30 percent of areas classified as “Retention” would be affected by primarily completed post-fire harvest projects. Most of these treatments have occurred along the road to the Antelope Lake Recreation Area, and were associated with post-fire roadside hazard removal projects. Since only trees capable of hitting the road are removed in these projects, a variable amount of standing dead trees and surviving green trees are retained along the roadside corridor. Completed or current post-fire projects on public and private lands would still occur under the no-action alternative accounting for the areas affected under the “Modification” and “Partial Retention” classifications (21 percent and 8 percent respectively). In general, the no-action alternative would retain the largest area of untreated burned landscape.

Past activities and wildfire events, most importantly the Moonlight and Antelope Complex fires have cumulatively shaped the scenic landscape character of the analysis area. The no-action alternative would perpetuate adverse cumulative effects on the scenic quality of the analysis area over time because re-establishment of forested conditions may be slowed and/or hindered. This could result in a vegetative type change from a landscape dominated by forested conditions to a landscape dominated by brushfields for decades, if not a century to come.

3.10 Recreation and Mining

3.10.1 Affected Environment

Dispersed recreation use is moderate in the project area. Season of use is generally May through November, with activities including camping, hiking, hunting, horseback riding, mountain biking, off highway vehicle riding, fishing, firewood cutting, wildflower viewing, and rock hounding by individuals and small groups. January and February may see light use of snowmobile and cross-country skiing activities in the area.

Immediately adjacent to the east of the Moonlight and north of the Antelope Complex fires perimeters is the Antelope Lake Recreation Area that encompasses 2,300 acres, includes three developed campgrounds, one picnic area, and one boat ramp. The Recreation Area receives approximately 30,000 visitor days per year.

There are approximately 17 miles of non-motorized trails within the project area. The Antelope-Taylor Trail is 10 miles long, the Cold Stream Trail is 3 miles, and the Middle Creek Trail is 4 miles long.

3.10.2 Environmental Consequences

3.10.2.1 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative Effects

Refer to section 3.4.1 for recreation and mining analysis area and time frame rationale, which are identical to Forest Vegetation.

None of the Antelope-Taylor Trail overlaps with either fire perimeter or treatment units. Less than one mile of the Middle Creek Trail overlaps with the Antelope Complex fire perimeter and less than one half mile of this trail overlaps with a treatment unit and is congruent with the treatment unit boundary. Almost all of the Cold Stream Trail overlaps with the Antelope Complex fire perimeter; however in this case the trail winds through unburned areas or low vegetation burn severity and does not overlap with any treatment units.

Currently there are 353 miles of open existing roads within the analysis area, none of which are proposed for closure or decommissioning after project implementation. Only some of these roads overlap with treatment units and only these would be impacted by project implementation activities. Project implementation is expected to occur for 12-24 months; therefore closure of specific roads at specific times to public access would result from project implementation activities and would diminish after project completion.

Cumulatively closure to public access would increase slightly from other projects within the analysis area; however those activities would have a negligible effect on public recreation opportunities in the vicinity of those projects and project implementation activities.

3.10.2.2 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

No public access closures are expected to result from the no action alternative as no project activities would be proposed under this alternative.

Cumulatively closure to public access would increase slightly from other projects within the analysis area; however those activities would have a negligible effect on public recreation opportunities in the vicinity of those projects and project implementation activities.

3.11 Range

3.11.1 Affected Environment

The range analysis area is identical to that of the Wildlife, Forest Vegetation, and Fire, Fuels and Air Quality analysis areas. Refer to section 3.3.1.1 for a complete discussion of the analysis area, time frames, and justifications for the analysis area and use of time frames.

3.11.1.1 Allotments within Wheeler Fire

The majority of the Wheeler fire was on the Clark's Creek Allotment. The Wheeler fire had little impact to the Bass, Doyle, Jenkins, and Fitch Canyon Allotments. None of the Key Areas were burned. The pastures burned in the Clark's Creek Allotment; the permittee, voluntarily did not use Dry Flat, North 3 Creeks, and South 3 Creeks, in 2008. The unburned Clark's Creek pasture was used for 17 days with 200 pair 10/20-11/7, which is after seed set and plants go dormant. The Key Areas in Jenkins Allotment were not burned. The same permittee runs on Clark's Creek and Jenkins and has some flexibility with his other permits and private land.

