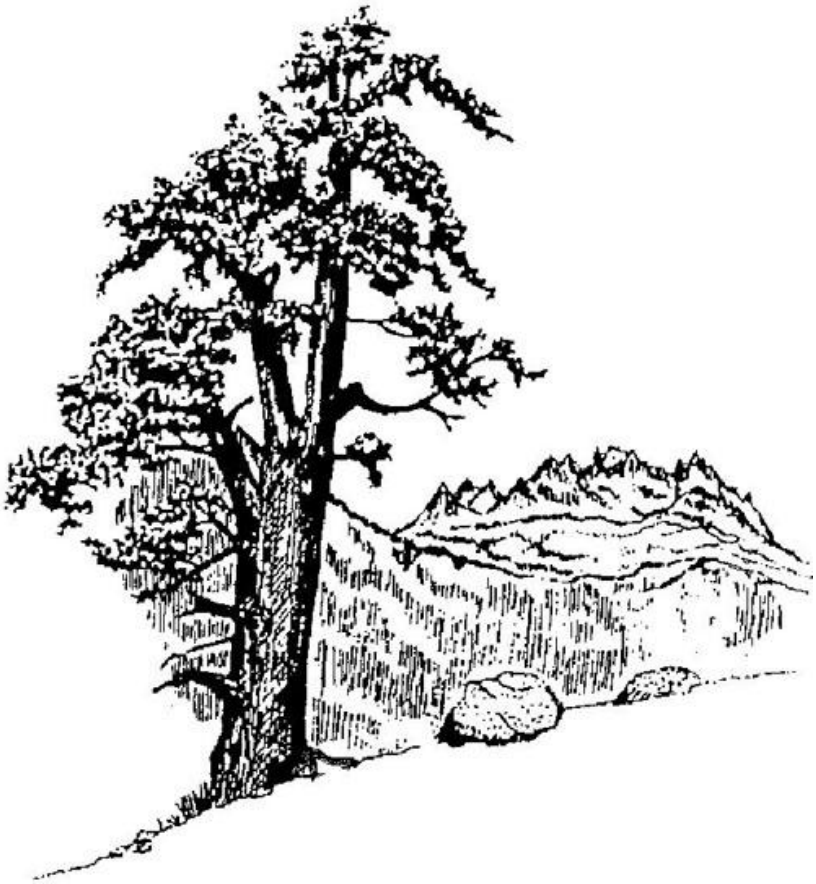
United States Department of Agriculture

Forest Service

**Pacific Southwest Region**

# Draft Environmental Impact Statement for Greys Mountain Ecological Restoration Project

**Sierra National Forest, Bass Lake Ranger District**
**Madera County, CA**



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because of all or part of an individual' income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means of communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET' Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 79503272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer. Printed on recycled paper – June 2009

# GREYS MOUNTAIN ECOLOGICAL RESTORATION PROJECT

## Draft Environmental Impact Statement

Madera/Mariposa Counties, California; Sierra National Forest; Bass Lake Ranger District

**Lead Agency**: USDA Forest Service
**Cooperating Agencies**: N/A
**Responsible Official**: Scott Armentrout, Forest Supervisor
1600 Tollhouse Road, Clovis, CA 93611

**For Information Contact**: Burt Stalter, District Fuels Specialist
57003 Road 225, North Fork, CA 93643
(559) 877-2218 ext. 3208

**Abstract:** This document examines the environmental effects of a proposal to move towards meeting management goals and objectives for the Greys Mountain Ecological Restoration Project (Greys Mountain Project) as set forth in the SNF Land and Resource Management Plan (SNF-LRMP) as amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) and the 2007 Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS). The purpose of the proposal is to achieve ecological restoration objectives and protect communities in the Wildland Urban Intermix (WUI) from wildfire. The ecological restoration goals of the Greys Mountain Project is multi-faceted and includes the following: (1) increase forest resilience to insects, disease, and drought through prescribed fire and mechanical thinning treatments, (2) promote heterogeneity in forest structure for improving wildlife habitat, (3) decrease the occurrence of uncharacteristically severe wildfires and their impacts to ecosystems and watersheds, (4) promote native biodiversity, (5) restore degraded montane meadows, (6) improve habitat quality and connectivity for sensitive wildlife species, (7) decrease impacts of invasive plant species, (8) decommission and restore unneeded user defined vehicle trails, and (9) provide sustainable delivery of ecosystem services, such as clean water and carbon sequestration, in an era of changing climate. Alternatives considered in detail are: Alternative 1 (No Action), would leave the area in its present condition; Alternative 2 (proposed action), would thin conifer stands to reduce stand densities and ladder fuels and promote stand heterogeneity; masticate ladder fuels and brush/shrub patches; utilize prescribed , understory and pile burning; manually treat and/or prescribed burn noxious weed infestations; prepare and plant failed conifer plantations; restore degraded aquatic features; reduce fuel loading and ladder fuels in prehistoric and historic sites; restore user-defined vehicle trails to natural condition; restore native plant communities for cultural gathering needs; improve wildlife habitat by restoring key structures and components; improve and maintain existing forest transportation routes; improve and maintain existing range management facilities and resources; reduce conifer stand densities within developed recreation sites. Alternative 3, would contain similar types of treatments as Alternative 2, but would limit the degree of treatment to that needed to achieve only the fire and fuels objectives in all treatment areas.

**Public Comments**: Reviewers should provide the FS with their comments during the review period of the draft environmental impact statement. This would enable the FS to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy

Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978)). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement (City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3). The opportunity to comment ends 45 days following publication of the notice of availability (NOA) in the Federal Register.

**Send Comments to**: Scott Armentrout, Forest Supervisor; SNF, 1600 Tollhouse Road, Clovis, CA 93611; FAX: (559)294-4809; Electronic mail: comments-pacificsouthwest-sierra@fs.fed.us. Office hours are Monday-Friday 8:00am to 4:30pm.

The acceptable format(s) for electronic comments is: Rich Text Format (.rtf), MS Word (.doc) or pdf.

# Table of Contents

**Summary** ..... **x**

**Chapter 1. Purpose of and Need for Action** ..... **1**
Document Structure ..... 1
Background ..... 1
Purpose and Need for Action ..... 6
Proposed Action ..... 6
Decision Framework ..... 10
Forest Plan Direction ..... 10
Public Involvement ..... 11
Issues ..... 11

**Chapter 2. Alternatives, Including the Proposed Action** ..... **13**
Design Criteria Common to All Action Alternatives ..... 32
Monitoring Plan ..... 49
Comparison of Alternatives ..... 53

**Chapter 3. Affected Environment and Environmental Consequences** ..... **57**
Past, Present and Reasonably Foreseeable Actions ..... 57
Cultural Resources ..... 61
Botany: Rare Plants and Noxious Weeds ..... 70
Geology/Soils ..... 81
Lands/Special Uses/Recreation ..... 93
Terrestrial Wildlife ..... 97
Terrestrial Wildlife Management Indicator Species ..... 123
Aquatic Wildlife and Management Indicator Species ..... 140
Range Management ..... 171
Hydrology/Water Quality ..... 185
Forest Vegetation/Silviculture ..... 201
Fire/Fuels ..... 217
Air Quality ..... 241
Engineering / Transportation ..... 257
Economics ..... 260
Short-term Uses and Long-term Productivity ..... 267
Unavoidable Adverse Effects ..... 267
Irreversible and Irretrievable Commitments of Resources ..... 267
Legal and Regulatory Compliance ..... 268

**Chapter 4. Consultation and Coordination** ..... **273**
Preparers and Contributors ..... 273
Distribution of the Environmental Impact Statement ..... 274

**Glossary** ..... **276**

**Literature Cited** ..... **287**

**Index** ..... **299**

**Appendices** ..... **300**
Appendix A – Map Package for Greys Mountain Project ..... 300
Appendix B – Best Management Practices Associated with Greys Mountain Project ..... 301
Appendix C---Soils and Geology ..... 319
Appendix D – Data Tables for Greys Mountain Project ..... 326
Appendix E -- Acronyms ..... 330

# Table of Tables

Table 1. Summary of proposed action treatments ..... 9
Table 2. Meadows and WIN sites identified for restoration within the project area (ND = no quantified measurement of encroachment). ..... 18
Table 3. Riparian Area Management Zones ..... 39
Table 4. Summary of Relationship between Riparian Area Criteria ..... 40
Table 5. Streamside Management Zone designation by stream class ..... 42
Table 6. Roads that have hydrologically connected drain points and culvert problems in subdrainage 503.0056. ..... 45
Table 7. Comparison of Alternatives Table ..... 53
Table 8. Present and Reasonably Foreseeable Actions Contributing to Cumulative Effects by Resources this Action is likely to affect. ..... 59
Table 9. Forest Service Sensitive Plant Species Known or with Potential to occur within the Greys Mountain Project Area. ..... 71
Table 10. Soil Map Units for the Greys Mountain Project ..... 82
Table 11. Soil families for the Greys Mountain Project ..... 83
Table 12. Soil transect summary for the Greys Mountain Project ..... 85
Table 13. Special Status species on the Sierra NF and a summary of their habitats, area of consideration, and rationale for inclusion/exclusion from detailed analysis within the project BE/BA. ..... 98
Table 14. Action Alternatives Summary of changes to CWHR Forest Type within treatment units of the Greys Mountain Project ..... 102
Table 15. Greys Mountain Project Proposed Treatment Units within California spotted owl PACs or HRCAs ..... 105
Table 16. Greys Mountain Treatment Units within Northern Goshawk PAC's ..... 108
Table 17. Action Alternatives Summary of changes to CWHR Forest Type within the Boundaries of the Greys Mountain Project ..... 128
Table 18. Summary of subwatershed conditions. *From project hydrologist review (Stone 2011). ..... 140
Table 19. Perennial streams (mi); resident trout occupancy (mi), mean summer water temperature (period 7/15-9/15), and maximum daily temperature (greatest mean daily period 7/15/9/15).141
Table 20. Summary of potential habitat within project area subwatersheds (acres based on GIS). ..... 146
Table 21. Activities proposed under Alternative 1 ..... 151
Table 22. Acres of habitat cumulatively affected under Alternative 1. (*lacustrine/riverine miles converted to acres assuming 9 ft wide stream) ..... 156

Table 23. Alternative 2 activities (acreages approximations generated by GIS). Riverine/Lacustrine and wet meadow habitats have Class I SMZ buffers (100 feet) with no direct affects anticipated. Affected miles or acres reflect treatments in the outer 50 feet..... 158
Table 24. Overlap of Proposed Treatment Areas and Potential Habitat for species. Thinned includes hand thin. (*lacustrine/riverine miles converted to acres assuming approximately 9 ft wide stream) ..... 159
Table 25. Acres of habitat cumulatively affected under Alternative 2. (*lacustrine/riverine miles converted to acres assuming 9 ft wide stream)..... 165
Table 26. Effects from Greys Mountain Alternative 1 (No Action) on aquatic threatened, endangered, candidate, and sensitive species ..... 168
Table 27. Effects from Alternatives 2 and 3 on aquatic threatened, endangered, and sensitive species. ..... 168
Table 28. Summary of ecological status data collected at two key area meadows within to the Greys Mountain Project Area. ..... 174
Table 29. Current Permitted Numbers and Season of Use for Soquel Allotment. ..... 176
Table 30. Current Permitted Numbers and Season of Use for the Central Camp Allotment. ..... 178
Table 31. Allowable utilization levels by vegetation community ..... 179
Table 32. Desired conditions for montane meadows and riparian conservation areas. ..... 180
Table 33. Stream mile summaries for all 8th-field subdrainages potentially affected by project activities..... 186
Table 34. List of priority roads that area causing impacts to watershed function by hydrologic connectivity. AOP stands for Aquatic Organism Passage. ..... 191
Table 35. Points of hydrologic connectivity and stream crossings with high bypass potential. *A "Non-Functional Culvert" is one that has been identified as being ½ plugged to completely plugged or buried..... 192
Table 36. Calculated base ERA % and ERA % with the Proposed Action or Alternative 3..... 194
Table 37. CWE results for post harvest prescribed fire in 2015. The baseline ERA% is prorated (i.e., "recovered") for each year between actions. As a result, the baseline ERA% is somewhat reduced. ..... 194
Table 38. Acres of activities proposed within project area subdrainages under Alternative 2 (approximate maximum acres generated by GIS). ..... 197
Table 39. Fire History within the Project Boundary ..... 219
Table 40. Fire History Outside of the Project Boundary (within a 3 mile radius)..... 219
Table 41. Adapted from How to Predict the Spread and Intensity of Forest and Range Fires. Richard C. Rothermel, 1983 and Rocky Mountain Research Station Fuel Models, Scott and Burgan, 2005 ..... 225
Table 42. Rocky Mountain Research Station Fuel Models, Scott and Burgan, 2005 ..... 226
Table 43. Indicators for Fuel Models in Timbered Brush/shrub Covered Areas. ..... 227
Table 44. Shows the predicted results of fuel model conversions anticipated with this Alternative. ..... 233
Table 45. Cumulative Effects: Past, Present and Reasonable Foreseeable Activity, summary. . 236
Table 46. Sensitive receptors identified within 10 miles of the Greys Mountain Project ..... 242
Table 47. Federal de minimus Threshold Levels for Criteria Pollutants based on Air Basin attainment status. ..... 244
Table 48. Class I airsheds near the Greys Mountain Project area. ..... 246
Table 49. Statewide Emission Inventory for Natural Sources-Wildfire..... 249
Table 50. Potential emissions if a wildfire were to burn within the entire Fish Project boundary. ..... 250

Table 51. Tons of Estimated Pollutants per Individual Project—Annual Underburn Program of Work ..... 250
Table 52. Total Emissions from All Prescribed Fire Treatments Proposed in this Action (in tons) ..... 252
Table 53. Total tons of emissions for mechanical treatments and road maintenance-reconstruction activities for the completion of operations in Alternative 2. ..... 252
Table 54. Emissions conformity to General Conformity Rule for Criteria Pollutants ..... 253
Table 55. Greys Mountain economic analysis for alternative 2 ..... 262
Table 56. Greys Mountain economic analysis for alternative 3 ..... 264
Table 57. Full time Job relationship to specific project tasks ..... 266
Table 58. Soil disturbance class by percent present for each soil transect completed ..... 322
Table 59. Forest floor summary ..... 322
Table 60. Forest slope summary ..... 322
Table 61. Large woody debris (LWD) summary ..... 323
Table 62. Summary of meadow encroachment for the selected meadows in the Greys Mountain Project area ..... 323
Table 63. Soil transect data for T units 1, 11, 12, 18 and 28 ..... 324
Table 64. Soil transect data for T units 29, 30, 32, 35, and 36 ..... 325
Table 65. Conifer Plot Data Tables ..... 328

# Table of Figures

Figure 1. Locations of meadow restoration sites within the Greys Mountain ERP (note: Meadows 504M292 and 293 have been combined into one site). ..... 19
Figure 2. Map of WIN 51015 in meadow 504M292 and 504M293; red triangles denote main WIN features. ..... 21
Figure 3. Map of WIN 51036 in Poison Meadow (meadow 504M209); red triangle denotes main WIN features. ..... 22
Figure 4. Map of WIN 51037 in meadow 504M211; red triangles denote main WIN features. ..... 23
Figure 5. Map of WIN 51038 in Meserve meadow (meadow 504M132); red triangles denote main WIN features. ..... 24
Figure 6. Map of WIN 51104 in Progeny meadow (Meadow 503M8); red triangles denote WIN features. ..... 25
Figure 7. Map of WIN 51241 in Chipmunk meadow (Meadow 504M220); red triangle denotes main WIN feature. ..... 26
Figure 8. Map of WIN 51244 in meadow 504M208; red triangles denote main WIN features. ..... 27
Figure 9. Map of WIN 51246 in Railroad meadow (Meadow 504M198); red triangles denote WIN features. ..... 28
Figure 10. Map of WIN 51295 in meadow 504M7; red triangles denote main WIN features; darker green polygons represent the true meadow components. ..... 29
Figure 11. Map showing the alignment of the OHV track through meadow 503M7. This track will be restored to improve soil productivity and allow for native vegetative recovery. ..... 30
Figure 12: Associated Bounds and Treatments within Old Forest Linkages ..... 40
Figure 13. Associated Bounds and Treatments within Old Forest Linkages ..... 43
Figure 14. Points of hydrologic connectivity and bypass potential along system roads in subdrainage 503.0056. Repair of the crossings (i.e., culverts) and relocation of the hydrologically connected drain points should be part of the road maintenance plan for 06S0 . 46

Figure 15. Looking down cultural resource boundary within Greys Mountain Ecological Restoration Project area; previously treated unit to left of pine in center of photo; cultural resource site with heavy fuel loading to right of pine. ..... 63
Figure 16. Locations of Noxious Weeds within the Greys Mountain Project Area. ..... 75
Figure 17. Occupied mountain yellow-legged frog (brown triangles indicating RAMU) in relation to Greys Mountain project treatment units. ..... 161
Figure 18. Allotment boundaries and meadows with proposed restoration within the project area. ..... 173
Figure 19. Location of Greys Mountain Project in relation to the Willow Creek 5th-Field watershed. ..... 187
Figure 20. Stream Side Management Zone (SMZ) and subdrainage map of the Greys Mountain Project Area. Color-coded lines represent different stream orders, which are offered a protection buffer based on designated class. ..... 188
Figure 21. Hauling Chart displaying modeled surface fire behavior by fuel models for each project alternative. ..... 235
Figure 22. Step-pools built into two narrow headcuts at the toe of Summit Meadow, Sierra National Forest. ..... 316
Figure 23. . Log-and Fabric Step-Falls used for headcut mitigation, Johnson Meadow, Sierra National Forest. ..... 317
Figure 24. Greys Mountain Project selected meadows for conifer encroachment ..... 319
Figure 25. Greys Mountain Project soil transects ..... 320

# Summary

The Sierra National Forest (SNF), Bass Lake Ranger District (BLRD) proposes to restore ecological structure and function to create a resilient landscape that can better withstand future disturbances and continue to provide sustainable ecosystem services for future generations. To accomplish this goal, the SNF BLRD proposes several restoration objectives aimed at promoting native biodiversity and ecosystem resilience in the Greys Mountain Project area. The Greys Mountain Project would restore the ecological processes and forest heterogeneity through a series of prescribed fire and thinning treatments aimed at reducing ladder fuels and dead and down fuel loads. Another objective is to create a network of landscape area treatments and defensible fuels profiles near key transportation corridors to reduce the intensity and rate of spread of wildfires across the landscape and near communities. Proposed treatments also would improve stand resistance to drought, insects, and disease by reducing inter-tree competition and improving tree vigor. Montane meadow restoration would be accomplished in targeted hydrologic systems through a combination of treatments, including improvements to degraded hydrologic features, encroaching conifer removal, and noxious weed management. Proposed treatments would restore culturally-significant vegetation and protect important historic and cultural resources threatened by uncharacteristically severe wildfire. .

The area affected by the proposal includes 9600 total project boundary acres within the Willow Creek and Fresno River watersheds, in the Southern Sierra Nevada. The project is immediately north of the community of Bass Lake, California and south of Soquel Meadow, east of Nelder Grove Historical Area and west of Graham Mountain. Vegetation types include ponderosa pine plantations, mixed conifer, true fir, and hardwood species, as well as areas dominated by brush/shrubs, herbs and grasses (meadows), rock, and steep slopes.

This action is needed, because under the amended SNF-LRMP (Sierra Nevada Forest Plan Amendment [SNFPA], Record of Decision [ROD], USDA-FS 2004), an ecosystem approach to project development and planning is recommended. Where there are significant departures from the desired condition or potential for a loss in key ecosystem functions, opportunities for management actions to address this departure were developed. An emphasis on the inter-relationship of the major functional program goals was placed on these opportunities. Of particular concern was the Willow Creek watershed with its highly departed ecological condition and its importance in providing valuable ecosystem services and community benefits to meet the ecological, social, and economic needs of the public.

Current forest conditions, due to past management activities (including harvesting operations, fire exclusion/suppression, housing development, etc.) have been changed from one where fires were of frequent, low/ moderate intensity to infrequent, high intensity. Owing to these changes, forest stands have become less diverse, more homogenous, and more susceptible to uncharacteristically severe wildfire and drought. Current forests stands are typified by an overabundance of shade-tolerant conifer species in the lower and mid-level canopies of the forested stands. Other areas have converted from forested stands to brush/shrub species. This overstocking of conifers has led to a decline in forest health and high susceptibility of loss from insects, disease, wildland fire, and climate change.

A variety of wildlife species are highly dependent on conditions provided by functioning and intact ecosystems, including, Pacific fisher, California spotted owl and Northern goshawk., These species are highly susceptible to habitat loss and fragmentation caused by wildfire, insect and disease outbreaks, past logging practices, and changing climate. Although there is inherent uncertainty (due to gaps in information) surrounding habitat management of these sensitive

species, , the vulnerability of these habitats to future stressors can be reduced through the implementation of ecological restoration treatments focused on improving ecosystem resilience, retaining key habitat structures (large live trees and snags), and restoring important forest characteristics (heterogeneity, fire-resilient tree species).

- **Alternative 1 – No Action**. Under the No Action alternative, current management plans would continue to guide management of the project area. No ecological restoration activities would be implemented to accomplish the purpose and need.
- **Alternative 2 – Proposed Action**. Treatment areas within the project area boundary were delineated to include those areas where some form of treatment was necessary to meet the purpose and need. First, treatment areas were designed to reduce the intensity and spread of wildfires in and around WUI. Treatment areas near key transportation corridors and within the defense zone of the WUI were designed next. Treatment areas were further designed to meet several additional ecological restoration objectives: (1) restoration of forest structure and composition (forest heterogeneity and biodiversity is promoted using prescribed burning and mechanical thinning) (2) fire and fuels management(treatments are designed to reduce ladder and surface fuels that occur within the lower and limited mid-level canopy); (3) wildlife habitat and watershed restoration (enhancement and retention of key habitat structures, meadow restoration), (4) forest health and ecological resiliency (overstocked stands are thinned in the lower- and mid-level canopy to promote resilience to changing environmental conditions resulting from insects, disease, wildfire, and drought; and (5) invasive species management (eradication or containment of noxious weed populations).
- **Alternative 3 – Lower and Limited Mid-level Canopy Treatments, All Treatment Areas.** In Alternative 3, treatment areas would remain the same as in Alternative 2, treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. Under Alternative 3 there would be no additional treatments (i.e. additional thinning in the mid-level canopy) to fully address stand density and forest health objectives.

  This alternative would receive treatment only to achieve fire and fuels objectives and limit treatments to mechanical clearing of ladder and surface fuels and prescribed burning.

  A summary of effects are in the following table. See chapter 3 of this document for the full discussion of effects.

## Summary of Effects by Alternative

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| Cultural Resources | The degree to which historic property values are diminished. | Cultural resource sites have the potential to be adversely affected if an uncharaceristically severe wildfire was to occur from untreated fuel accumulations.<br><br>Artifact looting could occur from increased access and visibility of sites resulting from an uncharacteristicall y severe wildfire Cultural site context could be affected by post fire runoff and erosion, increased tree mortality, and increased rodent and insect burrowing. Cultural resources could be affected by lack of road maintenance.<br><br>Cumuluative effects could result from failure to address fuel loading within cultural resource sites which could result in adverse effects from a severe wildfire. | By following the Stipulations and implementing the Standard Protection Measures outlined in the Regional PA, Attachment B and the Interim Fuels Protocol, following design measures, and consulting with SHPO to develop mitigations for potential adverse effects, the historic property values of sites would not be diminished as a result of implementing this alternative.<br><br>Artifact looting could occur from increased access and visibility of sites resulting from an uncharacteristically severe wildfire or through mechanical treatment and prescribed burning within sites. Cultural site context could be affected by post fire runoff and erosion, increased tree mortality, and increased rodent and insect burrowing should a severe wildfire occur.<br><br>Cumulative effects could occur post implementation in the form of increased visibility and looting, but would be minimal through post-implementation monitoring and appliction of Standard Resource Protection Measures of the Regional PA. | By following the Stipulations and implementing the Standard Protection Measures outlined in the Regional PA, Attachment B and the Interim Fuels Protocol, following design measures, and consulting with SHPO to develop mitigations for potential adverse effects, the historic property values of sites would not be diminished as a result of implementing this alternative.<br><br>Artifact looting could occur from increased access and visibility of sites resulting from an uncharacteristically severe wildfire or through prescribed burning within sites. Cultural site context could be affected by post fire runoff and erosion, increased tree mortality, and increased rodent and insect burrowing should a severe wildfire occur.<br><br>Cumulative effects could occur post implementation in the form of increased visibility and looting, but would be minimal through post-implementation monitoring and appliction of Standard Resource Protection Measures of the Regional PA. |
| **Botanical TES**<br><br>*Other plant species do not have habitat within the project area, therefore will not be impacted by any of the alternatives. | Determinations for TES species | | | |
| | No effect | 1 Threatened species<br><br>*Calyptridium pulchellum* | 1 Threatened species on SNF (not in Greys Mountain Project)<br><br>*Calyptridium pulchellum* | 1 Threatened species on SNF (not in Greys Mountain Project)<br><br>*Calyptridium pulchellum* |
| | May affect but is not likely to adversely affect | N/A | N/A | N/A |

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| | May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability (includes 3 species known to occur in project area and others that might occur but are protected by project design features for riparian and aquatic areas) | 8 Sensitive species<br>*Bruchia bolanderi*<br>*Collomia rawoniana*<br>*Epilobium howellii*<br>*Fissidens aphelotaxifolius*<br>*Hulsea brevifolia*<br>*Lewisia disepala*<br>*Meesia triquetra*<br>*Peltigera hydrothyria* | 8 Sensitive species<br>*Bruchia bolanderi*<br>*Collomia rawsoniana*<br>*Epilobium howellii*<br>*Fissidens aphelotaxifolius*<br>*Hulsea brevifolia*<br>*Lewisia disepala*<br>*Meesia triquetra*<br>*Peltigera hydrothyria* | 8 Sensitive species<br>*Bruchia bolanderi*<br>*Collomia rawsoniana*<br>*Epilobium howellii*<br>*Fissidens aphelotaxifolius*<br>*Hulsea brevifolia*<br>*Lewisia disepala*<br>*Meesia triquetra*<br>*Peltigera hydrothyria* |
| Noxious Weeds | Potential for noxious weed spread, number of infestations and number of plants per infestation. | Increased risk of spread if wildfire was to occur in the area and fireline equipment does not follow Noxious Weed Prevention Practices (e.g. under extreme emergency no time for equipment cleaning), also control of existing infestations would not occur. | Low risk of spread through use of project design criteria for prevention of spread as well as the fact that the proposed action includes controlling existing weed infestations. | Low risk of spread through use of project design criteria for prevention of spread as well as the fact that the proposed action includes controlling existing weed infestations. |
| Soils/Geology | Potential for reduction in Soil porosity due to compaction | Compacted soils (in 1.51 percent of the project area) would continue to recover over time with no additional disturbance. | Design Measures would minimize detrimental compaction of soils. | Design Measures would minimize detrimental compaction of soils. |
| | Soil Cover Remaining (Large Woody Debris) | Meets and/or exceeds current Soil Management Objectives | Reduction, but would continue to meet and/or exceed Soil Management Objectives | Reduction, but would continue to meet and/or exceed Soil Management Objectives |

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| Lands/Special Uses | Effects to Special Uses Permitted in Project Area. | No Effect | With implementation of Design Criteria minimal to No effect | With implementation of Design Criteria minimal to No effect |
| **Terrestrial Wildlife**<br>(T)=Threatened<br>(E)=Endangered<br>(P)=Proposed<br>(C)=Candidate<br>(FSS)=Forest Service Sensitive<br>*Listed below are species that do not have habitat within or adacent to the project area, nor are directly, indirectly or cumulatively effected by this project therefore the project would have No Effect on them:<br>**Valley Elderberry Longhorn Beetle** *Desmocerus californicus dimorphus* (T)<br>**Bald Eagle** *Haliaeetus leucocephalus* (FSS)<br>**Wolverine** *Gulo gulo*(FSS, C)<br>**Willow Flycatcher** *Empidonax trailli* (FSS)<br>**Sierra Nevada red fox** *Vulpes vulpes necator* (FSS)<br>**Townsend's big-eared bat** *Corynorhinus townsendii* (FSS) | **Determinations for TECPS Species**<br>No effect.<br>May affect but is not likely to adversely affect.<br>May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability. | Alternative 1 would have no direct effect on any TECSP species or their habitats.<br>However, by taking no action to reduce fuel levels, the threat of large scale, stand-replacing wildfires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to TECPS species. | Alternative 2: May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.<br>**California Spotted Owl** *Strix occidentalis occidentalis* (FSS)<br>**Great Gray Owl** *Strix nebulosa* (FSS)<br>**Northern goshawk** *Accipiter gentilis* (FSS)<br>**Pallid bat** *Antrozous pallidus* (FSS)<br>**Western red bat** *Lasiurus blossevillii* (FSS)<br>**American marten** *Martes americana* (FSS)<br>**Pacific fisher** *Martes pennanti pacifica* (FSS) | Alternative 3: May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.<br>**California Spotted Owl** *Strix occidentalis occidentalis* (FSS)<br>**Great Gray Owl** *Strix nebulosa* (FSS)<br>**Northern goshawk** *Accipiter gentilis* (FSS)<br>**Pallid bat** *Antrozous pallidus* (FSS)<br>**Western red bat** *Lasiurus blossevillii* (FSS)<br>**American marten** *Martes americana* (FSS)<br>**Pacific fisher** *Martes pennanti pacifica* (FSS) |

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| Aquatic Wildlife TES<br><br>*Listed are species that do not have habitat withinor adacent to the project area, nor are directly, indirectly or cumulatively effected by this project therefore the project would have no effect on them:<br><br>*Central Valley Steelhead (T)*<br><br>*Delta smelt (T)*<br><br>*Hardhead (FSS)*<br><br>*California Red Legged Frog (T)*<br><br>*Limestone Salamander (FSS)*<br><br>*Relictual slender salamander (FSS)*<br><br>*FYLF (FSS)*<br><br>*Western Pond Turtle(FSS)* | | Moutain Yellow Legged Frog (C/FSS)<br><br>Yosemite Toad (C/FSS) | | |
| | May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability | N/A | Moutain Yellow Legged Frog (C/FSS)<br><br>Yosemite Toad (C/FSS) | Moutain Yellow Legged Frog (C/FSS)<br><br>Yosemite Toad (C/FSS) |

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| **Aquatic Management Indicator Species** | Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations)<br><br>**Lacustrine/Riverine**: Stream Surface Shading, Flow, and Sediment<br><br>**Wet Meadow**: Flow | Lacustrine/Riverine Habitat<br><br>Wet Meadow Habitat<br><br>No expected direct, indirect or cumulative effects to habitat.<br><br>Habitat stable at Regional scale | Lacustrine/Riverine Habitat: Direct or indirect effects to Stream Surface Shading and Flow not anticipated.<br><br>Wet Meadow Habitat: Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow.<br><br>Both habitat types stable at Regional scale. | Lacustrine/Riverine Habitat: Direct or indirect effects to Stream Surface Shading and Flow not anticipated.<br><br>Wet Meadow Habitat: Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow.<br><br>Both habitat types stable at Regional scale. |
| **Terrestrial Management Indicator Species**<br><br>*Listed below are species that do not have habitat within or adacent to the project area, or species whose habitat would not be direcrtly or indirectly affected by the project:<br><br>**Greater sage-griouse** (*Centrocercus urophasianus*)<br><br>**Mule deer** (*Odocoileus hemionus)*<br><br>**Yellow warbler** (*Dendroica petechia*)<br><br>**Sooty grouse** (*Dendragapus obscurus*)<br><br>**Black-backed woodpecker** (*Picoides arcticus*) | Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations) | **All terrestrial MIS.**<br><br>No <u>direct</u> effects to MIS habitat from Alternative 1. Largest indirect effect on species habitat would be loss or alteration created by uncharacteristically severe wildland fire. | **Fox sparrow** (*Passerella iliaca)*<br><br>**Mountain quail** *(Oreortyx pictus)*<br><br>**California spotted owl** (*Strix occidentalis occidentalis*)<br><br>**American marten** (*Martes americana*)<br><br>**Northern flying squirrel** (*Glaucomys sabrinus*)<br><br>**Hairy woodpecker** (*Picoides villosus*)<br><br>Although there would be alterations to canopy closure on 121 acres (approximately 4 percent of the treatment area), these predicted changes would not alter the existing trend in the habitat at the project-level, nor would it lead to a change in the distribution of the aforementioned terrestrial MIS across the Sierra Nevada bioregion. | **Fox sparrow** (*Passerella iliaca)*<br><br>**Mountain quail** *(Oreortyx pictus)*<br><br>**California spotted owl** (*Strix occidentalis occidentalis*)<br><br>**American marten** (*Martes americana*)<br><br>**Northern flying squirrel** (*Glaucomys sabrinus*)<br><br>**Hairy woodpecker** (*Picoides villosus*)<br><br>Although there would be alterations to canopy closure on 53 acres (approximately 2 percent of the treatment area), these predicted changes would not alter the existing trend in the habitat at the project-level, nor would it lead to a change in the distribution of the aforementioned terrestrial MIS across the Sierra Nevada bioregion. |

| Resource Area | Indicator | Alt 1 | Alt 2 | Alt 3 |
|---|---|---|---|---|
| Hydrology | Cumulative Watershed Effects (CWE's)<br><br>Threshold Levels Reached | The only watershed considered a candidate for CWE response is subdrainage 503.0056. Baseline ERA % for this subdrainage is high at 9.25%, which resulted from past timber harvest activity. With the no action alternative, no tractor related ground disturbance or prescribed fire would occur, which, (given sufficient time), would allow the subdrainage to recover and stabilize. | The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%. | Alternative 3 treatment areas would remain the same as in Alternative 2 and thus baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in Alternative 3, none exceeded the Upper TOC of 14%. |
| Air Quality | Degree of degradation of Air Quality from Smoke | High degree of long lasting unhealthy to severe degraded air quality from potential uncontrolled wildfire(s). | With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas.<br><br>Potential air quality impacts from wildfires would be reduced with less ground fuels available. | With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas.<br><br>Potential air quality impacts from wildfires would be reduced with less ground fuels available. |
| Transportation System | Effects of Transportation System | With minimal maintenance there is a continued potential for loss of infrastructure investment from erosion, wet weather use and brush encroachment. | Roads not meeting acceptable Standards would be required to be have maintenance, or recontruction done for project implementation.<br><br>This can have the potential to reduce potential erosion problems caused by transportation corridors.<br><br>Implementation of BMP and erosion control measures would reduce the impacts of such construction. | See Alternative 2. |

# Chapter 1. Purpose of and Need for Action

## Document Structure

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

**Chapter 1**. Purpose and Need for Action: This chapter briefly describes the proposed action, the need for that 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 Proposed Action as well as alternative actions that were developed in response to comments raised by the public during scoping. The end of the chapter includes a summary table comparing the proposed action and alternatives with respect to their environmental impacts.

**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 planning record located at BLRD office in North Fork, California.

## Background

The Sierra National Forest (SNF)-Land and Resources Management Plan (LRMP ) 1991 was amended in 2001 by the Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (USDA-FS 1992, 2001b). Standards and Guidelines for project planning were to focus on the modification of fire behavior through fuels treatments. These treatments were to have the highest priority in areas described as Wildland Urban Interface/Intermix (WUI), (see map book; Map 2). In 2004, a Supplemental Environmental Impact Statement (USDA-2004a) was written to the SNFPA and a Record of Decision (ROD) was signed (USDA-FS 2004b). This ROD replaced the 2001 decision in its entirety. This decision recommended an ecosystem approach whereby the development and planning of projects would be not only based on fuels reduction treatments, but would create an overall approach by looking at all key elements within an ecosystem. WUI continued to be the highest priority area for treatments. The 2004 SNFPA decision as it relates to the SNF has been incorporated into the SNF-LRMP as an amendment.

As part of the SNFPA ROD (USDA-FS 2004b), an adaptive management and monitoring strategy designed to address high priority, key questions that relate to the uncertainties associated with management activities was to be initiated. In 2006, Region 5 (Pacific Southwest Region) of the

Forest Service, as well as other Federal and State Agencies, entered into an agreement with the University of California whereby the university would act as a neutral third party to studying the effects of management actions associated with implementation of the SNFPA ROD (USDA-FS 2004) management direction. Focus was on the four key areas where the highest priority management questions exist (detailed and incorporated from SNFPA FEIS, Appendix E [USDA-FS 2001] and SNFPA FEIS [USDA-FS 2004a]). These key areas include wildlife (specifically Pacific fisher/California spotted owl), fire and forest health, water quality and quantity, and public participation. Results of these studies were used to develop the alternatives (see Chapter 2).

Following management goals and direction from the SNFPA ROD (USDA-FS 2004b), treatment areas for the Greys Mountain Project were developed. These treatment areas were based on the basic fire and fuels strategy which remained in the SNFPA ROD (USDA-FS 2004b); reducing the risk of wildland fire to WUI and to effectively modify wildland fire behavior by strategically placing a pattern of area treatments (known in the SNFPA ROD (USDA-FS 2004b) as SPLATs, see map3) across broad landscapes. In addition, this strategy was broadened to include the need to consider and provide for other important objectives to improve forest health by restoring and maintaining ecosystem structure, composition and process.

A network of land allocations, designated as part of the SNF-LRMP as amended, have an associated set of desired conditions, management intents, and management objectives. From standards and guidelines (referred to as S&G) management direction is provided for project planning and implementation. The vegetation and fuels treatment standards and guidelines are intended to (1) act as sideboards for local managers as they design projects to meet fuels and vegetation management objectives and respond to site-specific conditions, and (2) retain important components of habitat that are believed to be important to species associated with old forests, including large trees, structural diversity and complexity, and moderate to high canopy cover. At the project level, these standards and guidelines are used in conjunction with desired conditions, management intents, and management objectives for the relevant land allocation to determine appropriate treatment prescriptions (SNFPA ROD; USDA-FS 2004b).

The Greys Mountain Project lies within the Willow Creek and Fresno River watersheds.

In June of 1995 the Minarets and Mariposa Ranger Districts (Later to become the Bass Lake RD) completed the Willow Creek Landscape Analysis. In the Willow Creek Landscape Analysis, the desired conditions for the ecological units that are within the project area are as follows:

- Improve forest heath,
- Manage for wildlife indicator species which are spotted owl and mule deer
- Manage fuel loading to reduce risk of high intensity fire.

This area includes high concentrations of recreational activity and human habitation, adjacent forests suffer with declining health from overstocking and include habitat for species-at-risk (such as California Spotted Owl, goshawk and Pacific fisher).

## Historical Conditions

During the period before significant Euro-American influence, natural fires and Native American burning occurred frequently and were of low to moderate intensity with return intervals ranging from five to ten years in the Project area vegetation types. These types of fires produced fire effects of low to moderate severity throughout this ecosystem. Occasional patches of high severity fire effects did occur where pockets of heavier surface fuel loads and ladder fuels aligned

with favorable slope, wind and aspect during drought conditions to induce mortality in larger conifer pockets.

Wildfire history cartographic data beginning in 1910 show most wildfires have started and burned from the lower elevations around the Oakhurst Basin and Bass Lake Area up into the mid elevations of the Project area. At these elevations fuel models change. More favorable terrain and micro-site weather conditions moderated fire behavior and allowed fires to be controlled by early day suppression forces. Since the 1930s as forests on the district and within the project area continued to grow without frequent fires, they have become densely overstocked.

Wildfires that burn in these areas today, burn at such levels that severe resource damage occurs, especially to soil layers. Once these soils are heavily damaged by fire, key ecosystem components can take longer to recover especially trees. Recent examples of this can be seen locally in the 2001 North Fork Fire; the 2003 Source Point Fire; and the 2008 Oliver Fire.

Nelder Grove, a historical area is adjacent to the northern border of the Greys Mountain Project area and is potentially impacted by a uncontrolled fire starting in or around the project area. Although there are no historical records of wildland fires reaching into the Nelder Grove Historical Area, fires could easily threaten the grove of giant sequoias based on topographic features of the area and given suitable burning conditions.

The project area has a long history of past logging activities with the first lumber mill in Madera County beginning operation just east of Sivels Meadow at a place known as the Board Ranch in 1852. From 1852 until 1927 various lumber mills processed timber logged from the area within the Project boundary. Railroad, cable and ground-based logging activities over this period removed approximately 7,500 to upwards of 21,000 board ft of timber per acre. A conservative estimate of 96,000,000 board ft of timber were removed by logging and have resulted in most of the forested areas consisting of trees less than 130 years of age.

Project area stands, once composed of fire resistant ponderosa and sugar pine, have become dominated by less fire resistant white fir and incense cedar. There was no evidence of tree replanting activities following historic logging and the current forest today is a result of young shade tolerant conifers such as white fir and incense cedar and scattered shade intolerant ponderosa pine and sugar pine growing once the mature dominant sugar and ponderosa pine forests were removed.

Timber harvesting since 1927 has generally consisted of salvage/sanitation, overstory harvests and commercial thinning, with most occurring from 1970 to 1995. The regeneration harvest areas were reforested and are now established younger-aged conifer plantations intermixed within the natural stands that help create a mosaic of habitat diversity for wildlife. These areas are very important for maintaining this ecological diversity and need to be managed by maintaining conifer stocking and competing vegetation at levels that reduce moisture stress and improve levels of survivability during natural disturbance events and wildfire.

## Existing Condition

Hundreds to thousands of small trees per acre are common beneath stands of white fir, sugar pine, incense cedar, and ponderosa/Jeffrey pine in the lower elevations and red fir in the higher elevations. These small understory trees consist of mostly shade tolerant incense cedar and white fir. These shade tolerant species have naturally reseeded into many areas where they are severely overstocked, create extensive fuel ladders or, in previously thinned areas, have created a dense layer of regeneration. Much of the regeneration is currently small in size; however without treatment it would grow into a dense even-aged understory with limited vertical heterogeneity. In

addition this overstocking has created stands that can no longer successfully survive natural disturbances such as drought conditions, climate change, insects/disease attacks and/or wildfire. Changes to the forest structure by past logging and the lack of fire have been a compounding factor in causing poor ecosystem conditions within the Project area.

The last century was unusually wet compared to prior centuries.[1] This wetter than normal period coupled with the exclusion of fire has set the stage for forest stands and riparian structures to become overcrowded with competing conifers, oaks and other vegetation. Changes in climatic conditions over the past thirty years have placed stress on many of these stands, and future predictions are similar. Disturbance agents such as insects and disease are predicted to increase to epidemic levels due to the warmer climate. More intense weather events such as heavy snow storms, wind storms and intense droughts would create conditions that favor these disturbance agents.

Inter-tree competition, drought, rising temperatures, and insect attacks are beginning to take a toll on both plantation and wild stands and are causing meadow systems to experience reductions in water holding capacity. White pine blister rust has also been causing mortality in sugar pine over the past 15 to 20 years. Dead and down surface fuel loadings have been rising at annual rates of approximately 1 ton per acre. Existing surface fuel loadings are from 10 to 80 tons per acre with most areas averaging 30-40 tons per acre. Fuel loadings of 10 tons per acre or less are the desired condition in the SNF LRMP.

Water storage in meadows has a great influence over water quality, quantity, habitat potential, and forage within the meadow system and downstream riparian areas. Because montane meadows serve a vital role as water storage and release systems, it is essential that the hydrologic function of meadows be preserved, improved, or restored. Five meadows within the Project area are degraded because of accelerated erosion associated with past land use activities. Accelerated erosion results in gully formation, incised streams, head cuts and soil loss. This creates a lowered groundwater table and a change in soil moisture conditions throughout the meadow, which in turn promotes a favorable growing environment for conifers previously excluded by the meadow moisture. As the density of encroaching conifers increases, so does the rate of evapo-transpiration, which continues to lower the groundwater table and encouraging even more conifer encroachment. This encroachment cycle (along with continued erosion) could eventually lead to the complete de-watering of the meadow system, severely impacting aquatic habitat, water quality, and water quantity.

These meadows have all been degraded to the extent where the groundwater tables have been lowered due to natural disturbances. These meadows have compromised hydrologic function, with vertically and laterally unstable stream systems. The resulting change in soil moisture conditions has resulted in conifer encroachment beyond the range of natural variability. Maintaining, improving or restoring hydrologic function in riparian areas such as meadows is necessary to meet the guidance set forth in the Sierra National Forest Land and Resources Management Plan (SNF-LRMP USDA, 1991), as amended by the Sierra Nevada Forest Plan Amendment ROD (SNFPA USDA, 2004). The desired condition in accordance with the Forest Plan as amended by the 2004 SNFPA is:

- Vertically and laterally stable stream channels with in the meadows
- No depletion of ground water due to encroaching conifers
- No impacts from roads/tacks/trails

[1] Sierra Nevada Forest Plan Amendment, Record of Decision, 2004.

- Minimal impacts from grazing

Forest stand structures and processes currently need to be restored to provide more quality wildlife habitat, specifically to improve the diversity and restore the fire cycle in the system as a process that is currently lacking.

Local Native American tribes have historically utilized areas within the project boundary for gathering of culturally significant resources for multiple uses. The preferred method of management to improve the quantity and quality of this vegetation in the past has been fire.

Due to the policy of avoiding cultural resource sites for the past 30 plus years during project implementation, fuels have unnaturally built up within cultural resource sites; creating the potential for significant damage in the form of partial or total loss of the resources should a fire occur. Moreover, the increase in fuels has altered the original setting for most cultural sites. Several prehistoric sites that had exposed features, access to water resources, and a view shed that have been encroached by an understory that detracts from its setting by obscuring features and the view shed and has left the water resources difficult to access or has substantially decreased the amount of water available. Moreover, artifacts such as obsidian and features such as milling stations have been shown to be damaged by high intensity fire to the extent that the artifacts and features no longer contribute to the data potential of a prehistoric cultural resource. Due to this same policy, trees and brush within historic resources, including railroad grades, have grown substantially contributing to an altered setting and in some places have affected the integrity of the sites. For instance, the walls of through-cuts and the downslope of fill on railroad grades have been compromised where trees and their roots have grown through the side walls. When a tree falls, it often takes a part of the grade feature with it, thereby disrupting the design and solidity of the grade. The feature is no longer intact and often continues to degrade through erosion and undermining of the resource. The spatial distribution of features is also a key element in a site's design. Where these features are obscured by underbrush or dense tree stands, a site's design is masked.

Man made features that are creating a degraded resource condition are forest roads in poor maintenance condition and user created vehicle trails that are not on the Sierra National Forest Travel Plan. These user created areas are a cause of high soil erosion during water runoff events which leads to reduced water quality and a reduction in soil production capacity. Unmanaged OHV use has resulted in unplanned roads and trails, erosion, watershed and habitat degradation and impacts to cultural sites; ("Four Key Threats Facing the Nation's Forests and Grass Lands; USDA-FS June 2004). In March of 2010 the Sierra National Forest completed the Travel Management Final Environmental Impact Statement (FEIS), which amends SNF LRMP and implements the 2005 Travel Management Rule (36 CFR Part 212). This decision prohibits motor vehicle travel by the public, off designated National Forest Transportation System facilities (roads, motorized trails and areas) except as allowed by permit or other authorization (this prohibition would not apply to snowmobiles).

# Purpose and Need for Action

The objectives for this project are:

- Protect human communities from moderate/high intensity wild fires as well as minimize the spread of wildfires that might originate in urban areas into the forested lands created by unnaturally high levels of fuel ladders and dead and downed fuels.
- Improve resiliency in stands that are currently overstocked and are becoming more susceptible to attack from insects, diseases, drought conditions, and/or wildfire.
- Restore hydrologic function in five meadows that have vertically and laterally unstable stream systems and changed soil moisture conditions has resulted in conifer encroachment beyond the range of natural variability.
- Improve the quality and quantity of culturally significant vegetation which has deteriorated due to the absence of fire as a tool for maintenance and rejuvenation.
- Reduce the potential for undesirable damage from high intensity fire behavior to historical sites which are over grown with dense conifers and high fuels loads. .
- Reduce resource damage caused by user-created vehicle routes in undeveloped recreation sites causing offsite movement of soil into streams and riparian areas that is reducing water quality for downstream users.
- Improve forest health conditions in developed recreation sites which are in a distressed state with mortality occurring and threatening public safety.
- Improve the integrity and characteristics that make cultural resources eligible for the NRHP by reducing fuels within cultural resource sites through hand thinning and piling with follow up burning, prescribed under burning, and mechanical treatments in an effort to reduce damage to the sites from the threat of intense forest fires, to decrease the potential for slope failure along railroad grades and stream channels, and to restore setting where setting in a key aspect of a site's integrity.

# Proposed Action

Restoration treatments would:

- ***Treat surface and ladder fuels (live and dead) to modify wildland fire spread and fire intensity levels***. This is proposed to be completed by thinning of pre-commercial (1-10" dbh) and commercial (10"-30" dbh) conifers, mastication and hand- dozer piling/burning of dead and downed fuels. Treatment areas have been initially identified to provide a "strategic" means to modify intensity and rate of spread of wildland fires across the landscape and near communities. This is commonly known as the "SPLAT" (Strategically Placed Area Treatment) strategy. In addition to the SPLATS, other areas would be treated for the specific purpose of constructing and reconstructing a fuelbreak along the west portion of the project, creating defensible fuel profiles near key transportation corridors and within the Defense zones of the Wildland Urban Interface (WUI). Fire suppression capabilities are enhanced by modified fire behavior inside the WUI zones. SPLATS and fuelbreaks also provide a safe and effective area for fire suppression activities to occur.

When needed utilize prescribed fire within treatment areas as a tool to reduce natural and activity-generated fuels through pile burning understory and/or broadcast burning.

- ***Enhance heterogeneity in forest stand structure at both the stand and landscape scale***. This is proposed to be completed using a combination of pre-commercial and commercial thinning of conifers and hand-dozer piling/prescribed burning of fuels. Treatment areas will follow the principles outlined in the PSW-GTR-220, including the removal of overrepresented shade-tolerant conifers in the lower- and mid-level canopy to provide discontinuity in fuels along both horizontal and vertical fuel profiles. Stand densities will be varied based on topography and natural site conditions. Cutting prescriptions will achieve ecological restoration goals of restoring stand structure consistent with an active fire regime.
- ***Reduce densities in overstocked conifer stands*.** This is proposed to be completed by commercially thinning from below (10”-30” dbh) pine, mixed conifer and fir stands and, where needed, precommercial (1-10” dbh) thinning the areas throughout the remainder of the treatment areas. Additional treatments within SPLATs have been proposed where stands are densely stocked and thinning is needed to reduce this inter-tree competition. This proposal reduces stand densities within the lower and mid-canopy layers of the treated stands to sustainable levels enabling stands to better withstand fluctuations in temperature and precipitation, attacks from insects and diseases, and the effects of wildfires by creating sustainable stand densities.
- ***Tie restoration treatment areas and fuel breaks together in strategic locations***. This is proposed to be completed by masticating over stocked conifer stands and brush/ shrub patches.
- ***Prepare sites within failed conifer plantations for conifer reforestation and future release needs***. This is proposed to be completed by hand using planting bars, hodads or mechanical augers. Conifer planting will be done by hand and release treatments will be done with hand tools such as Pulaski’s and McLeod’s.
- ***Reduce natural and activity generated surface fuel loads***. Hand/ machine piling and burning, jackpot, and understory burning. The majority of the burning will occur in the commercial thinning areas and hand thin areas within the project. Six areas within the project boundary will be prescribed burn only treatments.
- ***Treat infestations of noxious weeds***. This is proposed to be completed by prescribe burning and/or manual methods such as hand pulling. Post treatment monitoring will be completed to ensure any new populations are dealt with promptly.
- ***Restore production and enhance vitality of plant material***. This is proposed to be completed by hand thinning and under burning.
- ***Improve the integrity and characteristics that make cultural resources eligible for the NRHP by reducing fuels within cultural resource sites.*** This is proposed to be completed by hand thinning and piling with follow up burning, prescribed under burning, and mechanical treatments in an effort to reduce damage to the sites from the threat of intense forest fires, to decrease the potential for slope failure along railroad grades and stream channels, and to restore setting where setting in a key aspect of a site’s integrity**.** This project proposes to treat approximately100 acres of natural dead and down fuels and vegetation within cultural resources according to the unit prescription within which they are present

- ***Restore degraded meadows***. This is proposed to be completed by reducing encroaching conifers by thinning and pile burning and understory burning along meadow edges and stabilizing areas of accelerated erosion with structures where necessary. The overall goal of meadow restoration is to improve, enhance or completely restore the hydrologic function of degraded meadow systems such that water storage and residence time is maximized, increasing annual water availability to riparian-aquatic systems, wildlife, and livestock.. Restoration of meadows within the project area will address the physical repairs and vegetation treatments, noxious weeds, maintenance levels of designated OHV trails, user defined OHV track impacts, National Forest System (NFS) roads impacts, and improved grazing strategy.
- ***Improve wildlife habitat by restoring key components such as large dbh snags, adequate quantities of coarse woody debris, and by promoting health and vigor of oaks and encouraging growth of larger dbh trees***. This is proposed to be completed by girdling or topping trees for snag creation or using prescribed fire to create pockets of contiguous snags. Methods to achieve the desired level of CWD include falling and leaving trees ≥16"dbh, and recruitment of CWD through prescribed burning activities that will create some snags which will eventually fall over and contribute to CWD levels. Growth and vigor of oaks will be promoted where needed by clearing overtopping conifers. Commercial and precommercial thinning treatments will allow leave trees to increase in growth in both height and diameter.
- ***Restore user defined vehicle tracks and roads not identified as designated trails or roads under the Motorized Travel Management Final Environmental Impact Statement (March 2010) to the natural setting.*** This is proposed to be completed by following established S&G mitigation methods that return these tracks and roads to the natural setting to prevent future vehicular traffic. Restoration would include barricading/blocking vehicle access.
- ***Improve and maintain existing forest transportation routes within the project***. ("Restore degraded facilities" from scoping letter) This is proposed to be completed by replacing plugged or non-functioning culverts, grading of road surfaces to keep offsite soil movement to a minimum, develop and implement an intensive maintenance plan on designated OHV routes, replacing damaged or missing road signs and installing designated OHV trail markers and construct a short section of temporary road (0.25 miles) for treatment area access.
- ***Improve and maintain resources for range management activities***. ("Restore degraded facilities" from scoping letter) This is proposed to be completed by maintenance of stock drives, reconstruction of drift fences and installation of cattle guards.
- ***Reduce conifer stand densities within developed recreation sites for public safety and increased stand resiliency.*** This is proposed to be completed by removing potential hazard trees and thinning to improve stand health.

**Table 1. Summary of proposed action treatments**

| Proposed action Treatments | Units of Measure | |
|---|---|---|
| ***Structural Restoration Treatments*** | | |
| Commercial Thinning | Acres | **1650** |
| Mechanical Fuels and Vegetation Treatments | Acres | **915** |
| Handwork Fuels and Vegetation Treatments | Acres | **124** |
| Mastication Fuels and Vegetation Treatments | Acres | **318** |
| Fuel Break Construction and Reconstruction | Acres | **325** |
| Reforestation | Acres | **50** |
| Meadow Restoration (Conifer Removal) | Acres | **13** |
| Meadow Restoration (WIN) (Watershed Improvement Need Site Work) | Acres | **36** |
| Developed Recreation Sites (Hazard Tree and Thinning) | Acres | **31** |
| Cultural /Historical Site Restoration | Acres | **100** |
| Noxious Weed Management | Acres | **10** |
| Wildlife Habitat Restoration | Acres | **3607**[2] |
| | | |
| Range Maintenance (Stock Drive) | Miles | **7.6** |
| Road Maintenance | Miles | **56** |
| Road Reconstruction | Miles | **20.3** |
| Temporary Road construction | Miles | **0.25** |
| Designated OHV Trail maintenance | Miles | **5.5** |
| User Defined Vehicle Trail Reclamation | Miles | **0.42** |
| Measure or Effect | Units of Measure | ***Alternative 2*** *Proposed action* |
| ***Process Restoration Treatments*** | | |
| Prescribed Fire (Initial Entry) | Acres | **460** |
| Prescribed Fire (After structural restoration treatments have been completed) | Acres | **1833** |
| Total Process Restoration | Acres | **2292** |

[2] Acres of wildlife habitat would be improved through) 1. Reducing the risk of uncharacteristically severe wildfires; And 2. Promoting stand heterogeneity of forest vegetation, thereby making it more resilient to natural disturbances, and enhancing native wildlife species habitat and diversity.
Units of measure for proposed treatments are approximate.

# Decision Framework

Given the purpose and need, the deciding official will review the proposed action, other alternatives, and their environmental consequences, in order to determine whether to implement the proposed action as described, select a different alternative or take no action at this time.

# Forest Plan Direction

The proposed action and alternatives are guided by the SNF-LRMP. The SNF is subdivided into land allocations (management areas) with established desired conditions and associated management direction (Standards and Guidelines). All applicable standards and guidelines for the allocations would be adhered to. In addition a portion of the standards and guidelines are incorporated as design criteria where there are project-specific requirements (see Chapter 2, Design Criteria Common to All Alternatives). Land allocations that are found within the Greys Mountain Project boundary are shown on either individual maps for the specific land allocation or on the Land Allocations-Map 4. These maps are in the Map Package in Appendix A and include:

**Wildland Urban Interface/Intermix (both Defense and Threat Zones)**. This land allocation encompasses 4487 acres within the Greys Mountain Project boundary and is set in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. Of this acreage; 389 acres are designated as Defense Zone[3] and 4090 acres are designated as Threat Zone[4]. There were no local site-specific adjustments made to these boundaries as allowed by SNFPA ROD (USDA-FS 2004b) and are the zones mapped in the SNFPA FSEIS 2004. Totals may not add exactly add up due to rounding errors.

**California Spotted Owl Protected Activity Centers (PACs) and Home Range Core Areas (HRCA)**. This land allocation encompasses 3038 acres of the project area as suitable nesting habitat and nearly the entire Greys Mountain Project area is suitable foraging habitat. There are five PACs and nine associated HRCAs either entirely or partially within the project boundaries. The SNF-LRMP, as amended sets forth standards and guidelines for this land allocation that address mechanical treatments conducted to meet fuels management objectives in PACs located in the WUI defense zones and in threat zones where prescribed fire is not feasible and where avoiding PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy (USDA-FS 2004b, pgs. 59-61).

**Northern Goshawk PAC**. This land allocation encompasses 338 acres of suitable nesting habitat within two PAC's and nearly the entire Greys Mountain Project area is suitable foraging habitat. The SNF-LRMP, as amended sets forth standards and guidelines for this land allocation which are similar to those for California spotted owl PACs (USDA-FS 2004b, pgs. 59-61).

**Fisher Conservation Area.** This land allocation is designated in approximately 9600 acres within the Greys Mountain Project boundary. The standards and guidelines associated with this land allocation are as follows. Design measures to protect important habitat structures as identified by the wildlife biologist. Use mechanical treatments when

[3] Defense Zones designated in the project extend ¼ mile from private property lines.
[4] Threat Zones designated in this project extend 1 ¼ miles out from the Defense Zone boundary.

appropriate to minimize effects on preferred fisher habitat elements. (USDA-FS 2004b, pgs. 61 & 62).

**Riparian Conservation Areas (RCA)**. This land allocation encompasses the entire Greys Mountain Project boundary because of the extensive stream network within the project boundary.

# Public Involvement

A Notice of Intent (NOI) to prepare an Environmental Impact Statement for the Greys Mountain Project was published in the Federal Register on July 15, 2011. The notice asked that comments on the proposed action be received no later than 30 days after the publication date. The scoping letter was sent on June 6, 2011 to residents within 1.5 mile radius of the project area, to members and groups in the Native American community and to publics expressing interest in the project. The project was also listed in the SNF Schedule of Proposed Actions. On June 25, 2011 the Forest Service held a public field trip to the project area. The scoping letter included an invitation to participate in the field trip and a news release announcing the public meeting was sent to the Sierra Star (local newspaper) on June 17, 2011. The public field trip was attended by one individual from the local community.

There were four respondents, all of whom raised concerns and issues regarding the proposed project. All of the responses are in the project record on file at the Bass Lake Ranger Station.

Using the comments from the public, the interdisciplinary team developed a list of issues to address. A portion of these comments led to the development of Alternative 3.

# Issues

Comments from the public and other agencies were used to formulate issues concerning the proposed action. There were no comments received from members or groups from the Native American community. The Forest Service separated the issues into two groups: significant and non-significant. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons why they were found non-significant may be found in the project record located at Bass Lake Ranger Station in North Fork, California.

The Forest Service identified the following significant issues during scoping:

1. *Improper use of prescribed fire may put homes at risk.*

   Forest Service Response: Forest personnel are required to follow a suite of prescriptive measures to make sure prescribed fires do not put homes at risk. A summary of the fuels analysis and risk to communities can be found in Chapter 3, Fire/Fuels section of this document.

2. *Allow for opportunity of intense fire effects on the landscape*.
   Forest Service Response: Both action alternatives allow some areas of intense fire effects. A summary of the fuels analysis and potential for active crown fire can be found in Chapter 3, Fire/Fuels section of this document.

3. *Use fire as a treatment method on a greater scale rather than timber removal*.
   Forest Service Response: Current fire suppression policy under the National Fire Plan allows for wildfires on national forests to be managed for the most efficient and effective use of suppression resources.

4. *Removal of trees over 10" dbh is unnecessary for reducing potential for high intensity fire.*
   Forest Service Response: Both action alternatives respond to this issue. A summary of the fuels analysis and potential for active crown fire can be found in Chapter 3, Fire/Fuels section of this document.

5. *Removal of trees up to 30" dbh is unnecessary for fire/fuels management and for reducing fire severity.*
   Forest Service Response: Alternative 3 responds to this issue. See the Alternative 3 description in Chapter 2 of this document.

# Chapter 2. Alternatives, Including the Proposed Action

## Introduction

This chapter describes and compares the alternatives considered to meet the purpose and need of the Greys Mountain Project. It describes a no action alternative and two action alternatives in detail as well as those eliminated from detailed study. The end of this chapter presents the alternatives in tabular format so that the alternatives and their environmental impacts can be readily compared.

## Alternatives Considered in Detail

The Forest Service is required to analyze a no action alternative. The proposed action and two additional alternatives were considered in detail. These included the no action alternative, and a Lower and Mid-Level Canopy Treatment alternative (the non-commercial funding alternative), which focused on limiting the quantity of material removed to just that needed to meet fire and fuels objectives in all treatment areas. This alternative was developed to address, in part, the key issue #4 which was that removal of trees larger than 10 inches dbh would not reduce high intensity fires as in the proposed action.

An adaptive management study known as Sierra Nevada Adaptive Management Study (SNAMP), which studies Pacific fisher, focuses on an area directly west of the Greys Mountain Project. As the Greys Mountain Project falls within the Pacific fisher habitat zone, knowledge gained by the SNAMP project was utilized in the design of the Greys Mountain Project. Information used in developing the project alternatives includes: current movement patterns and 2008 through 2011 denning sites (both birthing and maternal) of Pacific fisher that have been radio collared and intensively monitored within and outside of the project area, and information about what type of habitat conditions are preferred by denning females. Protection measures in light of this new information were incorporated into the design measures for both action alternatives.

Alternatives would adhere to the suite of standards and guidelines to selectively maintain and develop these habitats of large coniferous trees, hardwoods, overstory canopy gaps, tree group retention areas, understory vegetation retention areas, and conifers with structural defects in accordance with the LRMP as amended. Adherence to the required standards and guidelines would help ensure that the native wildlife populations would be sustained over the long-term, while also meeting other forest management goals and mandates, such as fuels management, forest health, and commodity production.

### Tree Removal Methods

Under both action alternatives, implementation of thinning strategies would be accomplished using mechanical and hand treatments to remove excess fuels, reduce stand densities, and restore large tree dominance, species composition and heterogeneity. These treatments consist of:

1. Commercial thin consists of two methods of commercial tree removal are envisioned in the alternatives. Commercial tree harvest is envisioned within the project area. This method involves manual tree felling followed by skidding the logs to the landing. With this method limbs

and tops are removed in the woods and left. Mechanical tree removal uses harvesting machines to remove commercial-size trees greater than 10 inches dbh. Once felled whole trees are skidded to the landing where they are limbed and topped via a de-limbing machine. The residual limbs and tops remaining are piled and either burned or potentially available for biomass removal if circumstances allow. Commercial-size trees are hauled to a process mill and converted to lumber and generate revenue, while small biomass material is hauled to an electrical generation plant. Biomass removal requires appropriated funds. Harvest of commercial-size trees is done using ground based vehicles with rubber tires or tracks. These vehicles are often called skidders and are equipped with grapples or cables to transport trees or logs to a landing. Tractor logging occurs in areas with road systems and slopes that are consistently less than 35 percent slope. Some small areas over 35 percent slopes are also treated in this manner.

2. Pre-commercial thin of smaller sized trees less than 10 inches dbh for density management and fuel ladder reduction needs. These thinnings will be completed by hand with chainsaws and mechanically by mastication. Fuels created by these operations will be piled and burned and or underburned with prescribed fire.

3. Mechanical mastication (shredding) of biomass and fuels is typically accomplished by a mastication cutting head mounted on an articulating arm on a track-laying, low ground pressure vehicle. The cutting head chops the vegetation to a height of approximately 1-2 inches above ground height. The equipment is able to treat vegetation on slopes up to 55 percent while having little ground impact. The debris is left on the ground where it rapidly decomposes and provides erosion protection while it is decomposing, or it is burned after it has dried out.

4. Hand cutting (also called pre-commercial thinning) involves the felling of unwanted trees, either with a chain saw or a machine feller, for burning in place or in preparation for piling.

5. Mechanical (tractor) piling of fuels for prescribed burning involves using heavy equipment to scrape slash and other debris into piles for burning.

6. Lop and Scatter involves cutting the limbs from felled trees and scattering them in the general area where the trees were cut to allow the nutrients from the branches to be returned to the soil.

## Fuel Treatment Methods

Upon completion of the tree removal work FS personnel would apply prescribed fire to the area by using either pile burning or understory burning of pretreated stands to reduce activity-created slash and natural downed woody fuels. RX 1, 2, 3, 4, 5, 6, 7, 15, 22, 23 and 24 are designated for only understory burning as a treatment. Acres of prescribed fire are located in Table 1. Initial fuels treatments (first entry of understory burning and the pile burning) would be completed after treatment on each unit, but the units may be treated in different years. Treatment areas planned for understory burning would have multiple entries but in the post harvest burn areas, only 1 entry is planned for in the time span of this NEPA document. Any further burning in these areas would require analysis in another NEPA document. In the understory burning area alone, two to three entries over the first 15 – 20 years of the project may be necessary to reach and maintain the desired condition. In the post harvest burning areas understory burning would be accomplished at least once every ten years to reach and maintain desired conditions. Understory burning in untreated natural stands as well as treated stands are proposed for the two action alternatives. Reductions in hazardous fuels and the resulting fire behavior and severity would be consistent with the goals and objectives of the SNFPA (USDA-FS, 2004).

Fuel reduction treatments are used to lower the volume of flammable brush and slash across all emphasis areas. Prescribed burning occurs both in conjunction with tree removal and without

tree removal. Actual protection levels would depend on how fast the brush and trees grow back following the fuel treatment or any subsequent site preparation treatments. Proposed fuels reduction would involve using prescribed fire in specific areas throughout the project area, thinning of some overstocked plantations, emphasis area treatments, and thinning from below. 'Thinning from below" refers to the removal of subordinate and intermediate trees to reduce ladder fuels and reduce the competition for resources like sunlight and water. The following techniques would be used:

1. Understory burning: is a prescribed burn under an existing canopy of trees (hardwood or softwood), designed to reduce live and dead vegetation. This type of burning is completed in the fall or spring when fuel moistures are low enough to carry fire and still be within prescription parameters. Understory burning differs from broadcast burning as it has cooler temperatures to protect overstory vegetation. Permission to burn is granted by the San Joaquin Valley Air Pollution Control District (SJVAPCD).

2. Pile Burning: involves burning piles created by hand labor or tractors. Usually kraft paper is used to protect an ignition point so piles can be burned in more cold and wet weather conditions. Pile burning is known to be of a higher intensity than broadcast burning and; therefore produces less particulate matter. Permission to burn is granted by the SJVAPCD.

3. Fire line: involves construction of areas that create a break in fuels used to control fire. Areas are scraped to mineral soil removing all organic material. The width of fire line varies from 2 feet around hand piles to 6 feet around tractor piles. Fire lines are used to contain fuel-burning treatments (understory burns, pile burns, jackpot burns, and broadcast burns) when natural barriers to fire are lacking. Fire lines are usually located on topographic features that make control operations easier for onsite personnel. These are usually ridgetops and drainage bottoms with flowing water.

## Alternative 1 – No Action

Under the no action alternative, current management plans would continue to guide management of the project area. No restoration treatments would be implemented.

## Alternative 2 –Proposed Action

### How this Alternative was developed

Alternative 2 is a series of treatments that were developed over several years by a SNF interdisciplinary team with input in an attempt to restructure the forest and restore it to a resilient condition while minimizing adverse impacts to resources in the project area that could result from drought stress, insect infestation, and wildfire. The alternative was developed to meet certain landscape objectives including:

1) Enhancement of shade intolerant (sun loving) trees with uneven-aged thinning

2) Meeting habitat needs of sensitive species

3) Reintroduction of fire to mimic historic forest structures

One of the resultant adaptive management studies known as Sierra Nevada Adaptive Management Study (SNAMP) focuses on an area directly west of the Greys Mountain Project. As the Greys Mountain Project falls within the Pacific fisher habitat zone, knowledge gained by the SNAMP project and utilized in the design of the Greys Mountain Project include; current movement patterns and 2008/2009/2010/2011 denning sites (both birthing and maternal) of

Pacific fisher that have been radio collared and intensively monitored within and outside of the project area, and information about what type of habitat conditions are preferred by denning females.

## Alternative Description

Of the 9600 total acres within the project boundary, approximately 3575 acres were analyzed as areas where some form(s) of treatment are proposed (treatment areas). The remaining 6140 acres have no treatments proposed due to slopes greater than 35 percent, standard and guideline limitations on treatment and/or no treatment is needed to meet the purpose and need.

In Alternative 2 (proposed action) the treatments would include:

- Commercially thin 10 – 30 inch dbh mixed conifer, pine, and white fir stands on approximately **1,650** acres (*treats surface and ladder fuels, enhances heterogeneity in forest stand structure and reduces conifer stand density as described in Chapter 1 Proposed Action)*;
- Mechanically treat fuels and overstocked vegetation outside of commercially thinned stands on approximately **915** acres *(treats surface and ladder fuels, enhances heterogeneity in forest stand structure and reduces conifer stand density as described in Chapter 1 Proposed Action )*;
- Pre-commercially thin by masticating approximately **318** acres of conifer stands *(treats surface and ladder fuels, enhances heterogeneity in forest stand structure, reduces conifer stand density, ties restoration treatment areas and fuel breaks together, as described in Chapter 1 Proposed Action)*;
- Plant and hand release treated openings within commercial thin and mastication treatment areas on up to **50** acres *(prepare sites within failed plantations for reforestation and release needs as described in Chapter 1 Proposed Action)*
- Treat slash concentrations within commercially thinned stands by a combination of tractor or hand piling and burning or mastication *(enhances heterogeneity in forest stand structure, reduces natural and activity generated surface fuel loads, ties restoration treatment areas and fuel breaks together, as described in Chapter 1 Proposed Action)*;
- Prescribe underburn on up to approximately **460** acres within 11 stands (prescribed fire only treatment) *(enhances heterogeneity in forest stand structure, ties restoration treatment areas and fuel breaks together, restore production and enhance vitality of plant material as described in Chapter 1 Proposed Action)*;
- Prescribe underburn within treatment areas H 2, 3 and 4, and T 1,2, 4, 5, 8, 9, 10, , 16, 17, 21, 26, 30, 31, 32, 33, 35, 38 and 39 on approximately **1833** acres *(enhances heterogeneity in forest stand structure, ties restoration treatment areas and fuel breaks together, restore production and enhance vitality of plant material as described in Chapter 1 Proposed Action)*;
- Construct and reconstruct three existing fuelbreaks on approximately **325** acres(*treat surface and ladder fuels to modify wildland fire spread and fire intensity levels, ties restoration treatment areas and fuel breaks together, restore production and enhance vitality of plant material as described in Chapter 1 Proposed Action)*
- Improve and restore native plant communities important to local Native American tribes for traditional uses. This will be accomplished within the areas that are planned for

prescribed burning and will be completed by using prescribed burning and hand pruning with tools *(restore production and enhance vitality of plant material as described in Chapter 1 Proposed Action)*

- Reduce fuel loading and fuel ladders from encroaching conifers within prehistoric and historic sites by thinning and prescribed burning on approximately **100** acres *(improves the integrity that make cultural resources eligible for the NRHP as described in Chapter 1 Proposed Action)*;
- Restore degraded meadows by reducing encroaching conifers on approximately **13** acres *(restores degraded meadows as described in Chapter 1 Proposed Action)*;
- Restore hydrologic function through meadow stabilization on approximately **36** acres *(restores degraded meadows as described in Chapter 1 Proposed Action)*;
- Manually pull and/or prescribed burn of noxious weed patches on approximately **10** acres *(treats infestations of noxious weeds as described in Chapter 1 Proposed Action)*;
- Perform range stock drive maintenance by cutting out encroaching conifers and clearing stock drive tread over approximately **7.6** miles *(improves and maintains resources for range management activities as described in Chapter 1 Proposed Action* ;
- Perform maintenance on approximately **56** miles of forest system roads *(improves and maintains existing forest transportation routes as described in Chapter 1 Proposed Action)*;
- Perform reconstruction on approximately **20.3** miles of forest system roads *(improves and maintains existing forest transportation routes as described in Chapter 1 Proposed Action)*;
- Construct **0.25** miles of temporary road *(Improve and maintain existing forest transportation routes within the project as described in Chapter 1 Proposed Action)*
- Restore approximately **0.42** miles of user defined OHV tracks (*restores user defined vehicle tracks and roads as described in Chapter 1 Proposed Action)* ;
- Perform annual trail maintenance on **5.5** miles of designated OHV trails. *(improve and maintain existing forest transportation routes within the project as described in Chapter 1 Proposed Action)*

More detail on these actions can be found in Chapter 1 Proposed Action (6).

## Meadow Restoration Plans

This section outlines each meadow restoration plan in the project area. Table 2 can be referenced for meadow/WIN site location; however this Chapter also includes a site map showing the location of each WIN site, rock cache location, and potential ingress route into the meadow. Ten meadows have been selected for restoration within the project area. (Table 2) These meadows were identified as having multiple restoration needs, which include the physical repair of Watershed Improvement Need (WIN) sites, removal of encroaching conifers, and management related issues such as Off-Highway Vehicle (OHV) and/or road impacts.

**Table 2. Meadows and WIN sites identified for restoration within the project area (ND = no quantified measurement of encroachment).**

| WIN Site | Meadow Number/Name | Identified as top five in Conifer Encroachment Study? | Acres of Encroachment | Total Acres of Structural Meadow Restoration |
|---|---|---|---|---|
| 51295 | 503M7 | Yes | 2.5 | 3.0 |
| 51104 | 503M8 | No | 3.5 | 3.5 |
| 51038 | 504M132/Meserv Meadow | Yes | 0.5 | 0.0 |
| 51246 | 504M198/Railroad Meadow | No | 2.4 | 3.5 |
| 51244 | 504M208 | No | 0.1 | 0.3 |
| 51036 | 504M209/Poison Meadow | No | 0.86 | 7.5 |
| 51037 | 504M211 | Yes | 0.0 | 3.3 |
| None | 504M212 | Yes | 0.75 | 0.0 |
| 51241 | 504M220/Chipmunk Meadow | No | ND | 3.6 |
| 51245/51015 | 504M292/504M293 | Yes | 1.25 | 5.3 |
| | | **Totals** | **11.86** | **30.0** |

### Vegetation Treatments

Physically degraded meadows (i.e., meadows suffering from excessive gully erosion) will often have lowered ground water tables, which in turn can lead to accelerated conifer encroachment outside the range of natural variability. This phenomenon may also be related to or have been exacerbated by fire suppression over the last several decades. As the density of encroaching conifers increases, so will the rate of evapotranspiration, which will continue to lower the ground water table and encourage even more conifer encroachment. To stop this cycle and allow for ground water recovery and more water availability, removal of conifers that are encroaching within the meadow should be done before or during other restoration activities. Thus it is proposed that conifers up to 12” dbh be removed from the meadows to help reduce the depletion of ground water. Select cedar and/or fir trees within the project meadow (>12” dbh) may be girdled for snag creation if the area is deemed snag deficient.

An internal Forest Service study of conifer encroachment was conducted for the project area (Gallegos, personal communication, 2011). Five meadows were identified as having significant encroachment since the late 1940’s (Table 2), and additional acreage estimates of encroachment were made for the other meadows. It is proposed that a total of approximately 12 acres of encroaching conifer be removed from the selected meadows (no other woody vegetation is recommended for removal). These treatments are consistent with the Sierra Forest Plan Amendment, Riparian Conservation Objects, Standard and Guide 105 (USDA, 2004).

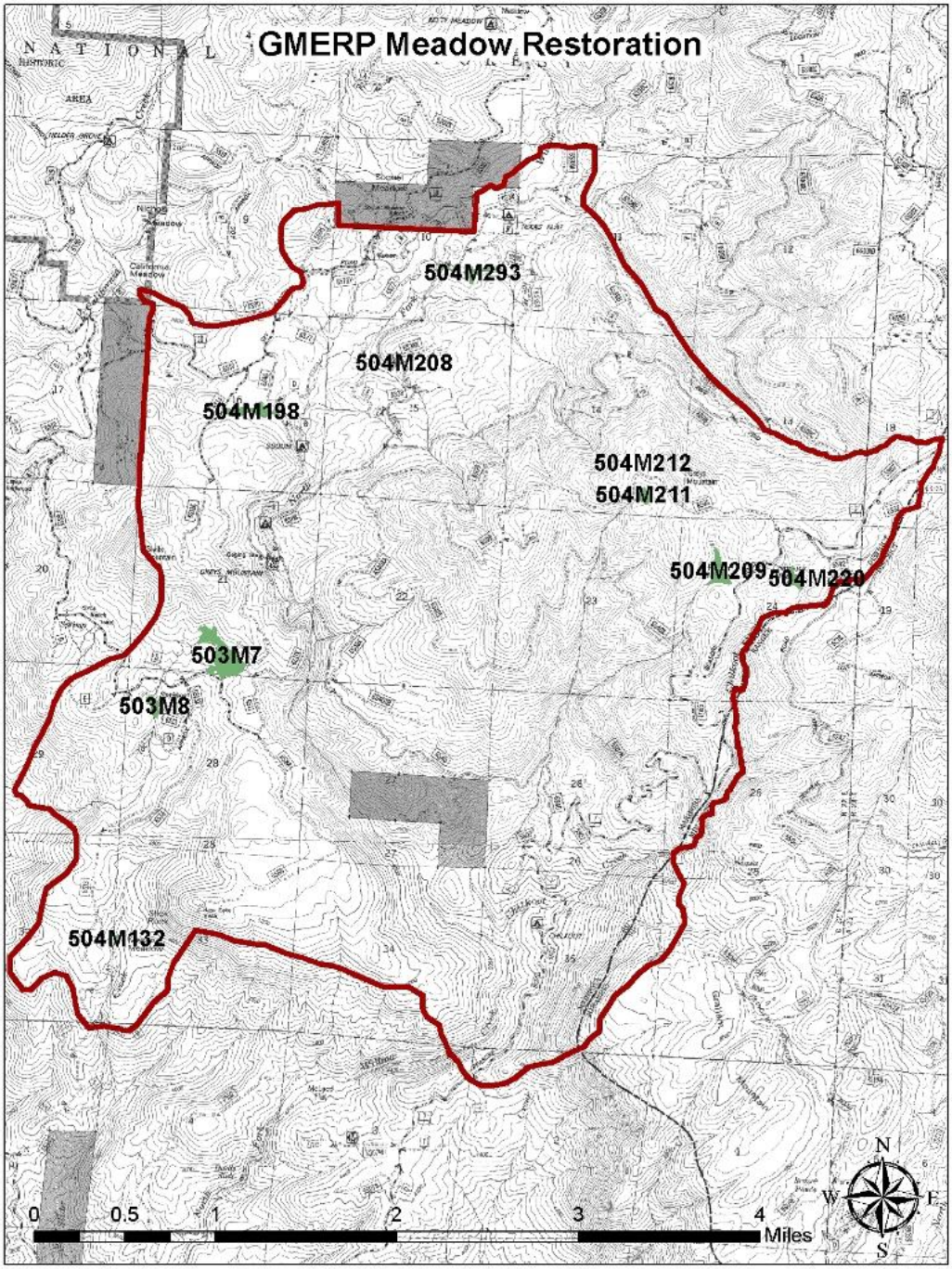



**Figure 1. Locations of meadow restoration sites within the Greys Mountain ERP (note: Meadows 504M292 and 293 have been combined into one site).**

**Conifer Removal**

Conifers will be removed by lop-and-scatter or chain saw within each meadow. Trees <6 feet tall will be lopped, scattered and left in place. Trees >6 feet tall will be bucked in place and the slash left to dry for a minimum of six weeks and then piled and burned. No mechanical treatment will occur. If applicable, 4" to 10" dbh trees will be cut into eight foot lengths and moved by hand with log carriers to the edge of the meadow where they will be cached for later use in restoration structures (see Log-and-Fabric Steps Falls under restoration methodology, (Appendix C). If no conifers are to be used for restoration purposes, they will be (depending on size) lopped and scattered, bucked in place, or bucked and moved to the meadow edge and left as biomass.

## Restoration methodology

Physical restoration designs are detailed in Appendix C. The restoration methods and designs will address essentially three types of erosional feature:

- Vertical instabilities (knick points and headcuts)
- Lateral instabilities (channel banks)
- Incised channels and/or straightened channels

Any or all of these erosional features may be present, and there are a variety of restoration designs that can be adapted or combined to each depending on factors of accessibility, environmental sensitivity, and cost. In some cases, rock will be conveyed by means of power wheel barrow, SWECO trail dozer, excavator or loader into and out of the meadows. Since there is a potential for ground disturbance, slash (from the vegetation treatments), ply wood, and/or ½" polyethylene mats will be placed along the ingress-egress routes to mitigate these impacts.

To successfully design any restoration structure, reference reach data (e.g., Rosgen level II analysis) must be collected on streams within the watershed or a watershed in the same hydro physiographic province. As such, reference reach surveys will be conducted prior to implementation. The surveys are done by hand and have no associated ground-disturbing activities.

### WIN 51015 (504M292/293)

Headcuts and knick points would be repaired by installing rock step pool structures (Appendix C). Minimal ground clearing and brushing would be done for small tractor or power wheelbarrow access. Rock caches would be located off of FS Road 6S36, and 6S38 for each of the two large headcuts (Figure 2). Split rail fencing along FS Road 6S36 would be installed to discourage OHV use in meadow. The east end of the meadow has very high conifer encroachment (approximately 1.25 acres). Physical restoration and/or stabilization efforts will restore/preserve approximately 5 acres of this meadow (Table 2).

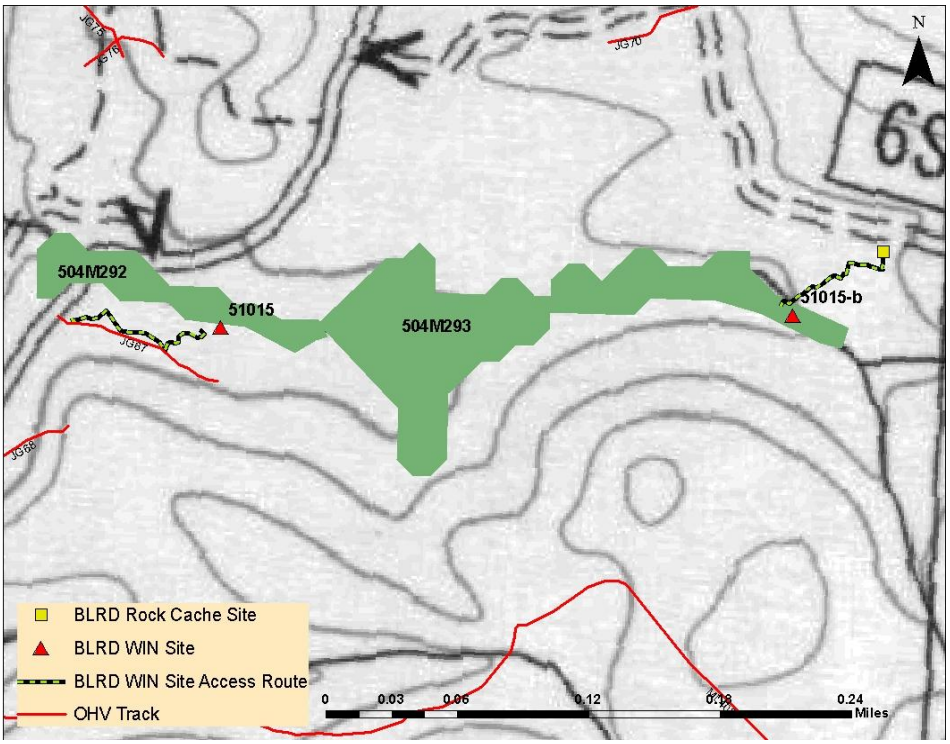



**Figure 2. Map of WIN 51015 in meadow 504M292 and 504M293; red triangles denote main WIN features.**

## WIN 51036 (Poison Meadow 504M209)

Reconstruction and repair of existing structures would be done. A rock cache would be located in a very large turnout on Beasore road just south of the meadow. Minimal brushing and ground clearing would be done to allow access. There is a medium level of conifer encroachment in the northern portion of meadow approximately 0.86 acres (11%). Some split rail fencing and signage would be needed along track ML91 to discourage OHV use of the meadow. Physical restoration and/or stabilization efforts will restore/preserve approximately 7.5 acres of this meadow (Table 2).

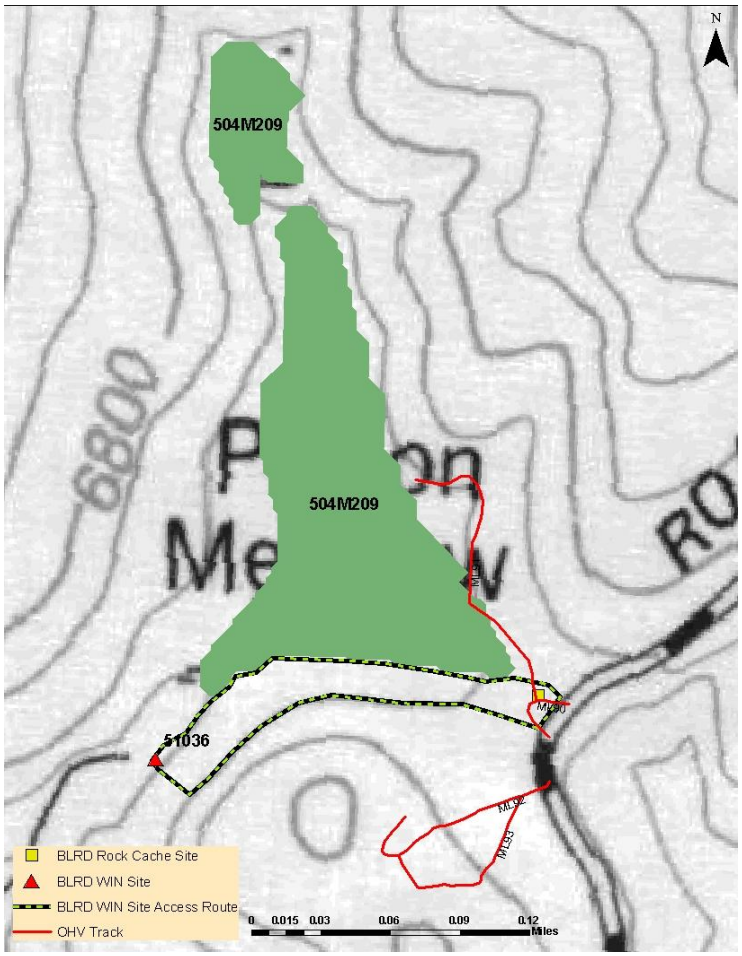



**Figure 3. Map of WIN 51036 in Poison Meadow (meadow 504M209); red triangle denotes main WIN features.**

## WIN 51037 (504M211/212)

Rock step pools would be built to address the two headcuts (P 315). Local rock could be used, or a rock cache could be located along FS Road 6S99 with easy access to the toe of the meadow. Meadow 504M212 is located 0.1 miles north of meadow 504M211. There are no WIN sites identified in this meadow (thus no physical restoration is planned), but there has been 0.75 acres of conifer encroachment identified through satellite and aerial photo review. Physical restoration and/or stabilization efforts will restore/preserve approximately 3 acres of meadow 504M211 (Table 2).

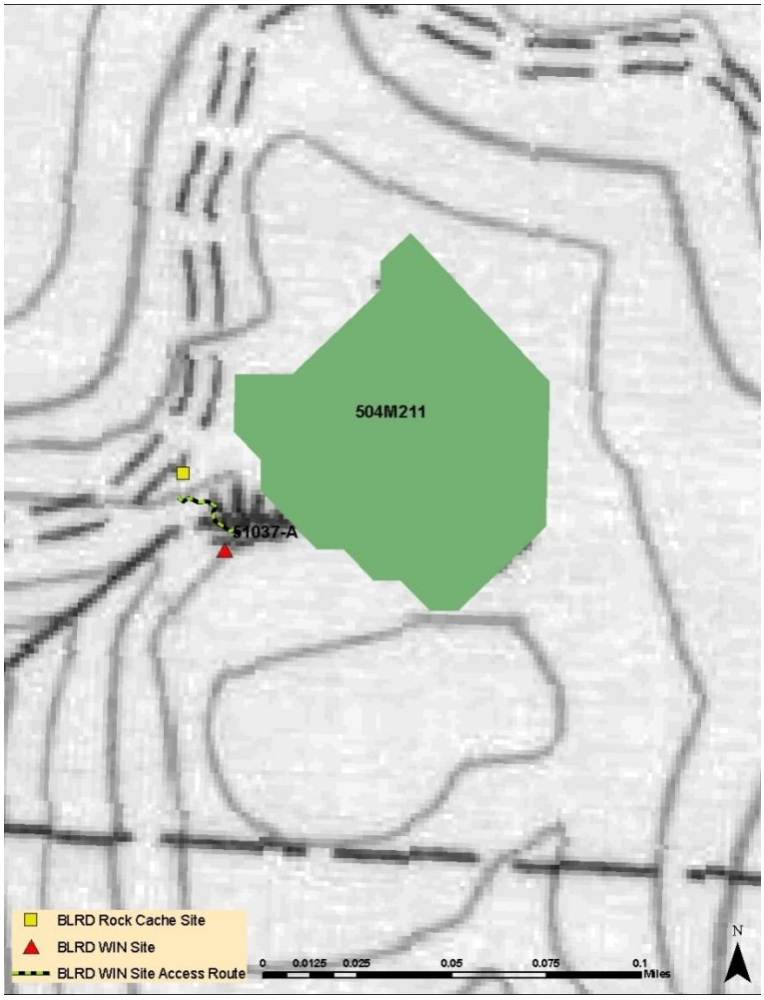



**Figure 4. Map of WIN 51037 in meadow 504M211; red triangles denote main WIN features.**

## WIN 51038 (504M132)

Physical stabilization of this feature is not recommended at this time, but the structure should be monitored annually. The meadow was part of a historic ranch site and has many apple trees still in evidence. Additionally, the soil moisture conditions seem to have promoted the development of alder and willow trees throughout the meadow. There is some conifer encroachment by shade tolerant cedars and some small ponderosa saplings. There is an estimated 0.5 acres of encroachment. It is recommended that the existing conifers (up to 12” dbh) be removed, but no other woody vegetation is proposed for removal.

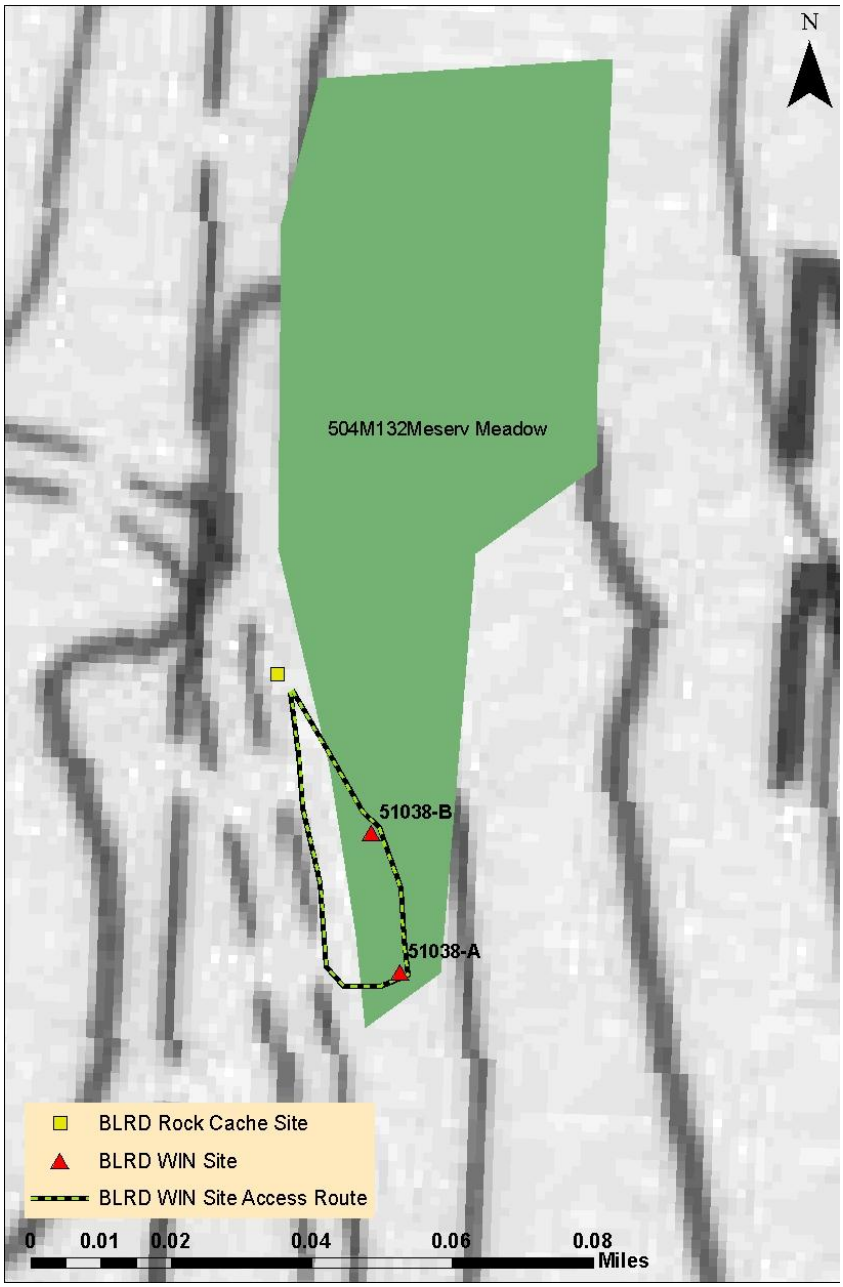



**Figure 5. Map of WIN 51038 in Meserve meadow (meadow 504M132); red triangles denote main WIN features.**

## WIN 51104 (Progeny Meadow 503M8)

Large ruts in southeast portion meadow from 4x4 truck use would be repaired. Primary access route is west of the meadow along a closed road/skid trail; this trail would be used to repair existing rock structures, and transport rock and equipment in to each headcut. The cache and access routes on the east side of the meadow are primarily to be used for the repair of the deep ruts in the meadow. Conifer encroachment is high throughout meadow (approximately 3.5 acres).

Split rail fencing would be put up along FS Road 6S13 to discourage further degradation due to OHV use. Rock step pool structures would be built to stop headward erosion of the headcuts (Appendix C). Sand, native soil and local sod may be used to fill OHV ruts. Physical restoration and/or stabilization efforts will restore/preserve approximately 3.5 acres of this meadow (Table 2).

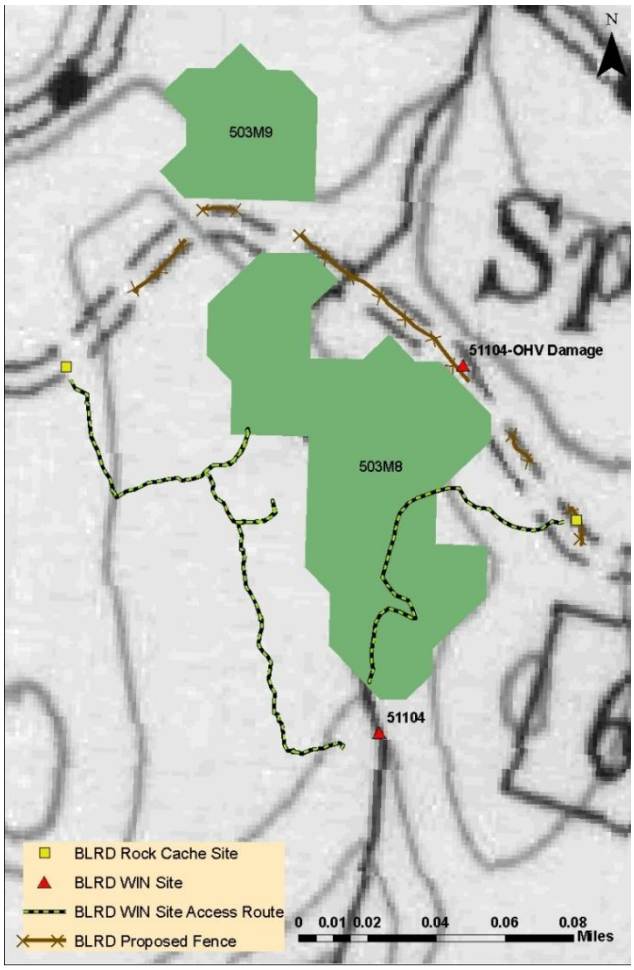



**Figure 6. Map of WIN 51104 in Progeny meadow (Meadow 503M8); red triangles denote WIN features.**

## WIN 51241 (Chipmunk Meadow 504M220)

A trail would be built through manzanita and buckbrush between the meadow and Beasore road to allow access for power wheelbarrows or a small tractor. The most topographically suitable area for the trail has been depicted on the map (Figure 7). Due to the small dimension of the headcut, local rock would be used to create a step pool or a log step fall structure using trees from the surrounding area would be built. Physical restoration and/or stabilization efforts will restore/preserve approximately 3.6 acres of this meadow (Table 2).

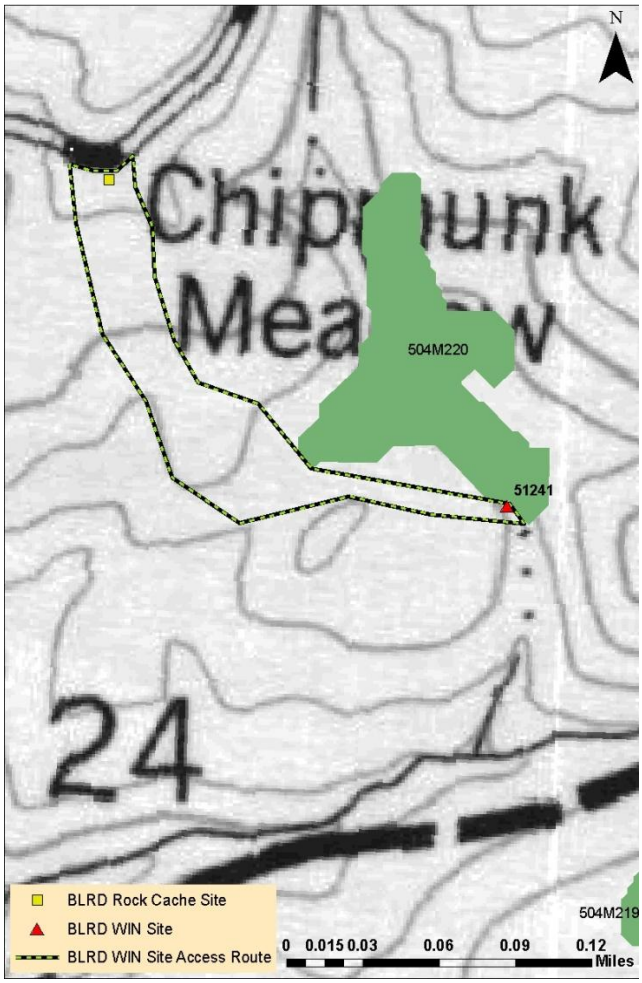



**Figure 7. Map of WIN 51241 in Chipmunk meadow (Meadow 504M220); red triangle denotes main WIN feature.**

### WIN 51244 (504M208)

Access is easy from 6S38, and a rock cache would be located at the junction of 6S38 and 6S38X. Split rail fencing would be constructed along FS Road 6S38 to discourage OHV use in meadow. Rock step pools and rock rundowns would be constructed (Appendix 3). Physical restoration and/or stabilization efforts will restore/preserve approximately 0.3 acres of this meadow (Table 2).