3.11.1.2 Allotments within Moonlight Fire

Following the Moonlight fire, the Lone Rock Allotment was not grazed in 2008 by the permittee. NRCS used EQIP funds to find pasture elsewhere to defer grazing for a year. The grazing on Lone Rock occurs predominately on the leased private meadow lands in the valley bottoms. Lights Creek Allotment only grazes 24 pair within the entire 23,500 acre allotment. Indicator Meadow was not burned in the fire. The fire skipped over Indicator Meadow. An end of season use check in 2008 showed very little use on Indicator Meadow; 0%-5% meadow, 0%-5% willow, and 0% bank alteration. Antelope Lake was not used in 2008 following the fire. The Key Areas in Antelope Allotment were not burned in the Moonlight fire. Taylor Lake and Hungry Creek Allotments are Vacant. They have not been grazed for the past 10 years.

At this time there are no plans to increase livestock stocking rates or increase use standards on any of the allotments due to the increase in transitory range created by the fire.

3.11.2 Environmental Consequences

3.11.2.1 Alternative A (Proposed Action), C, D, and E – Direct, Indirect, and Cumulative Effects

Short term recovery of meadows, and riparian areas from livestock was unimpeded because cows did not graze burned areas in 2008. Long term recovery will be unimpeded through adherence to use standards in Term Grazing Permit administration.

Project activities require coordination between the Forest Service Timber Sale Administrator and the Range specialist to the range permittee to ensure that livestock are kept away from active timber falling operations and truck haul routes. Direct effects on permittees and their cattle would be minimized through annual operating instructions, where the permittee schedules livestock to move to grazing area not affected by treatments. Vehicle collisions with cattle that may be along roads would be avoided by ensuring that contracts contain safety specifications for vehicle speeds and by alerting contractors on where cattle may be present.

The minor indirect effect on livestock form project activities would be in the form of increased stress cause by altering grazing rotations. Increased stress levels in livestock could result in a reduction in weight gain in calves, and a reduced conception rate in cows. Disturbance could also make cows more nervous, high strung, and harder to gather in the fall.

The increase in transitory (upland) range, may take some grazing pressure off of the meadows and riparian areas with a flush of dryland grass/forbs that livestock may find palatable.

3.1.2.2 Alternative B (No Action) – Direct, Indirect, and Cumulative Effects

There would be no direct, indirect, or cumulative effects to cattle, cattle grazing, or associated allotments as no project activities would occur.

Short term recovery of meadows, and riparian areas from livestock would be unimpeded because cows did not graze burned areas in 2008. Long term recovery will be unimpeded through adherence to use standards in Term Grazing Permit administration. Use standards are 20% willow use, 20% aspen use, 20% bank alteration, and 50% meadow use. Cows are removed from the pasture with whichever trigger is reached first.

3.12 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).

All action alternatives, with the harvesting of fire-killed and fire-injured trees, would provide short-term economic recovery (dollars) and wood supply to local manufacturers (mbf); and long-term safety from hazard trees along 123 miles of National Forest System roads.

All action alternatives, with reforestation, would re-establish forested conditions within 5 years after harvest.

Refer to the environmental consequences section for each resource area for a discussion of short- and long-term effects for each alternative.

3.13 Unavoidable Adverse Effects

Smoke from pile burning, dust, and exhaust from heavy equipment, helicopters, and trucks would be created by all action alternatives. Emissions would comply with State and local air quality rules and regulations. See the Fire, Fuels, and Air Quality section for a discussion of the significance of these effects among alternatives.

Some soil compaction could occur in ground-based harvesting units, although the benefits of effective ground cover from lop and scatter treatments and disruption of the hydrophobic layer would maintain overall soil quality. Refer to the Soils and Hydrology section for a discussion of the significance of these effects among alternatives.

3.14 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Under all alternatives, there would be an irreversible loss of timber volume and value in fire-killed and/or fire-injured trees that remain on site. The magnitude of this effect varies by alternative. See the Economics Section for a discussion of the significance of these effects among alternatives.