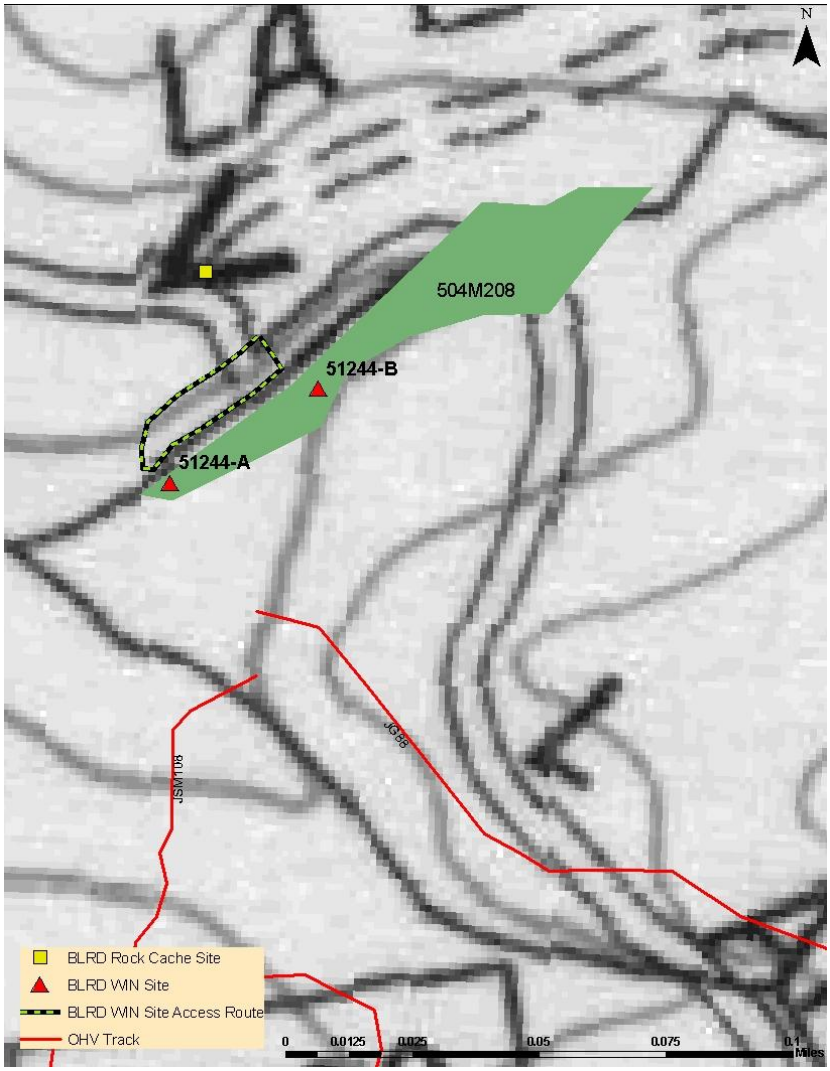



**Figure 8. Map of WIN 51244 in meadow 504M208; red triangles denote main WIN features.**

## WIN 51246 (Railroad Meadow 504M198)

Barriers would be installed to prevent access to the meadow.

An existing breach in the railroad bed would be widened by several feet to lessen the impact from livestock trailing and allow overland flow to move from the west to east end of the meadow during high flow. Conifer encroachment is very high in the west end of the meadow near 6S11 (head of meadow) at approximately 2.4 acres (~50%). Physical restoration and/or stabilization efforts will restore/preserve approximately 3.5 acres of this meadow (Table 2).

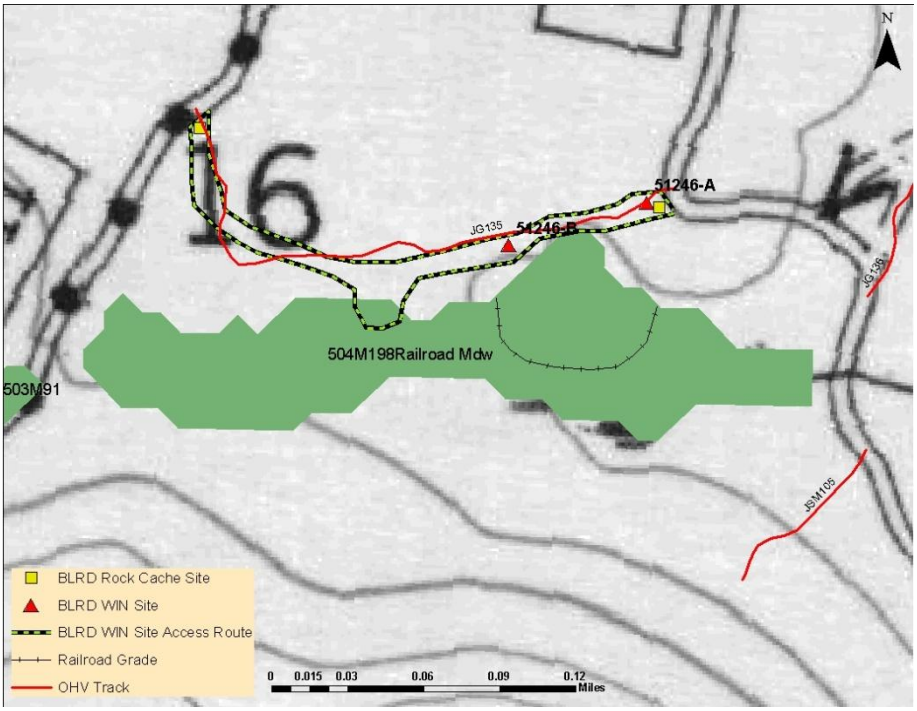



**Figure 9. Map of WIN 51246 in Railroad meadow (Meadow 504M198); red triangles denote WIN features.**

## WIN 51295 (503M7)

User created tracks will be barricaded and signage installed on both ends of the trail to prevent OHV access the track will be sub soiled to decompact the soils and allow regeneration of native vegetation Adequate water bars would be constructed to prevent surface erosion. Downed trees and slash along the track alignment that will be cut during the conifer encroachment treatment project would be distributed.

Conifer encroachment is very high in small pockets of the lower SE and upper NW ends of the meadow (approximately 2.5 acres). Physical restoration and/or stabilization efforts will restore/preserve approximately 3.0 acres of the true meadow segments (Table 2).

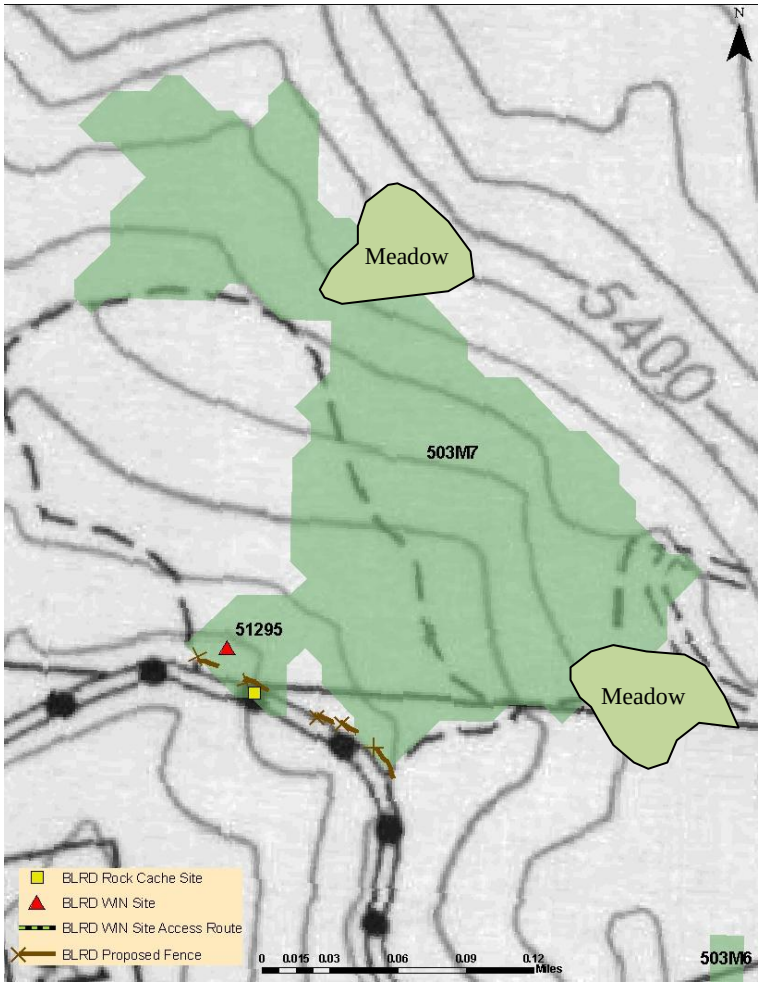



**Figure 10. Map of WIN 51295 in meadow 504M7; red triangles denote main WIN features; darker green polygons represent the true meadow components.**

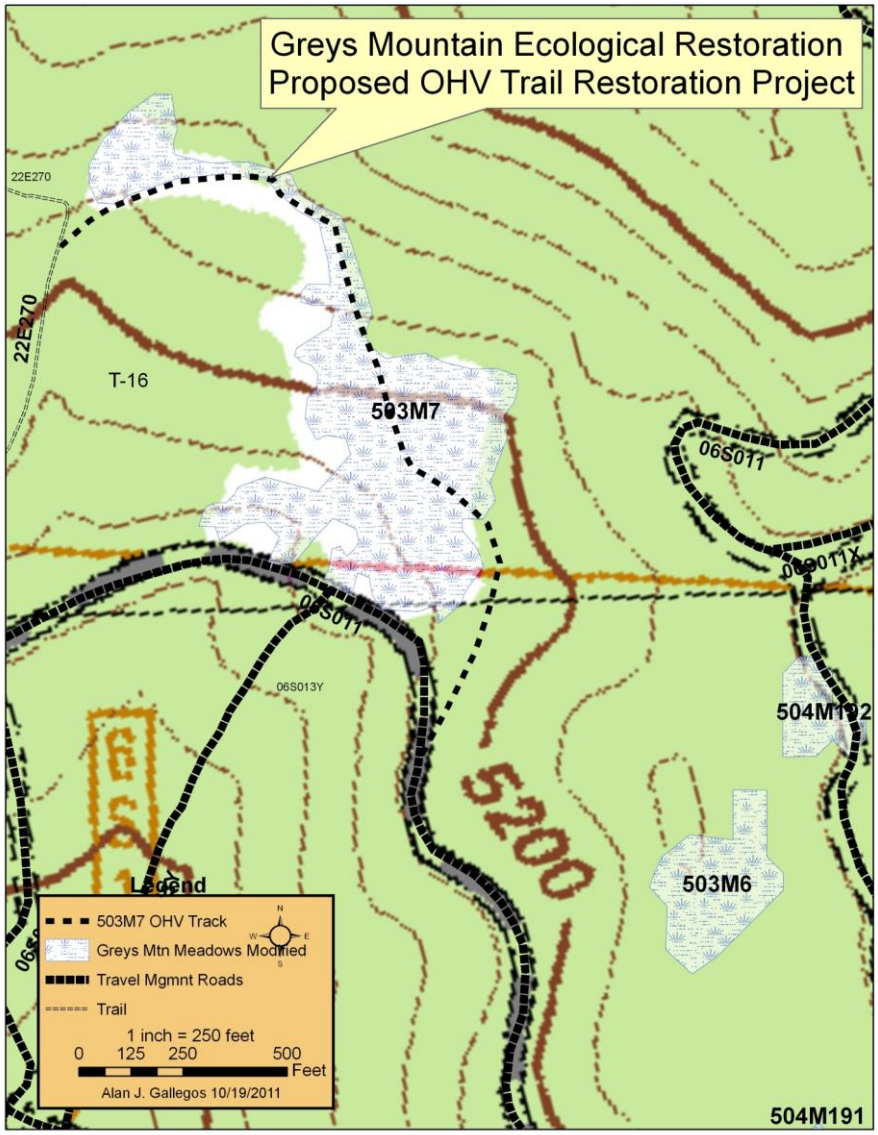



**Figure 11. Map showing the alignment of the OHV track through meadow 503M7. This track will be restored to improve soil productivity and allow for native vegetative recovery.**

## Alternative 3 – Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

In Alternative 3, treatment areas would remain the same as in Alternative 2, treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) to achieve fire and fuels objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only partially address stand density and forest health objectives. In treatment areas where wild stands occur, the break-up of crown continuity would not be the main focus, but the ability to raise the height of the canopy base (the average height of the bottom layer of branches) where

fire/fuels objectives are met. This includes the need to remove some material that is considered pre-commercial sized (i.e. less than 10 inches dbh). Maintenance and/or reconstruction of forest roads that were determined to not meet Forest Service standards would be brought back up to standard. Mechanical thinning would be completed within the first two to five years of implementation. Areas where follow-up treatments are needed, such as slash piling/burning, prescribed understory burning and noxious weed treatments, would be prioritized based on proximity to WUI and completed as appropriated dollars became available. Meadow restoration treatments would be completed as planned. Prescribe understory burning only areas would be completed as planned.

A treatment area map (map 1) can be found in the Map Package in Appendix A.

In Alternative 3, the treatments would include

- Precommercially thin trees 10" dbh mixed conifer, pine, and white fir stands on approximately **2883 acres**. This would be accomplished by hand or mechanical (mastication) methods.
- Plant and hand release treated openings within commercial thin and mastication treatment areas on up to **50** acres
- Treat slash concentrations within precommercially thinned stands by a combination of tractor or hand piling and burning or mastication.
- Prescribe underburn on up to approximately **460** acres within 11 stands (prescribed fire only treatment)
- Prescribe underburn as a followup treatment within treatment areas H 2, 3 and 4, and T 1,2, 4, 5,7, 8, 9, 10, 16, 17, 21, 26, 30, 31, 32, 33, 35, 38 and 39 on approximately **1833** acres
- Construct and reconstruct three existing fuelbreaks on approximately **325** acres
- Improve and restore native plant communities important to local Native American tribes for traditional uses. This will be accomplished within the areas that are planned for prescribed burning and will be completed by using prescribed burning and hand pruning with tools
- Reduce fuel loading and fuel ladders from encroaching conifers within prehistoric and historic sites by thinning and prescribed burning on approximately **100** acres
- Restore degraded meadows by reducing encroaching conifers on approximately **13** acres
- Restore hydrologic function through meadow stabilization on **36** acres of
- Manually pull and/or prescribed burn of noxious weed patches on approximately **10** acres
- Perform range stock drive maintenance by cutting out encroaching conifers and clearing stock drive tread over approximately **7.6** miles
- Restore approximately **0.42** miles of user defined OHV tracks
- Perform annual trail maintenance on **5.5** miles of designated OHV trails.
- Manually pull and/or prescribed burn of noxious weed patches on approximately **10** acres.

# Design Criteria Common to All Action Alternatives

The design criteria listed by resource area below are included in and are an integral part of each action alternative analyzed in detail within this document. They directed the design of treatment areas, the design of treatment types and/or are direction to follow during implementation. In listing these as part of all action alternatives, they are considered when analyzing the direct, indirect and cumulative effects of each alternative and have been incorporated to minimize potential environmental impacts of the management actions proposed by alternatives. As listed, they are a subset of the management direction provided in the SNF-LRMP (USDA-FS 1992) as amended by the 2004 SNFPA (USDA-FS 2004b) and 2007 SNF MIS standard and guidelines (S&G); applicable Forest Service Manuals and Handbooks; and Best Management Practices (BMP). The design criteria are also based on past implementation experience; the best available science and/or to address significant issues.

## Cultural Resources

Cultural resources would be protected through implementation of Standard Protection Measures of the Regional Programmatic Agreement (PA), the primary protection measure being avoidance for all project activities, including resource design criteria. The District Archaeologist would approve all landings; borrow sources, and temporary roads prior to Project implementation as needed.

In addition, where the proposed action is to reduce fuel loading and fuel ladders within prehistoric and historic sites, the cultural resources would not be managed under the above referenced measures. Instead the following design criteria would be followed in order to address the purpose and need, and comply with applicable regulation and policy.

1. For prehistoric and historic cultural sites with heavy fuel loading, treatment measures by way of hand thinning brush and understory would utilize chainsaws to thin fuels. Brush shall be piled for future burning **outside** site boundaries in prehistoric sites. Piles may be placed **within** historic sites where there are no wooden components and away from features. Pile locations would be delineated through coordination with the District Archaeologist and where necessary, hand lines shall be constructed around piles to contain fire.
2. For prehistoric cultural sites with heavy fuel loading, treatment measures by way of low-intensity burning through cultural sites may occur. Handlines would be constructed **outside** site boundaries where necessary to control direction of the fire. This would be done in coordination with the District Archaeologist and fuels personnel. Underburning would only occur in sites with a potential for a low intensity fire focused on cleaning out the understory.
3. For prehistoric and historic cultural sites with heavy fuel loading, thinning of forest stands may occur through mechanical treatment. Should identified tree stands need to be thinned in order to meet forest stand health requirements, those trees that can be reached from the site edge by a feller-buncher and would be cut and removed from prehistoric sites without disturbing the ground. Mechanical equipment may enter historic sites to reach trees to be cut in areas with no observed cultural deposits or features in coordination with the District Archaeologist.
4. An archaeologist would monitor all fuel reduction activities within and around cultural resource sites during implementation.

5. All cultural resource sites would be delineated prior to implementation.
6. Gathering areas would be improved through hand thinning and piling and underburning of fire-dependent species.
7. The cultural resource sites within WIN sites are currently unevaluated and must be treated as eligible. To mitigate the potential adverse effect, a determination of eligibility shall be conducted for these sites and any adverse effects mitigated prior to project implementation.
8. Harvest activities of potential hazard trees would avoid historic campground features in accordance with Standard Resource Protection Measures of the Regional PA

### Botany: Forest Service Sensitive Plants

1. All short-leafed hulsea populations will be flagged for avoidance (SNF 1992 LRMP S&G #s 67 and 68, SNFPA 2004 ROD S&G # 125).
2. Open granitic and/or gravelly areas in or adjacent to units M2, T-8, T-17, and T-21 will not be driven through for project implementation (except for on existing system roads) nor used for parking of vehicles, heavy equipment nor used as log landings. This is to ensure protection of the Yosemite bitterroot (known to occur near units M2 and T8) and suitable habitat for the following sensitive plant species that have not been discovered in the project area but may exist: Mono Hot Springs evening primrose, and Kelloggs' lewisia. (SNF 1992 LRMP S&G #s 67 and 68, SNFPA 2004 ROD S&G # 125).

### Noxious Weeds

1. All heavy equipment used for implementing the project will be washed before arriving on site to remove soil and seeds of noxious weeds. This is to ensure that weed seeds or propagules are not inadvertently introduced into the project area (SNFPA 2004 ROD S&G # 38 and 39; USDA Forest Service FSM 2081.3, Timber Sale Contract Clause B.6.35). See Appendix D of this document for more details.

### Geology/Soils

1. Leave a 100-foot wide buffer of 100 percent soil cover below large rock outcrops. These areas have a high potential to generate runoff that can cause accelerated erosion on soils down slope (FS Handbook).

2. Conduct mechanical equipment operations (mechanical thinning and biomass removal equipment, log skidders and tractor-piling operations) when the soil is sufficiently dry in the top 12 inches to prevent unacceptable loss of soil porosity (soil compaction). Field checking by a soil scientist would be done to determine if operations could continue under moist soil conditions. "Maintain 90% of the soil porosity over 85% of an activity area (stand) found under natural conditions" (BMP; FS Handbook).

3. Subsoil and water bar skid roads and trails in areas where soil compaction exceeds 15% of a treatment area (BMP; FS Handbook).

4. Limit mechanical operations, where sustained slopes exceed 35%, except where supported by on-the-ground interdisciplinary team evaluation. Apply slope limitation to mastication treatment units (FS Handbook; SNF-LRMP S&G).

5. Maintain 50% soil cover over all treatment areas. Where shrub species predominate, attempt crushing before piling to create small woody fragments left scattered over the site for soil cover and erosion protection (FS Handbook; SNF-LRMP S&G).

6. Maintain at least five well-distributed logs per acre as large woody debris (LWD) representing the range of decomposition classes defined in the Regional Soil Quality Standards and Guidelines (SNF- LRMP and SNFPA ROD S&G).

7. To avoid adverse soil disturbance, the soils would need to have soil moisture content below 14% to minimize the potential of detrimental soil disturbance.

## Recreation/Lands/Special Uses

### Lands and Special Uses

A number of the proposed activities may affect areas under special use permit. Forest Service project managers would notify permit holders and agencies, in person or writing, when Project activities including mastication, pre-commercial thinning and/or understory proscribed fire would be implemented that may affect their authorized special uses or agency jurisdictions. A list of permit holders is located in the Project record. Forest Service managers responsible for implementation would work with permit holders to ensure authorized improvements and/or right-of-ways are clearly identified on all contracts and visible during Project implementation. Appropriate protection measures would be put in place.

The following design criteria allow the Forest to meet commitments specified in special use permits:

1. Use of apiary site (in unit T39) for project activities would be upon notification to the permit holder prior to project activities occurring.
2. If the apiary site would be used for staging or landing, the site would be cleaned of debris and brought back to pre-project condition.
3. The apiary site consists of a flat area surrounded by an electric fence where up to 100 hives of bees are located. The electric fence would be protected and any damage to fence or apiary site shall be repaired immediately.
4. To avoid vibration disturbances to the occupied apiary site by project activities the permitted bee keeper would be notified in advance of project activities.
5. During project activities, continue to provide access to private property authorized under permit (located between units T28 and T29). The private road authorized under permit is native surfaced, 12-feet wide and approximately 950 feet long leading from road 6S10 to the Sturrock property at Soquel.
6. During project activities, continue to provide access to a Forest Roads and Trails Act (FRTA) easement providing access to private property located in unit T38. The easement would be used for project activities only after arrangements have been made to pay or perform pro-rata share of road maintenance. Project activities would not interfere with grantees use of road.

7. Ensure the culvert containing electronic equipment, satellite data transmitter and wooden walk way to the Madera Irrigation District stream gauging station (T16, T4, located on the stream bank of Willow Creek adjacent to a bridge near the Greys Mountain campground) continues to be accessible and is not damaged by project activities.
8. During preliminary activities and during implementation of project activities, protection of Madera Irrigation District ditch tender cabin a wooden structure and gate off of spur road 6S10A is necessary (T29).
9. The Forest Service has permanent full public easements for Road 6S10 across private property in the Paradise Springs and Soquel areas. Commercial hauling would be allowed across the easement only after arrangements have been made to pay or perform pro-rata share of road maintenance.

**Mining**

1. One mining claim is located in the project area in units (T31, T33, T34, and T37). There are no active operations occurring at this time. Consultation and coordination with District Minerals staff regarding mining activity status would take place when activities occur in affected project areas.

## Developed Campgrounds, Dispersed Camping and Use Areas, Designated Motorized trails.

**Developed Campgrounds**

The Forest Service operates 4 developed campgrounds in the project area;

In developed campgrounds:

1. To avoid conflicts with Forest visitors, a limited operating period (LOP) would be established during the developed campgrounds' peak season months which is between Memorial Day and Labor Day for Units T4, 7, 9, 38.
2. Outside the LOP and contingent upon the safety of the public, developed campgrounds would be fully accessible to the public on week-ends.
3. Stump cuts would be flush cut to ground and treated with borax.
4. Slash or fuels treatment would be completed soon after treatment to ensure developed campgrounds are clear of accumulated slash, limbs and cull logs, i.e. removed, piled, burned and/or chipped.
5. Any damage to developed campground structures such as fire rings, tables, bulletin boards, site barriers as a result of project activities would be repaired or replaced immediately, to pre-project condition.
6. The location of landings and staging areas for project equipment with in developed campgrounds would be in coordination with district recreation staff.

**Dispersed Camping and Dispersed Use Areas**

Several heavily used, popular dispersed recreation sites including the Texas Flat Overflow, Soquel Overflow, and Madera Ditch dispersed area; Slide Rock and Moon Rock are located in the project area and are accessed by Forest Service system roads.

1. During project activities, access to dispersed camping areas and/or dispersed use areas that are on designated roads or designated trails would continue contingent upon the safety of the Forest visitor.

**Designated Motorized Trails**

1. The designated motorized trails in the project area would not be used for skidding, hauling, or moving equipment. Note: All designated motorized trails are marked with a brown fiberglass carsonite post with decals showing trail number, skill level and vehicle type markers are posted at the beginning and end of the trail.
2. If necessary, movement of equipment across designated trail would be only at a right angle to trail, only at selected areas of the designated trail and upon consultation with Recreation OHV Staff.
3. If "gouging" or berms occur as a result of moving equipment across a designated trail, trail would immediately be repaired to ensure the safe passage of the Forest visitor and brought up to Forest Service motorized trail standards.
4. A clearing limit of 3 feet (from each side of a designated trail) would be established. (FSH 2309.18 Trails Management Handbook)
5. Designated trails would be kept clear of any debris or forest material, burned or otherwise. This includes material with-in trail clearing limits.
6. Directional felling and yarding away from designated trails is required.
7. Stump cuts adjacent to designated trails and within clearing limits, would be flush cut to ground and treated with borax.
8. During project activities, access to the designated trails would continue contingent upon the safety of the Forest visitor.
9. A as a result of project activities, any damage to designated trails or associated trail head facilities, such as trail signs, bulletin boards, or barriers would immediately be repaired or replaced to pre-project condition.

## Wildlife – Terrestrial

**Specific Management Provisions**

Forest Service requirements for managing Federally Listed and Forest Service Sensitive species and their habitats are defined in the following documents.

- National Forest Management Act (NFMA)
- Forest Service Manual and Handbooks (FSM/FSH-2670)
- Endangered Species Act (ESA)
- (SNF-LRMP) as amended by (2004 SNFPA)

In addition to the LRMP standards and guidelines, the following management actions would help maintain and/or enhance important Pacific fisher and American marten habitat for all action alternatives considered. These measures include information from the 2008 Conservation

Biology Institute Document "Baseline Evaluation of Fisher Habitat and Population Status and Effects of Fires and Fuels Management on Fishers In the Southern Sierra Nevada, Final Report to USDA Forest Service Pacific Southwest Region" (Spencer et al 2008); "An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests" (North et al 2009); and Sierra Nevada Adaptive Management Study Integration Team discussions, fieldtrips to the project area, as well as Land Allocations.

1. Maintain highest canopy cover possible to meet the prescription within stands, aim for 60% immediately post-harvest.

2. Thinning would not remove any trees larger than 30-inch dbh (SNFPA ROD, pg. 50).

3. Protect all suitable fisher denning habitat with a (LOP) from March 1 through June 30. This LOP would protect reproductively active fisher and young that may be present in the project area from treatment actions during their denning and early rearing periods.

4. Snags would be felled only if they meet the definition of a danger tree, have the potential to fall across prescribed fire control lines, and/or pose a threat to firefighter safety during prescribed fire implementation. Both OSHA 29 CFR 1910.266(c) and FSH 6709.11, glossary define a "danger tree" as *"A standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree."* Down logs created as a result of snag felling would remain in the stand where needed to meet down log requirements of S&G #10. Snags not meeting the criteria of a danger tree will remain as standing snags within the project area.

5. Retain dense groups of larger trees (greater than 30-inch dbh) with touching crowns at the rate of approximately one group per 2.5 to 3.5 acres. Ideally these groups would contain "defect" trees, those that have cavity and platform creating defects (mistletoe, rot, fork topped, broken limbs and tops) for pacific fisher denning and resting sites. Within these large tree groups, all trees over 20" dbh will be retained. These large tree groups will have a residual basal area of 240 $ft^2$ or more for mixed conifer and 210 $ft^2$ or more for pine and in many instances may reach 300 to 400 $ft^2$ per acre. Retention of these large tree groups with higher basal areas and the inclusion of defect trees are designed to maintain the integrity of suitable fisher denning and resting sites throughout the treatment units. Non-treated areas within proposed treatment units, such as riparian areas and steep slopes, will also provide extensive areas of tree group retention as no treatments will be occurring in these areas.

6. In certain incidences, small (five to ten acre) pockets or inclusions of decadent, high quality, dense fisher/spotted owl habitat that are identified in the field during project layout may be dropped from commercial treatment upon field review by the district biologist. A number of predominant trees are often observed within these types of inclusions, which may be remnant old forest pockets not previously logged during the extensive railroad logging that occurred on the district throughout the turn of the century. Due to the high habitat value present in these stands, and in accordance with Standard and Guideline #90 from the SNFPA ROD, this unique habitat inclusion may be removed from the treatment unit and will not be available for commercial entry.

7. Conifers with structural decadence, and/or the potential to become future dead tree snags, would be retained throughout the non-treatment areas of the project area. To maintain decadent stand characteristics within the treatment units, conifers >16”inches dbh with structural decadence and/or the potential to become future snags would be identified for retention within the treatment areas. Standard and Guideline #11 provides direction for retention of these structural elements. Within treatment units, conifers with the greatest existing or potential for structural decadence will be retained at an average of 1 every 100 feet. Conifers would be selected using the following characteristics listed in order of priority: evidence of known or potential cavities; broken top; conks or other heart-rot indicators; mistletoe or other abnormal witches broom formation or other diseased or insect damaged trees; teakettle branches; forked top; or broken large branches.

8. All black oaks would be retained throughout the project area. Within the treatment areas, conifers would be removed that overtop those black oaks, or that otherwise restrict sunlight from reaching them (e.g. from the south and west) now or within 15 years following treatment; the amount of conifer removal will be limited by the overall basal area thinning prescription thresholds. Hiding cover around oaks, such as shrubs and small trees would be retained around 2-3 decadent oaks per acre. These oak retention areas will be protected with a buffer area 35 feet from the bole, or to the dripline, whichever is greater, where no thinning or fuels treatments would occur.

9. Promote diversity in pine plantations by creating 1/10 acre openings associated with young black oaks between 1”inch and 12”inches dbh to encourage diameter growth of the oak through increased sunlight, release the oak from competition, and encourage future stand heterogeneity. To achieve this, Ponderosa and Jeffrey pine trees within pine plantations would be removed from a 180° swath on the Southern aspect around crowded young black oaks for a 50 foot radius. Additional Ponderosa and Jeffrey pine trees directly adjacent to the oak on the northern aspect may need to be cut to eliminate competition for space within the over-story and would be identified at the marker’s discretion. Other species that may be present within plantations such as cedar, fir, sugar pine, and giant sequoia would not be removed to maintain current diversity where it exists. (S&G #3; #26).

10. Shrub and understory diversity would be retained throughout the project area. All understory vegetation would be maintained in Old Forest Linkages associated with riparian areas (cooler, moister sites); black oak buffer zones; as well as areas where no treatment would be conducted such as heritage resource sites, botanical areas, slopes >35%, and rocky areas. Tree species associated with riparian areas, such as dogwoods, alders, and willows would not be removed. In addition, post sale treatments would retain pockets of understory growth spread throughout the treatment units so that an additional 15-20% of the total understory growth would be maintained in 1/10 acre pockets within plantations and ¼ acre pockets within wild stand treatment units.

11. The district biologist would be notified immediately if a nest or den of any TESCP species is discovered within or adjacent to a treatment area so that proper protection measures can be identified and implemented.

12. All temporary roads and skid trails necessary for project implementation would be obliterated or decommissioned according to the USDA Forest Service (BMP) 2-26 (USDA 2000).

13. Standards and Guidelines 28 and 29 provide guidance for developing and maintaining adequate habitat connectivity within riparian areas. Recent studies (Spencer 2008; North et al 2009) have also shown that fisher utilize riparian areas as travel corridors between high quality habitat. To provide for this habitat connectivity, design criteria have been developed to incorporate and expand upon established riparian area management zones; i.e. Streamside Management Zones (SMZ) and Riparian Management Areas (RMA) associated with perennial streams (Class I). The forest wildlife biologists have termed these zones (OFL). They incorporate and expand upon the measures required for SMZs and RMAs. OFLs consist of buffers measuring 300 feet total on either side of perennial streams. Design criteria for these Old Forest Linkages are detailed in Table 4 and Figure 12

**Table 3. Riparian Area Management Zones**

| Distance from Perennial Stream* | Vegetation Management Activities Allowed within zone | Zone Designation |
|---|---|---|
| 0-50 feet | No activities allowed | SMZ/RMA/OFL |
| 50-100 feet | No ground disturbing equipment allowed into area (dozers, skidders, etc.) Activities allowed include hand-felling of trees smaller than 12”inches dbh, pile-burning, and equipment reach-in with boom arm. Canopy cover is to remain ≥60%. | SMZ/RMA/OFL |
| 100-150 feet | Mechanical entry is allowed. Trees ≤12” dbh may be removed for fire and fuels reduction purposes by equipment. Canopy cover is to remain ≥60%. | OFL |
| 150-300 feet | Mechanical entry is allowed. Thinning from below would occur. Canopy cover is to remain ≥60%. | OFL |

*Distance from Perennial Stream is measured and applied to each side of the stream from bank-full left and bank-full right.

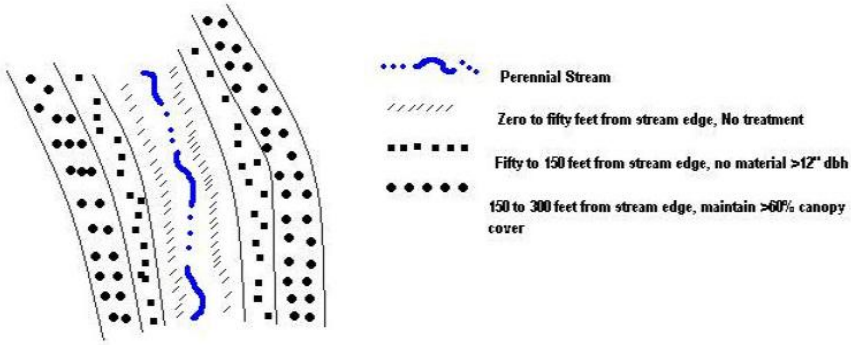



Figure 12: Associated Bounds and Treatments within Old Forest Linkages

## Wildlife – Aquatics

Current Known Information

Generalized SMZ designation is outline in Table 4 based on stream class and mapped in the Project Hydrology Report.

**Table 4. Summary of Relationship between Riparian Area Criteria**

| Feature Type | RCA Width | Stream Class | SMZ Width | RMA Width |
|---|---|---|---|---|
| Perennial Streams | 300 feet | I | At least 100 ft | 100 feet |
| Seasonally Flowing Streams | 150 feet | II | At least 75 ft | N/A |
| | | III | At least 50 ft | |
| | | IV | At least 25 ft | |
| | | V | None required | |
| Streams in Inner Gorge | Top of inner gorge | Varies | | |
| Special Aquatic Features (fens, bogs, springs, seeps, lakes, ponds, wetlands, etc.) | 300 feet | N/A | N/A | 100 feet |

Streamside Management Zones (USDA-FS 1992 (S&G 33 and 71); USDA Forest Service 2000 (BMP 1-8)) are mapped in the Project Hydrology Report. Activities within Class I streams are identified under the OFL prescription under Terrestrial Wildlife. Specific to MYLF:
Class I MYLF occupied (USDA-FS 1992 (Forestwide goal and objective 9, S&G 40): two known sites in analysis area (Soquel and Tex Flat). The extent of the populations will be delineated as part of the herpetology (amphibian) surveys. Occupied habitat would apply the OFL prescription of 150 feet.

1. Applicable to all SMZs:

1. Heavy mechanical equipment would not be allowed within SMZs.
2. To protect bank stability, do not cut stream bank trees (trees with drip line extending to or over edge of stream bank).
3. Do not cut any tree located within a channel.
4. When lighting piles, start burn from one end only to allow escape route for any species inhabiting piles.
5. No prescribed fire lighting into SMZs, but fire can creep into zone.

For water drafting (USDA-FS 2000 (BMP 2-21), a screened intake device and pumps with low entry velocity would be used to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats. A hydrologist or aquatic biologist would approve water-drafting sites.

If newly listed or unknown occurrences of Federally listed threatened, endangered, proposed, candidate or Forest Service sensitive aquatic species are found within the affected project area during sale preparation and implementation, additional species protection measures may need to be imposed by the district fisheries and aquatic biologist.

M**ountain Yellow-legged Frog:**
1. Class I MYLF occupied (USDA-FS 1992 (Forestwide goal and objective 9, S&G 40): two known sites in analysis area (Soquel and Tex Flat). The extent of the populations would be delineated as part of the amphibian surveys. Occupied habitat would apply the OFL prescription of 150 feet. In addition to the above requirements for all SMZs:

1. Treatments within the outer 100 feet of the SMZ would be limited to those prescribed for Pacific fisher.
2. Hand treatments of non-merchantable trees could be implemented within the inner 50 feet of the SMZ, although piled material should not be left within 50 feet.
3. Project activities would occur after June 15th.

4. No heavy equipment would enter the SMZ.
5. Treatments within the outer 100 feet would be limited to those prescribed for Pacific fisher.
6. Hand treatments of non-merchantable trees could be implemented within the inner 50 feet of the SMZ, although piled material should not be left within 50 feet.
7. Project activities occur after June 15th.

Special Aquatic Features (USDA-FS 2004 (S&G 91):

Do not allow mechanical equipment within 100 feet of meadows or other special aquatic features. This requirement includes treatment areas: T2, 17, 26, 27, 32, 33, 36, 37, 38, 42, 44, 46, 47, all Rx treatment areas.

## Hydrology

Design measures to protect water quality and ensure watershed health are detailed by BMPs described in the *Water Quality Management for Forest System Lands in California*, (USDA, 2000), the Riparian Conservation Objective Standards and Guides as set forth in the SNF LRMP (USDA, 1991) as amended by the 2004 SNFPA . General project BMPs with their corresponding design measures are listed in Appendix B.

Soil and Water conservation Practices Handbook, Sierra National Forest Supplement No.1, (FSH2509.22 )

provides standards for the establishment and management of SMZ's. Included is the incorporation of RMA's and their functional/hierarchical relationship to SMZ's (Figure 12).

All stream courses in the project area would be protected and assigned SMZ's (Figure 13). The stream courses mapped on the Project Area Maps provide information for development of watercourse protection measures such as:

1. Skidding would be designed in a manner to skid logs away from the drainages and cross drainages at designated locations.
2. Skidding would not occur across perennial creeks, and limited treatment could occur in streams with riparian vegetation.
3. Any project generated material that would cause obstruction of storm flows would be removed.
4. All channels have SMZ's, which are equipment exclusion zones. Materials may be end-lined out of this zone.
5. Perennial streams would have a minimum SMZ of 100 feet; seasonally flowing/intermittent streams would have a minimum SMZ of 50-75 feet and ephemeral channels would have a minimum SMZ of 25 feet based on field investigations. The chart below provides a summary of SMZ by Stream Class (Table 5).
6. Treatment in prescribed burn units would avoid direct lighting for prescribed fire within riparian vegetation and or within the SMZ of stream channel; prescribed fires may back into riparian vegetation areas or SMZ's.
7. Within RCAs reduce as much as possible ground disturbing impacts (i.e., soil compaction, vegetation disturbance, etc.).
8. Best Management Practices Evaluation Program form T01 would be utilized to evaluate implementation on those units with SMZ's and other aquatic protection requirements.

Most units have avoided crossing stream channels. The exception is 4$^{th}$ order ephemeral draws. Fuels treatments should be laid out to utilize designated and/or existing crossings.

**Table 5. Streamside Management Zone designation by stream class**

| Stream Class | Minimum Ground Cover Density (%) | SMZ Width (ft) 30% Slope | SMZ Width (ft) 40% Slope | SMZ Width (ft) 50% Slope | SMZ Width (ft) 60% Slope | SMZ Width (ft) 70% Slope |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| I | 50 | 100 | 130 | 160 | 190 | 220 |
| II | 50 | 75 | 105 | 135 | 165 | 195 |
| III | 50 | 50 | 80 | 110 | 140 | 170 |
| IV | 50 | 25 | 45 | 65 | 85 | 105 |
| V | 50 | 0 | 0 | 0 | 0 | 0 |

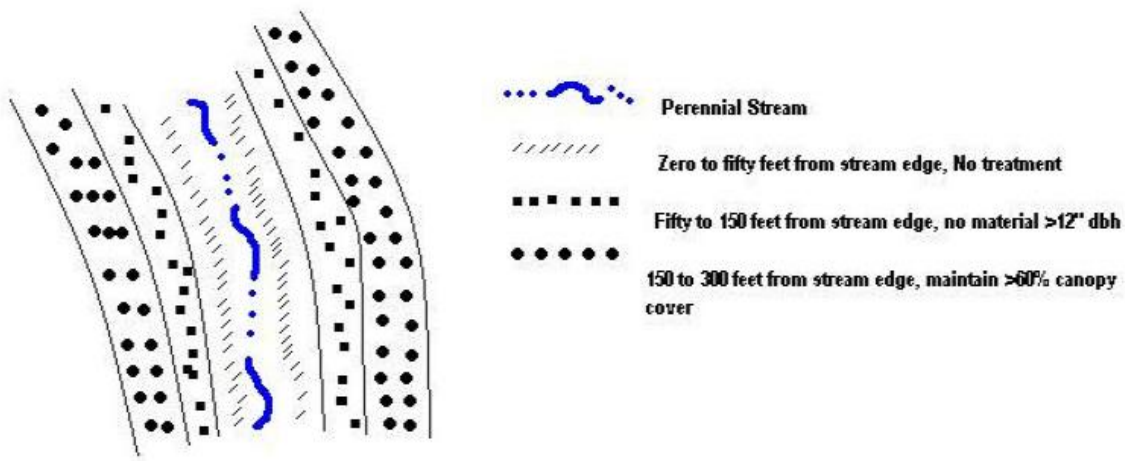



**Figure 13. Associated Bounds and Treatments within Old Forest Linkages**

## Meadow Restoration

1. Wildlife and botanical surveys would be conducted prior to any restoration activity to ensure protection of those resources and compliance with all relevant BMP's.
2. All encroaching conifers approved for removal (up to 12" dbh) would be felled, lopped-and-scattered, bucked in place, or bucked and carried to the meadow edge. All conifer material would be left as biomass, burned or used in the restoration structures.
3. In all cases, native vegetation (e.g., sod) removed during restoration activities would be saved and preserved for later planting. Areas of bare soil in the floodplain would also be planted with native willows to expedite and enhance the stabilization process. Willows would be either cultivated or harvested locally from the same meadow(s) or meadows in the same watershed and at the same elevation range.
4. Water would be dammed and diverted around the restoration areas during construction. This would be done either by pumping the water using a portable pump or by gravity draining impounded water using a 10" inch flexible corrugated plastic pipe. Diverted water would be put back into the channel at the bottom of the meadow or spread on the meadow surface.

Rock used to build step-pool structures would come from local forest stock piles. Currently, rock comes from the tunnel talus at Powerhouse 8 off Forest Road 8S03.

5. All ingress-egress by equipment would occur only when soil moisture conditions are low and the ground firm. If equipment does need to enter the meadow, it would only travel and work on the periphery (or dry portions) of the meadow, and in all cases, ½"inch to ¾"inch plywood and or ½"inch polyethylene mats would be laid down along the equipment route in order to distribute the load more uniformly over the meadow surface and mitigate any tread damage that may occur.
6. Any ingress routes enlarged and/or created for equipment to access to the meadow(s) would be obliterated upon completion of the project or properly closed if access to the project area is required for maintenance within the first five years after completion.
7. Refueling of equipment would occur at least 100 feet from any riparian area.
8. To allow vegetation to recover and to protect the area(s) from trampling damage by cattle stock, enclosing the restoration areas would be done for two years. To offset the potential loss of available water for stock, offsite watering systems can be evaluated on a case-by-case basis and be installed in coordination with the Range specialist and the permittee.

Prescribed Fire:

1. For the SMZ's defined, a minimum protective ground cover of 50% would be established and continuously maintained from October 15th to June 15th of each year consisting of any combination of living plants, litter, slash, and duff.

    - Living plants must be at least 5 feet high to qualify as protective ground cover.
    - Litter and/or slash must be at least 2 inches deep and made up of material 4 inches or less in diameter to qualify as protective ground cover.
    - Duff or humus must be 2 inches deep to qualify as protective ground cover.
    - The 50% ground cover would be determined by using a series of random 100 point transects.

2. Where ground cover is less than the required 50% minimum, treatment would be applied to increase the protective efficiency of the SMZ/RCA to minimum standards. Treatments may include the establishment of living plants, introduction of litter, slash, or other treatments as prescribed by the district hydrologist or fisheries biologist.
3. Prescribed burning within SMZ/RCA may be implemented as follows: hand piling and burning, jackpot burning, and/or broadcast burning provided that the ground cover is not reduced more than 50%. If the protective ground cover is reduced more than 50%, then protective mitigation measures would have to be employed under the guidance of the district hydrologist or fisheries biologist.
4. Treatment in prescribed burn units would avoid direct lighting for prescribed fire within riparian vegetation and or within 5 feet of the edge of stream channel; prescribed fires may back into riparian vegetation areas.

5. Living woody, riparian vegetation would not be willfully killed, destroyed or removed. Riparian vegetation includes but is not limited to the following species:
    - Maples (Acer species)
    - Alders (Alnus species)
    - Dogwoods (Cornus)
    - Poplars, cottonwoods, aspens (Populus species)
    - Oaks (Quercus species)

6. Enough streamside shading would be maintained so as not to adversely affect the existing temperature regimes (confer with Phil Strand, Fisheries Program Manager for more information and guidance for shading requirements).

Roads

Forest Service system roads and temporary roads used for project activities would be constructed or brought to maintenance level 3 standards and follow relevant water quality protection BMP's (Appendix C). Roads used in subdrainage 503.0056 would be repaired and rocked (especially at points of hydrologic connectivity and high stream bypass potential –Table 6, Figure 14) to mitigate the very high CWE potential in this subdrainage.

**Table 6. Roads that have hydrologically connected drain points and culvert problems in subdrainage 503.0056.**

| Subdrainage | Road | Drain Points Hydrologically Connected to Streams or Meadows | Stream Crossings with Non-Functional Culverts |
|---|---|---|---|
| 503.0056 | 06S011 | 3 | 3 |
| | 06S013 | 6 | 0 |
| | 06S013Y | 4 | 0 |

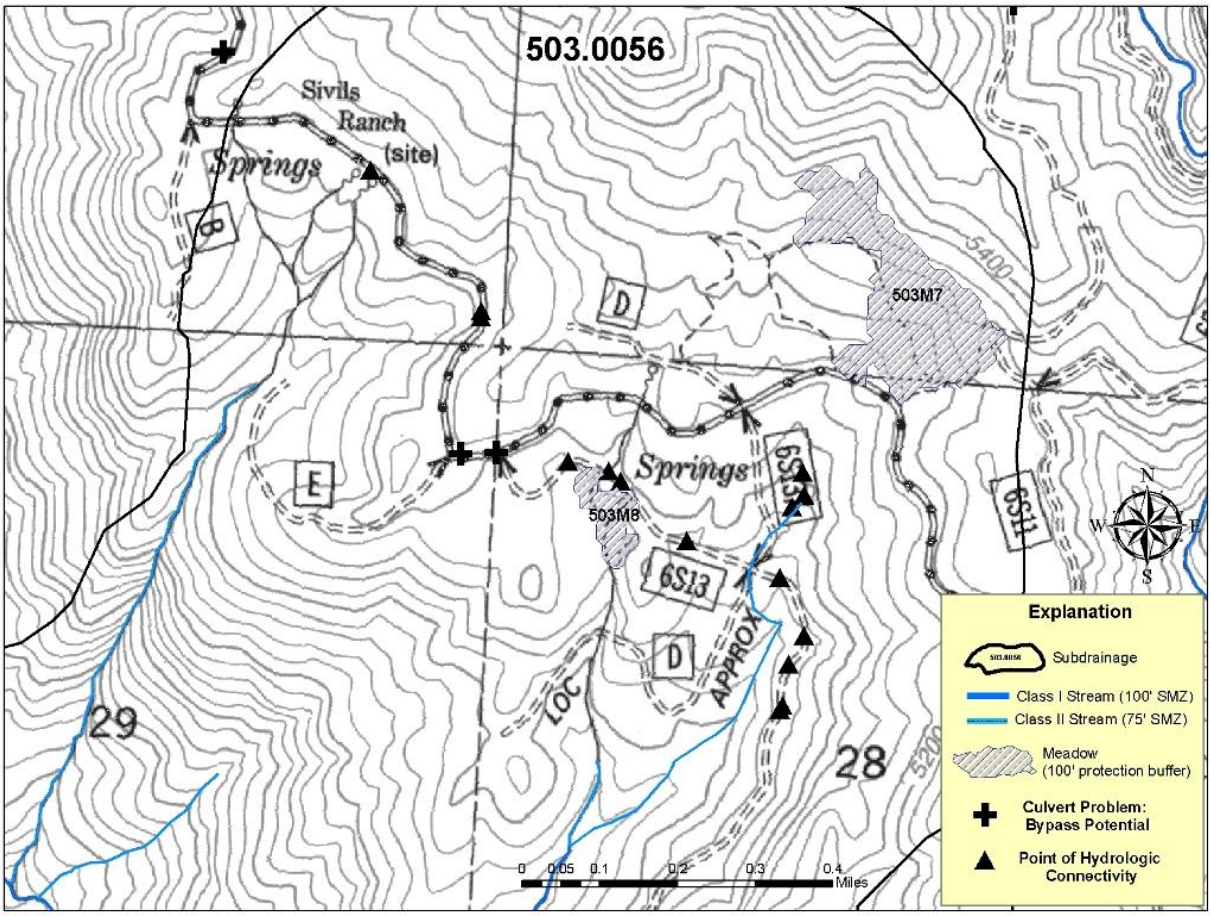



**Figure 14. Points of hydrologic connectivity and bypass potential along system roads in subdrainage 503.0056. Repair of the crossings (i.e., culverts) and relocation of the hydrologically connected drain points should be part of the road maintenance plan for 06S0**

Stream Crossings

The greatest potential for the proposed action or Alternative 3 to affect the hydrologic connectivity of streams and aquatic habitat exists at stream crossings. To minimize the potential for project-related effects on hydrologic connectivity, existing crossings would be used whenever possible. In the event that it is necessary to construct a temporary crossing, the methods used for construction would be selected to avoid or minimize detrimental soil and vegetation disturbance and to maintain hydrologic connectivity between upstream and downstream features. All temporary crossings would be removed following the completion of project-related activities and would be treated as necessary to restore to pre-project conditions (final approval of treatment to pre-project conditions would be done by the Timber Sale Administrator *after* consultation with the district hydrologist and/or forest fisheries biologist). Implementation of the activity-specific BMP's (Appendix B) would further ensure that hydrologic connectivity in streams and special aquatic features not be adversely affected by the proposed action or Alternative 3.