Temporary road construction under all action alternatives represents irretrievable commitments for the period of time the roads are used. New temporary roads, skid trails, landings would be closed and subsoiled to a minimum of 18 inches, reforested, and closed after use, restoring the productivity of the site. Compaction associated with ground based harvesting activities is an irretrievable commitment of soil resources that would ameliorate over time. Anticipated levels of compaction are within the Forest Service, Region 5 soil quality standards. Refer to the Soils and Hydrology section for a discussion of the significance of these effects among alternatives.

3.15 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.”

The following laws contain requirements for protection of the environment that apply to the proposed action and alternatives:

Endangered Species Act. There are no threatened or endangered species within the project area.

Clean Water Act. There are no 303(d) listed water bodies within the project area. The nearest 303(d) listed water body is the North fork Feather River. Project activities are located about 30 miles upstream of the confluence of Indian Creek and the North fork Feather River. Application of project design features and BMPs is expected to maintain designated beneficial uses within and downstream of the project area.

Clean Air Act. All burning would be completed under approved burn and smoke management plans. Burning permits would be acquired from the Northern Sierra Air Quality Management District. They would determine when burning is allowed. The California Air Resources Board provides daily information on “burn” or “no burn” conditions. Burn plans would be designed and implemented in a way to minimize particulate emissions.

National Historic Preservation Act. Protection of historic sites would comply with the Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and Advisory Council on Historic Preservation Office Regarding the Identification, Evaluation and Treatment of Historic Properties Managed by the National Forest of the Sierra Nevada, California dated 1996.

National Forest Management Act. The Forest Service is complying with the provisions of this law.

Executive Orders

Environmental Justice, Executive Order 12898 of February 1, 1994. Although low-income and minority populations live in the vicinity, activities proposed for the Moonlight and Wheeler Project would not discriminate against these groups. Based on the composition of the affected communities and cultural and economic factors, proposed activities would have no disproportionately adverse effects to human health and safety or environmental effects to minorities, low income, or any other segments of the population. Scoping was conducted to elicit comments on the proposed action from all potentially interested and affected individuals and groups without regard to income or minority status.

Indian Sacred Sites, Executive Order 13007 of May 24, 1996. In accordance with this order existing tribal involvement processes with the Tribes listed in Section 4.1.1.3 of this document were followed.

Invasive Species, Executive Order 13112 of February 3, 1999. This Moonlight and Wheeler Project revised FEIS covers botanical resources and noxious weeds. The project standard management requirements are designed to minimize risk of new weed introductions, minimize the spread of spotted knapweed, yellow starthistle, medusahead, and Scotch broom within and between units, and minimize likelihood of spread of Canada thistle from infested units to uninfested units. This project is likely to spread Canada thistle within already infested units.

Recreational Fisheries, Executive Order 12962 of June 6, 1995. The effects to fish habitat from the project are expected to be so small that direct effects on fish productivity and the quality of the recreational fishery would be negligible.

Migratory Birds, Executive Order 13186 of January 10, 2001. The environmental analyses of deferral actions are to evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern. There are no interagency determination calls to be made for migratory birds with federally listed species. Proposed activities and alternatives are not expected to effect migratory birds.

Floodplain Management, Executive Order 11988 of May 24, 1977 and Protection of Wetlands, Executive Order 11990 of May 24, 1977. These executive orders provide for protection and management of floodplains and wetlands. Compliance with these orders will be assured by incorporating the project riparian management objectives; adhering to the SAT guidelines, as set forth in the HFQLG FEIS and ROD; and implementation BMPs, Standard management Practices, and project design criteria.

Use of Off-road Vehicles, Executive Order 11644, February 8, 1972. The Off-Highway Vehicle process currently ongoing on the PNF would not be affected by the alternatives proposed in the Moonlight and Wheeler Project, allowing for route designation, timeframes, and guidelines to be followed.

Special Area Designations

Research Natural Areas (RNA). The Mud Lake Modoc Cypress RNA is located within the fire perimeter, about 1 ½ miles from the nearest proposed treatment area, and would not be affected.

Inventoried Roadless Areas. No Inventoried Roadless Areas exist in the project area and would, therefore, not be affected.

Wilderness Areas. No wilderness areas exist in the project area and would, therefore, not be affected.