## Silviculture

1. An LOP would be imposed in well stocked stands heavy to fir (over 50% fir) where operations could begin August 1st or later when the sap is not running (fir bark is much more easily dislodged when the sap is running than later in the year). The District

Silviculturist would determine which stands require a LOP during the thinning layout phase.

2. Based on SNFPA ROD (USDA-FS 2004b) S&Gs for mechanical treatments, as well as design criteria, silvicultural prescriptions would be written utilizing thinning from below techniques with basal area levels for stand species composition.
3. To minimize the threat of insect attack, all pine logs created as a part of harvest operations would be removed from the sale areas as either logs or biomass material within 6 weeks of creation. Unutilized pine material would not be concentrated but spread to dry quickly or chipped and spread. Pine logs greater than 3 inches in diameter that are created between July 1st and October 15th and left in the stand would not exceed 8 feet in length.
4. Commercial thinning operations taking place before July 1st or after October 15th in pine stands would require additional measures to minimize creation of pine slash concentrations. Additional bucking of slash may be needed to minimize creation of favorable insect breeding habitat. Any pine logs greater than 3 inches in diameter created after October 15th or before July 1st left in the stand should not exceed 4 feet in length. Precommercial thinning of pine stands should not take place before July 1st or after October 30th each year.

5. Where whole tree yarding is utilized, careful consideration must be given to the protection of the residual trees from damage. Rub trees (previously designated for removal) and/or rub logs should be retained where needed to minimize damage. These would then be removed upon completion of yarding. Skid trails should be as straight as possible and approved prior to skidding. Landing size should be kept to a minimum especially in areas where additional trees must be felled to create landings. To minimize landing size, logs/biomass should be removed as quickly as feasible from landings during skidding operations and not allowed to accumulate.

6. During post sale treatments, 15 to 20 percent of the understory growth would be retained within plantations and wild stands in pockets approximately 1/10 acre in size. (When determining understory pockets to be retained, understory pockets around oaks, groupings of larger diameter trees, steep slopes, draws, etc. within treatment units would be included.) Understory pockets would not be retained in locations where they would jeopardize the effectiveness of planned fuels treatments.

## Fire/Fuels

SNFPA ROD (USDA-FS 2004b) S&G #1, 2, 3, 4, and 5 addresses fuels treatments. S&G #1, 2, 3, 4, and 5 implementation criteria include:
The utilization of prescribed fire to maintain appropriate levels of surface and ladder fuels to meet fire and fuels objectives would be conducted in prescribed fire treatment areas and units identified in the proposed action. To reduce the potential impacts (fire effects) that may occur with the implementation of prescribed fire, the following criteria would need to be considered in the areas where prescribed fire would be used:

1. Prescribed fire areas should be considered where there are larger residual trees (of size less susceptible to fire damage) with light fuel loadings, and/or areas where conifer reproduction is not being used for re-generation of openings.

2. Prescribed fire will be conducted as outlined in a burn plan, to minimize effects to trees during active growing period and within Spotted owl, Goshawks, and Pacific fisher denning habitat areas.
3. 
4. The best available control measures (BACMs) for prescribed fire would be done as required under Section 190 of the Clean Air Act, as amended in 1990.
5. Prescribed fire should be used during the late fall, winter, late spring or early summer, to minimize effects to trees during active growing period and within Pacific fisher denning habitat areas.

## Air Quality

1. Avoid cumulative impacts to air quality by coordinating prescribed burning activities within the Forest, with burning activities conducted by others (SNF LRMP 1992 S&G # 216)
2. Mitigate fugitive dust impacts on air quality by including dust abatement as a requirement for construction activities that have potential to generate dust (SNF LRMP 1992 S&G # 217).
3. Avoid prolonged effects from prescribed burning activities on air quality by burning only on Air Quality Control Board (AQCB) approved burn days when satisfactory wind dispersion conditions prevail (SNF LRMP 1992 S&G # 218).
4. Participate with AQCB to qualitatively define air quality control regulations and guidelines and effects of air quality on the Forest, from sources outside the Forest (SNF LRMP 1992 S&G # 219).
5. Obtain appropriate permits prior to conducting prescribed burning activities (SNF LRMP 1992 S&G # 220).
6. Incorporate air quality management considerations into fire management (SNF LRMP 1992 S&G # 230).
7. Employ commonly used reduction techniques such as burning units after harvest before new live fuels appear; burning in the springtime prior to “green-up,” burning when 1,000-hour fuels (woody debris larger than 3 inches in diameter) moistures are high, and burning when the duff is wet (after fall precipitation, or during winter and spring).
8. Employ avoidance techniques such as burning on cloudy days when the plume and residual smoke cannot be seen, burning during periods of atmospheric instability for better smoke dispersal, and burning during periods of low visitor use.
9. Employ techniques to optimize flaming combustion, including burning piled fuels rather than broadcast burning, reducing the amount of soil in piles, and employing rapid ignition to create a high intensity fire.
10. Ensure that all activities conform to the State Implementation Plan (SIP)

11. As part of prescribed fire implementation, burn bosses are to make observations on a regular basis of the smoke conditions that are being created by implementation. These include the travel direction and dispersion quality of smoke such as smoke settling into smoke sensitive areas and continued or potential for visibility degradation especially

across main travel routes. When possible, lighting techniques and/or burn operations are changed to minimize the continuance of these impacts.

### Engineering

1. Perform road maintenance, reconstruction, and new road construction activities to support project access needs in accordance with the standards and guidelines established in the Forest Plan, Forest Service Handbook 7709 and 6709, as well as the Bass Lake Ranger District Hazard Tree guidance (BLRD Hazard Tree EA 2006)..
2. Maintain all National Forest System roads to standards established in the.58. Insure drainage structures are functional and stable to prevent potential resource damage and degradation of water quality. (S&G #78, #79, #124, #206 and BMP's)
3. Perform a final field review of project roads to determine reconstruction needs prior to project activities. Where economically feasible, place aggregate on existing native surface roads located in areas with high and very high soil erosion hazard ratings. (S&G #129)
4. Close all temporary roads required for unit access upon completion of use; remove all culverts, rip and ditch landings, construct waterbars, block the entrance with a log and dirt berm, and disguise the entrance with brush to discourage additional traffic.
5. Roadways would be managed for safe passage by road users. This would include the management of hazards associated with roadside vegetation, including the identification and mitigation of danger (hazard) trees. A danger tree, as defined in Forest Service Handbook (FSH) 7709.59, Chapter 40, is a standing tree (live or dead) that presents a hazard to people due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem, or limbs and the direction of lean of the tree (FSH 6709.11, Glossary). Selection criteria guidelines for the marking and removal of danger trees would be tiered to the BLRD Hazard Tree Environmental Assessment, (USDA-FS 2006a).
6. Water could be available for dust abatement during project activities; however, water may not be drafted from creeks if the stream flow is less than 1.5 cubic feet per second. Other methods of dust abatement such as trip restrictions, speed reductions, or approved dust oil may be considered as an alternative to using water. Disposal of clearing slash would be by pile and burn or chipping. Stumps may be treated by scattering beyond the toe-of-fill and below the road surface. When feasible, roads would be out sloped to reduce concentrations of water and soil erosion.

# Monitoring Plan

### Cultural Resources

Monitoring would be necessary to ensure that identified protection measures are effective (Regional PA, Stipulation IV and Interim Fuels Protocol, Stipulation VI) and proposed treatment measures have had no adverse effect to cultural resources. Monitoring shall occur within 1 year post-project implementation to assess short-term effects and then at intervals of once every three years for twenty years to assess long-term effects.

### Botany

Post project; monitor the Sensitive Plant occurrences within the project area to assess their presence and condition. Monitor for three to five years to ascertain that the noxious weeds have been eradicated successfully.

### Geology/Soils

Monitoring of soil conditions would be conducted on a selection of activity areas to determine if soil S&Gs and soil management objectives are being met**.** Eleven soil transects have been established in the project area to determine existing soil conditions. Six of these soil transects would be repeated after treatment is implemented.

Monitoring would be accomplished in accordance with the National Forest Soil Disturbance Monitoring Protocol (USDA Forest Service, 2009). Soil monitoring would be conducted along transects according to the protocol after the proposed treatments. Soil monitoring should be designed to determine the extent of detrimental soil compaction from mechanical treatments. Soil cover should be determined from both mechanical treatment and prescribed fire. After implementation of the proposed action, pre-treatment soil transects should be re-established in activity areas and post-treatment soil transects should be repeated along the same transect that were established for the pre-treatment soil transect. Timing for conducting post-treatment soil transects is important to determine soil cover after prescribed fire, especially soil cover condition going into the following winter.

Monitoring of meadows would consist of establishing photo monitoring points that would record the extent of existing conifer encroachment. Photos would be taken initially before treatment and every three years for 15 years. Additional monitoring of the reclaimed OHV trail within meadow 503M7 would be completed primarily looking for the regeneration of native plants and grasses along the trail and for the occurrence of unauthorized OHV usage.

### Terrestrial Wildlife

It may be possible to lessen the potential effect of CWE in subwatershed 503.0056 by reducing the number of acres treated within the HUC8 subwatershed or reducing the miles of system road. In addition, correcting problems with road drainage and surface erosion of the road surface could reduce effects from a CWE. If all of the treatments proposed within this subwatershed are adopted, a Stream Condition Inventory Plot should be established downstream of the site and include V* (Hilton and Lisle 1993) to measure possible effects to aquatic habitat.

### Range

Establishment of additional long term meadow condition and trend monitoring plots for Texas Flat Meadow and Progeny Meadow sites are recommended in order to assess meadow ecological status and trend and trend and also to determine the effectiveness of the channel restoration and conifer removal on these ecological factors.

### Fire/Fuels

Monitoring of the conditions following initial treatments would be completed to determine if additional treatments are needed to meet fire and fuels objectives. Particular attention would be given to those treatment areas associated with SPLATs and DFPZs surrounding the identified

communities, as these are the priority areas within the project for follow-up treatments to reduce surface fuels, if needed.

### Air Quality

As part of prescribed fire implementation, burn bosses are to make observations on a regular basis of the smoke conditions that are being created by implementation. These include the travel direction and dispersion quality of smoke such as smoke settling into smoke sensitive areas and continued or potential for visibility degradation especially across main travel routes. When possible, lighting techniques and/or burn operations are changed to minimize the continuance of these impacts.

## Alternatives Considered and Eliminated from Detailed Study

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the need for the proposal, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm.

Four action alternatives were proposed, two of which were considered and eliminated from detailed study.

*An alternative was suggested that would use high intensity fire to create high severity fire effects to create and increase snag habitat for avian wildlife species.*

This alternative was eliminated because, the environmental conditions that would be required to produce the required fire behavior only occurs during summer month's within fire season and the fire behavior that would be associated with these conditions could not be easily kept within the planned treatment units by holding forces. The benefits would be far outweighed by the resource damage that would happen should an escape occur

*An alternative was suggested that would use landscape scale fires to manage fuels and vegetation instead of logging.*

This alternative was eliminated because; the use of prescribed fire alone would not meet the purpose and need for this project. On favorable terrain structural restoration needs would need to be completed mechanically with a follow-up with prescribed fire. Prescribed fire only treatments are planned for areas that are too steep for mechanical treatments and would link together treated areas to provide fuels modifications to help limit wildfire spread over large areas. This project has over 2300 acres of proposed prescribed fire.

*An alternative was considered that would allow mechanical treatments in 100 acres of subdrainage 503.0056.*

This alternative was eliminated because it has substantially similar consequences as alternatives considered in detail with the exception of hydrologic resource impacts; it is not significantly distinguishable from alternatives already being considered and it would require a SNF LRMP amendment due to CWE threshold exceedance. After considering

the potential beneficial ecological effects of treatment (100 acres without an extreme forest health need) and the potential hydrologic impacts there was not sufficient ecological benefit to risk the CWE effects.

# Comparison of Alternatives

The following table displays a summary of the alternatives and their environmental impacts in comparative form. As one can see in the table, there is little difference in overall treatment acres, however because Alt 2 (preferred alternative) uses structural and process restoration treatments, the potential for meeting the desired conditions of ecological restoration is much higher than in Alt 3 which uses limited levels of structural restoration treatments and process restoration treatments.

**Table 7. Comparison of Alternatives Table**

| Proposed action Treatments | Units of Measure | Alternative 1 No Action | Alternative 2 Preferred Alt | Alternative 3 Fire/Fuels |
|---|---|---|---|---|
| ***Structural Restoration Treatments*** | | | | |
| Commercial Thinning | Acres | 0 | 1650 | 0 |
| Mechanical Fuels and Vegetation Treatments | Acres | 0 | 915 | 2750 |
| Handwork Fuels and Vegetation Treatments | Acres | 0 | 124 | 124 |
| Mastication Fuels and Vegetation Treatments | Acres | 0 | 318 | 318 |
| Fuel Break Construction and Reconstruction | Acres | 0 | 325 | 325 |
| Reforestation | Acres | 0 | 50 | 50 |
| Meadow Restoration (Conifer Eradication) | Acres | 0 | 13 | 13 |
| Meadow Restoration (WIN Site Work) | Acres | 0 | 36 | 36 |
| Developed Recreation Sites (Hazard Tree and Thinning) | Acres | 0 | 31 | 31 |
| Cultural /Historical Site Restoration | Acres | 0 | 100 | 100 |
| Noxious Weed Management | Acres | 0 | 10 | 10 |
| Wildlife Habitat Restoration | Acres | 0 | 3607[5] | 3607 |
| | | | | |

[5] Acres of wildlife habitat improved through: 1. reducing the risk of uncharacteristically severe, stand-eliminating wildfires. 2. Promoting stand heterogeneity of forest vegetation, thereby making it more resilient to natural disturbances, and enhancing native wildlife species habitat and diversity.

| | | | | |
|---|---|---|---|---|
| Range Maintenance (Stock Drive) | Miles | 0 | 7.6 | 7.6 |
| Road Maintenance | Miles | 0 | 56 | 0 |
| Road Reconstruction | Miles | 0 | 20.3 | 0 |
| Temporary Road construction | Miles | 0 | 0.25 | 0 |
| Designated OHV Trail maintenance | Miles | 0 | 5.5 | 5.5 |
| User Defined OHV Trail Reclamation | Miles | 0 | 0.42 | 0.42 |
| ***Process Restoration Treatments*** | | | | |
| Prescribed Fire (Initial Entry) | Acres | 0 | 460 | 460 |
| Prescribed Fire (After structural restoration treatments have been completed) | Acres | 0 | 1833 | 1833 |
| Total Process Restoration | Acres | 0 | 2340 | 2340 |

* These acres represent an acre of each treatment. Many of these treatments occur on the same actual acre. For example, a single acre may have thinning, piling lop and scatter and underburn treatments all prescribed. For this reason, the total number of treatment acres may appear to exceed the total number of acres to receive fuels treatments. Treatments unit of measures are approximate.

| | Alternative 1<br>No Action | | Alternative 2<br>Preferred | | | | Alternative 3<br>Fire & Fuels | | |
|---|---|---|---|---|---|---|---|---|---|
| Measures: | Brush Areas | Forest-Mod. To Heavy Fuel level Areas | Brush Areas | Mixed Conifer Heavy Fuels/Slash | Mixed Conifer Fuels treated | Fir Stands Fuels treated | Brush Areas | Mixed Conifer Heavy Fuels | Mixed Conifer Fuels Treated |
| Fuel Model (Resultant) | SH5 | TU5 | SB1,TU1,SB2 | SB2 | TL8 | TL1, TL3 | SH5 | TU5 | TL8 |
| Predicted Rate of Spread (chains/hour) | 68 | 11 | 3.3-19.4 | 19.4 | 7.6 | 1.2-2.2 | 68 | 11 | 7.6 |
| Predicted Flame Length (feet) | 16 | 8.5 | 2.0-7.3 | 7.3 | 4 | 0.7-1.3 | 16 | 8.5 | 4 |
| Predicted Fireline Intensity (BTU/ft²) | 2259 | 606 | 27-431 | 431 | 117 | 3-9 | 2259 | 606 | 117 |
| Predicted Crown Fire Potential (Yes/No; Type) | Yes Crown | Yes Crown | No Surface | Yes Torching | No Surface | No Surface | Yes Crown | Yes Crown | No Torching |
| Resistance to Control (High, Moderate, Low) | Extreme | Mod/ High | Low/ Mod | Mod | Low / Mod | Low | Extreme | Mod/High | Mod/ High |
| Conifer Mortality (%) Fir & Pine | 99/80 | 34/44 | 0 to 17/14 | 21/22 | 0/0 | 0 | 99/80 | 34/44 | 0/0 |
| Estimated Range of Basal Area Remaining (ft²/acre) for ≥10-inch dbh trees | | | Wild Stands = 120 – 240ft$^2$ (pockets to 360ft$^2$) | | | | Wild Stands = 120 – 510ft$^2$ | | |
| Estimated Range of Stems per Acre Remaining for ≥10-inch dbh trees (# trees/acre) | | | Wild Stands = 40 to 85 trees | | | | W/Stands = 75 – 160 trees | | |
| Estimated Range of Canopy Cover Remaining (%) | | | Wild Stands = 39 – 85% (majority 60%+) | | | | W/Stands = 39 – 85% (majority 75%+) | | |
| Estimated Range of Tree Diameter Remaining (≥ 10" dbh) | | | Wild Stands = 10" – 52" Avg. dia. all stands will increase | | | | W/ Stands = 10" – 52" Avg. dia. all stands will remain the same | | |

| | | | |
|---|---|---|---|
| Large Snag and Down Wood Standard for Treated Areas | In the event of an uncharacteristically severe wildfire, projected loss of nearly all current snags and down wood. | Maintain a minimum of 4 of the largest snags per acre.<br><br>Listed in Design Criteria Common to All Alternatives (pages 24 | Listed in Design Criteria Common to All Alternatives (pages 24) |
| Saw Log Volume/Value<br>ccf & $ | 0 | 14,711 / $2,771,109 | 0 / 0 |
| Biomass<br>Volume/ costs<br>tons & $ | 0 | 2211 / $64,107 | 2211 / $64,107 |
| Road Reconstruction Cost<br>$ | 0 | $124,996 | 0 |
| Road Maintanence Cost<br>$ | 0 | $44,091 | 0 |
| Temporary Road Construction Cost<br>$ | 0 | $1,855 | 0 |
| Non Harvest Treatments Cost<br>$ | 0 | $1,220,055 | $1,356,780 |
| Estimated Revenues<br>$ | 0 | $(669,957) | $(1,420,888) |
| Fire Reduction Benefits [6]<br>$ | 0 | $1,391,222 | $1,812,880 |
| Jobs & Employee Related Income<br>#'s jobs & $ | 0 | 112 / $4,464,860 | 17 / $680,000 |

Numbers within parentheses are negative

[6] C. Larry Mason et al. Jan/Feb 2006. Investment in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits. Journal of Forestry:27-31 (total of firefighting cost avoided and timber loss avoided)

# Chapter 3. Affected Environment and Environmental Consequences

This chapter describes aspects of the environment likely to be affected by the proposed action and alternatives. Also described are the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or other alternatives. Together, these descriptions form the scientific and analytical basis for the comparison of effects in Chapter 2.

## Past, Present and Reasonably Foreseeable Actions _

According the 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).

In order to understand the contributions 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 nearly be impossible. Second, providing the details of past actions on an individual basis would not 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 cannot 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 have. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the CEQ issued an interpretive memorandum on June 24, 2005 regarding analysis of past action, 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 NEPA Regulations (36 CFR 220.4(f)) (July 24, 2008), which states, 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 reasonably 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 effects of the following present and future actions were added to the direct and indirect effects of the proposed action and alternatives

**Table 8. Present and Reasonably Foreseeable Actions Contributing to Cumulative Effects by Resources this Action is likely to affect.**

| Activity Type | Description | Year | Unit Of Measure | Air Quality | Aquatics | Botany | Fire/Fuels | Cultural Res. | Vegetation | Soil | Transportation | Watershed | Wildlife |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Use of Roads/Trails USFS, County, State owned and maintained | Includes the network of inventoried road/trail systems within project subwatersheds | On-going | 62 (mi) | X | X | X | | X | | X | X | X | X |
| Use of Campground and other USFS Owned Facilities | Greys Mountain, Chilkoot, Soquel and Texas Flat | Existing and on going | 4 sites | | X | | | X | | X | | X | X |
| Past/Current USFS Timber Sales within Greys Mountain subwatersheds | Includes:<br>• Green Timber Sales<br>• Salvage Harvest<br>• Thinning | Existing and ongoing | Approx. 7415 acres | X | X | X | X | X | X | X | X | X | X |
| Special Use Permits which include , buildings, corrals, and trails. | Range Improvements | Existing and ongoing | Approx. 25 acres | | | | | X | | | | X | X |
| Roadside Hazard Tree Removal | Removal of damaged, rotten, dead trees to abate roadside hazard using timber sale contracts. | 2003-present | 17 (mi) | X | X | X | | X | X | X | X | X | X |
| Fire/Fuels Management Activities | Includes Fuelbreak Construction and Maintenance, Prescribed Burning, ladder fuel | 1980s-present | Approx. 493 acres | X | X | X | X | X | X | X | | X | X |

| Activity Type | Description | Year | Unit Of Measure | Air Quality | Aquatics | Botany | Fire/Fuels | Cultural Res. | Vegetation | Soil | Transportation | Watershed | Wildlife |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | removal, mastication | | | | | | | | | | | | |
| Private Land Infrastructure for communities of Calvin Crest, Soquel Meadow and Paradise Springs | New home construction, power, water, private roads | Ongoing | Approx. 378 acres | X | X | X | X | | X | X | | X | X |
| Private Land-Vegetation Management in communities and other private lands | Timber harvesting, land type conversions<br>Hazard fuels reduction | Ongoing | Individual Community Private Acres | X | X | X | X | | X | X | | X | X |
| Special Use Permitted Activities | Apiary (1 sites),<br>Road Easments (2 sites)<br>Mining Claims (1 site) | Ongoing | Various Measures-Mapped Locations | | | | | | | | | X | X |
| Motorized Recreation | Pleasure driving; 4x4, OHV, and snowmobile uses of system and temporary roads | Ongoing | Approx. 100 mi | X | X | X | | | | X | X | X | X |
| Livestock Grazing | Soquel and Central Camp Allotments | Ongoing | | | X | X/X | | X | | X | | X | X |
| Fish Camp Project | Forest Health and Fire and Fuels Project | Outyear planning | 5000 acres | | X | X | X | X | X | X | X | X | X |

# Cultural Resources

## Affected Environment

### Existing Condition

All throughout the SNF are the remnants of past cultures that illustrate the centuries-old relationships between people and the land. These cultural resources hold clues to past ecosystems and human adaptations to them, provide links between living communities and the Forest's unique prehistoric and historic land uses, and help transform a visit to the woods into an encounter with history. These cultural resources comprise an irreplaceable and non-renewable resource record of past human life and land use. This record is contained in properties with archaeological and historical research value, and locations of cultural importance to local Native American groups.

Archaeological and Historic Values:

Physical remains of over 10,000 years of human history are found throughout the SNF. Except for the last century and a half of written history, the only record of this long human use is the remains left by the original native people and their descendants. At the time of contact with Euro-Americans, in the late 1700s and early 1800s, the Fresno River was the boundary between the Southern Sierra Miwok to the north and west, and the Chukchansi Yokuts to the south and east. The Western Mono occupied the area around what is now Bass Lake up to the crest of the Sierra Nevada range. The boundaries between the groups were ambiguous, with a lot of overlap in the area between the Miwok, Yokuts and Mono.

The processes of subsistence, the hunter-gatherer lifestyle, and the resulting indigenous land use are seen in the archaeological record with features common to the material culture of the native people of the Sierra Nevada (e.g., village sites, bedrock mortars, stone tool artifacts). Some of these sites have ethnographic documentation that indicates a fairly recent history of tribal use; in some cases, tribal use continues at sites that have an occupational history that spans thousands of years.

Historic-era cultural resources reflect particularly the cultural and economic products of the rapid pace of technological achievement in the last 150 years imposed on the terrain of the Sierra Nevada. These resources often reflect environmental changes resulting from industrial and technological advances in resource extraction, landscape use, and management. Sites include remnants of exploration and settlement, Forest Service administration, grazing/range management, mining, transportation, travel, tourism and recreation, and the forest products industry. Each of these themes has an array of associated sites and features. For example, features associated with railroad logging operations may be work camps, refuse dumps, railroad grades, trestles, and discarded equipment.

Native American Cultural Values:

There is a deep and abiding concern with many Native American people about what occurs in their aboriginal territory. The SNF honors the traditional ties that many tribal communities and Native American people have to this portion of the Sierra Nevada. Access to and use of the Forest and other public lands is critical for many Native American people, as community identity and cultural survival are dependent on continued access to ceremonial and sacred places, cemeteries, traditional gathering areas, traditional cultural properties, and resources at a variety of locations on forest land. Certain plants, animals, and locations provide for many needs, including food, medicine, utilitarian type materials, and ceremonial items. Specific resources insure that significant cultural traditions, such as basket weaving, survive and continue. These areas

contribute to the tribal communities' way of life, their identity, their traditional practices and cohesiveness.

Contemporary Native American interests can 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. The SNF manages such known sites as cultural resources under the provisions of the NHPA. The location of these sites is kept administratively confidential. The SNF will maintain appropriate access to sacred and ceremonial sites, and to tribal traditional use areas, and has consulted with affected tribes and tribal communities to address access to culturally important resources and areas in this project analysis.

Current Condition:

Cultural resources are the buildings, sites, areas, architecture, and properties that bear evidence of human activity and use across the landscape, and have scientific, historic, and cultural importance. The results of 32 years of cultural resource surveys and investigations have identified approximately 72 historical and archaeological properties and numerous miles of linear segments related to logging history within the 9600 acre project area. Site types include prehistoric habitation and processing locales and historic railroad logging, mining, and homesteading. With new discovery upon almost every new survey effort, there continue to be many undiscovered cultural resources in the SNF.

The cultural resource landscape on the SNF is a complex arrangement of scattered archaeological and historical sites, dense district components, and an intricate network of linear sites (e.g., railroad grades, log chutes, mining ditches, water diversion ditches, etc.). Often, these varying components are overlapping in space, but not time. Other components are overlapping in time, spanning the proto-historic and historic periods where the same site will elicit artifacts typically designated either "prehistoric" or "historic", but that were used contemporaneously. Though the NHPA was passed in 1966, a concerted effort to incorporate the law into Forest management practices throughout the nation did not occur until the late 1970s. Therefore, historic practices often had effects on prehistoric cultural resources, while subsequent historic practices had effects on earlier historic resources. With the implementation of Forest Heritage Resource Programs, an effort to protect resources 50 years old or older began with large scale surface inventories and recordation of cultural resource sites. To date, the SNF has recorded approximately 5,000 cultural resource sites. Large expanses of the forest, largely in designated wilderness, remain unsurveyed but undoubtedly contain additional cultural resources.

For over 30 years, standard cultural resource management practices have focused on avoiding potential project impacts on cultural resources. While this is an effective method to mitigate potential project impacts, this practice has at times led to an unnatural density of ladder fuels (see Figure 15) and created the potential for significant damage in the form of partial or total loss of the resources should a high intensity fire occur, which can be devastating to resources with wooden components and quite detrimental to the non-wooden components (Deal 2002; Gassaway 2011; Shultz 2004; Winthrop 2004). Additionally, the increase in fuels has altered the original setting for most cultural sites. Several prehistoric sites that had exposed features, access to water resources, and a viewshed have been encroached by an understory that detracts from its setting by obscuring features and the viewshed and has left the water resources difficult to access or has substantially decreased the amount of water available. Prehistoric artifacts such as obsidian and features such as milling stations and historic artifacts such as glass and features with wooden components can be damaged by high intensity fire to the extent that the artifacts and features may no longer contribute to the data potential of a cultural resource (Shultz 2004).

**Figure 15. Looking down cultural resource boundary within Greys Mountain Ecological Restoration Project area; previously treated unit to left of pine in center of photo; cultural resource site with heavy fuel loading to right of pine.**

Historically, it was not uncommon for logging railroads and roads to be constructed through prehistoric archaeological sites. Similarly, many historic railroads and wagon roads were converted to FS system roads over time. While a road passing through or overlaying a cultural resource may have had some effect on that resource, this is not always the case and often prehistoric resources retain subsurface integrity, while historic linear systems often maintain many aspects of integrity including setting, design, location, association, materials, workmanship and feeling.

### Desired Condition

The desired condition for cultural resources is based on the identified Indicator: preservation of those characteristics and values that qualify a cultural resource for National Register eligibility. In addition, enhancement of those values that contribute to National Register eligibility is sought.

## Environmental Consequences

### Methodology Data Sources

Existing information from cultural resource records, historic archives, maps, and Global Information System (GIS) spatial layers was reviewed to provide specific information about cultural resources, or the likelihood that unidentified properties might exist in the project area. Approximately 1/3 of the project area had been surveyed to current standards for prior projects between 1981 and 1987. Because the SNF does not shovel test during survey, the possibility for cultural resources buried under heavy duff and vegetation and/or cultural deposits buried by erosional activities does exist. For areas that had never been surveyed or required re-survey, current survey was conducted using an intensive (0 – 30 meter transects) coverage. Approximately 430 acres are located on slopes greater than 30% slope and/or are small pockets of impenetrable brush. Per the Interim Fuels Protocol, a non-intensive survey strategy including post-implementation monitoring is being utilized. Survey in areas of impenetrable brush would be deferred until after project implementation per the Interim Fuels Protocol.

To evaluate candidate sites for proposed treatments, known sites within treatment units were visited to assess the density of fuels and the current setting. Proposed treatment within these sites would comply with stipulations and standard protection measures of the Regional PA and the

Interim Fuels Protocol. Analysis is based on preserving and enhancing those characteristics and values that make a cultural resource site eligible for the NRHP.

Cultural resource compliance for this project is documented in *Greys Mountain Ecological Restoration Project Archaeological Reconnaissance Report (Draft)*, ARR R2012051551005 (Potter 2012). This report, which describes the location and composition of the cultural resource sites within the project boundary, is kept administratively confidential under the provisions of the Archaeological Resource Protection Act of 1979, 36 CFR 296 and 36 CFR 800.11(c) *Confidentiality*.

## Spatial and Temporal Context for Effects Analysis

### Spatial Analysis

The location and extent of the cultural resource is the unit of spatial analysis when considering effects in action alternatives. For some cultural resources (e.g., Traditional Cultural Property), the setting beyond the cultural resource location must also be considered when determining whether an adverse effect would occur.

### Effects Timeframes

- Short-term effects occur within one year.
- Long-term effects occur up to 20 years.
- Cumulative effects are analyzed at a 20-year interval.

## Alternative 1 – No Action

### Direct and Indirect Effects

Numerous studies have been conducted on fire effects to cultural resources. Typically, effects are categorized as direct, operational/suppression, and indirect (Shultz 2004; see also Gassaway 2011) and can be the result of both wildland fire and suppression effects and effects from fire management of prescribed burns. The severity of effects on cultural resources is dependent upon the temperature of a fire and the amount of time those resources are exposed to heat. Usually, the higher the temperature and longer duration of heat exposure, the greater potential a cultural resource has to be irreparablely damaged. Experimental studies have shown that, in general, buried deposits are typically not adversely affected by burning (Deal 2002), but surface deposits both underneath the duff layer and above have been demonstrated to lose data potential. For example, a common dating technique used in Central California is obsidian hydration which measures the rate of water hydration on a worked surface (hydration rim). The hydration rim is used to determine relative age of an artifact. At 300 C (572 F) diffusion of obsidian bands begins to occur and the band is no longer visible at 400 C (752 F). At 760 C (1292 F), obsidian may melt altering the morphology of the artifact (Winthrop 2004).

Direct effects from fire on cultural resources are caused by exposure to flame, proximity to heat or effects of smoke (Gassaway 2011). Indirect effects typically occur after a fire as a result of changes in soil and vegetation. These include an increase in soil erosion which can bury or displace cultural deposits, an increase in tree mortality which can also displace cultural deposits through uprooting or damage deposits through falling, and an increase in rodent activity which also displaces cultural deposits and affects the soil structure (Gassaway 2011). Indirect effects can also occur in the form of looting and site vandalism due to increase exposure and ease of access to cultural resource sites. Operational/suppression effects occur from management

activities associated with a fire including construction of fire lines through hand and mechanical methods and development of staging areas.

The degree of effects to cultural resources from burning is dependent upon type of fuel, fuel load, fuel moisture content, soil type and moisture content, weather, and terrain. In the project area, there is a combination of ground, surface and crown fuels. Many cultural sites have become overgrown with vegetation creating fuel ladders. 80 percent of the project area has significantly departed from historic fire regime intervals and developed a load of ladder fuels. The duration of heat exposure and temperature would be significantly increased during a wildfire.

Should a wildfire occur, indirect effects could occur as a result of increased access to and visibility of cultural resources, increasing the likelihood of adverse effects from artifact looting. Cultural resources severely affected by wildfire are also subject to effects from increased surface runoff and erosion, increased tree mortality which may displace artifactual and morphological context should a tree uproot, and an increase in rodent burrowing and insect populations which may affect vertical and horizontal distribution of artifacts (Gassoway 2011). Lack of road maintenance may also affect linear resources through erosion, blow-outs where culverts are plugged and effects to morphological features.

Due to the policy of project avoidance of cultural resources, trees and brush within historic resources, including railroad grades, have grown substantially contributing to an altered setting and in some places have affected the integrity of the sites. For instance, the walls of through-cuts and the down slope of fill on railroad grades have been compromised where trees and their roots have grown through the side walls. When a tree falls, it often takes a part of the grade feature with it, thereby disrupting the design and solidity of the grade. The feature is no longer intact and often continues to degrade through erosion and undermining of the resource. The spatial distribution of features is also a key element in a sitefts design. Where these features are obscured by underbrush or dense tree stands, a sitefts design is masked. Within the project area, there are a number of prehistoric and historic sites with an unhealthy increase in potentially devastating ladder fuels, and altered settings and designs.

### Cumulative Effects

Cumulative effects on cultural resources can be variable as past, current and future actions within the project area have occurred and may continue in the future (i.e. logging activities, road construction). Historic logging, mining, homesteading and road construction activities did not account for the presence of prehistoric or earlier historic cultural resources. As no action would occur under this alternative, cumulative effects could result from benign neglect to address the fuel loading within cultural resource sites which could increase the potential for future adverse effects from high intensity wildfire resulting in a higher degree of erosion, looting resulting from increased visibility, and suppression effects, and would continue to adversely affect integrity of setting for cultural resource sites.

### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

As no undertaking would occur in this alternative, compliance with Section 106 as outlined in its implementing regulations (36 CFR 800) and the Regional PA is not applicable. However, under Section 110 of the NHPA and Executive Order 11593, continued responsibility for protection, interpretation, evaluation, nomination, and preservation remain the responsibility of the Forest regardless of whether or not an undertaking occurs.

### Summary of Effects

This alternative has the potential for indirect effects on ~72 cultural resources and miles of linear historic resources since no land management activities would occur. As no action would occur under this alternative, cumulative effects are unlikely.

## Alternative 2 – Proposed Action

### Design Features and Mitigation Measures

Cultural resources would be protected through implementation of Standard Resource Protection Measures of the Regional (PA), the primary protection measure being avoidance for all project activities, including resource design criteria and through application of the Interim Fuels Protocol within selected cultural resource boundaries.

### Direct Effects

This project seeks to restore the cultural resource landscapes for a limited number of sites closer to the time at which they were occupied. To accomplish this, proposed treatments would be utilized within site boundaries. A reduction in fuels through thinning of vegetation including hand and mechanical treatments and prescribed burning would not only enhance the setting, design and feeling of cultural resources, it would also protect these resources from the devastating effects of high severity wildfires enabling the future preservation of these resources. Future treatments may be required to maintain the desired condition within these resources.

There are approximately ~72 cultural resource sites and miles of historic linear resources that have the potential to be affected by implementing this alternative. Two of these sites are linear historic railroad logging and flume systems that have the potential to be adversely affected. These systems include railroad grades, spur grades, log chutes, and flume remains that retain intact earthworks and features such as sheave posts, trestle remains, retaining walls, and trash dumps. The majority of the cultural resource sites and features would be protected through the application of avoidance measures (Attachment B, Standard Resource Protection Measures, Regional PA).

As noted in the fire history section, it has been determined that under certain burning conditions a fire could severely affect the ecosystem within the project area beyond sustainable levels. This would be devastating to maintaining the characteristics and values of cultural resource sites necessary for NRHP eligibility. Several cultural resource sites within treatment units are proposed for treatment to enhance the setting of the cultural resources and reduce the adverse effects from a potential severe wildfire. Prescribed burning through designated cultural sites would reduce fuel loading and prevent future loss of data potential from excessive heat damage and minimize the need for suppression actions. In addition, Standard Resource Protection Measures of the Interim Fuels Protocol would be implemented to protect sites during prescribed fire implementation.

Several of the WIN proposals may have an adverse effect to cultural resource sites, as they propose to remove or obliterate features of cultural resource sites and install new features.

Reducing fuel loading along linear resources may inadvertently invite unauthorized vehicular groups to travel along them, potentially impacting their characteristic features. As these linear sites are not currently part of the designated motorized trail system, any such offense is subject to citation and closure signs shall be posted should a trail begin to develop. Post-implementation monitoring would be conducted to ensure unauthorized motorized travel is not occurring along these linear resources.

Many roads within the project area would require heavy maintenance or reconstruction. This may include brushing, blading, construction of drainage dips, and replacing plugged or non-functioning culverts. As design criteria in the proposed action, prehistoric archaeological resources would be protected by padding in accordance with Standard Resource Protection Measures of the Regional PA. Where FS system roads overlay historic linear resources, continued use of FS system roads is consistent with stipulations of the Regional PA. Brushing typically does not affect, and may even enhance setting, of historic linear resources. Should a FS system road that overlays a historic linear resource within the project area require reconstruction that would alter the characteristics of the historic linear resource, that segment of the linear resource shall be evaluated for National Register eligibility prior to reconstruction.

The four campgrounds in the project area were established between 1958 and 1960. Therefore, they qualify as cultural resources. For those campgrounds that still retain historic features, there is the potential for harvest operations to adversely affect these resources. In campgrounds proposed for thinning to improve stand health, Mechanical Treatment Stipulations of the Interim Fuels Protocol would be followed. Thus, harvest activities are not anticipated to have an adverse effect on this cultural resource type.

No historic values would be diminished as a result of implementing this alternative

## Indirect Effects

For those cultural resource sites with heavy fuel loading where no treatment is proposed, indirect effects are the same as Alternative 1. Indirect effects could occur as a result of mechanical treatment and prescribed burning operations through increased access to and visibility of cultural resources, increasing the likelihood of adverse effects from artifact looting. Follow-up patrols and monitoring should minimize this potential effect.

## Cumulative Effects

Cumulative effects could occur in the form of looting and vandalism through increased cultural resource visibility after project implementation. This can be mitigated through continued monitoring post-implementation. Cumulative effects could result from future vegetation management projects and road maintenance work. These potential effects would be mitigated through application of Standard Resource Protection Measures of the Regional PA and monitoring of site condition on a regular basis. Therefore, it is anticipated cumulative effects from this action alternative would be minimal.

## Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Regulatory Framework

The FS is directed to identify, evaluate, treat, protect, and manage historic properties by several laws. The NHPA of 1966, as amended, provides comprehensive direction to federal agencies about their historic preservation responsibilities. Executive Order 11593, entitled *Protection and Enhancement of the Cultural Environment*, also includes direction about the identification and consideration of historic properties in Federal land management decisions.

The NHPA of 1966, as amended, extends the policy in the Historic Sites Act of 1935 (49 Stat. 666; 16 U.S.C. 461-467) to include resources that are of State and local significance, expands the NRHP, and establishes the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officers. NHPA Section 106 directs all Federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The ACHP regulations (36 CFR 800)

implements NHPA Section 106. NHPA Section 110 sets inventory, nomination, protection, and preservation responsibilities for Federally-owned cultural resources.

Section 106 of the NHPA and the ACHP's implementing regulations, *Protection of Historic Properties* (36 CFR Part 800), further requires that federal agencies provide the ACHP with an opportunity to comment on federal undertakings. Programmatic agreements (36 CFR 800.14(b)) provide alternative procedures for complying with 36 CFR 800. Region 5 has such an agreement: *First Amended Regional Programmatic Agreement Among the U.S.D.A. 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* (Regional PA). This agreement provides specific standards for conducting cultural resources inventory, evaluation, and management, including Forest Heritage Program requirements, identification standards, standard procedures for protecting cultural resources, reporting and public participation. Attached to the Regional PA per Stipulation IX is the *Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects* (Interim Fuels Protocol), allowing for non-intensive inventory and/or deferred inventory in areas of >30% slope and/or impenetrable brush in order to accomplish fuels objectives. Prescribed burning and mechanical treatments may occur within cultural resource boundaries in accordance with the stipulations and standard resource protection measures of the Interim Fuels Protocol.

Executive Order 11593 - *Protection and Enhancement of the Cultural Environment*, issued May 13, 1971, directs Federal agencies to inventory cultural resources under their jurisdiction, to nominate to the NRHP all Federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and to assure that Federal plans and programs contribute to preservation and enhancement of non-Federally owned properties.

In the Forest Land and Resource Management Plan (LRMP 1991), the SNF has identified three objectives to integrate cultural resource management with other multiple use management (LRMP 1991: 3.19):

1. Meet legal requirements for inventory, evaluation, and interpretation of cultural resources.
2. Assist local Native American communities in continuation and enhancement of their cultural traditions.
3. Interpret the culture history of the Forest for the public.

In accomplishing these objectives, the Forest needs to manage and protect cultural resources by monitoring activities and natural occurrences, and taking preventative and mitigative actions. Management direction emphasizes site identification, evaluation, and management (LRMP 1991: 4.3.18) through a set of Standards and Guidelines (LRMP 1991: 4.5.2.15):

1. Identification: project-specific and forest-wide inventories for cultural resources (S&G 193, 194).
2. Evaluation: National Register of Historic Places evaluations and nominations (S&G 193, 195, 203).
3. Management: programs for contributions to research (S&G 196); coordination with Native Americans (S&G 197, 198); protection and preservation of sites (S&G 199, 200,

201); development of management plans (S&G 202, 204); and interpretation of cultural history (S&G 205).

Federally Recognized tribal governments with interest in the SNF, as elsewhere in the United States, have a special political and legal relationship with the U.S. Government. Federally Recognized tribes are beneficiaries of a trust relationship with the Federal Government. In accordance with Section 106 of the NHPA, the SNF consults regularly with Federally Recognized and Non-Federally Recognized tribes and other interested parties and is responsible for considering tribal interests.

Consultation with tribes, the local Native American communities, and other interested parties to identify other cultural values, including contemporary Native American interests, was initiated with a Public Scoping Letter that was sent on May 31, 2011 to members and groups in the Native American community in accordance with NEPA policy. In addition, a consultation letter in compliance with Section 106 of the NHPA and Regional PA was sent to Native American community members and groups on September 9, 2011. Consultation has consisted of meetings, letters, and presentations, and is documented in the project record. At the time of publishing, the SNF has received no responses from the tribal community.

### Summary of Effects

By following the Stipulations and implementing the Standard Resource Protection Measures outlined in the Regional PA and the Interim Fuels Protocol and following cultural resource design criteria, no historic values would be diminished as a result of implementing this alternative. Potential effects to sites from proposed road reconstruction and WIN projects would be mitigated after SHPO consultation. Therefore, it is not anticipated there would be direct effects to cultural resources from this alternative. Potential indirect effects to cultural resources under Alternative 2 are minimal and would be mitigated with post-implementation monitoring.

As all heritage resource sites would be protected through project design from current project activities and predictable future project activities, it is anticipated there would be no cumulative effects from this alternative.

## Alternative 3 – Lower and Mid-Level Canopy Treatments, All Treatment Areas

### Design Features and Mitigation Measures

Design features and mitigation measures would be the same as Alternative 2 with the exception of thinning through mechanical treatment within cultural resource sites under the Interim Fuels Protocol.

### Direct, Indirect and Cumulative Effects

Direct effects are the same as Alternative 2 with the exception of thinning through mechanical treatment within cultural resource sites. Indirect and cumulative effects will be the same as Alternative 2.

### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Compliance with Forest Plan and other relevant laws, regulations, policies, and plans for Alternative 3 is the same as Alternative 2.

# Botany: Rare Plants and Noxious Weeds

## Affected Environment

### Existing Condition

**General description of the vegetation with an emphasis on rare plant habitat:** The Greys Mountain project area is on the west slope of the central Sierra Nevada, and ranges in elevation from 3825 to 7160 ft elevation. The project area falls within the Sierra *Nevada Ecological Section (M261E) in the USDA Forest Service National Hierarchical* Framework of Ecological Units (Miles and Goudey, 1997). Vegetation varies from mixed chaparral, ponderosa pine and mixed conifer forest at low to middle elevations, to red fir and lodgepole forest at the higher elevations, with montane chaparral and montane meadows scattered throughout the area.

The southern region of the project area has some areas of rock outcrops, which though often considered "barren" sites, are characterized by a suite of diverse native species adapted to live in the desert-like conditions of these exposed areas. These outcrops are not included in areas proposed for treatment as they do not have trees but they provide habitat for rare plant species, thus are protected from ground disturbance for this reason.

The following summary of the vegetation within the Greys Mountain Project area sets the stage for analyzing effects of the alternatives on Forest Service Sensitive Plants by examining project effects on their habitat.

<u>CHAPARRAL</u>: The lower elevations of the project area contain elements of foothill chaparral, dominated by mariposa manzanita (*Arctostaphylos visicida* ssp. *mariposa*) buckbrush (*Ceanothus cuneatus*), mountain mahogany (*Cercocarpus betuloides*), and foothill pine (*Pinus sabiniana*), but most of the chaparral in the project area is best classified as montane chaparral, dominated by greenleaf manzanita (*Arctostaphylos patula*), mountain whitethorn (*Ceanothus cordulatus*), deerbrush (*Ceanothus integerrimus)*, littleleaf ceanothus (*C. parvifolius*),

<u>FORESTED AREAS</u>: The lower reaches of the project area are forested by ponderosa pine forest dominated by a mixture of ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), and black oak (*Quercus kelloggii*) with an understory of mariposa manzanita, buckbrush, deerbrush, and canyon live oak (*Quercus chrysolepis).* Higher in elevation the forest changes to true mixed conifer forest with the addition of sugar pine (*Pinus lambertiana)* and a higher proportion of white fir. The understory shrubs are more typical of montane chaparral. At the highest elevations of the project area there are areas of red fir forest (*Abies magnifica),* with chinquapin in the understory and large areas devoid of herbaceous or woody plants in the understory.

<u>RIPARIAN VEGETATION</u>: This vegetation type is adapted to wet or moist conditions and is found along streams and in meadows, springs, and seeps. Riparian vegetation along streams varies considerably within the project area, ranging from clearly defined bands of riparian forest dominated by white alder (*Alnus rhombifolia*), mountain alder (*A. incana* ssp. *tenuifolia*), willow (*Salix* spp.), and Oregon ash (*Fraxinus latifolia*) to simply a strip of herbaceous riparian plants with upland forest trees growing next to the stream.

MEADOWS AND FENS: There are several meadows within the project area: as well as several unnamed meadows. Meadows are defined as openings in forests which generally have high water tables dominated by herbaceous vegetation that is adapted to wet conditions. Meadows are typically hetereogeneous, containing patches of different plant assemblages in response to variations in moisture, drainage, elevation within a given meadow. Overall, meadows can be classified as dry, moist, or wet; and montane, subalpine, or alpine (Ratliff, 1985). Some meadows contain areas of peat soils called fens. Fens are areas of perennial saturation where peat soils form because accumulation of organic matter exceeds decomposition (Cooper and Wolf, 2006). Fens are of significance because of their contribution to hydrologic function in meadows and because they provide habitat for several rare plant species.

## Forest Service Sensitive Plant Species in the Project Area

Sensitive species are those species that have been specifically designated by the Regional Forester as needing special management in order to prevent them from losing long-term viability or becoming federally listed as endangered or threatened; either because they are naturally rare or because their numbers have been reduced by human causes. In the SNF the former is generally the case. Much has been written about endemism and rarity in the California flora (e.g. Fiedler, 2001: http://www.cnps.org/cnps/rareplants/inventory/rarity.php; and Shevock 1996: http://ceres.ca.gov/snep/pubs/web/PDF/VII_C24.PDF). Based on a review of the scientific literature, historical collections available through the Consortium of California Herbaria (an online search tool which allows viewing of specimens housed at most major herbaria in the state since scientific collecting began), there is no reason to suspect that the Forest Service Sensitive plant species known or suspected to be present in the Greys Mountain Project area were significantly more common in the past.

Table 9 shows the Forest Service Sensitive Plants that are known to occur or that may occur within the Greys Mountain Project area based on the fact that suitable habitat is present. Species known to occur within the overall project boundary are shown in bold text:

**Table 9. Forest Service Sensitive Plant Species Known or with Potential to occur within the Greys Mountain Project Area.**

| SPECIES | OCCURRENCE IN GREYS MOUNTAIN PROJECT AREA | HABITAT REQUIREMENTS |
|---|---|---|
| | | |
| *Bruchia bolanderi*<br>BOLANDER'S CANDLE MOSS | None known to occur but suitable meadow / streambank habitat present. | RIPARIAN/MEADOW. Vertical banks of streams, 5000-7500 feet. |
| *Camissonia sierrae* ssp. *sierrae*<br>MONO HOT SPRINGS EVENING PRIMROSE | None known to occur but rocky/gravelly habitat present. | ROCKY/GRAVELLY. Gravel and sand pans and ledges associated with outcrops in chaparral, ponderosa pine, mixed conifer and red fir/lodgepole forests, 4500 – 8500 feet. |
| ***Collomia rawsoniana***<br>**RAWSON'S FLAMING TRUMPET** | **Occurs along North Fork Willow Creek, which traverses unit T9.** | **RIPARIAN/MEADOW. Streamsides and meadow edges 2500 – 7000 feet.** |
| *Cypripedium montanum*<br>MOUNTAIN LADY'S SLIPPER ORCHID | None known to occur, many populations occur within 5 miles of Greys Mountain Project area, but none were found during surveys in 2011 | FORESTED. Moist areas and dry slopes in late-successional conifer forest. Known from the vicinity of Nelder Grove to the west of the project, Mariposa Grove, Wawona, Sugar Pine, and Nelder Grove; 4000-7200 feet. |

| | | |
|---|---|---|
| *Epilobium howellii*<br>SUBALPINE FIREWEED | None known to occur. The nearest occurrence is about 1 miles away at Cold Springs Summit. | RIPARIAN/MEADOW. Meadow edges, moist ditches and streamsides in conifer forest, 5000-8800 feet. |
| *Fissidens aphelotaxifolius*<br>BROOK POCKET -MOSS | None known to occur but habitat is present. | RIPARIAN/MEADOW. Rocky substrate in streams, < 6300 feet. |
| *Helodium blandowii*<br>*BLANDOW'S BOG-MOSS* | None known to occur but fen habitat is present in several meadows. | RIPARIAN/MEADOW. Wet meadows, fens, and seeps in coniferous forests, 6500 – 9500 feet. |
| ***Hulsea brevifolia***<br>**SHORT-LEAFED HULSEA** | **Four occurrences known, in dry forested habitat.** | **FORESTED. Granitic or volcanic soils in openings and under canopy in mixed conifer and red fir forest, 5000 – 9000 feet.** |
| ***Lewisia disepala***<br>**YOSEMITE BITTEROOT** | **Two populations occur in the Greys Mountain Project area, within or surrounded by Units M2 and T8** | **ROCKY/GRAVELLY. Granitic sand and gravel in ponderosa pine, mixed conifer, and upper montane coniferous forest, 4000 – 7500 feet.** |
| *Lewisia kellogii* ssp. *kelloggii*<br>KELLOGG'S LEWISIA | None known to occur but rocky habitat present, mostly below elevation preferred by this species. | ROCKY/GRAVELY. Open, gravelly flats in mixed conifer and subalpine forest, 6000 – 11,000 feet. |
| *Meesia triquetra*<br>THREE-RANKED HUMP-MOSS | None known to occur but fen habitat present in several meadows. | RIPARIAN/MEADOW. Fens in montane meadows within conifer forest, 4500 – 8000. |
| *Meesia uliginosa*<br>ONE-NERVED HUMP MOSS | None known to occur but suitable fen habitat present. | RIPARIAN/MEADOW. Fens in montane meadows within conifer forest, 7500 – 9000 feet. |
| *Mimulus gracilipes*<br>SLENDER-STALKED MONKEYFLOWER | None known to occur but potential habitat present in southern part of project, not in treatment units. | ROCKY/GRAVELLY. Granitic sand and gravel usually associated with outcrops in foothill chaparral and ponderosa pine, forest, 1500-4225 feet. |
| *Peltigera hydrothyria*<br>VEINED WATER LICHEN | None known within project boundary but potential habitat in streams of project area. Surveys focused on road crossings. | RIPARIAN/MEADOW (AQUATIC)/Cold, clear, unpolluted streams in conifer forests, 4000 – 8000 feet. |
| *Trifolium bolanderi*<br>BOLANDER'S CLOVER | None known, most likely absent due lack of detection during many surveys over the past 20 years. | RIPARIAN/MEADOW. Montane meadows in mixed conifer forest, 6800-7300 feet. |

More information about the three Forest Service Sensitive Plants known to occur within the project area is found below:

***Collomia rawsoniana* - Rawson's flaming trumpet**

Rawson's flaming trumpet is a perennial herb that spreads both by seed and via underground stems (rhizomes). The tubular flowers are bright orange red, pollinated by hummingbirds and several species of bee (Hevron, 1989). The entire distributional range of this relict species is confined to a 15 by 10 mile area between 2500 and 7000 feet elevation. All occurrences are within Madera County, and most are on the Bass Lake

Ranger District. Populations occur along streams and around meadows within about 12 major drainages (roughly equivalent to "occurrences" as defined by California Natural Diversity Database CNDDB) of the Department of Fish and Game (CNDDB, 2011) all but one of which flows into the San Joaquin River. The exception is the Nelder Creek occurrence, which flows into the Fresno River. Each major drainage may have over 5 miles of patchily occupied flaming trumpet habitat. Estimates of population size are usually given as number of stems, which is a poor indication of number of individuals, since what constitutes a ramet vs. a genet is just beginning to be understood for this rhizomatous perennial herb. It has been found that a large patch is often composed of many genetic individuals and that sexual reproduction is probably occurring at an adequate rate to keep genetic variability high enough to sustain the species over time (Wilson, Clines, and Hipkins, 1999).

Flaming trumpet populations are found both in ponderosa pine forest and in mixed conifer forest. Flaming trumpet is dependent on the cool, moist conditions found along streams in good hydrologic condition. Research has shown that there is a balance between light and shade at which flaming trumpet flowers optimally (Liskey, 1993). Some disturbance can be beneficial, especially if it simulates the loosening of soil and opening of canopy that would be present after natural windfall of forest trees. The populations of flaming trumpet on the Bass Lake Ranger District have been studied and monitored for many years (Hevron, 1989; Liskey, 1993; Wilson, Clines, and Hipkins, 1999; Taylor et al. 1987). Populations of flaming trumpet occur along Chilkoot and North Fork Willow Creek within Tractor Unit T9, , but the stream will be buffered by a streamside management zone of at least 100 feet.

***Hulsea brevifolia* – short-leaved hulsea**

The short-leaved hulsea is a locally endemic herb found in montane forests of the central and southern Sierra Nevada (Hickman, 1993). Plants are 3 to 6 decimeters tall, with leafy stems. Leaves are toothed, and stems and leaves are covered with hairs, some of which are glandular, making plants sticky to the touch. Flowerheads are bright yellow-orange, less than 20 millimeteres in diameter (Hickman, 1993). Elevation range is from 5,000 to 9,000 feet, but most occurrences are found above 6500 feet in the red fir forest type. This plant grows in dry forests and openings.

Short-leaved hulsea is a perennial herb. There are about 50 occurrences documented on the Sierra National Forest, and others on adjacent forests and in Yosemite National Park. Elevational range is 5000 to 9000 feet, from Tuolumne County south to Tulare County. Habitat for short-leaved hulsea is gravelly or sandy exposed areas as well as densely wooded sites in coniferous forest, usually red fir forest. Occurrences range in size from a few dozen plants to many thousand plants. Most occurrences appear to represent a variety of age classes, from the current year's seedlings to older, well established plants. Many populations consist of thousands of individuals.

There are six populations of short-leafed hulsea in the project area. Two of them occur in tractor units (T6 and T11), and the rest are along Roads 5S07 and 6S99**.**

***Lewisia disepala* – Yosemite bitteroot**

This early blooming perennial herb is known from granite domes surrounding Yosemite Valley; locally abundant on Mt. Watkins, Basket Dome, and on the unnamed domes east and west of Mt. Starr King, and on granite domes as far south as Kern County. In 1980, Steve Botti estimated that about 20,000 plants were known from Yosemite National Park,

and about 110 plants from Tulare County, 200 miles to the south. In 2004, USGS botanists found approximately 11,000 plants from three populations in Yosemite National Park. Populations found outside of Yosemite consist of as few as one hundred to over three thousand plants. As of November 2005, there were a total of 22 occurrences outside of Yosemite. Thirteen occurrences have been located on the Sierra National Forest: eight in Madera County and five in Fresno County. The Sequoia NF has seven occurrences: 3 in the Scodie Mountains of Kern County, 2 in the Dome Land Wilderness and 2 west of the Kern Canyon in Tulare County. There are two Tulare County occurrences on BLM land east of the Sequoia NF boundary and west of Lamont Peak. The Sierra National Forest occurrences are at the lowest elevations for the species and face the most threats (off-highway vehicles, dispersed camping, target shooting, campfires, etc.).

Two populations occur in the Greys Mountain Project area, within or surrounded by Units M2 and T8. These populations of Yosemite bitterroot were monitored in 2010 for another project.

**Noxious weeds and invasive non-native plants:** Invasive non-native plants (weeds) are species which, if allowed to spread, cause ecological and economic damage. Invasive weeds may be officially listed as "noxious" at the federal or state level. The California Invasive Plant Council (Cal-IPC, 2006) assigns ratings of high, moderate, or limited ecological impact to weeds statewide based on ecosystem impacts, potential for invasiveness, and ecological distribution. Weeds on the California Noxious Weed list with ratings of "A" or "B" are of highest priority for state and county weed managers (CDFA, 2011). New infestations of State A and B rated weeds are controlled promptly by county or California State Department of Food and Agriculture biologists or by Forest Service employees in cooperation with county agriculture department staff.

Surveys conducted in 2011 for this project revealed that the primary invasive weed species in the Greys Mountain project area are bull thistle (*Cirsium vulgare)* and klamathweed (*Hypericum perforatum*). The bull thistle is mostly in meadows. Overall, the area is not heavily infested with weeds. No California State Noxious Weed species are currently known from this area. Figure 16 shows the locations of these species in relation to the treatment units within the project area. Details about the locations of these species and their impacts follow:

**Bull thistle (*Cirsium vulgare*) - CIVU.** There are infestations of bull thistle in or adjacent to units T4, T226, T29, T33, T37, and along access roads to and within the project area. There is also bull thistle in some of the meadows proposed for restoration: Meadow 504M293, 504M132 (Meserve Meadow), 503M8 (Progeny Meadow), 504M198 (Railroad Meadow), and 503M7. Although not as highly invasive as other noxious thistles, bull thistle competes with and displaces native species and decreases forage values in meadows and uplands at elevations up to and 7,000 feet (Randall, 2000). Cal-IPC rates bull thistle as having moderate ecological impact statewide, but notes that this species can be very problematic regionally, and especially in riparian areas such as meadows (Cal-IPC, 2006). Bull thistle has recently been documented at elevations higher than 7,000 feet in the Sierra Nevada (e.g. up to 8795 feet at Sonora Pass on the Stanislaus National Forest (UC Berkeley, 2011).

**Klamathweed or common St. Johnswort (*Hypericum perforatum*) – HYPE.** Infestations of klamathweed are found along Sky Ranch Road leading to the project area, and in T16, T17, and T31. This weed is also present in the following meadows proposed for restoration: 503M7, 503M8 (Progeny Meadow), and 504M132 (Meserve Meadow). Klamathweed is a perennial herb up to 4 feet tall with bright yellow flowers. The root

system can extend up to 5 feet deep and up to laterally 1.5 feet. Leaves have tiny perforations (clear spots) throughout and black glands on the undersurface. Each plant can produce between 15,000 and 33,000 seeds each year, and seeds remain viable up to 10 years (DiTomaso and Healy 2007). This weed originated in Europe and has been imported to numerous countries because of its medicinal properties. It is a pest because it displaces native plants by forming monocultures in wildlands, including rangelands and coniferous forests, and it is toxic to livestock (Piper, 2000).

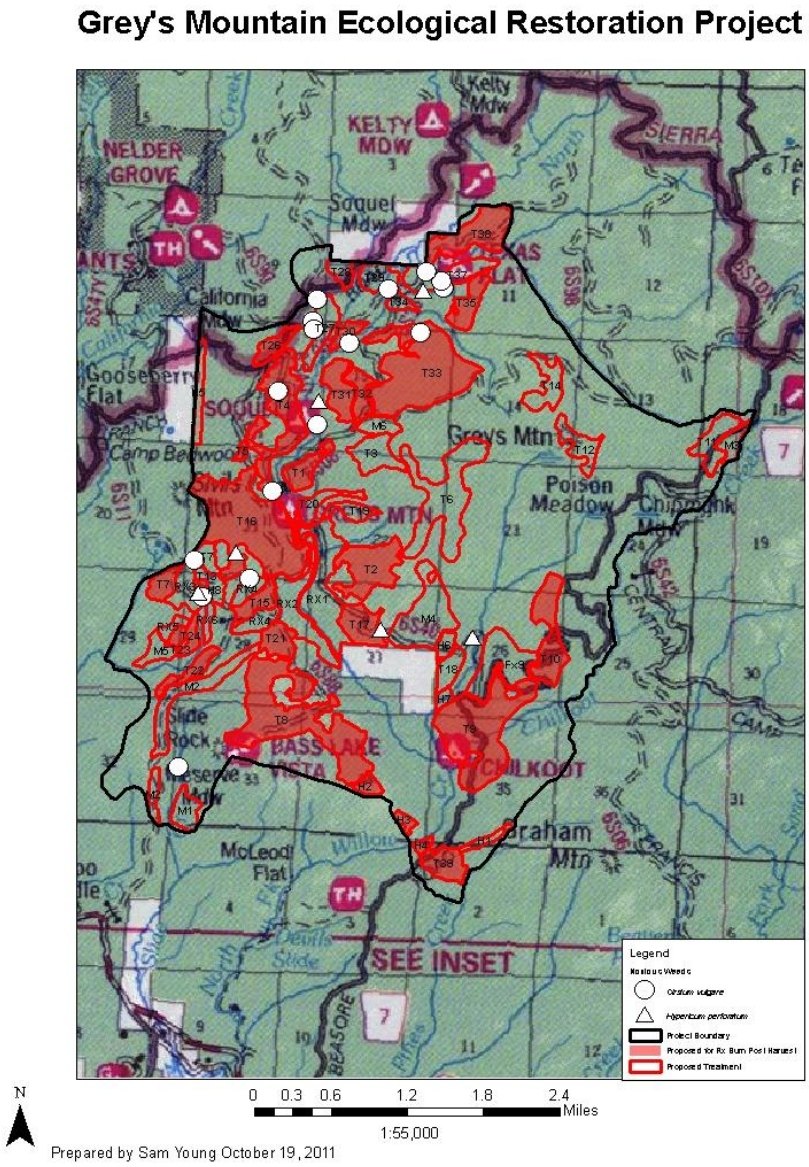



**Figure 16. Locations of Noxious Weeds within the Greys Mountain Project Area.**

## Desired Condition

**For Forest Service Sensitive Plants** the desired condition is to maintain the six short-leafed hulsea populations within the Greys Mountain project area at their current population numbers by maintaining or improving habitat conditions required by this species (openings in coniferous forest with intact (non-compacted) soil structure. The desired condition is also to maintain suitable habitat for Forest Service Sensitive plants that may exist undiscovered in the project area.

**For invasive weeds**, the desired condition is to maintain native plant communities with the absence or minimized presence of non-native invasive plants, and to use Integrated Weed Management to prevent, control, and monitor invasive weeds.

# Environmental Consequences

## Methodology

Existing information from Sierra National Forest botany and noxious weed records and GIS files were reviewed to evaluate where to focus field surveys for this project.

Surveys for the project were conducted in 2011, specifically looking for Forest Service sensitive plants and noxious weeds in the units proposed for treatment in the Greys Mountain project area and associated roads and meadows. The results were summarized in brief above (in Table 9 and in the noxious weed and rare plant descriptions) and are described in more detail in Appendix B of the Biological Assessment (BA)/Biological Evaluation (BE) (Clines 2011a) and the Noxious Weed Risk Assessment (Clines 2011b). All rare plant information is maintained in a GIS database and survey forms are turned in to the California Natural Diversity Database. (CNDDB, 2011). The noxious weed data is mapped in GIS and control efforts would begin prior to and/or during project implementation.

Because there are 15 species of Forest Service Sensitive Plants that may occur in the project area or along access roads where they may be affected, but only three that are known to occur, this analysis would be based on effects to habitats for all of these species as shown in (Table 9 above): Riparian, Rocky/Gravelly, and Forested.

## Spatial and Temporal Context for Effects Analysis

For direct and indirect effects the timeframe is one to five years, based on the fact that monitoring of project effects on rare plant and invasive weed populations would be conclusive within this time frame. For cumulative effects, the timeframe is 20 years, over which the desired effects of the project activities would have a chance to take effect.

# Alternative 1 – No Action

## Direct Effects

No direct effects would occur to FSS plants if the no-action alternative is chosen because project activities would not take place.

## Indirect Effects and Cumulative Effects

Indirect and cumulative effects have the potential to occur to FFS plants under the no-action alternative primarily from the potential of uncharacteristically severe wildfire. Uncharacteristically severe wildfire has the potential to cause significant disturbance to soil, ground cover and canopy cover, placing FSS riparian species at risk, since these types of plants normally do not regenerate after unusually high-intensity fires. Through suppression actions, extreme fires can also allow the opportunity for the spread of invasive weeds, which can affect FSS species through competition of resources. The invasive weeds in the project area would continue to spread without the manual control proposed in the action alternatives.

In addition, riparian and meadow habitat in the nine meadows proposed for restoration would continue to deteriorate, thus suitable habitat for the nine rare plant species that occur in these types of habitats ( Table 9 above) would be reduced in quantity and quality over time.

.

### Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

FS Manual 2672 provides standards for biological evaluations and provides a list of all Regional Forester designated sensitive wildlife and plant species occurring on NFS lands. Current policy as shown in the FS Manual (FSM 2672.4) is to conduct a pre-field review of available information, and in instances where there is evidence of sensitive plant species or habitat, conduct a field reconnaissance if necessary to determine whether the project poses a threat to sensitive plants. The results of surveys and conflict determination are documented in the BE (Clines 2011)

SNF-LRMP, as amended (USDA 1991, 2004). The Forest Plan direction for Sensitive species is to develop and implement management practices to ensure Sensitive species do not become threatened or endangered because of FS actions. Under Forest Plan *Management S&Gs*, the forest is to: a) develop sensitive plant species management guides to identify population goals and compatible management activities that would maintain viability (S&G 67) and b) manage sensitive plant species to avoid future listing as threatened and endangered. Standard and Guideline 68 directs the Forest to ensure maintenance of genetic and geographic diversity and viable populations of Sensitive plants. The Forest Plan also states that the Forest would conduct sensitive plant surveys and field investigations prior to any ground-disturbing activity in areas that sensitive plants are known or suspected to occur. Avoidance or mitigation measures are to be included in project plans and NEPA documents (USDA FS 1992). The Forest Wide Goals and Objectives identified in the Forest Plan for threatened, endangered, and proposed plant species and FS R5 sensitive plant species are: a) Manage fish, wildlife and plant habitats to maintain viable populations of all resident fish, wildlife and plant species, b) Manage habitat for State and Federally listed threatened and endangered fish, wildlife and plant species to meet the objectives of their recovery plans, c) Emphasize habitat improvement for sensitive, threatened, endangered and harvest species, d) Manage habitat for FS sensitive fish, wildlife and plant species in a manner that prevents any species from becoming a candidate for threatened or endangered status. Additionally, the Forest is directed to manage botanical resources to maintain present diversity of species.

The FS Manual (FSM 2080) outlines the laws and regulations guiding the FS's noxious weed management (http://www.fs.fed.us/im/directives/fsm/2000/2080.txt).Alternative 1 is in compliance with the Forest Plan, FSM 2670, FSM2080, and other Regulations, Policies, and Plans relevant for FSS Plants and Noxious Weeds, although goals stated in these plans and policies would not be reached as quickly.

### Summary of Effects

It is expected that under Alternative 1, the number of populations of FSS would remain the same and the number of plants per occurrence would remain constant or increase. The number of noxious weed infestations would increase directly as a result of no action being taken to limit spread.

## Alternative 2 – Proposed Action

### Design Features and Mitigation Measures

This alternative has been designed to minimize or avoid negative effects to FSS plants. (See Chapter 2 Design Criteria Common to All Action Alternatives).

## Direct and Indirect Effects

### FOREST SERVICE SENSTIVE PLANTS

The following direct effects to sensitive plants are possible as a result of timber harvest or fuels reduction activities: Direct killing of plants when equipment runs over them or parks on them, when logs are skidded or dragged over them, when slash piles block their light, and when piles are burned directly over them and the heat intensity is too great to survive. Mastication could directly kill plants by running them over or by covering them with a dense layer of chipped wood and limbs. The project has been designed to eliminate or minimize these effects.

**Plants of Riparian, Meadow, and Aquatic Habitats**: For the known occurrences of Rawson's flaming trumpet along Chilkoot and North Fork Willow Creeks in Unit T4, there would be no direct effects because the project is designed specifically to prevent impacts to streamside management zones (see Hydrology Project Design Measures). For the other eight species of these habitats that might occur in the project area, project design measures for hydrology and aquatics would prevent direct and indirect effects to plants of meadows, streamsides, and aquatic habitats listed in Table 9. The meadow restoration work would improve habitat conditions for any of these species should they might occur nearby.

**Plants of Rocky/Gravelly Habitats:** The Yosemite bitterroot populations near units M2 and T8 would not experience direct or indirect effects as the project is designed to avoid impacts to these populations. No plants of rocky habitats were found during surveys of the project area, but not all rocky areas were surveyed as no treatments were proposed within them. However, the project has been designed to prevent incidental effects to rocky/gravelly areas, thus no direct or indirect effects would occur to the three species that may be present: Mono Hot Springs evening primrose, Yosemite bitterroot, or Kellogg's lewisia.

**Plants of Forested Habitats:** The short-leafed hulsea populations in the treatment units and along access roads would all be flagged for avoidance, thus no direct effects should occur. Positive indirect effects may result from opening of the canopy near the populations as they respond positively to this type of disturbance as evidenced by observations of response to fire and thinning (Clines, personal observation). Thus no negative direct or indirect effects are expected for this species.

### NOXIOUS WEEDS AND INVASIVE NON-NATIVE PLANTS

Ecosystem health is threatened by the spread of invasive non-native weeds in a variety of ways. Dense infestations can reduce native biodiversity, compete with threatened, endangered and sensitive (TES) plant species, reduce wildlife habitat quality and quantity, modify vegetative structure and species composition, change fire and nutrient cycles, hybridize with native species, and degrade soil structure (Bossard *et al*, 2000).

Because the project is designed to improve the ecosystems of the project area by removing known infestations of invasive weeds and preventing the introduction and spread of new infestations or species of weeds, there would be beneficial direct and indirect effects to ecosystems as a result of Alternative 2.

## Cumulative Effects

Past, present, and reasonably foreseeable actions within and near the project area are detailed in Table 8. For the Yosemite lewisia and other plants of rocky/gravelly habitats, use of Forest Roads and motorized recreation are currently having some impacts (individual plants are likely killed when driven over repeatedly based on botanical monitoring over the past 10 years), but the Greys Mountain project would not add to these impacts as the project is not occurring within these types of habitats and the project has been designed to prevent damage to rocky/gravelly

soils. For Rawson's flaming trumpet, which grows along streams, the populations within the project area are stable and thriving but there are occasional instances of motorized recreation damage or cattle grazing or trampling. The Greys Mountain project would not add to these slight impacts because there are SMZs along the streams inhabitated by flaming trumpet. For other Sensitive Plants of meadow, riparian and aquatic habitats that may occur within the project area past, current, or future effects experienced at some level could be from the following activities: motorized recreation use, cattle grazing and trampling, roadside hazard tree removal, and fire/fuels management activities. No negative cumulative effects are expected for plants of meadow, aquatic, and riparian areas because aquatic and hydrology project design measures will prevent damage to these habitats. For the short-leaved hulsea, use of Forest roads, motorized recreation, roadside hazard tree removal, and cattle trailing might affect the populations. No negative cumulative effects are expected because project design measures specify that this species will be flagged for avoidance during project implementation; in addition short-leafed hulsea has been observed to benefit from light disturbance (it flourishes after fire and along roadsides), and the populations in the project area were observed to be in good condition, thus there is no evidence that past activities have diminished the vigor of short-leafed hulsea.

For noxious weeds, any activity listed in Table 8 could have spread weeds in the past and has the potential to spread weeds currently and in the future. Surveys for this project revealed that the area is relatively free of noxious weeds, especially considering the amount of historical and current activity occurring therein. The project will reduce the number of infestations of noxious weeds and thus no negative cumulative effects for noxious weeds are expected.

No negative cumulative effects are expected for Botanical Resources as the project has been designed to reduce or eliminate direct and indirect effects to rare plants and to avoid the introduction and spread of noxious weeds.

Positive cumulative effects for ecosystems are expected in that the project area would have a reduced number of infestations of invasive (noxious) weed species over the long term beginning with the actions proposed in this project. Rare plants reliant upon meadow habitat would have more suitable habitat to move into as a result of the meadow restoration actions proposed for this project

## Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 2 is in compliance with the Forest Plan, FSM 2670, FSM2080, and other regulations, policies, and plans relevant for FSS plants and noxious weeds because botanical field surveys were conducted, and the project has been designed to protect FSS plants and prevent and control noxious weeds.

## Other Relevant Mandatory Disclosures

No federally listed TES plant species occur within the project area (see BA/BE for plants – Clines 2011a). No consultation with US Fish and Wildlife Service was necessary.

## Summary of Effects

It is expected that after implementation of Alternative 2, the number of populations of FSS would remain the same and the number of plants per occurrence would remain constant or increase. The number of noxious weed infestations would decrease directly as a result of project activities.

# Alternative 3 – Proposed Action

## Design Features and Mitigation Measures

This alternative has been designed to minimize or avoid negative effects to FSS plants. (See Chapter 2 Design Criteria Common to All Action Alternatives).

## Direct and Indirect Effects

### FOREST SERVICE SENSTIVE PLANTS

The effects are the same as for Alternative 2.

### NOXIOUS WEEDS AND INVASIVE NON-NATIVE PLANTS

The effects are the same as for Alternative 2.

## Cumulative Effects

Cumulative Effects are the same as for Alternative 2.

## Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 3 is in compliance with the Forest Plan, FSM 2670, FSM2080, and other regulations, policies, and plans relevant for FSS plants and noxious weeds botanical field surveys were conducted, and the project has been designed to protect FSS plants and to prevent and control noxious weeds.

## Other Relevant Mandatory Disclosures

No federally listed TES plant species occur within the project area (see BA/BE for plants – Clines 2011a). No consultation with US Fish and Wildlife Service was necessary.

## Summary of Effects

It is expected that after implementation of alternative 3, the number of populations of Forest Service sensitive plants would remain the same and the number of plants per occurrence would remain constant or increase. The number of noxious weed infestations would decrease directly as a result of project activities.

# Geology/Soils

## Affected Environment

The following section addresses the affected environment or existing pre-treatment condition for soils within the project area, including selected meadows for conifer encroachment removal. This report addresses the environmental consequences of the proposed action to soil productivity, mitigations measures to reduce the impacts of the proposed action.

Data used to determine existing soil conditions and projected effects to the soil resource include: the Soil Survey of the Sierra National Forest, (Giger, 1993), site specific data from eleven soil transects collected in 2011 (see Appendix C), following the National Soil Monitoring Protocol (USDA Forest Service, 2009) and past monitoring of similar projects using BMP Monitoring Protocols (USDA, 2002) and the Region 5 Soil Monitoring Protocol.

## Existing Condition

### Soils

Soils in the proposed project area vary in their sensitivity to management. Soils with higher clay content and soil moisture contents have the highest potential to reduced soil porosity. Soil compaction can occur down to 12” deep.

Parent material of the area consists of biotite granites, granites, massive quartzite beds, and tonalites with sparse potassium feldspars and commonly interstitial to quartz and plagioclase (Bateman, 1989). Glacial till is present in minor occurrences around White Chief Mountain and Greys Mountain in the northeast area of the project area. Rock outcrop is present throughout the project area. With the presence of multiple parent materials, many different soil types have formed across the landscape making up the project.

The project area is underlain by six soil types and rock outcrop, which combine to form 11 soil map units. Those soil types formed from granitic rocks include Cagwin, Cannell, Chaix, Chawanakee and Holland. Holland is also formed from meta-sedimentary rocks and Neuns is formed from a combination of metamorphosed granitic and meta-sedimentary rocks. Description of soils within the Greys Mountain Project area include soil map units and soil types, (see Table 10 and Table 11) and a project area map showing the proposed treatment units and soil map units, (in Appendix C).

## Table 10. Soil Map Units for the Greys Mountain Project

| Greys Mountain Soil Map Units | | | | | | | |
|---|---|---|---|---|---|---|---|
| Map Unit | Map Unit Name | Acres | Soil Erosion Hazard | Sensitivity | Soil Compaction Hazard | Runoff Potential | Treatment Units |
| 116 | Cagwin/Rock Outcrop | 168.89 | High | High | Low | Mod/High | T11 & M3 |
| 117 | Cannell | 45.70 | Mod | Low/Mod | Low | Low | T11 & M3 |
| 120 | Chaix | 2071.12 | Mod/High | Low/Mod | Low | Low | Rx 1 & 2, H 5 & T 4, 5, 16, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37 & 38 |
| 124 | Chaix/Holland | 813.61 | High | Mod/Low | Mod/High | Low | Fx 9, H 6 & 7, M 4 & T 9, 10, 17, 18 & 39 |
| 126 | Chawanakee/ Rock Outcrop | 360.01 | High/Very High | High | Low | Mod/High | M 1, 2 & 4 & T 2, 6 & 22 |
| 139 | Holland/Chaix | 61.52 | High/Very High | Mod/High | High/Low | Mod | M 5, Rx 5 & T 7 |
| 140 | Holland/ Chawanakee | 1624.98 | High/Very High | Mod/High | High/Low | Mod | Fx 9, H 1, 4 & 6, M 1, 2, 4 & 5, Rx 1, 2, 4 & 5 & T 8, 9, 10, Rx15, 16, 17, 18, Rx22, Rx23, Rx24 & 39 |
| 141 | Holland/ Chawanakee | 1572.48 | High | Low/High | High/Low | Mod | H 2 & 8, M 2 & 4, Rx 1, 2, 3, 4, 5 & 6 & T 2, 3, 7, 8, 13, Rx15, 16, 17, 19, 20, 21, Rx22, Rx23, Rx24 & 39 |
| 142 | Holland/Neuns | 113.15 | Mod/High | Low/Mod | High/Mod | Low | T 16 |
| 146 | Neuns | 2717.09 | Mod/High | Low/Mod | Mod | Low | M 4 & 6 & T 1, 2, 3, 6, 10, 12, 14, 20, 32 & 33 |
| 148 | Rock Outcrop/ Chawanakee | 131.28 | High/Very High | High | Low | Mod/High | H 2 & 3 & T 8 |

**Table 11. Soil families for the Greys Mountain Project**

| Greys Mountain Soil Families | | | | | |
|---|---|---|---|---|---|
| Soil Family | Taxonomy Name | Temp. Regime | Texture | Hyd Grp | Drainage Class |
| Cagwin | Dystric Xeropsamments | Frigid | A: 0 to 5 inches, loamy coarse sand | A | Somewhat excessively drained |
| | | | C: 5 to 17 inches, gravelly loamy coarse sand | | |
| Cannell | Dystric Xerochrepts | Frigid | A: 0 to 7 inches, gravelly coarse sandy loam | B | Well drained |
| | | | Bw: 7 to 32 inches, gravelly coarse sandy loam | | |
| | | | C: 32 to 50 inches, gravelly loamy coarse sand | | |
| Chaix | Dystric Xerochrepts | Frigid | A: 0 to 6 inches, coarse sandy loam | B | Somewhat excessively drained |
| | | | Bw1: 6 to 18 inches, coarse sandy loam | | |
| | | | Bw2: 18 to 36 inches, gravelly coarse sandy loam | | |
| Chawanakee | Dystric Xerochrepts | Mesic | A: 0 to 4 inches, coarse sandy loam | C | Somewhat excessively drained |
| | | | Bw: 4 to 19 inches, coarse sandy loam | | |
| Holland | Ultic Haploxeralfs | Mesic | A1: 0 to 3 inches, sandy loam | B | Well drained |
| | | | A2: 3 to 7 inches, sandy loam | | |
| | | | AB: 7 to 14 inches, light sandy clay loam | | |
| | | | BAt: 14 to 25 inches, sandy clay loam | | |
| | | | Bt1: 25 to 34 inches, clay loam | | |
| | | | Bt2: 34 to 51 inches, sandy clay loam | | |
| | | | Bt3: 51 to 60 inches, sandy clay loam | | |
| | | | C: 60 to 66 inches, sandy loam | | |
| Neuns | Dystric Xerochrepts | Mesic | A: 0 to 7 inches, gravelly loam | B | Well drained |
| | | | Bw1: 7 to 13 inches, gravelly loam | | |
| | | | Bw2: 13 to 35 inches, cobbly loam | | |
| | | | Bw3: 25 to 45 inches, very cobbly loam | | |
| | | | C: 45 to 54 inches, extremely cobbly loam | | |

Soils intermixed with high amounts of impervious surfaces such as rock outcrop or shallow soil are sensitive to management because they are susceptible to runoff, subsequent erosion of soil adjacent to rock outcrop and are sensitive to disturbance from displacement of the A horizon. Within the project area soil map units 116, 126 and 148 contain rock out crop. Proposed treatment units which contain rock outcrop and shallow soils, that will result in ground disturbance, include H 2 & H-3; M-1, M-2, M-3 & M-4; and T-2, T-6, T-8 & T-11 (Table 10). Rock outcrop has the potential to produce a large quantity of runoff during a storm, resulting in accelerated erosion below areas of the rock outcrop where shallow soils are located. Areas with high abundances of outcrop can have a large increase in accumulated erosion occurring.

Some areas are located on steep 25%-35% slopes where skidding may be adverse (uphill skidding) and ground disturbance could occur. Proposed treatments units which have steeper slopes are located in treatment units T-3, T-8, T-11, T-16 and T-18.

Cagwin, Chaix and Chawanakee soil families are considered shallow soils and the corresponding soil map units in the project area are 116, 120, 124, 126, 139, 140, 141, and 148. Units in the proposed treatment which lie on shallow soils include Fx 9; H 1, 2, 4, 5, 6, 7 & 8; M 1, 2, 3, 4 & 5; Rx 1, 2, 3, 4, 5 & 6 and T 2 through 29. The majority of the shallow soils have formed from a granitic parent material providing the soils with a loamy to coarse-loamy soil texture primarily. With a coarser soil texture the likelihood of compaction occurring in these soils is much lower when compared to the other soils in the project area.

Soils with the highest susceptibility to compaction in the project area include only the Holland family. Soil map units 124, 139, 140, 141 and 142 contain Holland family soils. Units within the proposed treatment area which lie on these soils include Fx 9; H 1, 2, 4, 6, 7, & 8; M 1, 2, 4 & 5; Rx 1, 2, 3, 4, 5, 6, 22 & 24 and T 2, 3, 5, 8, 9, 10, 13, 16, 17, 18, 19, 20, 21, & 39. A sandy loam is present in the upper A horizons transitioning to a sandy clay loam throughout the B horizon down to the C horizon at 60 inches. A higher abundance of clay minerals causes the soil to have an increased chance of compaction occurring within the top 12 inches of the soil profile when moisture levels are above 14%. Most ground based operations rarely causes compaction below 12 inches.

Soils with the highest sensitivity to management in the project area include Cagwin, Chawanakee and Chaix. These soils are sensitive to management based on the thickness of the A horizon, depth to bedrock and the Maximum Erosion hazard rating. These soils have a high sensitivity to management and have a high potential to loss of productivity under most soil disturbing activities, unless other than normal measures are applied (Giger, 1993). Soil map units 116, 126, 139, 140, 141 and 148 contain Cagwin, Chawanakee or Chaix soil families. Units within the proposed treatment which lie on high sensitivity soils include Fx 9; H 1, 2, 4, 6 & 8; M 1, 2, 3, 4 & 5; Rx 1, 2, 3, 4, 5, 6, 22, 24 and T 2, 3, 6, 8, 9, 10, 11, 13, 16, 17, 18, 19, 20, 21 & 39. These soils have a parent material consisting primarily of granitic rocks and are a much less mature soil when compared to Holland or Neuns. The soils can be categorized as being either an entisol or inceptisol. Entisols are the youngest of the 12 soil orders and are commonly found with only an A horizon over a C horizon, not enough time has occur to allow the formation of a mineral B horizon. Inceptisols however are slightly older and have enough time to allow the formation of the mineral B horizons in their subsurface profiles. A less mature soil has few horizons within its profile, commonly only an A horizon, as a result any displacement within the A horizon can result in decreased soil productivity in theses soils.

## Meadows

The meadows within the Greys Mountain project area are important ecological sites and are habitat to unique plants and animals. Conifer encroachment due to heavy grazing, logging, fire suppression, climate change, or a combination of factors can reduce meadow areas and have an effect on the meadow's biology and hydrology (MacDonald and Kuitu, 2009). For the purpose of this analysis, a meadow is defined as "an opening in a forest, generally at higher elevations, that is exceptionally productive of herbaceous plants usually resulting from high soil water content, or a perched water table," (Soil Conservation Society of America).

## Soil Productivity

Current pre-treatment soils conditions have been completed in the project area of the Greys Mountain Project using the National Soil Monitoring Protocol (USDA Forest Service, 2009a). A total of 11 soil transects in ten proposed areas proposed for commercial thinning using mechanical equipment were completed in the project area.

Within the Greys Mountain Project a majority of the completed transects were revealed to be class 0, with a few class 1's and 2's (Table 12). No class 3 disturbance levels were discovered in any of the completed transects throughout the project area. Mean forest floor depth was 4.80 centimeters, mean slope was 16.65% and mean Large Woody Debris (LWD) points/acre was 33.25, see (appendix C).

Within four transects T11A, T29, T30 and T35 compaction was discovered and in only three units T11A, T29 and T30 was there an occurrence of platy soil structure. Unit T11A is the upper portion of unit T11 northwest of the Beasore Rd. With an 80 % confidence, the interval (0.00%, 7.53%) has captured the true proportion of compaction (10-30cm) and platy structure (0-10cm) occurring within units; T11A, T29 and T30, table 10 & 11 (Appendix C) What this means is the interval from 0.00% to 7.53% will have captured the true proportion of compaction and platy structure occurring within the given unit eighty percent of the time. If the transects were reran in the same units, eighty percent of the time the interval 0.00% to 7.53% would capture the true proportion of compaction and/or platy structure occurring in these units. Only within one transect, T30 was bare soil discovered. With an eighty percent confidence the interval (2.98%, 17.02%) has captured the true proportion of bare soil within this unit occurring, (Appendix C). This particular site had numerous undeveloped campsites found within and frequent non-system roads located through the unit.

**Table 12. Soil transect summary for the Greys Mountain Project**

| Soil Transect Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil Transect | Soil Disturbance Class | | | | Mean Slope | Mean Forest Floor Depth | LWD Points/Acre |
| | Class 0 | Class 1 | Class 2 | Class 3 | | | |
| GM T1 | 100.00% | 0.00% | 0.00% | 0.00% | 17.10% | 4.40 | 22.50 |
| GM T11A | 97.00% | 3.00% | 0.00% | 0.00% | 26.57% | 3.97 | 40.00 |
| GM T11B | 100.00% | 0.00% | 0.00% | 0.00% | 12.20% | 4.13 | N/A |
| GM T12 | 100.00% | 0.00% | 0.00% | 0.00% | N/A | 5.07 | 32.50 |
| GM T18 | 100.00% | 0.00% | 0.00% | 0.00% | 22.97% | 7.30 | 70.00 |
| GM T28 | 97.00% | 3.00% | 0.00% | 0.00% | 16.27% | 4.80 | 27.50 |
| GM T29 | 100.00% | 0.00% | 0.00% | 0.00% | 12.43% | 3.70 | 22.50 |
| GM T30 | 94.00% | 3.00% | 3.00% | 0.00% | 7.83% | 3.97 | 20.00 |
| GM T32 | 100.00% | 0.00% | 0.00% | 0.00% | 14.97% | 5.23 | 22.50 |
| GM T35 | 97.00% | 3.00% | 0.00% | 0.00% | 18.90% | 5.80 | 42.50 |
| GM Rx6 | 100.00% | 0.00% | 0.00% | 0.00% | 17.30% | 4.47 | 32.50 |

**Meadow Productivity**

Conifer encroachment on the meadows in the Greys Mountain Project area was assessed using aerial photos in ArcGIS (Rossington, 2011a). An existing meadow GIS shapefile was used to identify 2008 meadows within the Greys Mountain project area. The meadow shapefile was compared to the 2008 NAIP aerial photos and some of the meadows were modified to more accurately represent boundaries shown in the aerial photo. The meadows in 1944 were mapped using scanned aerial photos of the Sierra National Forest and compared to the 2008 air photos to identify areas where conifer encroachment had occurred in the meadows.

The meadows were classified into one of eight categories based on their percent change in area from 1944 to 2008 due to conifer encroachment, see Appendix C . Twenty-seven meadows in the Greys Mountain Project area were analyzed for conifer encroachment and classified but only six were chosen for a further field assessment. Five meadows were identified as encroached meadows and include Meserve Meadow (504M132); 504M293, 504M211, 504M212, and 503M7, (Appendix C). A sixth meadow was initially identified in the aerial photo analysis and determined to not be encroached.

A field assessment was preformed for each of the six meadows identified in the aerial analysis. The assessment consisted of a combination of qualitative and quantitative data including general information; evidence of roads, OHV trails, and grazing; tree islands; areas of encroachment; knickpoints and incised channels; vegetation types in the meadow; hydrology and installation of piezometers; and management issues and recommendations. The following is a summary of a report documenting the results of the field assessment (Rossington, 2011b).

At each meadow, identification of roads, OHV trails, dominate forest type and vegetation was completed around the perimeter. An estimate of conifer encroachment in each meadow was accomplished by counting the number of encroaching trees within the established meadow perimeter. Streams in the meadow were observed for the occurrence of any knickpoints or channel incisions. Soil transects at varying lengths were placed in each of the six meadows identified for field assessment. The purpose of these transects was to provide information on how soils changed to due conifer encroachment or meadow expansion and to aid in mapping the soils found within the meadow. In the encroached meadows, at least one end of the soil transect was placed in an encroached area. Whereas in meadows with distinct wet and dry areas the soil transects were positioned to transgress both the wet and dry portions of the meadow.

**Meserve Meadow (504M132)**
Meserve Meadow is a riparian meadow with a perennial stream flowing through it. About 30 percent of the herbaceous portion of the meadow is located within a wide section of the stream channel. Under the woody riparian vegetation, the stream is incised 20-30 centimeters and is presumed to be caused by a weir-like structure in the stream.

Much of the area mapped as conifer encroachment during the original aerial analysis is woody riparian canopy with an herbaceous meadow understory. The meadow polygon in ArcGIS was modified to include this area and more accurately represent Meserve Meadow. After the modification, Meserve Meadow was determined to be 28.96% encroached and fell into class 5, extensive encroachment. This conifer encroachment is located on the eastern edge of Meserve meadow. About 70 small conifers (<2 meter (m) and 80 large conifers (>2m) are growing near the edge of Meserve Meadow in meadow soils with a high water table. These conifers are predominately cedar, white fir, and ponderosa pine. The proposed treatment area is approximately 0.5 acres.

**504M293**
Young conifers were observed growing in the northern portion of the meadow above the dry lobe near transect point 504M293-A'. About 130 small conifers (<2m) and 50 large conifers (>2m) are growing in these areas and are dominated by incense cedar and white fir. There are five tree islands also present in the meadow.

Field assessment of conifer encroachment is consistent with the aerial analysis.
**504M211**

Young conifers were observed growing on the east side of the meadow in addition to two tree islands near the same point, as well as on the southern end of the meadow. About 75 large conifers (>2m) and 30 small conifers (<2m) are growing in these areas and are dominated by white and red fir ranging from 1-12" in diameter.

The observed young conifers growing in the areas mapped were determined to be conifer encroachment during the aerial analysis. Although these portions of the meadow were mapped as encroached areas, no vegetative evidence such as rushes or sedges was observed in these areas that may indicate a previous meadow. It is possible the 1944 mapped meadow had been expanded past its original boundaries due to railroad logging. The soils in the area of encroachment near the western margin of the meadow showed no evidence of meadow migration.

**504M212**

Many small conifers encroaching at the northern end, especially near the meadow edge were observed in the field. Soils transect point 504M212-A was placed in this group of encroaching conifers. In total, about 150 large conifers (>2m) and 35 small conifers (<2m) are encroaching on the northern and southern ends of the meadow, predominately consisting of red and white fir. There is about one acre of encroachment in these two areas combined. The field assessment of conifer encroachment is consistent with the aerial analysis. Along with the areas of conifer encroachment, five tree islands were also identified during the field assessment.

There is a road present on the west side of the meadow to provide egress and ingress access to the area.

**503M7**

The conifer encroachment in the lower main part of the meadow was consistent with the areas mapped during the aerial analysis. In the lower main portion, young cedars are encroaching the meadow near both ends of the soil transect. About 50 large conifers (>2m) and 20 small conifers (<2m) are encroaching in these areas. Along the neck portion of the meadow, it appears that the encroaching ponderosa pines were planted deliberately. About 0.28 acres of the upper lobe was encroached by about 50 small conifers not visible in the initial aerial analysis.

During the initial aerial analysis, 503M7 was estimated to be encroached by 3.75 acres or 31.69%. After including the area of encroachment in the upper lobe discovered during the field assessment, 503M7 is estimated to be encroached by 4.03 acres or 34.04%. Although the meadow was mapped throughout the neck, upon examination in the field, only a small area of meadow existed in the neck area. There seems to be meadow throughout the neck area in 1944 air photo, but the meadow may have been expanded past its natural boundaries due to railroad logging in this area.

## Desired Condition

Thresholds and indicators have been identified to meet desired conditions for the soil resource. Use of thresholds and indicators provides a consistent method to analyze, describe, and report on soil condition throughout the region.

The following desired soil conditions are applicable to the project:

1. Soil loss should not exceed the rate of soil formation (approximately the long-term average of 1 ton/acre/year). Maintain sufficient soil cover to prevent accelerated soil erosion from exceeding the rate of soil formation.

2. Soil porosity should be at least 90% of total porosity found under natural conditions over 85% of a treatment unit. A 10% reduction in total soil porosity corresponds to a threshold soil bulk density that indicates detrimental soil compaction.

3. Fine organic matter occurs over at least 50% of the area. Fine organic matter includes plant litter, duff, and woody material less than 3 inches in diameter. The dry weight of fine organic matter without woody material is about 0.2 to 3 tons per acre.

4. Large woody material is at least five well-distributed logs per acre representing the range of decomposition classes found. Desired logs are at least 20 inches in diameter and 10 feet long. To alleviate the risk of adverse fire effects, dry weight should be less than about 3 tons per acre.

5. In meadow areas, where wet soils naturally occur, moist soil moisture conditions would be maintained and water dependent vegetation would be sustained.

### Indicators of Effect

Areas proposed for ground based harvest have soils that are highly susceptible to reduction of soil porosity caused from compaction by heavy equipment operating when soils are moist or wet.

Prescribed fire and tractor piling would reduce soil cover and accelerate erosion that could result in a loss of soil productivity.

Ground based harvest systems on slopes that are too steep or are on shallow soils would displace surface soil horizons that could result in accelerated erosion and/or reduce soil productivity.

## Alternatives, Including the Proposed Action

The Forest Service analyzed a No Action alternative, the proposed action and an additional action alternative in detail. Action alternatives included, the proposed action and a Lower and Limited Mid-Level Canopy Treatment alternative, which focused on limiting the quantity of material removed to just that needed to meet fire and fuels objectives in all treatment areas.

## Alternative 1 – No Action

Under the no action alternative, current management plans would continue to guide management of the project area. No restoration treatments would be implemented

### Direct & Indirect Effects

Under the Alternative 1, soil conditions would not change from the existing conditions. Soil transect data indicates that soil cover and (LWD) are meeting Regional Soil Standard and Guideline thresholds. Both soil cover and levels of LWD would continue to increase due to no disturbance taking place. Only one unit T30 had areas of bare soil as previously discussed with the majority having no areas of bare soil. Average LWD was 33.25 points/acre, well above the guideline of 5 logs per acre. Only four units T11A, T28, T30 and T35 contained soil disturbance level one disturbance and of the four only one contained a level two disturbance, unit T30. Any non-system roads may eventually recover through implantation of the forest road and OHV programs and forest closure to areas not designated as official OHV trails. However, the user created trail in meadow 503M7 would continue to impact the Aquic soils and ground water

dependant vegetation present within the meadow, accelerated erosion from the trail would further decrease soil productivity and impacts to the heritage resource site could occur.

If vegetation is left in its current state of high fuels and high wildfire risk, it is inevitable that a wildfire would occur. Many areas within a potential wildfire area would not meet soil quality standards in terms of soil cover and surface erosion rates in a fire event. The estimated area of potential high soil burn severity is approximately 150 acres. Soil cover would be less than 20% and some soils would develop hydrophobic conditions. Accelerated erosion would occur, especially during precipitation events. Soil Productivity would be reduced in some areas by at least one site class. Past monitoring of wildfire areas on the nearby Stanislaus National Forest has found that bare ground averaged about 70% by spring of the first year and by spring of the second year bare ground averaged 27% (Janicki, 2003). In a study conducted by Berg and Azuma (2002) bare ground and evidence of surface erosion recovered to pre-fire conditions within four to five years after a wildfire. LWD would in all probability be consumed in a fire and long term soil productivity could be decreased as well.

Meadows would have continued conifer encroachment not just along the perimeter of the meadow but further transgression into the meadow itself. The water table would slowly decline from its current level, decreasing not only the productivity/sustainability of the soils for herbaceous plants but also the habitat for forest wildlife.

### Cumulative Effects

The project area was evaluated for Cumulative Watershed Effects (CWE) using the Region 5 CWE Model. This model accounts for soil disturbance in terms of an equivalent roaded acre. The ERA model quantifies disturbance based on the degree of disturbance as compared to an acre of road and measured relative to disturbance in a given watershed. See the Project Hydrology Report for additional information on the Cumulative Watershed Effects Analysis. All the subdrainages have ERA values below the lower threshold of concern. Baseline CWE (ERA %) for subdrainage 503.0056 is high at 9.25%, which resulted from past timber harvest activity. With the no action alternative, no tractor related ground disturbance or prescribed fire would occur, which, (given sufficient time), would allow the subdrainage to recover and stabilize.

## Alternative 2 – Proposed Action

### Direct & Indirect Effects

Treatment activity that has the potential to affect soil productivity includes commercial thinning, mastication operations, pre-commercial thinning w/ mechanical piling, tractor piling of slash, prescribed burning, meadow conifer removal and stabilization, and OHV trail restoration. Each activity has varying potential to produce impacts to soil resources via mechanical disturbance, soil compaction and reduced soil cover.

The use of mechanical harvesters, rubber tired skidders, tractor piling, and masticators would cause soil disturbance, which could result in detrimental soil disturbance and compaction, as well as accelerated soil erosion. Minor amounts of soil disturbance are already present within units T11A, T28, T30 and T35 however due to project design criteria, marginal soil disturbance would occur. Shallow soils occur in units Fx 9; H 1, 2, 4, 5, 6, 7 & 8; M 1, 2, 3, 4 & 5; Rx 1, 2, 3, 4, 5, 6, 7, 15, 22, 23 & 24 and T 2 through 29. Soil with a high compaction hazard occur in units Fx 9; H 1, 2, 4, 6, 7, & 8; M 1, 2, 4 & 5; Rx 1, 2, 3, 4, 5, 6, 22, 24 and T 2, 3, 5, 8, 9, 10, 13, 16, 17, 18, 19, 20, 21, & 39. Sensitive soils occur in units Fx 9; H 1, 2, 4, 6 & 8; M 1, 2, 3, 4 & 5; Rx 1, 2, 3, 4, 5, 6, 22 &24 and T 2, 3, 6, 8, 9, 10, 11, 13, 16, 17, 18, 19, 20, 21, & 39 Steep slopes occur in tractor units T4, 6, 10, 12, 14, 16, 17, 18 and 33 and mastication units M4 and 5.