Wild and Scenic Rivers. There are no wild and scenic rivers within the project area. The PNF has identified river segments that are eligible, but not yet designated, for wild and scenic river status. There are no eligible segments within the project area.

Municipal Watersheds. There are no municipal watersheds located within the project area.

4 Consultation and Coordination

4.1 Preparers and Contributors

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

4.1.1.1 ID TEAM MEMBERS:

Rich Bednarski, Team Leader, Writer/Editor, 30 years

Katherine Carpenter, Planner, Writer/Editor, 1.5 years

Chris Collins, Wildlife Biologist, 15 years

Ryan Tompkins, Silviculturist, 7 years

James Belsher-Howe, Botanist, 15 years

Cristina Weinberg, Archaeologist, 21 years

Kristina Van Stone Hopkins, Fisheries Biologist, 12 years

Jason Moghaddas, Fire Ecologist, 10 years

Eric Moser, Hydrologist, 20 years

Vince Archer, Soil Scientist, 10 years

Pete Hochrein, 30 years

Elaine Vercruysse, Logging Systems, 6 years

Bill Overland, GIS Specialist, 3 years

Kyle Felker, GIS Specialist, 20 years

Gary Rotta, Wildlife Biologist, 30 years

4.1.1.2 FEDERAL, STATE, AND LOCAL AGENCIES:

U.S. Fish and Wildlife Service

California Department of Fish and Game

Environmental Protection Agency

Northern Sierra Air Quality Management district

4.1.1.3 TRIBES:

Washoe Tribe of California and Nevada

Mechoopda Indian Tribe of Chico Rancheria

Concow Maidu Tribe of Mooretown

Estom Yumeka Tribe of Enterprise Rancheria

Greenville Rancheria

Susanville Indian Rancheria

Tyme Maidu Tribe of Berry Creek Rancheria

4.2 Distribution of the Environmental Impact Statement

This revised final EIS has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies, federally recognized tribes, Sate and local governments, and organizations representing a wide range of views regarding contributions to the stability and economic health of rural communities.

- Advisory Council of Historic Preservation, Planning and Review
- USDA Animal and Plant Health Inspection Service
- Natural Resources Conservation Service
- USDA National Agricultural Library, Acquisitions and Serials Branch
- National Marine Fisheries Service, Southwest Region
- US Army Corps of Engineers, South Pacific Division
- US Environmental Protection Agency, Office of Federal Activities
- Environmental Protection Agency, Region 9
- US Department of Interior, Office of Environmental Policy and Compliance
- Federal Aviation Administration, Western-Pacific Region
- Federal Highway Administration, California HDA-CA
- US Department of Energy, Office of NEPA Policy and Compliance
- All individuals listed in section 1.6 of this EIS.

In addition to this list numerous interested parties will receive notification of the EIS's availability and location on the World Wide Web through written correspondence.

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6 Glossary

90th percentile weather conditions — high air temperature, low relative humidity, strong wind conditions and low fuel moisture content levels that historically that are met or exceeded on 10 percent of days during the fire season. It defines potential fire behavior as a result of these conditions: a 90th percentile weather day has the potential for severe wildfire behavior.

Basal area — the total cross-sectional area of all stems, including the bark, in a given area, measured at breast height (4.5 feet above the ground). Usually given in units of square feet per acre.

Biomass —trees less than 10 inches dbh not used as sawlogs. This material is usually chipped and/or removed from the project area and hauled to the mill to be used for cogeneration of energy or as fiber for wood products.

Board feet — a unit of measure of sawlog volume, equivalent to 12 inches by 12 inches by 1 inch. One thousand board feet is denoted as mbf.

California Wildlife Habitat Relationships (CWHR) — a system developed jointly by Region 5 of the Forest Service and the California Department of Fish and Game that classifies forest stands by dominant species types, tree sizes, and tree densities, and which rates the resulting classes in regard to habitat value for various wildlife species or guilds. The CWHR system has three elements: (1) major tree dominated vegetation associations, (2) tree size, and (3) canopy cover. The major tree dominated CWHR habitats in the Empire Project include red fir, Sierra mixed conifer, ponderosa pine, white fir, montane hardwood, and montane riparian.