### Commercial Thinning

Areas planned for commercial thinning, standard operating practice to leave at least 50 percent, well distributed soil cover for erosion protection on slopes under 35%. If slopes are greater than 35%, soil cover should be at least 70%. Past observations on the Sierra NF have found that this amount of soil cover generally prevents accelerated erosion. A buffer of 100 feet would be provided around rock outcrop to prevent accelerated erosion of the adjacent soils from rapid runoff from rock outcrops. During times of increased soil moisture, increased amounts of soils disturbance would also occur. In addition an increased risk of soil compaction could also occur during times of increased soil moisture. Soils would need to have soil moisture content below 14% to minimize the potential of detrimental soil disturbance and/or compaction. Areas located on steep 25%-35% slopes where skidding may be adverse (uphill skidding) could result in increased amounts of ground disturbance.

### Pre-Commercial Thinning

Areas planned for pre-commercial thinning will be completed via mastication. Areas planned for mastication pose little risk of reducing soil productivity. The masticator equipment reduces erosion potential by increasing soil cover and generally causes little soil disturbance and compaction. Soil masticating equipment generally does not result in compacted soils because the equipment has lower ground pressures then conventional logging equipment and because this treatment creates a bed of chips that the masticator travels over. Most mastication treatment would be on slopes less the 35%; however some areas with slopes in excess of 35% would be treated. Some soil disturbance would probably occur where the masticator makes turns during the operations. During times of increased soil moisture, increased amounts of soil disturbance would also occur however this would be minimized through the application of design criteria.

### Hand Piling

Hand piling and meadow conifer removal through hand piling would have no adverse affects on the soil resource. Hand cutting of conifers in meadows would maintain or increase aquic soils by removing conifers that are transpiring water out of meadow soils (Lesh, 2009 & Norman, 2005). Of the meadows selected for hand piling, Board Ranch and Meserve Meadows would have the most conifers removed from their interior and periphery.

### Tractor Piling

In areas where tractor piling of slash is planned, it is a standard operating practice to leave at least 50 percent, well distributed soil cover for erosion protection on slopes under 35%. If slopes are greater than 35%, soil cover should be at least 70%. Past observations on the Sierra NF have found that this amount of soil cover generally prevents accelerated erosion. A buffer of 100 feet would be provided around rock outcrop to prevent accelerated erosion of the adjacent soils from rapid runoff from rock outcrops erosion would be minimized.

### Mastication

Effects of mastication were addressed in the above discussion of precommerical thinning.

### Prescribed Fire

Areas planned for prescribed fire pose little risk of causing significant effects to soil productivity based on the past performance of the prescribed fire program on the Sierra National Forest. Past prescribed fires on the forest has resulted in low burn intensity in most areas. Prescribed fire

burns in a mosaic pattern leaving patches of unburned vegetation and patches of burned areas, where duff and litter is completely consumed. Most trees are left undamaged, except for a few small patches that have burned at moderate burn intensity with moderate burn severity. Soil quality standards have been met from past prescribed fires and are expected to be met from the proposed action. Soil cover of 50% is expected to be met in the prescribed fire treatment areas.

### OHV Trail Restoration

Only one area is proposed for OHV trail restoration and it is located within meadow 503M7. Subsoiling the trail to de-compact the soil would allow the regeneration of native grasses and herbaceous plants and allow subsurface water to move freely down gradient. Roughly 10,065 square feet (0.231 acres) of soil would be reclaimed back to its natural condition after subsoiling is completed. After subsoiling is completed water bar construction would aid in decreasing the amount of surface erosion occurring on the trail. Additional barricades and signs preventing OHV riders from using the trail would further advance the regeneration of the trail as well.

## Cumulative Effects

Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%.

Post harvest prescribed fire is proposed for many of the tractor units within the project area. Re-entry could occur any time after the logging operation is complete, but since it is difficult to predict when this might occur, a three year re-entry was estimated (i.e., 2015) and used as a recovery factor for the CWE analysis. CWE response is low to unlikely for all subdrainages.

# Alternative 3 - Lower and Limited Mid-level Canopy Treatments, All Treatment Areas

## Design Features and Mitigation Measures

Same design features and mitigation measures occur for alternative 3 as for alternative 2; see design features and mitigation measures for alternative 2.

## Direct & Indirect Effects

In alternative 3, treatment areas would remain the same as in alternative 2, treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. Under alternative 3 there would be no additional treatments (i.e. additional thinning in the mid-level canopy) to fully address stand density and forest health objectives.

This alternative would limit treatments to mechanical clearing of ladder and surface fuels.

There is no difference between the effects of alternative 2 and alternative 3 for the soil resource (see affects analysis for alternative 2). The same areas will be treated, but those acres proposed for commercial thinning in alternative 2 would be treated by pre-commercial thinning by mastication or hand-treatments instead in alternative 3.

## Cumulative Effects

Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%.

Post harvest prescribed fire is proposed for many of the tractor units within the project area. Re-entry could occur any time after the logging operation is complete, but since it is difficult to predict when this might occur, a three year re-entry was estimated (i.e., 2015) and used as a recovery factor for the CWE analysis. CWE response is low to unlikely for all subdrainages.

## Compliance with the Land and Resource Management Plan

Compliance, with the LRMP measures, is built into the design criteria of the project. As documented in the effects analysis, the action alternatives would avoid tractor logging on steep slopes with high erosion hazard, erosion control measures would be applied appropriately, and ground cover and LWD would be sufficiently maintained. With implementation of the project design features, the action alternatives would be in compliance with LRMP requirements for the soil resource.

In addition, soil cumulative effects were assessed per S&G #94 to determine if more than 25 percent detrimental ground disturbance is proposed in the RCA or more than 15 percent of a CAR. Ground disturbing activities are defined in the SNFPA ROD (2004) as “activities that result in detrimental soil compaction or loss of organic matter beyond the thresholds identified by soil quality standards”. This soils analysis concludes that soil productivity would not be affected because of soil design criteria, including Soil Design Measures 3 and 4, which limits detrimental soil disturbance to no more than 15% of a treatment unit. Based on this information, ground disturbance would not exceed these percentages in RCAs, and there are no CARs in the project area, so a peer review is not required.

# Lands/Special Uses/Recreation

## Affected Environment

### Lands and Special Uses

Land Uses and Mining Claims (See Lands and Recreation Uses Greys Mountain Project Area Map, 08/08/11)

Most of the National Forest System (NFS) lands inside the project area have Reserved Domain status. There are five Land-type special-uses authorized within the project area including: an apiary site (in unit T39); a road to private property authorized under permit (located between units T-28 and T29); a Forest Roads and Trails Act (FRTA) easement providing access to private property located in unit T38; the (MID) stream gauging station at Willow Creek west of Greys Mountain Campground, and a ditch tender cabin both authorized under Special Use Permit (located in unit T-29) .

- The apiary site consists of a flat area surrounded by an electric fence where up to 100 hives of bees are located.
- The private road authorized under permit is native surfaced, 12-feet wide and approximately 950 feet long leading from road 6S10 to the Sturrock property at Soquel.
- The FRTA easement was granted to provide access to private property. The easement may be used by the FS for protection and administration of (NFS) lands as long FS activities do not interfere with the Grantees use of the road.
- The MID stream gauging station is located on the stream bank of Willow Creek adjacent to a bridge near the Greys Mountain campground. The station is made out of a large culvert and contains electronic equipment that measures stream depth on a year round basis.
- The MID ditch tender cabin is a wooden structure is located off the 6S10A spur road. The native surfaced road is 14 feet wide and approximately ¼ mile long. A gate is located at the beginning of the A spur.

All of these uses have been authorized under permit for years and are easily recognizable features on the landscape.

MID also operates a siphon or ditch that is used on occasion to deliver water to Willow Creek. MID periodically performs maintenance on the ditch to keep it in a serviceable condition. The siphon was constructed prior to the Forest proclamation and does not require a special use authorization.

The Forest Service holds permanent, full public easements for Road 6S10 across private property located east of Highway 41 in the Paradise Springs and Soquel areas.

There is one locatable mining claim in the project area. Willow Creek #1 is located in the vicinity of the Texas Flat Overflow dispersed recreation area. There are no active operations occurring at this time.

## Developed and Dispersed Recreation

Recreation: See Lands and Recreation Map in Appendix A.

The Forest Service operates the Soquel, Greys Mountain, Texas Flat and Chilkoot developed campgrounds in the project area. The Soquel Campground 17.73 acres, is a developed campground located on Forest road 6S40 with 11 sites that can accommodate up to 66 people overnight. The use season for this facility is June through September. The campground is full most weekends from June through August. Greys Mountain Campground 17.42 acres, also located off Forest road 6S40, with 25 sites that can accommodate up to150 people overnight. This site is used heavily on weekends June through August. Texas Flat Group Campground 6.65 acres, is located off Forest road 6S08 with four group sites that can accommodate up to 48 people overnight. This site is used heavily on weekends June through August. Chilkoot Campground 5.29 acres, located off Forest road 6S07,has 15 sites that can accommodate 90 people overnight. This site is used heavily on weekends June through August. California Land Management, a state agency, manages these campgrounds for the SNF under a concessionaire permit. All four campgrounds total 47 acres.

Several dispersed recreation sites including the Texas Flat overflow and Soquel Overflow are also located inside the project area. Dispersed recreation uses are common in the project area including snow shoeing, cross-country skiing, and snowmobiling in the winter months. In the other seasons of the year, the project area is popular with horseback riders, motorized vehicle recreationists, hikers, and other general forest users.

### Motorized Recreation

There are 5.5 total miles of designated motorized trails in various treatment units.

Man made features that are creating a degraded resource condition are forest roads in poor maintenance condition and user created vehicle trails that are not on the National Forest Transportation System (NFTS). These user created areas are a cause of high soil erosion during water runoff events which leads to reduced water quality and a reduction in soil production capacity. Unmanaged OHV use has resulted in unplanned roads and trails, erosion, watershed and habitat degradation and impacts to cultural sites; “Four Key Threats Facing the Nation’s Forest’s and Grass Lands”; USDA-FS June 2004). In March of 2010 the SNF completed the Travel Management Final Environmental Impact Statement (FEIS), which amends the SNF LRMP and implements the 2005 Travel Management Rule (36 CFR Part 212). This decision prohibits motor vehicle travel by the public, off designated NFTS facilities (roads, motorized trails and areas) except as allowed by permit or other authorization (this prohibition would not apply to snowmobiles.

# Environmental Consequences

## Alternative 1 – No Action

### Direct, Indirect and Cumulative Effects

Under the no action alternative, current management plans would continue to guide activities in the project area. This includes all ongoing recreation activities, lands uses and mining claims with existing decisions or permits, and would not change if this alternative was selected.

While special-use permittees (including Forest Service campground concessionaires) would continue to perform hazardous fuels reduction around the facilities they operate, they would be limited to the standard 30 feet required by the Forest Service. Under consultation and in coordination with the Forest Service, permit holders may be able to extend fire clearances around their facilities to meet the 100 foot requirement of the State of California. There would be little protection from moderate to uncharacteristically severe wildfire.

The continuation of natural fuels build-up would pose a wildfire threat to campgrounds and permit holder improvements as well as loss of revenue for commercial permit holders. Overstocked stands have the potential to be effected by epidemic infestations of bark beetles in combination with disease, and/or drought-induced mortality, in forested areas, risking the livelihood of commercial permit holders (including Forest Service campground concessionaires) Commercial permit holders (including Forest Service campground concessionaires) would likely experience loss of revenue because recreationists and other forest visitors they depend on, may be hesitant to visit parts of the forest that have high tree mortality. As public safety concerns increase (mainly from snag densities and high fire danger) the potential need would arise for areas and trails to be closed to public access. The overall aesthetic landscape viewing value would also be significantly reduced.

## Alternative 2 – Proposed Action

### Direct Effects

Implementation of alternative 2 would not change recreation related management or permitted activities within the project area. The activities associated with the proposed action would include commercial, pre-commercial and biomass thinning of conifer stands and prescribed burning (understory and pile) with associated post-activity treatments. Implementation of this alternative may have direct effects to permitted operations and general recreation inside the project area if activities occur during Peak Season (Memorial Day to Labor Day) when campgrounds are most occupied by recreation visitors. Intrinsic values, much appreciated by the recreating public would be affected as well as an atmosphere of “quiet”, “peaceful”. The result would be “the lessening of the experience of natural sounds and the absence of mechanical and “industrial” sounds on forest lands (Russell, 2006).

.

Design criteria for recreation have been developed to minimize the impacts that could occur from the implementation of this alternative. The overall aesthetic landscape viewing value would be improved because forest visitors believe forests have intrinsic values and are valued for what they are rather than what they produce. These intrinsic values are ones that exist about forest resources in general as well as about a particular place. The view or scenery is believed to attract those from urban areas, is a value that attracts new residents and is appreciated by long-term residents (Russell, 2006).

While special-use permittees (including Forest Service campground concessionaires) would continue to perform hazardous fuels reduction around the facilities they operate, they would be limited to the standard 30 feet required by the Forest Service. Under consultation and in coordination with the Forest Service, permit holders may be able to extend fire clearances around their facilities to meet the 100 foot requirement of the State of California. There would be improved protection from moderate to uncharacteristically severe wildfire, increasing the area that is more fire resistant. The activities associated with the proposed action would reduce wildfire severity and develop a more fire resistant forest structure around developed campgrounds, dispersed areas and along designated OHV trails.

### Indirect and Cumulative Effects

Indirect effects are predicted to be minimal, limited to aesthetic perceptions of changes noted by forest visitors. There are no anticipated cumulative effects to Lands and Recreation Special Uses, developed and dispersed recreation or designated OHV trails resulting from this action because with the implementation of associated recreation design criteria, it would not change recreation related management or permitted activities within the project area.

## Alternative 3

### Direct, Indirect and Cumulative Effects

The effects of this alternative would be similar to that of alternative 2.

# Terrestrial Wildlife

## Affected Environment

The Greys Mountain Project is located within Madera County on the Bass Lake Ranger District of the Sierra National Forest. The project boundary encompasses 8,323 acres within the Willow Creek sub-watershed and 1,261 acres within the Upper Fresno River sub-watershed. The project area lies between two major forest road travel corridors: Beasore Road and Sky Ranch Road. The northern and western portions of the project area include [WUI]) defense and threat zone forest designations. The proposed project ranges from 4,000 feet to 7,000 feet in elevation. Primary vegetation types include: Sierra mixed conifer (68% of the project area), ponderosa pine (16% of the project area), and montane hardwood and hardwood conifer (9% of the project area). Montane and mixed chaparral habitat is present in 4% of the project area. The remaining habitat types each represent less than 1% of the project area and include: Jeffery pine, wet meadow, rocky outcrop, annual grassland, and lacustrine areas.

### Methodology for Analysis

A total of 13 terrestrial wildlife species were identified as Federally listed, or are candidates for listing, or are FSS Species, and that also may inhabit the project area or nearby areas. Federally listed species were determined by reviewing the USFWS on-line data base on September 9, 2011, (http://www.fws.gov/sacramento/y_old_site/es/spp_lists/auto_list_form.cfm). FSS Species were determined by reviewing the USFS Pacific Southwest Region's (R5) Sensitive Species List of June 8, 1998, as amended on March 6, 2001, May 7, 2003, and October 15, 2007.

The 13 species were evaluated to determine whether they or their habitats exist, or potentially exist, in or near the project area. If the species or their habitats do exist in the area, then they were further assessed to determine whether there was potential for the species or its habitat to be directly, indirectly, or cumulatively affected by the project. Seven of the 13 species met these criteria; therefore they were analyzed in detail. The following terrestrial wildlife species are either Federally listed, or candidates for listing, or Forest Service Sensitive Species, that are known, or believed to be, in or near the project Area:

- California Spotted Owl (*Strix occidentalis occidentalis*) Forest Service Sensitive (R5)
- Great gray owl (*Strix nebulosa*) Forest Service Sensitive (R5)
- Northern goshawk (*Accipiter gentilis)* Forest Service Sensitive (R5)
- Pallid bat (*Antrozous pallidus*) Forest Service Sensitive (R5)
- Western red bat (*Lasiurus blossevillii*) Forest Service Sensitive (R5)
- American marten (*Martes americana*) Forest Service Sensitive (R5)
- Pacific fisher (*Martes pennanti pacifica*) Forest Service Sensitive (R5)

6 of the 13 species were not analyzed in detail within the Greys Mountain Project Biological Assessment/Biological Evaluation because they either do not occur in the project area, or do not have habitat within or adjacent to the project area, nor are affected directly, indirectly, or cumulatively by this project. Table 13 summarizes these species habitat, area of consideration, and the rationale for not including them in detailed analysis f. ***The Greys Mountain Ecological Restoration Project would have no effect on the following six species or their habitat, therefore they were not analyzed in detail in this BEBA:***

- Valley Elderberry Beetle (*Desmocerus californicus dimorphus*) Federally Threatened
- Bald Eagle (*Haliaeetus leucocephalus*) Forest Service Sensitive
- Wolverine (*Gulo gulo*) Federal Candidate Species; Forest Service Sensitive
- Willow flycatcher (*Empidonax trailli*) Forest Service Sensitive
- Sierra Nevada red fox (*Vulpes vulpes necator*) Forest Service Sensitive
- Townsend's big-eared bat (*Corynorhinus townsendii*) Forest Service Sensitive

**Table 13. Special Status species on the Sierra NF and a summary of their habitats, area of consideration, and rationale for inclusion/exclusion from detailed analysis within the project BE/BA.**

| Species (Elevation Range in Feet) | Habitat | Analysis Boundary | Rationale [a] |
|---|---|---|---|
| California wolverine (Elevation 7,000'-12,000') | Uses a variety of habitats within remote, undisturbed wilderness areas including alpine coniferous forests dominated by fir, spruce, hemlock, Douglas-fir, or lodgepole pine. Dens include snow-covered roots, standing or down logs with large cavities, holes under coarse woody debris, old beaver lodges, bear dens or rocky areas. | Not known to occur in Sierra National Forest; potentially extirpated from California | There are no known locations and no suitable habitat for California Wolverine in or adjacent to the project. The project area is within front country WUI and does not possess the remote wilderness characteristics associated with wolverine habitat. This species would not be analyzed further in this document. |
| Bald eagle (< 10,000') | Winter habitat in the Sierra NF, day perches, roost sites and foraging sites along large open waters with abundant prey. Known nest sites are at Bass Lake and Shaver Lake. | ½ mile from large water bodies | There are no known locations and no suitable habitat for Bald Eagle in or adjacent to the project. This species will not be analyzed further in this document. |
| Valley elderberry longhorn beetle (< 3,000') | Habitat consists of elderberry shrubs in Great Valley Oak Riparian Forests below 3000 feet in elevation | Within ¼ mile of project area | The project ranges from 3,800' to 7,200' in elevation which is above the elevational range of the Valley elderberry longhorn beetle. This species would not be analyzed further in this document. |
| Willow flycatcher (WIFL) (2,000'-8,000') | Western Sierra Nevada's Found in willow-dominated riparian areas, including moist meadows with perennial streams and smaller spring-fed or boggy areas | Within wet meadows with extensive willow patches | The meadows within the project are either not of the size, or do not contain the extensive patches of willow required by WIFL for breeding. Further, there are no recorded observations of willow flycatchers on the Bass Lake Ranger District. |

| Species (Elevation Range in Feet) | Habitat | Analysis Boundary | Rationale [a] |
|---|---|---|---|
| | | | This species will not be analyzed further in this document. |
| Sierra Nevada red fox (7,000'-12,000') | Red fir and lodge pole pine in subalpine and alpine fell-fields of the Sierra Nevada. Dens seem to be in rock/talus slides or earthen excavations/holes. | 3 mile radius around project area | There are no known locations and no suitable habitat for Sierra Nevada red fox in or adjacent to the project. The project area is within front country WUI and does not possess the remote wilderness characteristics associated with SN red fox habitat. This species will not be analyzed further in this document. |
| Townsend's big-eared bat (<10,000') | Found throughout the Sierra Nevada. Inhabits isolated mines/caves with low human disturbance. | ¼ mile around project boundary | There are no caves or other suitable habitat for the Townsend's big eared bat within the project. This species will not be analyzed further in this document. |
| California spotted owl (>8,000') | Sierra Nevada province in CA. Need at least 40% canopy closure and an average dbh of 11 inches | ½ mile around Project boundary | Potential impacts to the California spotted owl and/or its habitat will be analyzed in this document |
| Northern goshawk (<10,000') | Dense mature conifer and deciduous forests interspersed with meadows, other openings and riparian areas. Found in mixed conifer to lodge pole pine | ½ mile around Project boundary | Potential impacts to the Northern goshawk and/or its habitat will be analyzed in this document |
| Great gray owl (4,500'-7,500') | Found in large moist montane meadows surrounded by dense forest of medium to large mixed conifer and red fir. | ½ mile around large meadows (15 acres +) or meadow complexes | Potential impacts to the Great Gray Owl and/or its habitat will be analyzed in this document |
| Pallid bat (<6,000') | Uses a variety of habitats. Depends on oak woodlands for foraging. Roosts in mines, snags, and in crevices in oaks | ¼ mile around project boundary | Potential impacts to the pallid bat and/or its habitat will be analyzed in this document |
| Western Red Bat (<3,000') | Uses a variety of habitats. Prefers edges or habitat mosaics that have trees for roosting and open areas for foraging | ¼ mile around project boundary | Potential impacts to the Western red bat and/or its habitat will be analyzed in this document |
| American marten (>7,200') | Found in mesic, late successional coniferous forests. Dens are in trees, snags, downed logs and rocks in structurally complex old forests. | 3.1 mile radius around | Potential impacts to the American marten and/or its habitat will be |

| Species (Elevation Range in Feet) | Habitat | Analysis Boundary | Rationale [a] |
|---|---|---|---|
| | | project area | analyzed in this document |
| Pacific fisher (5,000'-8,500') | Coniferous and mixed forests with high canopy closure and late successional old-growth forest structural elements. Den and rest sites associated with water or riparian habitats. Rest sites include large standing conifers or hardwoods (snags or live trees). Dens occur in cavities of standing large diameter conifers or hard-woods (snags or live trees) | 3.1 mile radius around project area | Potential impacts to the Pacific fisher and/or its habitat will be analyzed in this document. |

# Environmental Consequences

## Mitigation and Monitoring

This project integrates management design measures that help mitigate potential impacts to wildlife habitat. These measures include, but are not limited to, LOPs which restrict treatment operations to avoid breeding seasons, Riparian management areas, streamside management zones, and OFL's for perennial streams. Project design criteria common to all alternatives were developed through the collaborative process of the SNAMP Integration Team meetings. These design criteria were developed to maintain habitat connectivity, special habitat elements for terrestrial wildlife species, and limit the amount of behavioral disruption during project implementation and post-treatment. Project design criteria are outlined in Chapter 2 of this document.

Monitoring of fisher and high quality fisher habitat within the Greys Mountain Project area and the adjacent four key-subwatersheds are being conducted by Rick Sweitzer, UC Berkeley fisher team, as part of the (SNAMP). (More information regarding SNAMP can be found on-line at http://snamp.cnr.berkeley.edu/).

## Alternative 1 – No Action

Alternative 1 is the no action alternative. Under the no action alternative, current approved management plans would continue to guide management of the terrestrial analysis area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: roads and trails; plantation maintenance, cattle grazing, and recreation. No project associated treatments would be implemented.

### Direct Effects

There would be no direct effects to any terrestrial wildlife species under this alternative because there would be no new activities conducted that would change habitat conditions.

### Indirect Effects

There may be indirect effects to terrestrial wildlife habitat if alternative 1 is selected as no fuels treatments would occur and the continued immediate threat of uncharacteristically severe, stand-

replacing wildfire would remain unabated. Additionally, in failing to reduce stand density, drought stress and subsequent insect and disease mortality would exacerbate the threat of uncharacteristically severe wildfire. Furthermore, the high probability of a drying climate change in the Western United States would potentially further compound these effects.

### Cumulative Effects

Alternative 1 would not produce impacts to the environment that add to cumulative effects.

## Alternative 2 – Proposed Action and Alternative 3-Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

### Direct Effects

Direct effects from the implementation of alternative 2 or alternative 3 may occur to California spotted owl, great gray owl, northern goshawk, American marten, Pacific fisher, western red bat, and pallid bat, although the potential effects would be limited to short-term noise disturbance of the project management, which potentially could lead to an energetic expense from avoidance reactions. No direct mortality from project activities is expected to occur to these species because LOPs restricting project activities would be implemented, for a variety of species, to protect nest and densities, as described in the BE/BA. In particular, a fisher LOP would be implemented for all suitable fisher denning habitat, throughout the project area, regardless of whether a densite buffer is present. This would protect fisher den sites that may be occupied, but not identified through the SNAMP project.

## Indirect Effects

Habitats in the project area are defined according to the "California Wildlife Habitat Relationship" (CWHR), as shown in Map 17 in the Map Package. Detailed CWHR assessment can be found in Appendices C and G of the Greys Mountain Terrestrial Wildlife BE/BA (USDA Forest Service 2011b). Species specific habitat needs as well as the habitat availability within the project area are listed within the following effects analysis. The effects analysis further describes the changes to this habitat for each alternative. Special project design measures for the Greys Mountain Project were developed in concert with the Bass Lake District interdisciplinary team, Pacific Southwest (PSW) Research scientists, and concerned public participation groups. These design measures would be implemented under either of the two action alternatives. Within this project area special considerations have been given to maintaining higher levels of heterogeneity and stand diversity through actions such as delineating OFLs surrounding perennial streams. Higher levels of biodiversity have also been planned for by marking retention groups of large diameter trees. 890 such tree groups were identified in the project area. These tree groups are composed of a cluster of three or more trees, 30" dbh or greater, with touching crowns, and would benefit those species which utilize dense groupings of large trees. Ideally these groups would contain "defect" trees, those that have cavity and platform creating defects including: mistletoe, rot, forked top, broken limbs, and broken tops. Another project design measure which would maintain biodiversity is the identification of retention areas around large oaks within treatment units. Two to three large oaks per acre were identified and marked with a dot of paint. These oaks would retain a zone of <u>no activity</u> around them measuring 35 feet, or dripline circumference around the oak (whichever is greater). A total of 1,429 oaks were identified throughout the project area for this understory retention treatment.

The delineation of OFLs, retention of large tree groups, and oak no treatment zones would ensure a heterogeneous post treatment landscape resulting in the continued accessibility of both hiding cover and prey availability within these areas of biodiversity. As this project proposes thinning from below, very few changes in California Wildlife Habitat Relationship (CWHR) habitat type are expected to occur throughout the entire Greys Mountain Project area.

**Effects to Terrestrial Wildlife Habitat:** The Existing Vegetation GIS feature class was refined for the Greys Mountain Project using existing structure analysis from 292 stand examination plot data collected in 2011 throughout the project boundary, as well as forest aerial photography interpretation from the 2001 flight-line, and 1 meter resolution satellite imagery from the National Agricultural Imagery Program (NAIP). Plantation CWHR vegetation typing was refined through field verification as well as aerial photo interpretation by the district silviculturist. Based on past experience with similar situations and professional judgment, the district silviculturist was able to estimate the anticipated changes to CWHR habitat throughout the treatment units based on the various stand prescriptions and proposed alternatives. A summary table is shown below for the CWHR vegetation changes that are expected to occur through the implementation of Alternative 2 or 3.

**Table 14. Action Alternatives Summary of changes to CWHR Forest Type within treatment units of the Greys Mountain Project**

| | | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **CWHR Habitat Type Pre-treatment** | **CWHR Habitat Type Post-treatment** | **Number of Acres of Density Change** | **Number of Acres of Density Change** |
| PPN4D | PPN4M | 4 acres | 1 acre |
| PPN5D | PPN5M | 3 acres | 2 acres |
| MHC4D | MHC4M | 1 acre | 1 acre |
| SMC4D | SMC4M | 110 acres | 46 acres |
| SMC4D | SMC4P | 1 acre | 1 acre |
| SMC5D | SMC5M | 2 acres | 2 acres |
| **Total Acres CWHR Habitat Density Change** | | **121 acres** | **53 acres** |

Total planning area acreage for the Greys Mountain Project is 9,581 acres, and treatments units are planned for approximately 3,420 of those acres. A total of 121 acres, or 4% of the total acreage of treatment units are anticipated to have changes in CWHR density under Alternative 2, and 53 acres or 2% under Alternative 3. These changes in CWHR habitat density are spread across the treatment units as detailed in Appendix G of the Terrestrial Wildlife BE/BA (USDA 2011a).

The projected changes to CWHR habitat under the proposed Alternative 2 may result in short term effects in the way terrestrial wildlife species utilize the habitat. Individuals may leave treatment areas during project implementation, and would likely rely more heavily on other areas of their home range. The canopy cover in the project area is expected to convert to higher quality habitat within 5-15 years after completion of the management actions as the remaining tree crowns grow and the understory develops. The resulting stand also should show increased health, growth rate, and resistance to large scale stand replacing wildfire.

There are no expected indirect effects to the following species due to lack of suitable habitat within the project area: Great gray owl, Townsend's big-eared bat, and western red bat.

Indirect Effects are summarized below for the following species: Pacific fisher, California spotted owl, Northern goshawk, Pallid bat, and American marten.

**Pacific Fisher:** CWHR type changes are projected for 121 acres for Alternative 2 and 53 acres for Alternative 3. Alternative 2 is the most aggressive management alternative and shows the greatest amount of change in CWHR 2.1 fisher habitat scores. These changes are relatively minor however, and the percentage of CWHR 2.1 habitat retained would be greater than 95%.

There are also currently four standing dead conifers per acre ≥16" dbh which may be used as fisher denning and resting sites throughout the project treatment units. Snags would only be removed if they meet the definition of a danger tree. All currently marked danger trees (intended for removal) are immediately adjacent to roadways in the project area and on average less than one danger tree per acre is marked for removal. There are additional black oaks throughout the project area that may serve as denning or resting sites that are not accounted for in these numbers of trees per acre. As the majority of large trees >20"dbh would be retained through the implementation of Alternative 2 or 3, and all snags that do not meet the definition of a danger tree would be retained, the Greys Mountain Project area would continue to provide adequate numbers of resting and denning structures for fisher.

There may be a short-term reduction in prey availability within some areas of the treatment areas; however, long-term positive effects of treatment should promote the growth and re-growth of understory vegetation, which provides forage for prey species, as well as hiding and thermal cover. The horizontal and vertical diversity of forest vegetation structure and species also may be improved in some sites as a result of partially opening the forest overstory, particularly with Alternative 2. This in-turn would bring greater biodiversity into the stands, promoting greater prey species abundance and diversity.

Habitat connectivity would be maintained throughout the implementation of this alternative by design criteria common to all alternatives including OFLs, retention of shrub understory throughout treatment units, large tree groups, and areas between units where no treatments would occur. The inclusion of untreated areas along steep sloped regions and riparian corridors (primarily Willow Creek, Chilkoot Creek, and several unnamed perennial tributaries) would maintain habitat connectivity and fisher dispersal routes.

The untreated areas, interconnected with OFLs would accommodate daily fisher movements as well as dispersal movements, providing habitat connectivity throughout the Greys Mountain Project area and dispersal routes to the north and south. Fisher should also retain movement opportunities between adjacent high quality habitat areas such as Nelder Grove. These areas of no treatment are mapped in the project BE/BA and provide a visual representation of movement capabilities throughout the project area during project implementation and post-treatment. Additionally, with Design Criteria Common to All Action Alternatives, the inclusion of large tree groups and the preservation of understory vegetation in cooler, moister sites within treatment units would maintain heterogeneity of the habitat post treatment and aid in fisher movements.

Design criteria common to all action alternatives includes a LOP restricting project activities from March 1 through June 30 which would be applied to all potential fisher denning habitat and should limit potential disturbance to females during denning and kit rearing. Units with a fisher LOP are outlined in the project BE/BA.

Disturbance of habitat may result in short term effects in the way fisher utilize the habitat. Fisher may leave treatment units during project implementation, and would likely rely more heavily on other areas of their home range. Individual energetic expenses may be increased if fishers have to

travel farther to forage, however with areas of adjacent suitable habitat outside treatment areas but within their home range, it is unlikely this would result in individual mortality.

Habitat disturbance in the project area may lead to increased predation of fisher by mountain lion, bobcat, or coyote. Predation potential could increase if an individual fisher were to move into unfamiliar habitat, although this would be unlikely as all male and female home ranges extend beyond the project boundary. Habitat disturbance in the project area may also exacerbate individual fisher mortality induced by disease. The degree of these potential effects are unknown, but may be illuminated through the SNAMP research.

Alternative 3 would focus solely on treating surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. There would be no additional treatments to address stand density/forest health objectives.

Without density management of the stands for forest health purposes, insect and disease induced mortality of trees throughout overstocked stands would remain a threat to fisher habitat. Minor outbreaks of disease or insect infection can be beneficial in creating decadent habitat characteristics; however extensive outbreaks which can occur during drought periods can drastically affect large contiguous blocks of land. Habitat effects could be similar to those that would occur with severe wildfire and could ultimately lead to habitat fragmentation or vegetation type conversions.

Long-term positive effects of fuels treatments (due to the reduction of fire hazard) outweigh the short-term negative effects of fuel treatments (due to immediate loss of forest biomass) on fisher, especially when assuming a more severe fire regime in the future. Vegetation treatment has short-term impacts to habitat quality, particularly over the first year, however, new understory growth within the first two years by herbaceous, as well as woody vegetation, can also lead to habitat enhancement for a variety of wildlife, including fisher and fisher prey species, in the form of new forage and hiding/thermal cover. Habitat recovery following an uncharacteristically severe wildfire would take considerably longer—based on the silvicultural report prepared for this project an estimated 90-110 years if brought back to conditions similar to the historical logging that occurred throughout the project area in the late 1800's.

**California Spotted Owl:** Suitable spotted owl foraging habitat consists of mature conifer stands with a minimum average dbh of 11", a minimum canopy cover of 40%, and high quantities of down logs and standing snags. Suitable nesting habitat has canopy cover of ≥60%, and large diameter trees with cavities, mistletoe brooms, and other structures suitable for nesting platforms. Within the project boundary there are approximately 7,603 acres of high and moderate quality CWHR California spotted owl habitat (nearly 80% of the project area).

A total of 3,033 acres within the project area are within California spotted owl Protected Activity Centers (PACs) or Home Range Core Areas (HRCAs) (Map 6, EIS map packet). This constitutes over 30% of the project area. Of these 3,033 acres, 1,084 are proposed for treatment in the Greys Mountain project, primarily within the HRCA designations. Fuels treatments have been designed for these areas to reduce the risk of uncharacteristically severe wildfire.

Eight separate owl activity centers are currently known within the project area, with seven of those activity centers falling within treatment units. These are displayed in Table 15. Additionally, there are several PACs and HRCAs within a 1.3 mile buffer of the project area where no work is proposed but owls could experience some noise disturbance from project implementation. These include portions of the following PAC/HRCAs: MAD0002, MAD0003, MAD0010, MAD0078, MAD0085, MAD0076, and MAD0089. This noise disturbance would be

minimized by geographic features such as ridgetops and canyons that would buffer mechanical noise.

The project proposes to maintain the highest canopy closure possible while still meeting fire and fuels objectives, and under Alternative 2 managing for forest health and stand density as well. The prescriptions aim for a canopy closure of not less than 50%, with a preference for 60% or greater immediately post treatment. All S&Gs from the SNF LRMP as amended by the SNFPA ROD (USDA 2004) would be followed in the implementation of this project. As this project proposes thinning from below, very few changes in CWHR habitat type are expected to occur throughout the entire project area.

Proposed treatment units overlap seven California spotted owl PACs (Table 15). Canopy cover would not be reduced below 60% within PACs and 50% within HRCAs, where currently available, to meet S&G 7. Additionally, a LOP from March 1 through August 15 would be applied to all treatment units within a quarter mile boundary of all active spotted owl nest sites to minimize disturbance to breeding owls. Appendix C in the Terrestrial Wildlife BE/BA (USDA Forest Service, 2011b) provides additional habitat information for CWHR changes expected to occur for each proposed project alternative while Appendix G displays detailed unit based CWHR changes.

**Table 15. Greys Mountain Project Proposed Treatment Units within California spotted owl PACs or HRCAs**

| SNF PAC/ HRCA ID | Treatment Proposed for area | NEPA Unit # of Trtment | Acreage of PAC/ HRCA proposed for treatment | Projected CWHR Changes | Comments |
|---|---|---|---|---|---|
| MAD0026 PAC | Tractor thinning and post harvest underburning | T37<br>T35 | 78 acres | 4 acres of SMC4D are projected to convert to SMC4M through thinning and underburning treatments | Canopy closure would be maintained at 60% or greater where currently available. |
| MAD0026 HRCA | Tractor thinning and post harvest underburning | T33 | 213 acres | 10 acres of SMC4D are projected to convert to SMC4M through thinning and underburning treatments | Canopy closure would be maintained at 50% or greater where currently available. |
| MAD0031 PAC | light thinning, hand thinning, and post harvest underburning | Fx9<br>T18<br>H7<br>H6<br>T9 | 155 acres | 2 acres of PPN4D are projected to convert to PPN4M through thinning and underburning treatments | Canopy closure would be maintained at 60% or greater where currently available. |
| MAD0031 HRCA | Tractor thinning and post harvest underburning | T8<br>T9 | 65 acres | 3 acres of PPN5D are projected to convert to PPN5M through thinning and underburning treatments; changes would occur primarily in the fuelbreak areas | Canopy closure would be maintained at 50% or greater where currently available. |
| MAD0042 PAC | Hand thinning, tractor thinning, underburning | H5<br>T5<br>T16 | 72 acres | 2 acres are projected to convert from SMC4D to SMC4M through thinning and underburning | Canopy closure would be maintained at 60% or greater where currently available. |

| SNF PAC/ HRCA ID | Treatment Proposed for area | NEPA Unit # of Trtment | Acreage of PAC/ HRCA proposed for treatment | Projected CWHR Changes | Comments |
|---|---|---|---|---|---|
| | | | | treatments | |
| MAD0042 HRCA | Tractor thinning | T16 | 214 acres | 20 acres are projected to convert from SMC4D to SMC4M through thinning and underburning treatments | Canopy closure would be maintained at 50% or greater where currently available. |
| MAD0043 PAC | Tractor thinning, Mastication | T8 M2 M1 | 71 acres | 3 acres of PPN5D are projected to convert to PPN5M through thinning and underburning treatments; changes would occur primarily in the fuelbreak areas | Canopy closure would be maintained at 60% or greater where currently available. |
| MAD0043 HRCA | Mastication, Prescribed burning, tractor thinning, post treatment underburning | M1 M2 Rx4 Rx6 T21 Rx22 | 160 acres | 8 acres of SMC4D are projected to convert to SMC4M and 4 acres of PPN4D are projected to convert to PPN4M through prescribed burning, and thinning/underburning treatments | Canopy closure would be maintained at 50% or greater where currently available. |
| MAD0076 HRCA | Mastication | M3 | 23 acres | No Changes to CWHR area projected to occur within CWHR Spotted Owl habitat. | Decadent chaparral would be converted to early seral stage chaparral through mastication activities |
| MAD0087 HRCA | Tractor thinning/ underburning | T6 | 28 acres | 1 acre of SMC4D is projected to convert to SMC4M through thinning and underburning treatments | Canopy closure would be maintained at 50% or greater where currently available. |
| MAD0089 HRCA | Tractor thinning/ underburning | T5 | 5 acres | No changes to any CWHR types are projected for this treatment unit | |
| | | | **Total acres within treatment areas: 1,084** | **Total of 53 acres projected CWHR density change** | NOTE: PPN=Ponderosa Pine; SMC=Sierra Mixed Conifer |

The project forest vegetation types are primarily Sierra mixed conifer and Ponderosa pine, which as part of S&Gs requires maintaining four of the largest snags per acre distributed irregularly across the landscape (USDA 2004b). The project would retain an average of 11 snags ≥10” dbh and four large snags ≥16” dbh across the treatment units, which meets the requirements set forth in the SNFPA ROD. The project would also retain adequate numbers of large (≥20” dbh) live conifers to serve as replacement snags in the future as some of these large trees receive environmental damage and decadence or succumb to disease and/or insect attacks.

Quantitative information on the ideal levels of coarse woody debris (CWD) retention levels are limited, however a synthesis of the available literature is available in RMRS-GTR-105 "*Coarse Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest"* (Brown et al. 2003). This study examined available literature on the ecology of CWD, its importance to wildlife and soils, its contribution to potential fire behavior, historical stand structures and large fuel accumulations, and potential re-burn severity as a basis for identifying optimum quantities of CWD (Brown et al. 2003). CWD is typically defined as dead standing and downed pieces of wood larger than 3 inches in diameter (Harnon et al 1986, Brown et al 2003). For warm, dry ponderosa pine and Douglas-fir forest vegetation types, Brown et al. (2003) recommend retaining between 5-20 tons per acre of CWD ≥3" dbh. Larger logs (≥8" dbh) are used more frequently by a variety of wildlife species, while also posing a lower fuels loading threat for high severity fire since they are classified as >1,000 hour fuels. Prescribed burning proposed for the Greys Mountain Project is of low intensity, and generally does not consume fuels >1,000 hours (≥8 dbh). Therefore nearly all logs ≥11 dbh should remain as CWD within the Greys Mountain treatment units.

This project proposes to thin from below, mostly reducing understory vegetation. There is a potential for noise disturbance to spotted owls during project implementation from an increase in human presence, operating equipment, and transportation of materials. Owl activity centers or nests near unit operations would be protected by a ¼ mile LOP during the breeding season from March 1-August 15. This LOP would minimize disturbance to breeding owls. California spotted owls in proximity to work crews and vehicles during project implementation may be disturbed sufficiently to leave the immediate area, resulting in a small energetic expense. Owls may also experience a missed feeding opportunity due to increased anthropogenic activity in the area. These potential effects are expected to be of short duration during the period of active vegetation removal.

Low intensity prescribed burning is planned for post-thinning treatment throughout nearly all of the tractor thinning units as a secondary fuels maintenance treatment. Understory burning and commercial thinning activities may eliminate some woodrat nests within the project area, which could lead to a decrease in available prey items and therefore an indirect effect to the California spotted owl. Woodrats and other spotted owl prey species have evolved in the presence of frequent, low-to moderate-intensity fires, and any burning occurring as a secondary fuels treatment would be of low/moderate intensity. Therefore, any potential effects from prescribed burning in the treatment units would be negligible. Although there may be a short term decreases in woodrat numbers, it is anticipated that woodrats would return to treated areas from adjacent areas within a few years. Additionally, availability of other prey items such as flying squirrels should remain constant as their nests/dens occur higher in the canopy and would not be affected by an understory burn.

**Northern goshawk:** Within the project boundary there are approximately 7,840 acres of suitable foraging habitat, and 5,795 acres of suitable nesting habitat. There are two historic Northern goshawk (PACs) located within the boundaries of the project: SIEGH43 and SIEGH45 (Map 7, EIS map packet). Northern goshawk survey visits were conducted throughout all suitable habitat including both PACs within the project area from July 20, 2011 through August 28, 2011. This constitutes the first year of surveys in a two-year protocol as per the protocol: *Survey Methodology for Northern Goshawks in the Pacific Southwest Region*, U.S. Forest Service (2002). The second year of surveys for northern goshawk in the project will take place in the summer of 2012.

A northern goshawk nest was found occupied on July 27, 2011 just east of the 6S36A road near Texas Flat campground in PAC SIEGH43. Two nests were found in this nest stand, although, only one of the nests appear to have been utilized in 2011. This nest sight and any future nest sites located within the Greys Mountain project would be protected with a LOP from February 15 through September 15 as outlined in S&G #76 (USDA Forest Service, 2004).

An historical PAC survey was conducted within Soquel SIEGH45 from July 20, 2011 through August 4, 2011. It is believed that no Northern goshawks nested in PAC SIEGH45 during the 2011 season, and that red tailed hawks nested within the boundary of that PAC.

**Table 16. Greys Mountain Treatment Units within Northern Goshawk PAC's**

| SNF PAC ID | Treatment Proposed for area | NEPA Unit # of Trtment | Acreage of PAC proposed for treatment | Projected CWHR Changes | PAC Status |
|---|---|---|---|---|---|
| SIEGH45 | Tractor thinning, underburning | T1, T3 | 50 acres | 3 acres of SMC4D are projected to convert to SMC4M through thinning and underburning treatments | Not currently occupied by Northern Goshawk.<br><br>Red tailed hawk nest documented in 2011. |
| SIEGH43 | Tractor thinning, underburning | T35 | 33 acres | 2 acres of SMC4D are projected to convert to SMC4M through thinning and underburning treatments | Successful Northern Goshawk nesting documented in 2011 |

All goshawk nest sites within the project area would be protected by an LOP. Outside of the LOP, portions of both goshawk PACs would be thinned to the degree allowed under the SNF LRMP as amended by the SNFPA ROD (USDA 2004b). Less than 25% of the total PAC area is proposed for treatment. The PACs would not be reduced to less than 60% canopy cover, therefore, would not be diminished to less than nesting habitat. All snags would be retained during project implementation except in those cases where they pose a hazard.

Goshawks in proximity to work crews and vehicles during project implementation may be disturbed sufficiently to leave the immediate area, resulting in a minor energetic expenditure. All Northern goshawk nest sites located within the project area would be protected by a ¼ mile LOP during the breeding season from February 15 through September 15. This would minimize disturbance to breeding goshawks. There may be a disturbance to northern goshawk prey base during project implementation. Birds, squirrels, and other small animals may leave treatment areas for the short term period when lower canopy fuels are being removed. However, these animals should return to the area shortly after work is completed.

**Pallid Bat:** Bats roosting in proximity to a treatment unit could be disturbed by project activity. Noise from chainsaws, and the noise and vibration of skidders and log trucks is probably sufficient to disturb bats roosting in close proximity to the work activity. Suitable roosting and maternal cavity habitat may be affected in treatment areas where trees from 20" to 30" dbh may be harvested, since conifer trees in that size class may have suitable cavities for pallid bat roosts and maternal sites. As this project proposes to thin from below, a relatively small number of trees in that size class have been proposed for removal. Potential suitable habitat occurs across the majority of the project area, so it is possible that some suitable roost or maternal trees may be removed. Post-treatment foraging opportunities should be enhanced or not significantly changed

because understory vegetation would be cleared in some areas and retained in others which would provide a diversity of microhabitats for ground dwelling insect prey.

**American Marten:** The project ranges from 4,000 to 7,000 feet in elevation, considerably limiting the potential impacts to martens which are most often found above 7,200 feet in elevation. At the far eastern edge of the project boundary there are approximately 330 acres, (3% of the project boundary) that are considered suitable marten habitat based on elevation and CWHR habitat typing. Mastication unit M-3, and tractor harvest/under burn units T12 and T11 are within suitable marten habitat.

Status and trend monitoring for fisher and American marten was initiated in 2002 by the SNFPA carnivore monitoring program. The monitoring objective is to be able to detect a 20 percent decline in population abundance and habitat (USDA Forest Service 2006). From 2002 – 2008, 439 sites were surveyed throughout the Sierra Nevada on 1,286 sampling occasions, with the bulk of the sampling effort occurring within the Southern Sierra fisher population monitoring study area (USDA Forest Service 2009). Sampling for this program occurs throughout late spring and into fall, with no sampling occurring during the winter months. There are nine sample stations located within a 3 mile radius of the project boundary. One of these stations are within the project boundary and has not detected marten presence from 2000-2009. Of the remaining eight sample stations, seven have not detected marten to date during the SNFPA monitoring program and one station to the northeast of the project has occasionally detected marten. (USDA Forest Service 2009). The nearest marten detection from the SNFPA carnivore monitoring program is over 1.5 miles northeast from the project boundary (USDA Forest Service 2009).

More intensive camera sampling (concentrating primarily on locating Pacific fisher) has been conducted by the UC Berkeley fisher crew beginning fall 2007 throughout the project and the surrounding area. This sampling effort is active year-round. Cameras have detected marten activity in a few 1km$^2$ grids adjacent to the project area. A 1km$^2$ grid cell was considered to be marten active when a marten was detected at one or more camera stations within the grid cell (Rick Sweitzer, UC Berkeley SNAMP Fisher Study). There are 24 marten active grid cells within a 3 mile radius of the Project boundary. All detections occurred at or above the 6,000' elevation level. The three marten active grid cells in the project boundary were all winter detections, well outside of the breeding season for American marten. 2 detections were made in March of 2009 and 1 detection was made in March of 2010. (Rick Sweitzer, unpublished SNAMP data). Much of the project area receives heavy volumes of snow throughout the winter, and no proposed vegetation management activities would occur in the winter months, limiting potential disturbance to marten.

The *ExistingVegetation* GIS feature class was refined for the project using existing structure analysis from 292 stand examination plot data collected in 2011 throughout the project boundary, as well as forest aerial photography interpretation from the 2001 flight-line, and 1 meter resolution satellite imagery from the (NAIP). Plantation CWHR vegetation typing was refined through field verification as well as aerial photo interpretation by the district silviculturist. Based on past experience with similar situations and professional judgment, the district silviculturist was able to estimate the anticipated changes to CWHR habitat throughout the treatment units based on the various stand prescriptions and proposed alternatives. Summary tables are shown below for the CWHR vegetation changes that are expected to occur through implementation of Alternatives 2 and 3.

Treatment acres relative to existing vegetation were based on mapping and field visits conducted by the district silviculturist. These field visits refined the base vegetation layer and determined the net acres of treatment. Table 14 displays the CWHR vegetation changes that are projected to

occur with the implementation of Alternatives 2 and 3. None of the CWHR changes are projected to take place within marten habitat.

Marten in proximity to work crews and vehicles during project implementation may be disturbed sufficiently to leave the immediate area or may miss a foraging opportunity, resulting in an energetic expense. However, this is unlikely as the entire project area lies below the primary elevational range of marten, and marten activity within the project area as detected by the SNAMP fisher crew appears to be confined to the winter months when no vegetation management activities would occur.

Habitat connectivity would be maintained throughout the implementation of all action alternatives by design criteria common to all alternatives including OFLs and areas where no treatments would occur. The inclusion of untreated areas along steep sloped regions and riparian corridors (primarily Willow Creek, Chilkoot Creek, and unnamed perennial tributaries) would maintain habitat connectivity and marten dispersal routes.

Marten habitat preferences and structure is similar to fisher habitat, though martens have a higher elevational range. Project design criteria, specifically for fisher habitat, would ensure that sufficient legacy structures (large trees with defects, large snags, and large downed logs) would remain after treatment and follow-up treatments to maintain habitat suitability for martens as well. An LOP from May 1 to July 31 would be applied to a 100-acre buffer around known marten den sites which would reduce potential disturbance to martens during the reproductive season. There are no currently known marten den sites within the project area.

The project proposes to maintain the highest canopy closure possible while still meeting fire and fuels objectives, and under alternative 2 managing for forest health and stand density as well. The prescriptions aim for a canopy closure of >50%, with a preference of greater than 60% immediately post treatment. All S&Gs from the SNF LRMP as amended by the SNFPA ROD 2004 (USDA 2004b) would be followed in the implementation of this project. As this project proposes thinning from below, very few changes in CWHR habitat type are expected to occur throughout the entire Project area. Under the most aggressive Alternative (Alternative 2) 121 acres of CWHR habitat would experience a density type change spread across the treatment units. All changes to CWHR habitat would occur in units below 7,000 feet in elevation. No habitat that is currently suitable for denning would be reduced below suitable denning habitat. Habitat disturbance in the project area may lead to increased predation of marten by mountain lion, bobcat, or coyote. Habitat disturbance in the project area may also exacerbate individual marten mortality induced by disease. The degree of these potential effects are unknown, but may be illuminated through the SNAMP research.

Long-term positive effects of fuels treatments (due to the reduction of fire hazard) outweigh the short-term negative effects of fuel treatments (due to immediate loss of forest biomass) on marten, especially when assuming a more severe fire regime in the future. Habitat within the project treatment areas is expected to recover within 5-10 years post-treatment, and should reach current conditions within 15 years. Habitat recovery following a severe wildfire would take considerably longer—based on the silvicultural report prepared for this project an estimated 90-110 years if brought back to conditions similar to the historical logging that occurred throughout the project area in the late 1800's.

## Cumulative Effects and Determinations

### Potential Cumulative Effects by Species

The following is a cumulative effects assessment for terrestrial wildlife species considering past, present, and reasonably foreseeable activities. Additional details of cumulative effects can be found in the Terrestrial Wildlife.

### *Pacific Fisher*

**Assessment Area:** For this cumulative effects analysis of past, present, and reasonably foreseeable activities on the fisher we would use three levels of analysis. The first assessment level is at the multiple home range scale. We chose to buffer the project area by the size of an average female home range. We used 7,000 acres as the average home range size for a female fisher, which is based on the average female fisher 95% fixed kernel reported by SNAMP ($28.4km^2$ approximately 7,018 acres) for all female fishers tracked by the UC Berkeley SNAMP fisher crew in 2008-2009. This leaves us with an assessment area that consists of a 4-mile buffer surrounding the project area. This buffered area measures 73,210 acres, and would incorporate any female fisher home ranges that would overlap or adjoin the project area. This should show any potential cumulative effects to individual females surrounding the project area.

The second level of assessment for cumulative effects encompasses all suitable fisher habitat on the BLRD ranging from 3,500 to 8,000 feet in elevation. This boundary represents the portion of the Southern Sierra Fisher Conservation Area (SSFCA) that is present on the Bass Lake RD and equates to approximately 323,500 acres, or approximately 46 adult female fisher home ranges. This boundary is consistent with the genetic data reported by Tucker et al. (2009) which used the program "Geneland" to assign genetic subpopulations within the larger SSFCA encompassing the Sierra and Sequoia National Forests. Through analysis of genotypes three distinct "subpopulations" emerged: (1) the North population which encompasses most of the BLRD including the Chowchilla Mountains and Shuteye area, (2) the Central population which encompasses a small eastern portion of the BLRD, the entire High Sierra Ranger District of the SNF, and the northern portion of the Sequoia NF, and (3) the South subpopulation which encompasses the Southern Sequoia NF and Kern Plateau (Tucker et al. 2009). Therefore, this second level boundary of assessment for cumulative effects for the Greys Mountain Project encompasses 100% of the North subpopulation and around 10% of the Central subpopulation nearest to the San Joaquin River. This should show any potential cumulative effects to the North subpopulation.

The third and final level of assessment is at the range of the entire SSFCA. The SSFCA encompasses the known occupied range of the Pacific fisher in the Sierra Nevada and measures 1,018,000 acres. We would tie all three assessment levels together and show any potential cumulative effects to the Southern Sierra fisher population as a whole.

**Greys Mountain Project:** As discussed in the direct and indirect effects section, the most aggressive management action alternative (Alternative 2) of the project would have minimal effects to fisher habitat (CWHR 2.1 habitat). Specifically, all action alternatives would retain a high degree of overstory forest canopy cover (>50% with a preference of greater than 60%, when conditions allow); all trees >30 inches dbh, and all snags, would be retained during mechanized treatments, except where they pose an immediate safety hazard. Trees >20 inches dbh would be retained, in adequate quantity, to help assure availability of resting and denning structures now and into the future. Black oaks also would be retained, as well as large tree groups. The project would not impede movement or dispersal to other currently connected suitable habitat areas

because habitat connectivity would be maintained within and adjoining the project area. And no treatments would occur throughout suitable fisher habitat during their breeding season (refer to the effects analysis of the BE/BA (USDA Forest Service, 2011b).

All action alternatives also may result in long-term positive effects to the fisher by: 1) reducing the potential for catastrophic, stand eliminating wildfires; and 2) promoting the growth and re-growth of understory vegetation, which provides forage for prey species, as well as hiding and thermal cover. The horizontal and vertical diversity of forest vegetation structure and species also may be improved in some sites as a result of partially opening the forest overstory, particularly with Alternative 2. This in-turn would bring greater biodiversity into the stands, promoting greater prey species abundance and diversity, including promoting the establishment and improved growing conditions of black oaks, which are important components of fisher habitat. All of these factors combined outweigh the short-term negative effects of treatments (due to immediate partial loss of forest biomass and disturbance), especially considering that a more severe fire regime is predicted for the future, and without fuels reduction, large scale, stand replacing wildfires would most likely cause serious and significant impacts to the population.

**Other Current and Future Land Management Projects on the Bass Lake RD:** Currently there are four land management projects on the Bass Lake District that are of the size that could influence the cumulative effects on fisher habitat. Thinning treatments have been completed for three of the four projects, including: Sonny Meadows North (with 955 acres of treatments), Sonny Meadows South (with 1,400 or more acres of commercial thinning), and Rush Creek (approximately 500 acres of commercial thinning). Post-harvest follow-up treatments are still in the implementation phase for these three projects. It was determined that treatments for Sonny Meadows North, South, and Rush Creek would not result in loss of suitable habitat, although temporary, activity-related disturbances were expected within proximity of management activities. Overall habitat suitability would increase over the long term as a result of the completed treatments, and these projects would not increase habitat fragmentation since post-harvest habitat would remain suitable.

The Cedar Valley Project (approximately 915 acres of commercial thinning) is nearing the end of the implementation phase. It was determined that the Cedar Valley Project may result in a short-term reduction of denning habitat quality on approximately 628 acres. However, this habitat would remain suitable as foraging habitat, and is expected to recover within 10-15 years to higher quality fisher habitat. The Cedar Valley Project would not impede movement or dispersal to other currently connected suitable habitat areas.

There is also one reasonably foreseeable project; Fish Camp Project, (with approximately 1200 acres of treatments). The Fish Camp project has been analyzed in NEPA under the Fish Camp Environmental Impact Statement with the Record of Decision being completed in 2011, This project would incorporates provisions similar to those proposed for Greys Mountain for fisher conservation. Treatments within this project could begin in 2012.

**Timing of Vegetation Management Projects on the Bass Lake RD**: It is expected that implementation of the Sugar Pine Project will be completed before any ground operations occur on the project. This is due to the fact that the Sugar Pine project is part of the SNAMP, and is therefore restricted by the time limitations of research being conducted as a part of the on-going research for SNAMP. Treatments for the Sugar Pine Project are expected to commence in the summer of 2011 and would be completed under a service contract that would last approximately 2 years. A LOP from March 1 through June 30 is being implemented for all suitable Pacific fisher denning habitat within the Sugar Pine Project.

Commercial thinning treatments in Sonny Meadows North and South, and Rush Creek have been completed. Some follow-up mastication and prescribed burning would be conducted over the next few years. Commercial thinning treatments in Cedar Valley are nearing completion, and are projected to be completed before project implementation begins. Some follow up mastication and prescribed burning activities would occur over the next few years throughout the Cedar Valley units. The few remaining Cedar Valley commercial thinning treatment areas are likely to be conducted concurrently with the Sugar Pine treatments. Since treatment units occur throughout a total of 25-35% of the project boundary area for all vegetation management projects on the BLRD, and few of these projects are occurring simultaneously, fishers should retain movement capabilities throughout all suitable habitat areas. The BE/BA (USDA Forest Service 2011b) shows the past, present, and reasonably foreseeable actions on the BLRD. District-wide, less than 4% of fisher habitat is within a present vegetation management project boundary.

Provided the vegetation management projects on the BLRD have habitat management goals which include retention and promotion of large trees and oaks, as well as project design criteria promoting stand heterogeneity as well as retention of snags, large tree groups, decadent/cavitary trees, down woody debris, and understory trees/shrubs, it is unlikely that the cumulative effects of the vegetation management projects, considered with all past, present, ongoing, and reasonably foreseeable activities on the BLRD would have an effect on the North population of Pacific fishers within the Southern Sierra.

## Additional Vegetation Management Projects within the SSFCA

**High Sierra Ranger District, Sierra NF:** The effects of implementing the Kings River Experimental Watersheds (KREW) Project on fisher were evaluated in the 2008 Kings River Project Biological Evaluation/Assessment for the Pacific Fisher (USDA Forest Service 2008b). The effects of the Dinkey North project on fisher were evaluated concurrently with the Dinkey South Project. The KREW Project – Providence unit is just northeast of the boundary of the Dinkey South Project area and is projected to result in no more than a 6% loss of fisher habitat within its boundaries immediately after project implementation. The KREW Project – Bull unit is approximately 6 miles southeast of the Dinkey South Project area and is projected to result in less than a 1% loss in suitable fisher habitat within its boundaries immediately after that project is implemented. The Dinkey North Project borders the Dinkey South Project area to the north and is projected to result in a 1% loss in suitable fisher habitat within its boundaries immediately after project implementation. All of these projects are predicted to ultimately result in an increase of the quality and amount of fisher habitat within project boundaries over the long term.

**Stanislaus and Sequoia National Forests:** Projects on the Stanislaus National Forest are not expected to result in a change in CWHR size class and cover type, though there would be a 15% reduction in canopy. The predicted habitat value for fisher would remain at 4M on these projects. Projects on the Sequoia National Forest are also not expected to result in a change in CWHR size class and cover type though would result in a loss of habitat. The current projections are that there would be a 10 to 20% reduction in suitable fisher habitat for these projects combined. Currently there is approximately 2,344 acres of suitable fisher habitat identified within in these project areas, so the reductions would be between 234 and 469 acres.

While present and reasonably foreseeable vegetation treatments occurring or proposed on the Sierra, Stanislaus, and Sequoia National Forests would result in temporary reductions to fisher habitat suitability, these effects are relatively small, with changes calculated to occur across approximately 3% of the SSFCA.

Suitable fisher habitat on the SNF has increased slightly from 422,000 acres about ten years ago to 449,000 acres in recent years (USDA Forest Service 2006b). Rick Truex, a USDA Forest Service fisher scientist believes fishers may have increased their spatial distribution on the SNF since the mid-1990s, and that the annual occupancy rate within SNF seems to be consistent, though the spatial pattern of detections appears more variable among years than on the Sequoia National Forest (Truex pers. comm.). The combination of a stable or slightly increasing amount of suitable fisher habitat on the SNF over the last ten years and perhaps an increasing spatial distribution of fishers make it reasonable to conclude the cumulative effects of vegetation management activities on the SNF have not reduced overall habitat suitability for fishers on the Forest.

The information listed above is in alignment with the findings from the (USFWS). Their annual review of native species that are candidates for listing as endangered or threatened (Federal Register: Vol. 72: 69034-69105), reemphasized that the three remaining areas containing fisher populations, including the southern Sierra Nevada, "appear to be stable or not rapidly declining based on recent survey and monitoring efforts".

In addition, the California Department of Fish and Game (CDFG) in their Evaluation of Petition: Request of the Center for Biological Diversity to list the Pacific fisher (CDFG 2008) found that the information provided, and was evaluated by the CDFG did not indicate an immediate or substantial change in either population or distribution of fishers since the selected benchmark analysis period beginning with the assessment provided by Grinnell et al. (1937). Based on this information, the CDFG finds that the fisher has sustained itself since the Grinnell period, with no evidence of recent, immediate, or significant change in population or distribution, despite a decline in late successional forest. Available information suggests this may be the case for a number of reasons. Recent studies of fisher habitat use, occurrence, and movement patterns indicate fishers also use managed forest habitats of mixed tree age structure and canopy closure, which have essential attributes such as snag/large tree attributes remaining for resting/denning. Fishers are no longer subject to the significant mortality factors of trapping and poisoning of prey that were common in past decades. Forest management in California has been trending toward more retention of late successional stands and this change in management activity likely has been, and would be, beneficial to species such as the fisher in the future.

Based on the above analysis of potential impacts within the project area and in consideration of other past, present, ongoing and reasonably foreseeable actions from within the range of the Southern Sierra fisher population, it was determined that implementing either the proposed action (alternative 2) or alternative 3 of the project would not contribute to significant cumulative effects to Pacific fisher or their habitat. This determination is supported by recent findings published by both the USFWS and the State of California with regard to fisher population viability and habitat sustainability.

It is my determination that Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration project *would not affect the* Pacific fisher as a result of vegetation treatments, as none would occur under alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to this species.

It is my determination that alternatives 2-3 (the action alternatives) of the Greys Mountain Ecological Restoration project *may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the* Pacific fisher. Suitable fisher habitat occurs in and near the project area, and the proposed actions would not result in significant reductions of that habitat (CWHR 2.1 habitat) at the project level, unit level, female home range level, or at the regional

level for the Southern Sierra Fisher Conservation Area. Sufficient levels of large live trees ≥20”dbh, and large snags ≥16”dbh that provide potential den and rest sites, would be maintained, even under the most aggressive action alternative. This project does not propose to remove any oaks, and measures would be implemented to protect black oaks. Understory vegetation would be retained in clumps throughout treatment units to maintain heterogeneity of the stand and habitat. A few fishers may be disturbed by project activities, although this only would be for the short-term duration of those actions. Most importantly, management actions, throughout all suitable fisher habitat would not occur during the fisher breeding season because a LOP (March 1 – June 30) would be implemented. The project would not impede movement or dispersal to other currently connected suitable habitat areas because habitat connectivity would be maintained within and adjoining the project area.

Silvicultural prescriptions would maintain canopy cover of at least 50%, with a preference for at least 60%, immediately post treatment, and these prescriptions focus on removing surface and ladder fuels, and thinning from below. There would be very few changes to habitat types as a result of this management. Large trees (30”dbh and above), and all snags, would be retained during mechanized treatments, except where they pose an immediate safety hazard. The project would not impede movement or dispersal to other currently connected suitable habitat areas because habitat connectivity would be maintained within and adjoining the project area.

All action alternatives also may result in long-term positive effects to the fisher by: 1) reducing the potential for uncharacteristically severe, stand eliminating wildfires; and 2) promoting the growth and re-growth of understory vegetation, which provides forage for prey species, as well as hiding and thermal cover. The horizontal and vertical diversity of forest vegetation structure and species also may be improved in some sites as a result of partially opening the forest overstory, particularly with Alternative 2 and 3. This in-turn would bring greater biodiversity into the stands, promoting greater prey species abundance and diversity, including promoting establishment and improved growing conditions of black oaks, which are important components of fisher habitat. All of these factors combined outweigh the short-term negative effects of treatments (due to immediate partial loss of forest biomass and disturbance), especially considering that a more severe fire regime is predicted for the future, and without fuels reduction, large scale, stand replacing wildfires would most likely cause serious and significant impacts to the population.

## *California Spotted Owl*

The California spotted owl has a continuous distribution throughout the Sierra Nevada with a network of 234 managed HRCAs (600 acres each) on the Sierra National Forest. Given the scope and scale of the project relative to the size of the Sierra National Forest and the Sierra Nevada; the area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on the California spotted owl would focus on the SNF. A determination of viability for the California spotted owl would be made based on the following analysis.

Since about the mid 1960s, past activities have included clearcutting and salvage logging (1960s to 1972), sanitation and salvage harvests (1972 through 1978), clearcutting, shelterwood cutting, and salvage harvests (1978 through 1992), and commercial thinning from below and salvage in recent times. The only fires to burn substantial amounts of timber were the Rock Fire in 1981, the Big Creek Fire in 1995 and the North Fork Fire in 2001, with each fire burning about 3000 acres of forest. Clearcuts or burned areas that took place prior to 1972 are typically successful plantations today, exhibiting size class 3 and density class M stands. Other, more recent disturbances, while they may be reforested have probably not yet reached size class 3.

In its 12-month finding in which it decided to not list the California spotted owl as Threatened or Endangered, the USFWS concluded that the scale, magnitude, or intensity of effects on the California Spotted Owl resulting from fire, fuels treatments, timber harvest, and other activities did not rise above the threshold necessitating protection of the species under the Endangered Species Act (ESA) (USDI, 2006). The USFWS reached this conclusion after considering the impacts of the Forest Service's implementation of the SNF LRMP as amended by the SNFPA ROD (USDA 2004b). The USFWS' (USDI, 2006) conclusion is supported by:

- "Data which indicate that California spotted owl populations in the Sierra Nevada are stable and comprise 81% of the species' known territories
- The anticipation that current and planned fuels-reduction activities throughout the range of the species would have a long-term benefit by reducing the risk of stand replacing wildfire; these activities embrace those described by the SNF LRMP as amended by the SNFPA ROD.
- Protection measures are being implemented for the California Spotted Owl on private lands, including the largest private landholders within the range of the species"

At a forest-wide scale, there currently are 234 designated HRCAs/PACs which encompass 146,760 acres. Approximately 468,861 acres of suitable habitat currently exist on the Forest. Considering the proposed treatment activities of the project, along with other ongoing actions, and reasonably foreseeable activities, less than one percent of suitable habitat on the Sierra National Forest would be affected. Because the alternatives put forth in this project would increase forest stand structure and heterogeneity, and retain high canopy cover, along with the project's goal of increasing large diameter trees would result in long-term increases in California spotted owl suitable habitat over time; along with the relatively stable geographic distribution and population levels of spotted owls in the area, the cumulative effects of vegetation management activities in the Greys Mountain and Sugar Pine treatment units taken together with all other past, present, and reasonably foreseeable activities on the Forest would not result in a loss of viability for the California spotted owl.

It is my determination that Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* California spotted owl. This is due to the fact that no vegetation treatments would occur under Alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to California spotted owl habitat in and near the project area.

It is my determination that Alternatives 2-3 (the action alternatives) of the Greys Mountain Ecological 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. Spotted owls are known to occur in and near the project area, and a few owls may be disturbed by project activities, although this would only be for the short-term duration of those actions, and no management activities would not occur during their breeding period (March 1-August 15), within ¼ mile of spotted owl activity centers or nest site centers. The project also may reduce some prey species over the short-term, however, other prey species would be available to sustain the owls within their home ranges, and prey species are expected to recover and possibly increase over the long-term as a result of increased understory growth and re-growth.

Silvicultural prescriptions within California spotted owl PACs would maintain >60% canopy closure where available and within spotted owl HRCAs would aim to maintain >50% canopy

closure where available. Silvicultural prescriptions outside of Spotted Owl PAC/HRCAs would maintain canopy cover of at least 50%, with a preference for at least 60%, immediately post treatment, and these prescriptions focus on removing surface and ladder fuels, and thinning from below. There would be very few changes to habitat types as a result of this management. Large trees (30"dbh and above), and all snags, would be retained during mechanized treatments, except where they pose an immediate safety hazard. The project would not impede movement or dispersal to other currently connected suitable habitat areas because habitat connectivity would be maintained within and adjoining the project area through OFLs and non-treated areas.

All action alternatives also may result in long-term positive effects to the California spotted owl by: 1) reducing the potential for uncharacteristically severe, stand eliminating wildfires; and 2) promoting the growth and re-growth of understory vegetation, which provides forage for prey species, as well as hiding and thermal cover. The horizontal and vertical diversity of forest vegetation structure and species also may be improved in some sites as a result of partially opening the forest overstory, particularly with Alternative 2. This in-turn would bring greater biodiversity into the stands, promoting greater prey species abundance and diversity, including promoting establishment and improved growing conditions of black oaks, which are important components of California spotted owl habitat. All of these factors combined outweigh the short-term negative effects of treatments (due to immediate partial loss of forest biomass and disturbance), especially considering that a more severe fire regime is predicted for the future, and without fuels reduction, large scale, stand replacing wildfires would most likely cause serious and significant impacts to the population.

### *Great Gray Owl*

Because the alternatives put forth in this project would not have a measurable effect to CWHR nesting and foraging habitat for great gray owl, and both action alternatives are projected to result in long-term increases in great gray owl suitable nesting habitat over time due to the project's goal of increasing large diameter trees and removing ladder fuels, the cumulative effects of vegetation management activities in the project treatment units taken together with past, present, and reasonably foreseeable activities on the Forest would not result in a loss of viability for the great gray owl. Therefore cumulative effects to the great gray owl through the implementation of Alternatives 2 or 3 of the project are expected to be so minimal as to be nearly undetectable.

It is my determination that Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* Great gray owl. This is due to the fact that no vegetation treatments would occur under Alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to this species.

It is my determination that Alternatives 2-3 (all of the action alternatives) for the Greys Mountain Ecological Restoration Project *may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the* great gray owl**.** Great grey owls have not been found in the project area and only marginal great gray owl foraging habitat occurs within the project boundary and adjacent areas. One great grey owl PAC is located north of the project boundary, therefore, there is a potential that one or a few individuals may be disturbed by project activity. However, no measurable reductions to great grey owl habitat are expected, and potential disturbances would be limited to the period of management activity. A LOP from March 1 through August 15 would protect any nest sites that are discovered within ¼ mile of vegetation management activities. Large trees (30"dbh and above), and all snags, would be retained during mechanized treatments, except where they pose an immediate safety hazard. The project would not impede movement or dispersal to other currently connected suitable habitat areas because

habitat connectivity would be maintained within and adjoining the project area through OFLs and non-treated areas.

### *Northern Goshawk*

The northern goshawk has a continuous distribution throughout the Sierra Nevada with a network of 57 managed territories on the SNF. Habitat for the northern goshawk has increased over the past decade from 382,000 acres in 1995 to 405,000 acres in 2005. Currently there are 405,000 acres of suitable northern goshawk habitat in the 4,000 to 8,000' elevation range on the SNF, with less than 1% of the suitable habitat occurring in the project boundary. Given the scope and scale of the project relative to the size of the Sierra Nevada and the goshawk's overall North American distribution, the area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on the northern goshawk would focus on the SNF. A determination of viability for the northern goshawk was made based on the following analysis.

All goshawk nest sites within the project area would be protected by an LOP. Outside of the LOP, portions of the three goshawk PACs would be thinned to the degree allowed under the SNFPA ROD (USDA 2004b). The PAC would not be reduced to less than 60% canopy cover, where available; therefore, would not be diminished to less than nesting habitat. All snags would be retained during project implementation except in those cases where they pose a hazard.

BEs for many of the past projects in the SNF were reviewed to help inform the present analysis. Review of these documents revealed the following basic information about effects to northern goshawks from these activities:

- 26 total project BEs were reviewed, dating back to 1993 on the SNF.
- Determinations reached were:
  - No effect – four BEs
  - May affect individual goshawks, but not likely to lead to a trend toward federal listing or loss of viability – 20 BEs
  - May affect individual goshawks, and likely to lead to a trend toward federal listing or loss of viability – 0 BEs
  - Northern goshawk was not addressed in the document we reviewed due to lack of habitat or other reasons – two BEs
- Types of Projects: Fuels reduction, harvest, hazard tree removal, thinning, and underburning were the proposed activities that were most often represented in the sample of BEs in which the northern goshawk was analyzed.
- Relative to "May Affect" projects, the described impacts to northern goshawks most often fell in the following categories:
  - Noise disturbances
  - Loss of foraging area if underburn gets out of control
  - Loss of plucking trees
  - Habitat quality reduction

As with other species, the SNFPA FEIS (USDA-FS 2001) provided our analysis of northern goshawks with useful historical and habitat information. Evidence suggests the number of goshawk breeding territories (ranging from 12 reported in the SNFPA (USDA-FS 2001) to the 57 such territories known to exist today) has increased since some of the earliest data was reported in Grinnell and Miller (1944 – as cited in USDA-FS (2001)). This is evidenced by the fact that there has been no apparent change in the geographic distribution of northern goshawks in the Sierra Nevada since then. Thus, goshawk numbers in the SNF remain fairly stable. Reasons for this, as put forth by the SNFPA (USDA-FS 2001), include (1) vegetation management practices,

(2) the fact that the SNF is near the southernmost edge of the goshawk's range, and (3) survey efforts for goshawks may be lower on the SNF.

The major risk factors identified by the SNFPA (USDA 2004) for goshawks are the effects of uncharacteristically severe, stand replacing wildfires on the amount and distribution of quality habitat. Implementation of Alternative 2 would result in 121 acres of CWHR 4D converted to 4M. This density type change is spread across the treatment units and comprises just over 1.5% of the total goshawk habitat present in the project boundary. Implementation of Alternative 3 would result in 53 acres of CWHR 4D converting to 4M, comprising less than 0.7% if the total goshawk habitat present within the project boundary. This habitat is expected to recover with 10-15 years to higher quality habitat.

Because the alternatives put forth in this project would result in long-term increases in northern goshawk suitable habitat over time, along with the relatively stable geographic distribution and population levels of goshawks in the area, and the project's goal of increasing large diameter trees, the cumulative effects of vegetation management activities in the Greys Mountain treatment areas taken together with past, present, and reasonably foreseeable activities on the Forest would not result in a loss of viability for the northern goshawk.

It is my determination that the Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* Northern goshawk. This is due to the fact that no vegetation treatments would occur under Alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to this species.

It is my determination that Alternatives 2-3 (the action alternatives) for the Greys Mountain Ecological 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. Northern goshawks are known to utilize areas within the project for nesting and foraging, and individual goshawks may temporarily be disturbed by project activities. Northern goshawk habitat also occurs in the project area, although the proposed treatments would not result in measurable reductions of that habitat. This habitat would remain suitable as nesting and foraging habitat, and is expected to increase in habitat quality within 5-15 years after project action. An LOP would protect all known nest sites within the project area.

## *Pallid Bat*

BEs for many of the past projects in the SNF were reviewed to help inform the present analysis. Our review of these documents revealed the following basic information about effects to pallid bats from these activities:

- 26 total project BEs were reviewed, dating back to 1993 on the SNF. The species was not listed as Forest Service Sensitive until the updated list from June 1998.

- Determinations reached were:
  - No effect – four BEs
  - May affect individual bats, but not likely to lead to a trend toward federal listing or loss of viability – ten BEs
  - May affect individual bats, and likely to lead to a trend toward federal listing or loss of viability – 0 BEs
  - Pallid bat was not addressed in the document we reviewed due to lack of habitat or other reasons – 12 BEs

- Types of Projects: Fuels reduction, hazard tree removal, thinning, and underburning were the proposed activities that were most often represented in the sample of BEs in which the pallid bat was analyzed.

- Relative to "May Affect" projects, the described impacts to pallid bats most often fell in the following categories:
    - Loss of roosting trees/snags
    - Displacement because of smoke from underburning
    - Noise disturbance

Pallid bats occur most frequently below 6,000 feet and are especially sensitive to the removal of hardwoods (USDA-FS 2001). Except for 4D and 5D, CWHR rates all size classes and densities in blue oak woodlands as high for pallid bat, in terms of meeting its foraging needs. Montane hardwood conifer and montane hardwood habitats are rated low for pallid bat by CWHR (California Department of Fish and Game, 2005). Currently, there are 32,600 acres of blue oak woodlands and 251,000 acres of montane hardwoods and montane hardwood conifers below 8,000 ft on the SNF in CWHR size classes 2 and higher. The protection, maintenance, and enhancement of such westside foothill oaks and montane oaks are expected to benefit pallid bats by ensuring the continued availability of roosting sites. Indeed, all of the alternatives proposed in the SNFPA FEIS were determined to lead to an increase in oak species (USDA-FS 2001).

Cumulative effects discussed in the SNFPA FEIS stated that there have been no recent changes in the range or distribution of the pallid bat (USDA-FS 2001). For these reasons, and given the long-term objective for increasing the number of large trees across the landscape, the intention of reducing fuels to reduce the potential for large stand replacing wildfire, and the foregoing discussion of effects, the cumulative effects of vegetation management activities in the project treatment areas taken together with past, present, and reasonably foreseeable activities on the Forest would not result in a loss of viability for the pallid bat.

It is my determination that Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* Pallid bat. This is due to the fact that no vegetation treatments would occur under Alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to this species.

It is my determination that Alternatives 2-3 (the action alternatives) of the Greys Mountain Ecological 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. The project area has pallid bat habitat, and the bats themselves may occur there, so there is a risk that some individuals may be disturbed by project activities. This project does not propose to remove any snags unless they constitute a danger tree as identified in the Engineering Design Critera. Proposed activities also may result in the loss of roost or maternal trees, however, the management prescriptions would not result in significant changes in that habitat type, therefore, there would not be a measurable degradation of overall habitat suitability within or near the project area.

### *Western Red Bat*

There are no expected direct or indirect negative effects to the western red bat from the proposed project; therefore, there are no expected cumulative effects from the project.

It is my determination that the Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* Western red bat. This is due to the fact that no vegetation treatments would occur under Alternative 1 No Action.

It is my determination that Alternatives 2-3 (the action alternatives) of the Greys Mountain Ecological Restoration Project *would not affect the* Western red bat. This is due to the fact that no suitable roosting, hibernating, or maternal habitat would be impacted by any project activity.

## *American Marten*

The area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on marten encompasses the Bass Lake Ranger District. This is an appropriate scale for cumulative effects for a wide-ranging species (such as the marten) that has also been selected as a Management Indicator Species for the Sierra NF. Based on the following analysis, a determination of viability for the marten would be made.

BE for many of the past projects in the Sierra NF were reviewed to help inform the present analysis. Our review of these documents revealed the following basic information about effects to marten from these activities:

- 26 total project Biological Evaluations (BEs) were reviewed, dating back to 1993 on the Sierra NF.
- Determinations reached were:
    - No effect – seven BEs
    - May affect individual marten, but not likely to lead to a trend toward federal listing or loss of viability – 15 BEs
    - May affect individual marten, and likely to lead to a trend toward federal listing or loss of viability – 0 BEs
    - Marten were not addressed in the document we reviewed due to lack of habitat or other reasons – four BEs
- Types of Projects: Fuels reduction, harvest, hazard tree removal, and thinning were the proposed activities that were most often represented in the sample of BEs in which the marten was analyzed.
- Relative to "May Affect" projects, the described impacts to marten most often fell in the following categories:
    - Temporary disturbances
    - Foraging area may be burned if underburning gets out of control
    - Removed hazard trees could serve as resting or denning sites
    - Habitat altered or removed
    - Reduction of habitat quality (e.g., reduction in canopy cover)
    - Habitat would be entered
    - Noise disturbance

No large vegetation management projects have occurred above 7,000'ft over the past decade as most recent projects are centered around the WUI areas of the district which generally occur below 6,000'ft in elevation. Additionally, most marten habitat on the forest occurs in Wilderness areas where few vegetation management activities occur.

Because the alternatives put forth in this project would result in long-term increases in marten suitable habitat over time and the project's goal of increasing large diameter trees, the cumulative effects of vegetation management activities in the Greys Mountain treatment units taken together with past, present, and reasonably foreseeable activities on the Forest would not result in a loss of viability for the American marten.

It is my determination that Alternative 1 (the no action alternative) for the Greys Mountain Ecological Restoration Project *would not affect the* American marten as a result of vegetation treatments, as none would occur under Alternative 1. However, by taking no action to reduce fuel levels, the threat of large scale stand replacing fires would remain unabated, and if such an event occurs, there could be significant detrimental impacts to this species.

It is my determination that Alternatives 2-3 (the action alternatives) of the Greys Mountain Ecological Restoration Project *may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the American marten*. Suitable marten habitat occurs in and near the eastern edge of the project area and the proposed actions would not result in significant reductions of their habitat at the project or unit level. Sufficient levels of large trees >20”dbh, that provide potential den and rest sites, would be maintained, even under the most aggressive action alternative. This project does not propose to remove any oaks, and measures would be implemented to protect black oaks. A few marten may be disturbed by project activities, although this only would be for the short-term duration of those actions. There would be a 100-acre buffer applied to any marten den sites discovered within the project area which would minimize potential project-related disturbances to breeding marten.

Silvicultural prescriptions would maintain canopy cover of at least 50%, with a preference for at least 60%, immediately post treatment, and these prescriptions focus on removing surface and ladder fuels, and thinning from below. There would be very few changes to habitat types as a result of this management. Large trees (30”dbh and above), and all snags, would be retained during mechanized treatments, except where they pose an immediate safety hazard. The project would not impede movement or dispersal to other currently connected suitable habitat areas because habitat connectivity would be maintained within and adjoining the project area.

All action alternatives also may result in long-term positive effects to the marten by: 1) reducing the potential for uncharacteristically severe, stand eliminating wildfires; and 2) promoting the growth and re-growth of understory vegetation, which provides forage for prey species, as well as hiding and thermal cover. The horizontal and vertical diversity of forest vegetation structure and species also may be improved in some sites as a result of partially opening the forest overstory, particularly with Alternative 2. This in-turn would bring greater biodiversity into the stands, promoting greater prey species abundance and diversity. All of these factors combined outweigh the short-term negative effects of treatments (due to immediate partial loss of forest biomass and disturbance), especially considering that a more severe fire regime is predicted for the future, and without fuels reduction, large scale, stand replacing wildfires would most likely cause serious and significant impacts to the population.

# Terrestrial Wildlife Management Indicator Species

The purpose of this report is to evaluate and disclose the impacts of the project on the habitat of terrestrial Management Indicator Species (MIS) identified in the SNF LRMP (USDA 1991) as amended by the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (ROD) **(USDA Forest Service 2007a**). This report documents the effects of the proposed action and alternatives on the habitat of selected project-level MIS.

MIS are animal species identified in the SNF MIS Amendment ROD signed December 14, 2007, which was developed under the 1982 NFS Land and Resource Management Planning Rule (1982 Planning Rule) (36 CFR 219). The current rule applicable to project decisions is the 2004 Interpretive Rule, which states "Projects implementing land management plans…must be developed considering the best available science in accordance with §219.36(a)…and must be consistent with the provisions of the governing plan." (Appendix B to §219.35). Guidance regarding MIS set forth in the Sierra NF LRMP as amended by the 2007 SNF MIS Amendment ROD directs Forest Service resource managers to (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS affected by such projects, and (2) at the bioregional scale, monitor populations and/or habitat trends of MIS, as identified in the Sierra NF LRMP as amended.

## Affected Environment

### MIS Habitat Status and Trend

All habitat monitoring data are collected and/or compiled at the bioregional scale, consistent with the LRMP as amended by the 2007 SNF MIS Amendment ROD (USDA Forest Service 2007a).

Habitats are the vegetation types (for example, early seral coniferous forest) or ecosystem components (for example, snags in green forest) required by an MIS for breeding, cover, and/or feeding. MIS for the Sierra Nevada National Forests represent ten major habitats and two ecosystem components (USDA Forest Service 2007a). These habitats are defined using the CWHR System (CDFG 2005). The CWHR System provides the most widely used habitat relationship models for California's terrestrial vertebrate species (ibid). Included in Appendix A at the end of this document are tables explaining the acronyms used for available habitat stages in the CWHR system. It is also described in detail in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

Habitat status is the current amount of habitat on the Sierra Nevada Forests. Habitat trend is the direction of change in the amount or quality of habitat over time. The methodology for assessing habitat status and trend is described in detail in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

### MIS Population Status and Trend

All population monitoring data are collected and/or compiled at the bioregional scale, consistent with the LRMP as amended by the 2007 SNF MIS Amendment ROD (USDA Forest Service 2007a). The information is presented in detail in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

Population monitoring strategies for MIS of the Sierra NF are identified in the 2007 Sierra Nevada Forests Management Indicator Species (SNF MIS) Amendment ROD (USDA Forest Service 2007a). Population status is the current condition of the MIS related to the population monitoring data required in the 2007 SNF MIS Amendment ROD for that MIS. Population trend is the direction of change in that population measure over time.

There are a myriad of approaches for monitoring populations of MIS, from simply detecting presence to detailed tracking of population structure (USDA Forest Service 2001, Appendix E, page E-19). A distribution population monitoring approach is identified for all of the terrestrial MIS in the 2007 SNF MIS Amendment, except for the greater sage-grouse (USDA Forest Service 2007a). Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time. Presence data are collected using a number of direct and indirect methods, such as surveys (population surveys), bird point counts, tracking number of hunter kills, counts of species sign (such as deer pellets), and so forth. The specifics regarding how these presence data are assessed to track changes in distribution over time vary by species and the type of presence data collected, as described in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

## Methodology for Analysis

Project-level effects on MIS habitat are analyzed and disclosed as part of environmental analysis under the NEPA. This involves examining the impacts of the proposed project alternatives on MIS habitat by discussing how direct, indirect, and cumulative effects would change the habitat in the analysis area.

These project-level impacts to habitat are then related to broader scale (bioregional) population and/or habitat trends. The appropriate approach for relating project-level impacts to broader scale trends depends on the type of monitoring identified for MIS in the LRMP as amended by the SNF MIS Amendment ROD. Hence, where the Sierra NF LRMP as amended by the SNF MIS Amendment ROD identifies distribution population monitoring for an MIS, the project-level habitat effects analysis for that MIS is informed by available distribution population monitoring data, which are gathered at the bioregional scale. The bioregional scale monitoring identified in the Sierra NF LRMP, as amended, for MIS analyzed for the Greys Mountain Project is summarized in Section 3 of the Terrestrial MIS report.

Adequately analyzing project effects to MIS generally involves the following steps:

- Identifying which habitat and associated MIS would be either directly or indirectly affected by the project alternatives; these MIS are potentially affected by the project.
- Summarizing the bioregional-level monitoring identified in the LRMP, as amended, for this subset of MIS.
- Analyzing project-level effects on MIS habitat for this subset of MIS.
- Discussing bioregional scale habitat and/or population trends for this subset of MIS.
- Relating project-level impacts on MIS habitat to habitat and/or population trends at the bioregional scale for this subset of MIS.

These steps are described in detail in the Pacific Southwest Region draft document “MIS Analysis and Documentation in Project-Level NEPA, R5 Environmental Coordination” (May 25, 2006). This MIS section documents application of the above steps to select project-level MIS and analyze project effects on MIS habitat for the project.

## Mitigation and Monitoring

Special project design measures for the project were developed in concert with the BLRD interdisciplinary team, PSW research scientists, and concerned public participation groups. These design measures would be implemented under any of the two action alternatives. Within this project area special considerations have been given to maintaining higher levels of biodiversity through actions such as delineating OFLs surrounding perennial streams (see Terrestrial Wildlife BE/BA, USDA-FS 2011a for a description of OFLs). Higher levels of biodiversity have also been planned for by marking retention groups of large diameter trees. 890 such tree groups were identified in the project area. Ideally, when available on the landscape these groups also contain "defect" trees: those that have cavity and platform creating defects such as mistletoe, rot, forked tops, broken limbs, and broken tops. No trees greater than 20" dbh would be cut within these groups. These large tree groups would have a residual basal area of 240 $ft^2$ or more for mixed conifer and 210 $ft^2$ or more for pine and in many instances may reach 300 to 400 $ft^2$ per acre.

Another project design measure which would maintain biodiversity is the identification of retention areas around large oaks within treatment units. Two to three large oaks per acre were identified and marked with paint. These oaks would retain a zone of no activity around them measuring 35 feet, or dripline circumference around the oak (whichever is greater). The delineation of OFLs, retention of large tree groups, and oak no treatment zones would ensure a heterogeneous post treatment landscape resulting in the continued accessibility of both hiding cover and prey availability within these areas of biodiversity (USDA-FS 2011a).

The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Specific project design criteria include: canopy cover would be maintained at 50 to 60% or greater where available; ground disturbance would be limited to those guidelines with the LRMP as amended; vegetation species diversity and composition would be maintained; management activities would be limited in designated riparian management areas; and retention of snags and downed logs would be retained at levels defined in the Design Criteria Common to All Action Alternatives. All riparian management areas within the project have been identified and buffers established. In addition, no operations would occur during the wet weather season. (USDA-FS 2011a)

### Category 1 MIS

Species that would not be discussed further in this document include Category 1 and Category 2 MIS. Category 1 defines MIS whose habitat does not occur in or adjacent to the project area. For the project, Category 1 MIS include the greater sage-grouse and the black-backed woodpecker. No sagebrush (SGB) or burned forest habitat is currently present in or adjacent to the project area.

#### Black-backed woodpecker

Although no burned habitat is currently present within the project area, there may be indirect effects to black-blacked woodpecker habitat through the implementation of the project. This is due to the fact that part of the purpose and need for the project is to reduce the potential for large scale, uncharacteristically severe wildfires to occur on the landscape, and the black-backed woodpecker relies on the presence of snags created by moderate and high severity fires. During the past decade from 2000 through 2010, the Sierra National Forest has experienced a total of 53 wildfires totaling 28,419 acres, with an average fire size of 536 acres. 65% of the total acres burned during this period were categorized as moderate and high severity burned areas, which create the habitat types preferred by the black-backed woodpecker (USDA FS 2010a).

The implementation of projects designed to reduce fuel loading and fire severity does not preclude the occurrence of wildfire across the landscape, it merely seeks to lessen the extent and

severity of such fires when they occur. Since treatments for the Greys Mountain Project are limited to a maximum of 3,420 acres out of the 9,580 acres within the project boundary (36% of the total area), there remains potential for low and moderate severity fire to occur throughout the entire project area, and the potential for high severity fire to occur within the untreated portion of the project boundary (64% of the total area).

It is reasonable to conclude that wildfires of all severity types would continue to occur across the Bass Lake Ranger District and the Sierra National Forest, even after the implementation of the project. Therefore, habitat for the black-backed woodpecker would likely continue to increase on the Bass Lake district and across the Sierra NF. Furthermore, 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 (USDA FS 2010a).

## Category 2 MIS

Category 2 defines MIS whose habitat is in or adjacent to the project area, but whose habitat would not be directly or indirectly affected by the project. For the project, Category 2 MIS include: mule deer, yellow warbler, and sooty grouse. Though habitat for these species occurs within or adjacent to the project area, that habitat would not be directly or indirectly affected by the project. The primary reasons for this appraisal are the project design features which limit the activities reducing canopy closure. These design features, as well as applicable Forest Service S&Gs protecting species habitats, are discussed further in the following sections of this document for each Category 2 MIS.

### Mule Deer

Mule deer were selected as the MIS for oak-associated hardwood and hardwood/conifer forest in the Sierra Nevada. CWHR habitat for mule deer includes montane hardwood (MHW) and montane hardwood-conifer (MHC) all tree density and size classes. CWHR analysis identified a total of 298 acres of montane hardwood and montane hardwood conifer habitat within the project treatment units. There are no projected changes to montane hardwood habitat throughout the project area since no oaks are proposed for removal by this project. Forest stands surrounding oaks have varying prescriptions based upon the size and dbh of the oaks present. Many older oaks >20” dbh would retain a zone of “No Treatment” surrounding them for a distance of 35 feet, or dripline of the oak (whichever is greater). This prescription is designed to maintain habitat heterogeneity and hiding cover for fisher and their prey surrounding the larger, decadent oaks within the project area. For younger oaks and oak saplings, more trees may be removed around the southern exposure of these young oaks to allow for more sunlight and encourage diameter growth and vigor of the oaks. Oaks respond well to disturbance, and are among the first species to sprout in openings created by prescribed fire or thinning activities. It is expected that the number and vigor of oaks within the Greys Mountain Project would increase following project implementation.

Since none of the proposed alternatives for the project would alter the existing 298 acres of habitat identified for the mule deer, there would be no direct or indirect effects to habitat for this MIS, making it a category 2 species for this analysis. Mule deer will not be discussed further in this document.

### Yellow Warbler

Yellow warblers are found in riparian deciduous habitats in summer (cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland) (CDFG 2005). Montane riparian (MRI) and valley foothill riparian (VRI) are the two CWHR types used

in this analysis to define the habitat. CWHR analysis identified did not identify any acres of MRI habitat type within the project area. However, it is reasonable to assume that some montane riparian habitat exists along the 21 miles of perennial streams within and adjacent to the project area but was simply not captured by the remote sensing lab when digitizing the 2009 vegetation data.

All applicable S&Gs from the Sierra National Forest LRMP (USDA-Forest Service 1992), and associated amendments (USDA-Forest Service 2001, 2004), and other applicable laws and regulations would be applied to this project. Sierra National Forest's LRMP forest-wide S&Gs that were not superseded by the 2001 or 2004 amendments (USDA-Forest Service 2001; USDA-Forest Service 2004) applicable to project for aquatic species, habitats, and riparian health can be found in the project aquatics and hydrology reports (USDA Forest Service 2011e, USDA Forest Service 2004f). With adherence to the S&Gs for aquatic and riparian health, the project would not cause a direct or indirect affect to yellow warbler habitat, making it a category 2 species for this analysis. Yellow warbler will not be discussed further in this document.

### Sooty (Blue) Grouse

The sooty grouse was selected as the MIS for late seral open canopy coniferous forest in the Sierra Nevada. CWHR habitat for the sooty grouse includes ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), and eastside pine (EPN), tree size 5, canopy closures S and P. CWHR analysis identified only 12 acres of habitat meeting this criteria in the project area: SMC5P (12 acres). Although 3 acres of SMC5P occur within treatment units, there would be no changes to the habitat type; all 12 acres would remain at current CWHR strata. Since none of the proposed Alternatives for the project would alter the existing 12 acres of habitat identified for the sooty grouse, there would be no direct or indirect effects to habitat for this MIS, making it a category 2 species for this analysis. Sooty grouse will not be discussed further in this document.

## Category 3 MIS

The MIS whose habitat would be either directly or indirectly affected by the project, identified as category 3 are carried forward in this analysis, which evaluates the direct, indirect, and cumulative effects of the proposed action and alternatives on the habitat of these MIS. The MIS selected for project-level MIS analysis for the Greys Mountain Project are: fox sparrow, mountain quail, California spotted owl, American marten, northern flying squirrel, and hairy woodpecker.

The following section documents the analysis for the Category 3 MIS species: fox sparrow, mountain quail, California spotted owl, American marten, northern flying squirrel, and hairy woodpecker. The analysis of the effects of the project on the terrestrial MIS habitat for the selected project-level MIS is conducted at the project scale. The analysis used the CWHR model (Mayer and Laudenslayer 1988)) data to determine vegetative type within the entire project boundary. Existing acres of vegetation type (base vegetation layer) were determined using the Sierra National Forest Corporate GIS vegetation feature class of 2009 Existing Vegetation. Detailed information on the MIS is documented in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a), which is hereby incorporated by reference.

Cumulative effects at the bioregional scale are tracked via the SNF MIS Bioregional monitoring, and detailed in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

**Table 17. Action Alternatives Summary of changes to CWHR Forest Type within the Boundaries of the Greys Mountain Project**

| | | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **CWHR Habitat Type Pre-treatment** | **CWHR Habitat Type Post-treatment** | **Number of Acres of Density Change** | **Number of Acres of Density Change** |
| PPN4D | PPN4M | 4 acres | 1 acre |
| PPN5D | PPN5M | 3 acres | 2 acres |
| MHC4D | MHC4M | 1 acre | 1 acre |
| SMC4D | SMC4M | 110 acres | 46 acres |
| SMC4D | SMC4P | 1 acre | 1 acre |
| SMC5D | SMC5M | 2 acres | 2 acres |
| **Total Acres CWHR Habitat Density Change** | | **121 acres** | **53 acres** |

## MIS Project-level Effects Analysis

### Shrubland (West-Slope Chaparral) Habitat (Fox Sparrow)

**Current Condition of the Habitat Factor(s) in the Project Area:** There are a total of 368 acres of shrub-land (chaparral) habitat within the project boundary. 253 acres are classified as montane chaparral (MCP) and the remaining 115 acres are classified as mixed chaparral (MCH). Of the 368 acres of chaparral within the project boundary 149 acres (40%) occur within proposed treatment units. Please refer to Table 17 (Greys Mountain Project CWHR Data Table, Project Area, Present Compared to Alternative 2 Proposal) for a full breakdown of all CWHR habitat types within the Project boundary pre- and post-treatment.

## Alternative 1 – No Action

Alternative 1 is the no action alternative. Under the no action alternative, current management plans would continue to guide management of the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences. The No Action Alternative would not implement the Greys Mountain Project.

### Direct and Indirect Effects to Habitat.

There are no direct effects to shrubland habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects. (USDA Forest Service 2011a, 2011c, 2011d).

### Cumulative Effects to Habitat in the Analysis Area.

**Cumulative Effects Conclusion:** There would be no direct or indirect effects; therefore there are no cumulative effects for the no action alternative of the project.

# Alternative 2 – Proposed Action

## Direct and Indirect Effects to Habitat.

Under Alternative 2, direct effects to 149 acres of shrubland habitat are proposed through mastication and prescribed burning treatments. These 149 acres would be treated to maintain the growth and vigor of existing trees, or to create conditions suitable for the establishment of planted trees. The change in seral stage of 149 acres of chaparral out of 368 acres within the project boundary is a treatment of 40% of the total chaparral available within the project boundary. There are an additional 219 acres of shrubland habitat identified within the project boundary that are not proposed for treatment under the proposed action alternatives and would continue to provide suitable habitat for fox sparrow during implementation of mastication and burning activities.

## Cumulative Effects to Habitat in the Analysis Area.

A table of current and future projects within the analysis area for the project can be found in the Table 9.

## Cumulative Effects Conclusion:

This project proposes to treat 40% of the existing shrubland within the project boundary. Further activities taking place within the cumulative effects boundary that may alter shrubland habitat include road brushing and plantation maintenance. These activities may alter a very small percentage of the available shrubland habitat through removal of senescent chaparral bordering roads and inside plantations, resulting in natural regeneration of early seral stage chaparral habitat.

# Alternative 3

## Direct, Indirect, and Cumulative Effects to Habitat and Conclusion.

The proposed treatments for the shrubland habitat within Alternative 3 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 3 would be the same as those discussed under the proposed action.

## Summary of Fox Sparrow Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the fox sparrow; hence, the shrubland effects analysis for the project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the fox sparrow. This information is drawn from the detailed information on habitat and population trends in the 2010 Sierra Nevada Forests Bioregional MIS Report (USDA Forest Service 2010a), which is hereby incorporated by reference.