Tree size and canopy cover classes are as follows:

Tree Size Classes in CWHR:

1 = Seedling (less than 1 inch dbh)
2 = Sapling (1-6 inches dbh)
3 = Pole (6-11 inches dbh)
4 = Small (11-24 inches dbh)
5 = Medium/Large (greater than 24 inches dbh)
6 = Multilayered (size class 5 over a distinct layer of size class 3 or 4, total canopy greater than 60- percent closure). In this EIS, class 6 is included in class 5.

Canopy Cover Classes in CWHR:

S = Sparse Cover (10-24 percent canopy closure)
P = Poor Cover (25-39 percent canopy closure)
M = Moderate Cover (40-59 percent canopy closure)
D = Dense Cover (greater than 60 percent canopy cover)

Canopy cover — the degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. Same as crown closure.

Crown closure — see canopy cover.

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

Desired conditions — desirable resource conditions for various land allocations or resources, as prescribed in forest plans.

Diameter at breast height (dbh) — the diameter of a tree trunk 4.5 feet above the ground.

Ephemeral — a watercourse that contains sporadic running water only sporadically, such as during or following storm events. Ephemeral streams have a definable channel and evidence that scour and deposition occur with less-than-annual frequency. Activity buffers are measured from edges of stream channels.

Fireline — a corridor, which has been cleared of organic material to expose mineral soil. Firelines may be constructed by hand or by mechanical equipment (e.g., dozers).

Flame length — the length of flame measured in feet. Increased flame lengths increase resistance to control and likelihood of torching events and crown fires.

Handpiling — piling by hand branches and limbs from tree harvests or thinnings by hand, for burning at a later time.

Home Range Core Areas — these areas are designed to encompass the best available spotted owl habitat, where the most concentrated owl foraging activity is likely to occur, and is in the closest proximity to owl protected activity centers where the most concentrated owl foraging activity is likely to occur. On the Plumas National Forest, each protected activity center is 300 acres and the home range core area is an additional 700 acres, totaling 1,000 acres.

Intermittent — a watercourse with non-permanent flow but having a definable channel and evidence of annual scour and deposition. Activity buffers are measured from edge of stream channel.

Landings — forested openings, cleared of vegetation, leveled and graded, and used to stockpile sawlogs for eventual loading of load log trucks for haul to a sawmill.

Operability — the ability to conduct vegetation management operations, which include construction of access roads and log landings, use of cable logging systems, clearing of central skid trails for tractor logging, and removal of trees that pose hazards to forest workers. Trees to be removed for operability would be designated by a Forest Service representative.

Perennial streams — streams that flows continuously. The groundwater table lies above the bed of the stream at all times. Activity buffers are measured from edge of stream channel.

Protected Activity Centers (PAC) — areas delineated around nesting sites of nesting pairs of particular wildlife species. Habitat disturbance is minimized or excluded within the delineated area.

Reconstructed (roads) — reconstruction of an existing road in or adjacent to its current location to improve capacity and/or correct drainage problems. Reconstruction consists of brushing, blading the road surface, improving drainage, and replacing/upgrading culverts where needed.

Regeneration — tree seedlings and saplings that have the potential to develop into mature forest trees.

Riparian Habitat Conservation Area (RHCA) — activity buffers of specified widths along streams and watercourses and around lakes and wetlands that vary according to stream or feature type, as described by the Scientific Analysis Team (SAT) guidelines.

Skidding — dragging a log with a tractor to a landing for loading onto a logging truck.

Slash — tree tops and branches left on the ground after logging or accumulating as a result of natural processes.

Snags — a fire-killed standing tree; for wildlife purposes, one that is at least 15 inches in diameter at breast height (dbh) and 20 feet high.

Spotted Owl Habitat Area (SOHA) — areas delineated in land and resource management plans for the purpose of providing nesting and foraging habitat for spotted owls. No treatments would occur in SOHAs.

Stocking levels — the number of trees per acre in a regeneration site.

Threshold of Concern — the level of watershed disturbance which, if exceeded, could create adverse watershed or water quality effects, in spite of application of best management practices and project design criteria.

Yarding — bringing sawlogs or biomass to a central location for removal from a treatment area.

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