**Habitat Status and Trend.** There are currently 1,009,681 acres of west-slope chaparral shrubland habitat on National Forest System lands in the Sierra Nevada. Over the last two decades, the trend is slightly increasing (changing from 8% to 9% of the acres on National Forest System lands).

**Population Status and Trend.** Monitoring of the fox sparrow across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with Point Reyes Bird Observatory (PRBO) Conservation Science, as part of a monitoring effort that also includes mountain quail, hairy woodpecker, and yellow warbler (USDA Forest Service 2010a,

http://data.prbo.org/partners/usfs/snmis/). Fox sparrows were detected on 36.9% of 1659 point counts in 2009 and 44.3% of 2266 point counts in 2010, with detections on all 10 national forests in both years. The average abundance (number of individuals recorded on passive point count surveys) was 0.563 in 2009 and 0.701 in 2010. These data indicate that fox sparrows continue to be distributed across the 10 Sierra Nevada National Forests. In addition, the fox sparrows continue to be monitored and surveyed in the Sierra Nevada at various sample locations by avian point count, spot mapping, mist-net, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008). Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in the population trend, the distribution of fox sparrow populations in the Sierra Nevada is stable.

**Relationship of Project-Level Habitat Impacts to Bioregional-Scale Fox Sparrow Trend.** The 368 acres of shrubland habitat that exists within the project boundary account for less than 0.04% of the 922,000 acres that exists at the bioregional scale, and only 149 of these acres are proposed for some form of treatment. Therefore, cumulative impacts within the project boundary would not alter the existing bioregional trends in this habitat, nor would they lead to a change in the distribution of fox sparrows across the Sierra Nevada bioregion.

### Mid Seral Coniferous Forest Habitat (Mountain quail)

**Current Condition of the Habitat Factor(s) in the Project Area:** There are currently 6,052 acres of mid seral coniferous forest habitat within the project boundary. Of these, 2,563 acres (42%) are within proposed treatment units. Refer to Table 2 (Greys Mountain Project Camp CWHR Data Table, Project Area, Present Compared to Alternative 2 Proposal) of this report for a full breakdown of all CWHR habitat types within the project boundary pre- and post-treatment.

## Alternative 1 – No Action

### Direct and Indirect Effects to Habitat.

There would be no direct effects to mid seral coniferous habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects. (USDA Forest Service 2011, 2011c, 2011d).

### Cumulative Effects to Habitat in the Analysis Area and Conclusion.

There are no direct or indirect effects of the no action alternative 1, therefore there are no cumulative effects for Alternative 1.

## Alternative 2 – Proposed Action

### Direct and Indirect Effects to Habitat.

Under Alternative 2, there are projected changes in CWHR composition of mid seral coniferous habitat These changes are projected to occur on 124 acres spread across the treatment units. seven acres of PPN4D would be converted to PPN4M and 115 acres of SMC4D would be converted to SMC4M through proposed mechanical thinning treatments. The remaining 2,515 acres of mid seral coniferous habitat within the treatment units would not experience a change in CWHR habitat type, size, or density under the Alternative 2 proposal. Due to the thinning prescriptions

proposed, additional seral stage changes beyond those described would not change. Stands would merely reflect less density. It is expected that those stands treated would experience better health, vigor, and growth and would be less susceptible to wildfires.

### Cumulative Effects to Habitat in the Analysis Area and Conclusion.

Many of the ongoing management activities within the cumulative effects boundary would not contribute to significant cumulative impacts upon mid seral coniferous forest habitat. Of the cumulative effects actions elevated within the analysis area, private land residential development, roadside hazard tree removal, on-going plantation maintenance, and past and future timber sale activity have the greatest potential to alter mid seral coniferous habitat. Additional effects through Alternative 2 proposed canopy cover changes of 0.5% of the total habitat in the cumulative effects boundary are insignificant, especially when one considers the vast amount of available mid seral coniferous habitat present within the cumulative effects boundary.

## Alternative 3

### Direct, Indirect, and Cumulative Effects to Habitat and Conclusion.

Under Alternative 3, there are projected changes in CWHR composition of mid seral coniferous habitat. These changes are projected to occur on 48 acres spread across the treatment units. one acre of PPN4D would be converted to PPN4M and 47 acres of SMC4D would be converted to SMC4M through proposed mechanical thinning treatments. The remaining 2,441 acres of mid seral coniferous habitat within the treatment units would not experience a change in CWHR habitat type, size, or density under the Alternative 2 proposal. Due to the thinning prescriptions proposed, additional seral stage changes beyond those described would not change. Stands would merely reflect less density. It is expected that those stands treated would be less susceptible to wildfires, but since no density management would occur the stands would not experience the health, vigor, and growth of the larger trees that would occur under Alternative 2.

Indirect effects can be expected by failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects. (USDA Forest Service 2011, 2011c, 2011d).

### Summary of Mountain Quail Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the mountain quail; hence, the early and mid seral coniferous forest effects analysis for the project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the mountain quail. This information is drawn from the detailed information on habitat and population trends in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a), which is hereby incorporated by reference.

### Habitat Status and Trend.

There are currently 2,776,022 acres of mid seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada. Over the last two decades, the trend for mid seral habitat is increasing (changing from 21% to 25% of the acres on National Forest System lands).

### Population Status and Trend.

Monitoring of the mountain quail across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science, as part of a monitoring effort that also includes fox sparrow, hairy woodpecker, and yellow warbler (USDA Forest Service 2010a, http://data.prbo.org/partners/usfs/snmis/). Mountain quail were detected on 40.3% of 1659 point counts (and 48.6% of 424 playback points) in 2009 and 47.4% of 2266 point counts (and 55.3% of 492 playback points) in 2010, with detections on all ten national forests in both years. The average abundance (number of individuals recorded on passive point count surveys) was 0.103 in 2009 and 0.081 in 2010. These data indicate that mountain quail continue to be distributed across the 10 Sierra Nevada National Forests. In addition, mountain quail continue to be monitored and surveyed in the Sierra Nevada at various sample locations by hunter survey, modeling, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008). Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of mountain quail populations in the Sierra Nevada is stable.

### Relationship of Project-Level Habitat Impacts to Bioregional-Scale Mountain Quail Trend.

The 6,052 acres of mid seral coniferous habitat that exists within the project boundary accounts for less than 0.2% of the 2,776,022 acres that exists at the bioregional scale. The change in canopy closure of 124 acres out of 2,766,000 acres of mid seral coniferous habitat in the Sierra Nevada bioregion would not alter the existing trend in the habitat, nor would it lead to a change in the distribution of mountain quail across the Sierra Nevada bioregion.

### Late Seral Closed Canopy Coniferous Forest Habitat (California spotted owl, American marten, and northern flying squirrel)

#### Habitat/Species Relationship.

**California spotted owl.** The California spotted owl was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. The California spotted owl is strongly associated with forests that have a complex multi-layered structure, large-diameter trees, and high canopy closure (CDFG 2005, USFWS 2006). It uses dense, multi-layered canopy cover for roost seclusion; roost selection appears to be related closely to thermoregulatory needs, and the species appears to be intolerant of high temperatures (CDFG 2005). Mature, multi-layered forest stands are required for breeding (Ibid). The mixed-conifer forest type is the predominant type used by spotted owls in the Sierra Nevada: about 80 percent of known sites are found in mixed-conifer forest, with 10 percent in red fir forest (USDA Forest Service 2001).

**American marten.** The American marten was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. Martens prefer coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and an interspersion of riparian areas and meadows. Important habitat attributes are: vegetative diversity, with

predominately mature forest; snags; dispersal cover; and large woody debris (Allen 1982). Key components for westside and eastside marten habitat can be found in the Sierra Nevada Forest Plan Amendment FEIS (USDA Forest Service 2001), Volume 3, Chapter 3, part 4.4, pages 20-21.

**Northern flying squirrel.** The northern flying squirrel was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. The northern flying squirrel occurs primarily in mature, dense conifer habitats intermixed with various riparian habitats, using cavities in mature trees, snags, or logs for cover (CDFG 2005).

### Project-level Effects Analysis – Late Seral Closed Canopy Coniferous Forest Habitat.

**Habitat Factor(s) for the Analysis:** (1) Acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat [CWHR 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]. (2) Acres with changes in canopy closure (D to M). (3) Acres with changes in large down logs per acre or large snags per acre.

**Current Condition of the Habitat Factor(s) in the Project Area:** There are a total of 1,009 acres of late seral closed canopy coniferous forest habitat within the project boundary. 292 acres are PPN5D, 5 acres of PPN5M, 392 acres of SMC5D and 320 acres of SMC5M. This habitat type accounts for 11% of the total acreage within the project boundary area.

## Alternative 1 (No Action)

### Direct and Indirect Effects to Habitat.

There would be no direct effects to late seral, closed canopy coniferous habitat under this alternative. There is a potential for indirect effects under the no action alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects. (USDA Forest Service 2011, 2011c, 2011d).

### Cumulative Effects to Habitat in the Analysis Area and Conclusion.

There are no direct or indirect effects of the no action alternative 1, therefore there are no cumulative effects for Alternative 1 of the Greys Mountain Project.

## Alternative 2 (Proposed Action)

### Direct and Indirect Effects to Habitat.

There are a total of 1,009 acres of late-seral closed canopy coniferous forest within the project boundary of the Greys Mountain Project. Of these, 366 acres (36%) occur within treatment units. Under Alternative 2, minimal changes to late-seral habitats are projected to occur within the fuelbreak treatment areas of the project. 3 acres of PPN5D are projected to be converted to PPN5M, and another 2 acres are projected to be converted from SMC5D to SMC5M. Total changes to late-seral habitat are expected for only 5 acres, or 0.5% of the available habitat within the project boundary.

# Alternative 3

## Direct and Indirect Effects to Habitat.

Changes to late-seral closed canopy forest habitat under Alternative 3 are similar to those described for Alternative 2.

## Cumulative Effects to Habitat in the Analysis Area and Conclusion.

Many of the ongoing management activities within the cumulative effects boundary would not contribute to significant cumulative impacts upon late seral closed canopy coniferous forest habitat. Of the cumulative effects actions elevated within the analysis area, private land residential development, roadside hazard tree removal, and past and future timber sale activity have the greatest potential to alter late seral stage coniferous habitat. Additional effects through Alternative 2 and 3 proposed canopy cover changes of 0.5% of the total habitat in the cumulative effects boundary are insignificant, especially when one considers the significant amount of available late seral coniferous habitat present within the cumulative effects boundary. Cumulative effects are not anticipated to alter the existing trend in the habitat at the project level.

## Summary of Status and Trend at the Bioregional Scale

**California spotted owl, American marten, and Northern flying squirrel.** The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the California spotted owl, American marten, and northern flying squirrel; hence, the late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat effects analysis for the project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data. This information is drawn from the detailed information on habitat and population trends in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a), which is hereby incorporated by reference.

**Habitat Status and Trend.** There are currently 1,006,923 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada. Over the last two decades, the trend is slightly increasing (changing from 7% to 9% of the acres on National Forest System lands); since the early 2000s, the trend has been stable at 9%.

**Population Status and Trend - California spotted owl.** California spotted owl has been monitored in California and throughout the Sierra Nevada through general surveys, monitoring of nests and territorial birds, and demography studies (Verner et al. 1992; Gutierrez et al. 2008, 2009, 2010; USDA Forest Service 2001, 2004, 2006; USFWS 2006; Sierra Nevada Research Center 2007, 2008, 2009, 2010). Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in population trend [e.g., localized decreases in “lambda” (estimated annual rate of population change)], the distribution of California spotted owl populations in the Sierra Nevada is stable.

**Population Status and Trend – American marten.** American marten has been monitored throughout the Sierra Nevada as part of general surveys and studies since 1996 (e.g., Zielinski et al. 2005, Moriarty 2009). Since 2002, the American marten has been monitored on the Sierra Nevada forests as part of the SNFPA monitoring plan (USDA Forest Service 2005, 2006, 2007, 2009, 2010b). Current data at the rangewide, California, and Sierra Nevada scales indicate that, although marten appear to be distributed throughout their historic range, their distribution has become fragmented in the southern Cascades and northern Sierra Nevada, particularly in Plumas

County. The distribution appears to be continuous across high-elevation forests from Placer County south through the southern end of the Sierra Nevada, although detection rates have decreased in at least some localized areas (e.g., Sagehen Basin area of Nevada County).

**Population Status and Trend – northern flying squirrel.** The northern flying squirrel has been monitored in the Sierra Nevada at various sample locations by live-trapping, ear-tagging, camera surveys, snap-trapping, and radiotelemetry: 2002-present on the Plumas and Lassen National Forests (Sierra Nevada Research Center 2007, 2008, 2009, 2010), and 1958-2004 throughout the Sierra Nevada in various monitoring efforts and studies (see USDA Forest Service 2008, Table NOFLS-IV-1). These data indicate that northern flying squirrels continue to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of northern flying squirrel populations in the Sierra Nevada is stable.

## Relationship of Project-Level Habitat Impacts to Bioregional-Scale Trends.

**California spotted owl/American marten/Northern flying squirrel.** The change in canopy closure of 5 acres out of 1,006,923 acres of late seral closed canopy coniferous forest habitat available throughout the Sierra Nevada forests would not alter the existing trend in the habitat, nor would it lead to a change in the distribution of California spotted owl across the Sierra Nevada bioregion. This projected change represents less than 0.0005% of the available habitat within the 10 Sierra Nevada forests.

## Snags in Green Forest Ecosystem Component (Hairy woodpecker)

### Habitat/Species Relationship.

The hairy woodpecker was selected as the MIS for the ecosystem component of snags in green forests. Medium (dbh between 15 to 30 inches) and large (diameter breast height greater than 30 inches) snags are most important. The hairy woodpecker uses stands of large, mature trees and snags of sparse to intermediate density; cover is also provided by tree cavities (CDFG 2005). Mature timber and dead snags or trees of moderate to large size are apparently more important than tree species (Siegel and DeSante 1999).

## Project-level Effects Analysis – Snags in Green Forest Ecosystem Component

### Current Condition of the Habitat Factor(s) in the Project Area:

Prior to 2004, the forest implemented S&Gs from the Sierra NF LRMP (1992) which called for maintaining an average of 1.5 snags per acre in sizes 15-24” dbh and an average of 0.5 snags per acre in sizes 25” dbh or greater. All countable snags had to be 20’ or greater height (S&G #64, p. 4-16). Additionally, a sufficient number of live trees had to be left in appropriate sizes to serve as replacement snags. The SNFPA (2004), modified the SNF LRMP with the followings guidelines: (1) in westside mixed conifer and ponderosa pine types, Forests should maintain four of the largest snags per acre, (2) in red fir forest type, they should maintain six of the largest snags per acre, (3) in eastside pine and mixed conifer forest types, they should maintain three of the largest snags per acre, and (4) in westside hardwood ecosystems, they should maintain four of the largest snags (hardwood or conifer) per acre, or if standing live hardwood trees lack dead branches, they should maintain six of the largest snags per acre (S&G #11, p. 51).

Current conditions within the project boundary meet and in some areas exceed the snag and down woody material retention guidelines laid forth in the 2004 SNFPA. The following standards and

guidelines for Snags and Down Woody Material apply to this project (SNFPA FSEIS ROD Pg. 51-52):

Down Woody Material: "Determine down woody material retention levels on an individual project basis, based on desired conditions. Emphasize retention of wood in the largest size classes and in decay classes 1, 2, and 3. Consider the effects of follow-up prescribed fire in achieving desired down woody material retention levels." Typically 10-20 tons of down woody material per acre is acceptable from a fuel loading standpoint, and would retain sufficient material to provide for post-treatment habitat for down woody utilizing species, based on extrapolation of pre-European stand conditions.

Snag Retention: "Design projects to implement and sustain a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife across a landscape. Retain some mid- and large-diameter live trees that are currently in decline, have substantial wood defect, or that have desirable characteristics (teakettle branches, large diameter broken top, large cavities in the bole) to serve as future replacement snags and to provide nesting structure. When determining snag retention levels and locations, consider land allocation, desired condition, landscape position, potential prescribed burning and fire suppression line locations, and site conditions (such as riparian areas and ridge tops), avoiding uniformity across large areas.

The general guidelines for large-snag retention are as follows:

Westside mixed conifer and ponderosa pine types – four of the largest snags per acre.

Use snags larger than 15 inches dbh to meet this guideline. Snags should be clumped and distributed irregularly across the treatment units. Consider leaving fewer snags strategically located in treatment areas within the WUI. When some snags are expected to be lost due to hazard removal or the effects of prescribed fire, consider these potential losses during project planning to achieve desired snag retention levels."

No snags are proposed to be removed in the project unless they meet the definition of a danger tree and are felled for safety (US Forest Service 2011).

Additional design criteria common to all action alternatives includes:

1. Maintain highest canopy cover possible to meet the prescription within stands, aim for 50-60% immediately post-harvest.

2. Thinning would not remove any trees larger than 30"dbh.

3. Retain groups of larger trees (greater than 30") at the rate of approximately one group per 2.5-3.5 acres. Ideally these groups would contain "defect" trees, those that have cavity and platform creating defects (mistletoe, rot, fork topped, broken limbs and tops) for den and rest sites.

4. Retain largest snags and logs. Do not remove snags unless it is safety concern (project does not propose to remove snags). Retain largest logs to maximum allowed by fuel loading standards.

## Alternative 1 (No Action)

**Direct and Indirect Effects to Habitat.** There would be no direct effects to snags in green forest habitat under this alternative. There is a potential for indirect effects under the no action alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Such a wildfire would convert current snags in green forest habitat to snags in burned forest habitat. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2011, 2011c, 2011d).

**Cumulative Effects to Habitat in the Analysis Area and Conclusion**.
There are no direct or indirect effects of the no action alternative for the project, therefore there are no cumulative effects for Alternative 1.

## Alternative 2 (Proposed Action)

**Direct, Indirect, and Cumulative Effects to Habitat and Conclusion**. There would be minimal direct effects to snags under the Alternative 2 proposed action. Currently, across the treatment units, there are an average of 11 standing conifer snags per acre that are ≥10" dbh. Of those standing conifer snags, a total of four per acre are ≥16" dbh. No snags are proposed for removal by any of the action alternatives in the project, except for in rare cases where they constitute a safety concern. Current conditions within the project boundary and cumulative effects boundary meet and in some areas exceed the snag and down woody material retention guidelines laid forth in the 2004 SNFPA. It is reasonable to assume that a few stage 4 through 7 snags may be lost in prescribed fire treatment areas, however this treatment is also likely to produce stage 2 and 3 snags. It is not expected that removal of snags that pose a safety concern along roadways or in treatment units would alter the available snag levels below the current standards set forth in the 2004 SNFPA ROD.

## Alternative 3

**Direct, Indirect, and Cumulative Effects to Habitat and Conclusion.**

The proposed treatments for forest snags within Alternative 3 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 3 would be the same as those discussed under the proposed action.

**Summary of Hairy Woodpecker Status and Trend at the Bioregional Scale**
The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the hairy woodpecker; hence, the snag effects analysis for the project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the hairy woodpecker. This information is drawn from the detailed information on habitat and distribution population trends in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a), which is hereby incorporated by reference.

**Ecosystem Component Status and Trend.** The current average number of medium-sized and large-sized snags (≥ 15" dbh, all decay classes) per acre across major coniferous and hardwood forest types (westside mixed conifer, ponderosa pine, white fir, productive hardwoods, red fir, eastside pine) in the Sierra Nevada ranges from 1.5 per acre in eastside pine to 9.1 per acre in

white fir. In 2008, snags in these types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA Forest Service 2008).

Data from the early-to-mid 2000s were compared with the current data to calculate the trend in total snags per acre by Regional forest type for the 10 Sierra Nevada national forests and indicate that, during this period, snags per acre increased within westside mixed conifer (+0.76), white fir (+2.66), red fir (+1.25), and productive hardwoods (+0.35) and decreased within ponderosa pine (-0.16) and eastside pine (-0.14).

Detailed information by forest type, snag size and snag decay class can be found in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a).

**Population Status and Trend.** Monitoring of the hairy woodpecker across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science, as part of a monitoring effort that also includes mountain quail, fox sparrow, and yellow warbler (USDA Forest Service 2010a, http://data.prbo.org/partners/usfs/snmis/). Hairy woodpeckers were detected on 15.1% of 1659 point counts (and 25.2% of 424 playback points) in 2009 and 16.7% of 2266 point counts (and 25.6% of 492 playback points) in 2010, with detections on all 10 national forests in both years. The average abundance (number of individuals recorded on passive point count surveys) was 0.116 in 2009 and 0.107 in 2010. These data indicate that the hairy woodpecker continues to be distributed across the 10 Sierra Nevada National Forests. In addition, the hairy woodpeckers continue to be monitored and surveyed in the Sierra Nevada at various sample locations by avian point count and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA Forest Service 2008). Current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of hairy woodpecker populations in the Sierra Nevada is stable.

**Relationship of Project-Level Habitat Impacts to Bioregional-Scale Hairy Woodpecker Trend.** The 7,061 acres of mid and late seral forest habitat that provides the green forest snag component within the project boundary account for less than 0.2% of the 3,835,000 acres of mid and late seral coniferous forest habitat within the Sierra Nevada bioregion. Therefore, none of the alternatives would alter the bioregional trend in the snag component of the coniferous forest habitat, nor would they lead to a change in the distribution of the hairy woodpecker across the Sierra Nevada bioregion.

## Summary and Conclusions

There are no direct effects to any MIS habitat within the Greys Mountain Project area for Alternative 1: No Action. However, there may be indirect effects to MIS habitat if an uncharacteristically severe wildfire was to occur, and no action had been taken to lessen some of the fuel loading within the project area.

If Alternative 2 were selected, there would be alterations to canopy closure on 121 acres of MIS habitat (approximately 4% of the treatment area) including shrubland, mid seral coniferous forest, and late seral closed canopy coniferous forest. These predicted changes are spread across the treatment units, and would not alter the existing trend in any of the habitats at the project-level, nor would it lead to a change in the distribution of the fox sparrow, mountain quail, California spotted owl, american marten, northern flying squirrel, or hairy woodpecker across the Sierra Nevada bioregion.

If Alternative 3 were selected, there would be alterations to canopy closure on 53 acres of MIS habitat (approximately 2% of the treatment area) including shrubland, mid seral coniferous forest,

and late seral closed canopy coniferous forest. These predicted changes are spread across the treatment units, and would not alter the existing trend in any of the habitats at the project-level, nor would it lead to a change in the distribution of the fox sparrow, mountain quail, California spotted owl, american marten, northern flying squirrel, or hairy woodpecker across the Sierra Nevada bioregion.

# Aquatic Wildlife and Management Indicator Species

## The Affected Environment

This section describes existing condition based on data collected within the aquatic analysis area.

## Existing Condition

The following tables summarize information within the analysis area subwatersheds. Table 18 presents stream channel survey information. Of stream channels evaluated within the analysis area, approximately 10 miles were channel types considered moderately to highly sensitive to disturbance. Of these 10 miles, approximately 1.2 miles were evaluated as being in Poor condition. The Project Hydrology Report (Stone 2011) indicates there is evidence that past activities have caused watershed degradation, but overall the channels and subdrainages in the project area appear to be recovering and reaching a state of equilibrium. The current condition for most of the stream reaches is good or fair for channel stability using modified Pfankuch (Rosgen 1996), which has been corroborated with Stream Condition Inventory data. There are, however, several areas (subwatersheds 503.0056 and 504.0061) within the proposed project boundary that are unstable and sensitive to disturbance. Subdrainage 503.0056 has a sub-basin where evidence of excess sediment in the stream channel was observed during interdisciplinary field review.

**Table 18. Summary of subwatershed conditions. *From project hydrologist review (Stone 2011).**

| Subwatershed | Acres | Channel Sensitivity * | Pfankuch stability (Rosgen modified)* | Rosgen Channel Typing (mi) | Rosgen Sensitivity (mi) | | | Poor Stability (mi) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Low (mi) | Moderate (mi) | High (mi) | |
| 503.0056 | 1211 | Extreme | Poor | | - | - | - | - |
| 503.0057 | 1246 | - | - | - | - | - | - | - |
| 503.3002 | 2472 | - | - | - | 0.34 | - | - | - |
| 503.3051 | 1484 | - | - | 0.34 | 0.24 | 0.5 | - | - |
| 504.0011 | 1972 | - | - | 0.74 | - | - | - | - |
| 504.0012 | 3033 | Low | Good | - | 2.59 | - | 3.56 | - |
| 504.0013 | 1369 | Low | Fair | 6.15 | - | - | - | - |
| 504.0014 | 1078 | Very High | Good | - | - | - | - | - |
| 504.0015 | 455 | Extreme | Good | - | - | - | - | - |
| 504.0059 | 1866 | Very low/ Moderate | - | - | 11.1 | 1.88 | 2.07 | 0.26 |
| 504.0060 | 2737 | Very low | Fair/Good | 15.05 | - | - | - | - |
| 504.0061 | 1262 | Moderate | Poor | - | - | - | - | - |
| 504.3001 | 1496 | - | - | - | 1.62 | 1 | 0.5 | - |
| 504.4051 | 1534 | Very High | Good | 3.12 | - | - | - | 0.93 |

Table 19 displays miles of perennial streams, miles occupied by resident trout, 2009 mean summer (7/15-9/15) water temperature, and maximum daily mean water temperature from the larger perennial streams. Streams in the analysis area meet the Desired Condition for water temperature identified in the Willow Creek Landscape Analysis (USDA-Forest Service 1995) and are within the expected summer temperature range (< 21º C) for the zoogeographic province described by Moyle (2002), which should be appropriate for native aquatic/riparian species.

**Table 19. Perennial streams (mi); resident trout occupancy (mi), mean summer water temperature (period 7/15-9/15), and maximum daily temperature (greatest mean daily period 7/15/9/15).**

| Subwatershed | Acres | Stream Drainage | Per. Stream (mi) | Fish Occupied (mi) | Mean Summer Temp (C) | Max Daily Mean(C) |
|---|---|---|---|---|---|---|
| 503.0056 | 1211 | Unnamed trib. to Nelder Creek | 1.8 | 0.0 | - | - |
| 503.0057 | 1246 | Redwood Creek | 0.5 | 0.0 | - | - |
| 503.3002 | 2472 | California Creek | 3.2 | 2.5 | - | - |
| 503.3051 | 1484 | Nelder Creek | 2.9 | 2.8 | 14.8 | 17.1 |
| 504.0011 | 1972 | Slide Creek | 2.2 | 0.0 | - | - |
| 504.0012 | 3033 | Chilkoot Creek | 5.6 | 5.3 | 14.2 | 16.3 |
| 504.0013 | 1369 | Unnamed trib. to North Fork Willow Creek | 2.3 | 1.6 | - | - |
| 504.0014 | 1078 | Soquel Creek | 2.1 | 0.8 | 12.2 | 13.3 |
| 504.0015 | 455 | Unnamed trib. to North Fork Willow Creek | 0.5 | 0.0 | - | - |
| 504.0059 | 1866 | North Fork Willow Creek | 3.9 | 3.9 | 17.3 | 19.7 |
| 504.0060 | 2737 | North Fork Willow Creek | 5.1 | 4.9 | 16.6 | 18.4 |
| 504.0061 | 1262 | North Fork Willow Creek | 4.8 | 3.6 | 12 | 13.9 |
| 504.3001 | 1496 | Pines Creek | 2.0 | 0.9 | 14.9 | 15.8 |
| 504.4051 | 1534 | Unnamed trib. to North Fork Willow Creek | 0.7 | 0.0 | 12.6 | 14.5 |

## Species Accounts and Status

The following provides summarized information on aquatic/riparian threatened, endangered, candidate, and Forest Service sensitive (FSS) species that are either known to occur or have potential habitat within the analysis area, along with the system used to quantify and evaluate potential habitat (CWHR). Complete descriptions and analysis are available in the project aquatic/riparian species biological assessment/ evaluation (Strand 2011). Species lists are based on the May 12, 2011 online database of federally threatened, endangered, proposed, and candidate species for the Sierra National Forest from the U.S. Department of the Interior (USDA) Fish and Wildlife Service (USFWS; http://sacramento.fws.gov/es/spp_list.htm). The U.S. Department of Agriculture (USDA) Forest Service's sensitive species list is based on the Pacific

Southwest Region's list of June 10, 1998, as amended on March 6, 2001 and May 7, 2003. These lists are the most current versions for the Sierra National Forest.

Further analysis is presented to determine the effects from the Greys Mountain Project on the following threatened (T), endangered (E), proposed (P), candidate (C), and/or Forest Service Sensitive (FSS) aquatic species, which have potential habitat within or adjacent to the aquatic analysis area:

FYLF (FSS), *Rana boylii*

Western pond turtle (FSS), *Clemmys marmorata* (Subspecies *marmorata* and *pallida*)

Mountain yellow-legged frog (C/FSS), *Rana muscosa* (=mountain yellow-legged frog, *Rana sierrae*)

Yosemite toad (C/FSS), *Bufo canorus*

## Habitat Suitability

The CWHR (CDFG 2008) was used to evaluate species habitat quantity and quality. The CWHR System contains life history, habitat relationships, and management information for amphibians and reptiles occurring in California. Suitable habitats for the species are described within the CWHR and suitability ratings for Reproduction, Cover, and Feeding are provided. Ratings are provided for habitat values as High, Medium, Low, or Unsuitable as described in the following:

**High**: Habitat suitability rating where habitat is optimal for species occurrence; habitat can support relatively high population densities at high frequencies. Suitability index value = 1.00.

**Medium**: Habitat suitability rating where habitat is suitable for species occurrence; habitat can support relatively moderate population densities at moderate frequencies. Suitability index value = 0.66.

**Low**: Habitat suitability rating where habitat is marginal for species occurrence; habitat can support relatively low population densities at low frequencies. Suitability index value = 0.33.

**Unsuitable**: Habitat stage is unsuitable for species occurrence, and the species where habitat is rated unsuitable is not expected to reliably occur in the habitat. Suitability index value = 0.00.

### Foothill Yellow-Legged Frog

Distribution: Historically, FYLFs occurred between sea level and 6,000 feet in most Pacific drainages west of the Sierra-Cascade crest from the Santiam River, Marion County, Oregon, to the San Gabriel Drainage, Los Angeles County, California (Hayes and Jennings 1988).

Life History: Breeding occurs in shallow, slow flowing water (with at least some pebble and cobble substrate) between March and June after high flows have receded. Breeding generally occurs in perennial streams defined by some shading (> 20%), water temperatures not exceeding 20°C for egg-laying and larval development, shallow riffles ($\leq$ 0.21 m), and cobble or larger substrates (CDFG 2008). Eggs hatch in 5 to 30 days and tadpoles transform in about 15 weeks, from July to September.

During breeding season and in the summer, FYLF are rarely encountered far from permanent water. During the winter, FYLF have been observed in abandoned rodent burrows and under logs as far as 100 meters (328 feet) from a stream (Zeiner et al. 1988). FYLF usually reach sexual maturity between one to two years, although some individuals may reproduce as early as six months after metamorphosis. Diet consists of a wide variety of invertebrates.

Status: Jennings (1996) indicates that FYLF no longer occur within 45% of historic habitat in California, and has disappeared from 66% of its historic habitat within the Sierra Nevada

mountain range. The Pacific Southwest Region of the Forest Service designated the FYLF as a sensitive species in 1998.

Occurrence in the Analysis Area: There is currently one known population of FYLF on the Sierra National Forest (Jose Basin – San Joaquin drainage), approximately 15 miles from the closest portion of the analysis area. Neither the CNNDB nor the Museum of Vertebrate Zoology ((MVZ); Berkeley, California) indicate FYLF specimens from the analysis area, and USFS surveys have not detected them.

Potential Habitat: The CWHR (CDFG 2008) notes that highly suitable habitats for this species are riverine and valley/foothill riparian with mostly submerged and flooded gravels, cobble, boulders, and bedrock. Potential suitable habitat for the FYLF was identified from GIS using perennial (stream order 4 and greater) streams below 5,000 feet in elevation with a 165-foot dispersal area on each side of the stream. The essential elements for the species are indicated to be algae, invertebrates, lithic (rocky substrate), and water. Within the analysis area there are approximately 19 miles of potential habitat providing approximately 745 acres of habitat. Potential habitat occurs within subwatersheds 503.0056; 504.0011; 504.0012; 504.013; 504.0059; 504.0060; and 504.3001.

The CWHR habitat values for the acres of potential habitat for breeding, cover, and feeding indicates that most (80%) the habitat in the analysis area is of Low or No quality for FYLF.

### Western pond turtle

Distribution: The westside central Sierra Nevada mountain range is an area of overlap between two pond turtle subspecies, *Actinemys marmorata marmorata* (northwestern pond turtle) and *Actinemys marmorata pallida* (southwestern pond turtle). These pond turtles, collectively known as western pond turtles (WPT), are found from sea level to 4,690 feet in elevation. Historically, WPT occurred along the west slope of Cascade/Sierra Nevada mountain ranges from the Columbia River to northern Baja California.

Life History: Across the Sierra National Forest it appears mating occurs in late April to early May (Holland 1991). Nesting extends from late April through August (Holland *ibid*) depending on the latitude, with a peak from late May to early July. Females may travel along a waterway as far as 1.2 miles (2 km) to distant nesting areas if suitable nesting habitat is not available locally (Rathbun et al. 1993). Nesting is favored at unshaded south facing slopes, with clay/silty soils. Clutch size examined by Holland (1991) ranged from 1-13 eggs. Eggs hatched between 80-126 days. Young WPT are believed to over-winter in the nest. Hatchlings out of the nest occupy shallow water habitats where they feed on nekton.

WPT forage early in the morning and then bask on logs or rocks intermittently. During the summer, turtles may forage in the late afternoon or early evening. WPT are believed to be relatively long lived with recaptures of marked specimens exceeding 40 years.

Status: In 1992 the USFWS was petitioned to list WPT under the ESA (USDSI-USFWS 1992). Following review, the USFWS declined to list the species. The Pacific Southwest Region of the Forest Service designated the western pond turtle as a sensitive species in 1993. Bury and Germano (2008) note that WPT abundance appears to be declining in the northern and southern portions of the species range, but not in the core of the range from central California to southern Oregon

Occurrence in the Analysis Area: Surveys for WPT have been conducted between 1995 and 2011. WPT have not been detected within the aquatic analysis area, nor are there any records of the species in the CNDDB or the MVZ databases for this area.

Potential Habitat across the Sierra National Forest: For the purposes of this analysis, potential habitat within the analysis area was evaluated as perennial (stream order 4 and greater) streams and lakes and ponds below 5000 feet elevation. Terrestrial habitat used for breeding or a movement corridor of 325 feet to either side of the channels and around lakes/ponds defines potential habitat (CDFG 2008). Within the analysis area there are approximately 19 miles of potentially suitable stream habitat. Potential habitat within the analysis area has been projected using GIS based on CWHR criteria. There approximately 1,430 acres of potential habitat within the analysis area. Water and Slow Water are identified as essential elements of habitat. The potential habitat occurs within subwatersheds 503.0056; 504.0011; 504.0012; 504.013; 504.0059; 504.0060; and 504.3001.

The CWHR habitat values for the acres of potential WPT habitat for breeding, cover, and feeding indicate most of the habitat (89%) in the analysis area is generally of Low or No quality for WPT.

### Sierra Nevada yellow-legged frog (mountain yellow-legged frog)

Distribution: The Sierra Nevada MYLF occurs at high elevation (4,500-12,000 ft) only in the Sierra Nevada Mountains of California (CDFG 2005). DNA sequencing by Vredenburg et al. (2007) suggest two species within the historic range of MYLF. *R. muscosa* (Sierra Madre yellow-legged frog) would apply to populations south of the divide between the Middle and South Forks of the Kings River. Populations to the north (including the analysis area) would be considered *R. sierrae* (Sierra Nevada yellow-legged frog). The FSS species list and the USFWS continue to refer to the species as MYLF and this evaluation includes that nomenclature.

Life History: The MYLF is diurnal and is seldom far from water. The species prefers well illuminated lakes and tarns, sloping banks of meadow streams, riverbanks, and isolated pools. At high elevations, breeding occurs between May and August as soon as the meadows and lakes are free of snow and ice (CDFG 2008). In lower elevations breeding occurs between March and June once high water in streams subsides. Following mating, the female deposits their 30-400 eggs in clusters submerged along stream banks or on vegetation and tadpoles develop after 2-3 weeks.

Tadpoles maintain a relatively high body temperature by selecting warmer microhabitats (margins of water bodies) where they may congregate in the hundreds feeding on algae. Tadpoles may require up to three years before metamorphosis. Following metamorphosis, it can take up to four years for juveniles to reach sexual maturity. MYLF may move several hundred meters between breeding, feeding, and overwintering habitats (Pope and Matthews 2001). They tend to follow lake shores and streams, but will move short distances across dry land (Matthews and Pope 1999). Since the adults and tadpoles overwinter underwater, at high elevations they are restricted to relatively deep lakes (over five feet deep) which do not freeze solid in winter. Over-wintering of tadpoles in an aquatic habitat makes them more susceptible to fish predation and diseases.

Status: Vredenburg et al. (2007) report that MYLF no longer occur at more than 92% of its historic sites, in the Sierra Nevada. The USDI-USFWS (2003) found that listing was warranted as threatened or endangered for this species. However the listing was precluded at the time based on other higher priority issues. It is designated as a candidate species and is currently managed as sensitive by the USFS.

Species Occurrence in the Analysis Area: On the Sierra National Forest there are 40 known locations currently occupied by MYLF. The species is known to occur at two sites within the aquatic analysis area. Habitat adjacent to both sites was surveyed to identify the extent of species occupancy and the species was not detected within or adjacent to any proposed treatment area. There are no records of the species occurring within the aquatic analysis area located in either the CNDDB or the MVZ databases.

Potential Habitat: Habitat for MYLF was evaluated as the perennial streams and lakes at or above 5,000 feet in elevation. Potential habitat was determined by GIS within the analysis area. There is approximately 19 miles of perennial stream habitat, and 55 acres of pond and lake habitat. An estimated acreage of suitable habitat was derived from the total miles of stream with a 165-foot habitat on each bank (CDFG 2008) and the total acres of lake/pond habitat with a 165-foot dispersal area. There are approximately 810 acres of potential suitable habitat for this species within the aquatic analysis area.

The CWHR habitat values for the acres of potential MYLF habitat for Breeding, Cover, and Feeding indicate most the habitat in the analysis area (81%) is of Low quality for MYLF.

### Yosemite toad

Distribution: The original range of the YT extends from Ebbetts Pass in Alpine County to south of Kaiser Pass and Evolution Lake in Fresno County (CDFG 2008) above 6000 feet elevation. However, populations have been found as far south as Spanish Mountain on the Sierra National.

Life History: YT breed in shallow pools and small, slow moving, shallow streams usually in meadows. Movement to and from breeding sites could be extensive, including travel over snowfields from over-winter hibernation sites in forested areas (CDFG 2008). Males arrive at breeding pools several days before females. Breeding takes place from mid-May to mid-August. Males appear to outnumber females at breeding sites, and females may only breed once in three years. Eggs are laid in single or double strands, typically in pools or streams not more than three inches deep with a loose silt substrate. A single female lays an estimated 1,500 to 2,000 eggs. Individual males only stay at breeding ponds for a week or two, and females leave shortly after breeding. Eggs hatch in about 10-12 days, and tadpoles metamorphose seven to nine weeks after the eggs are laid (USDI-USFWS 2002a).

After breeding both sexes were thought to remain in meadow areas to feed for two to three months before hibernating (Kagarise Sherman and Morton 1984), although recent studies indicate adults may move several hundred meters from meadows to upland foraging sites (Martin 2008; Liang 2010). Seasonal variation in home range size is considerable. Mullally (1953) estimated home ranges of some toads to be about 20 ft, but suggested that individuals may travel long distances away from water (CDFG 2008). Martin (2008) estimated home range at approximately 8,460 $m^2$ (2.1 ac), while Liang (2010) estimated mean home range of 27,430 $m^2$ (6.8 ac), and noted female home range was more than 1-1/2 times larger than males. YTs seek cover during non-breeding seasons (approximately August to March) in abandoned rodent burrows or by moving into adjacent forested areas (CDFG 2008).

YTs enter hibernation in late September or early October, and emerge in the spring. The toads utilize rodent burrows, crevices under rocks, or the base of willows for hibernation (Martin 2008). Males emerge from hibernation for breeding as soon as snow melts from meadows. Females first breed at 4-6 years and males at 3-5 years of age (USDI-USFWS 2002a).

Status: Current estimates indicate disappearance of YT from 47 to 69 percent from historical locations (USDI-USFWS 2002a). Remaining populations seem more scattered than they were historically and frequently appear to consist of small numbers of breeding adults. The USFWS (2002a) determined that listing was warranted as threatened or endangered for this species. However, the listing was precluded at the time based on other higher priority issues. The species is managed as sensitive by the USFS.

Occurrence in the Analysis Area: This species was inventoried for occurrence across the Sierra National Forest between 2002 and 2004. Potential breeding habitat in the aquatic analysis area was surveyed again in 2011. No breeding meadows or individual YT were identified within the aquatic analysis area during surveys. Three occupied meadows are located outside of the aquatic

analysis area, but may have foraging habitat within the analysis area based on CWHR criteria using 900-meter as dispersal for the species. The CNDDB identifies a record of the species at Chilkoot Lake from 1946, but several surveys of the site in the last 10 years have not detected current occupancy at this site.

Potential Habitat: Suitable breeding habitat for this analysis was considered all meadows above 6000 feet elevation. There are approximately 55 acres of meadow habitat above 6000 feet elevation within the aquatic analysis area. The CWHR model evaluates wet meadows as providing high quality habitat for YT Reproduction, Cover, and Feeding. YT habitat was evaluated as 900-meters surrounding meadows above 6000 feet elevation, which indicates approx. 4770 acres.

The CWHR habitat values for the acres of occupied YT habitat for Breeding, Cover, and Feeding indicates that most the habitat in the analysis area is of Medium quality (71%).

## Aquatic Management Indicator Species

Benthic macroinvertebrates and Pacific tree frog are aquatic/wet meadow associate Management Indicator Species (MIS) for the Sierra National Forest, and analyzed in a separate report (Strand 2011a). Benthic Macroinvertebrates (BMI) have been demonstrated to be very useful as indicators of water quality and aquatic habitat condition. They are sensitive to changes in water chemistry, temperature, and physical habitat. BMI are an important component of the foodweb, providing a food source for birds, mammals, amphibians, reptiles, and fish. The 37 miles of perennial streams represent potential habitat for BMI. The Pacific tree frog was selected as an MIS for wet meadow habitat in the Sierra Nevada. This broadly distributed species requires standing water for breeding; tadpoles require standing water for periods long enough to compete aquatic development, which can be as long as 3 or more months at high elevations in the Sierra Nevada (CDFG 2008). There are approximately132 acres of CWHR wet meadow habitat within the aquatic analysis area.

### Habitat Summary Table

Table 20 summarizes potential habitat within the project aquatic analysis area for each the special interest herpetofauna. The CWHR essential habitat elements for the species are:

FYLF: algae, invertebrates, lithic, water

WPT: water, slow water

MYLF: algae, invertebrates (aquatic and terrestrial), water

YT: algae, invertebrates, water, slow water

**Table 20. Summary of potential habitat within project area subwatersheds (acres based on GIS).**

| Species | Potential Habitat (ac) | CWHR Medium/Good (ac) |
|---|---|---|
| Foothill yellow-legged frog | 745 | 147 |
| Western pond turtle | 1429 | 157 |
| Sierra Nevada yellow-legged frog | 811 | 151 |
| Yosemite toad | 4769 | 3419 |
| Benthic macroinvertebrates (Riverine and lacustrine) | 37 mi | 37 mi |
| Pacific tree frog (wet meadow) | 132 | 132 |

## Desired Condition

Desired conditions for the project area were described in the Willow Creek Landscape Analysis (USDA - Forest Service 1995). The watershed analysis established desired conditions for canopy cover and water temperature. Potential effects on water would also be analyzed since it was a common essential habitat element identified for each of the species under the CWHR. Water was identified as a CWHR essential element for all the special interest amphibians and reptiles and will be analyzed as Flow.

**Riparian canopy cover** is the degree to which tree canopies obscure the sky or block the sun. Stream shading would vary by the width of the stream channel, which is generally a function of stream order. Lower order channels may have nearly overlapping canopies while large rivers may have limited shading from riparian vegetation. Stream shading is important in maintaining stream temperature with the effect varying by the height of adjacent vegetation, proximity to the stream, topography, angle of the sun, and aspect. The desired condition identified in the Willow Creek Landscape Analysis (USDA-Forest Service 1995) is that riparian canopy cover be maintained at current levels.

**Water temperature** has multiple effects on aquatic/riparian species and their behavior. Thermal effects relate to directing behavior (trigger migration or spawning); controlling factors (time of incubation and emergence); lethal (lead to breakdown of homeostatic system and increased susceptibility to disease); and growth (metabolic regulation; affected by food supply). Elevation, aspect, stream width, channel roughness coefficient, riparian shading, solar radiation, air temperature, cloud cover, and stream discharge levels can affect water temperature. Of these elements, direct effects on riparian shading and indirect effects on stream discharge level could have the most effect on stream temperature (Beschta et al. 1987; Moore et al. 2005). The desired condition identified in the Willow Creek Landscape Analysis (USDA-Forest Service 1995) is that water temperatures to be less than 70º F (21º C).

**Flow** is synonymous with stream discharge. Flow is affected by climate, geology, elevation, aspect, vegetative cover, road patterns, and topography. Changes to stream flow patterns, such as alteration of the timing, duration, and magnitude of runoff, could affect both life history of aquatic/riparian species, along with habitat availability and suitability. Alteration could be expressed as a change in flow pattern, in bank and channel instabilities, widening of the stream channel, and undermining of bank trees resulting in increased levels of sediment. Widening of the stream channel would decrease the level of canopy cover over the stream. A desired dondition for flow has not established as part of a Landscape Analysis, but timing and magnitude of flows should be consistent with life history needs for aquatic/riparian species.

## Environmental Consequences

This section analyzes the effects (environmental consequences) from the proposed action and alternatives on the aquatic/riparian management indicator, threatened, endangered, proposed, candidate and sensitive species and their habitats. Effects of the action refers to the direct, indirect, and cumulative effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that would be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process.

Aquatic species live in a wide variety of wetland habitats, from subalpine meadows to high-gradient streams. In general, the riparian condition, especially vegetation, is important for all aquatic organisms to complete their life cycles. These organisms benefit from the shade provided by riparian vegetation. In addition, most rely on both terrestrial and aquatic insects for food. Within the project area, all Class I stream channels (perennial steams; order 4 and higher) provide potential habitat for aquatic/riparian species. For herpetofauna, meadow edges, seeps and damp headwater areas as well as the riparian conservation areas surrounding streams also provide potential habitat.

Complete descriptions of project alternatives are available in Chapter 2 of this DEIS. The combined treatments proposed for the action alternatives involve tree thinning; prescribed fire, including underburning, mastication, mechanical piling and pile burning; vegetative clearing for the stock drive; vegetative clearing at prehistoric and historic sites, removal of conifer encroaching meadows, stabilization of stream segments within meadows, restoration of a user-defined off highway vehicle route, road reconstruction and maintenance; along with temporary roads and skid trails. All these activities individually and together would have risks and both short-term and long-term effects on aquatic/riparian species. Numerous effects on aquatic habitat and species have been attributed to actions proposed under the project. The following general summarization of potential effects does not indicate they are currently occurring or anticipated within the analysis areas.

Proposed management actions have the potential to directly alter stream shading (solar radiation); and indirectly or cumulatively alter water temperature; water quantity; water quality; sediment, nutrient, and litter inputs; woody debris; and channel structure. All of these elements can affect aquatic habitat and nutritional resources of aquatic organisms (Gregory et al. 1987; Dwire et al. 2006). Pilliod et al. (2003) identify that amphibians may be directly affected by fire (mortality), and indirectly affected through alteration of habitat. Habitat alteration could include decreased cover, increased temperature, increased nutrients, sedimentation, alteration in woody debris, channel scour, or hydroperiod alteration.

Various life stages of resident herpetofauna utilize macroinvertebrates as a food source and they represent a CWHR essential element. Macroinvertebrates are recognized for their importance in the aquatic/riparian systems. Erman (1996) notes that springs, seeps, peatlands and small first/second order streams could contain rare or endemic invertebrates. Thus, if the project alters stream temperature, canopy cover, hydrologic regime, sediment inputs, seeps/springs/headwater areas, and nutrient cycling (LWD or litter inputs), it could affect aquatic/riparian species indirectly through affects to the invertebrate community. Project effects on BMI are evaluated as an aquatic MIS (Strand 2011a).

Stream flow may increase as basal area (and evapotranspiration) declines, and peak flows can be indirectly affected by vegetation removal (Kattelmann 1996). Troendle (2001) indicated increased water yields following timber harvest, although treatments were primarily clearcuts

rather than thinnings that are being proposed under the project. Alteration of the hydrologic regime (timing, duration or magnitude of flows) from the combined effects of silviculture and underburning could affect success of amphibians that breed in the spring. Should such an alteration occur, it could also result in channel downcutting, bank instabilities and degradation of aquatic habitat through additional accumulations of sediment in pool habitat and filling of interstitial spaces. In snow-dominated areas, nearly all of the change in flows would occur during spring runoff, and spring runoff may occur slightly sooner if reductions in canopy allow faster melting of the snowpack

Fire, both prescribed and wild, has potential to affect aquatic/riparian systems. Potential affects from prescribed fire have been identified as streambank stability, aquatic foodwebs, stream temperature, and large wood dynamics (Dwire et al. 2006; Bêche et al. 2005). High intensity fires can severely disrupt aquatic ecosystems, and that these affects can be prolonged. Specific influences may include decreased channel stability; greater and more variable stream discharge; altered woody debris delivery and storage; increased nutrient availability; higher sediment delivery and transport; and increased solar radiation and altered water temperature regime (Bisson et al. 2003; Dunham et al. 2003).

## Incomplete and Unavailable Information

There is limited information on fire history within the riparian areas in the west, but it is expected to vary from those experienced in upland areas (Dwire and Kauffman 2003; Bisson et al. 2003). Riparian areas differ from upland areas in topography, microclimate, geomorphology, and vegetation. Further they are characterized as having cooler air temperatures, lower daily maximum air temperatures, and higher relative humidity. These characteristics may contribute to higher moisture content of live and dead fuels, and riparian soils, which presumably lowers the intensity, severity and frequency of fire (Dwire and Kauffman 2003). The ecological diversity of riparian corridors is maintained by natural disturbance regimes including fire and fire-related flooding, debris flows, and landslides. Many species have adapted life histories that are shaped by, and may depend on disturbance events (Dunham et al. 2003; Bisson et al. 2003; Rieman et al. 2005). Nakamura et al. (2007) note some success with reducing crown fire after thinning and burning for the Cone and Megram Fires. They also note that some fires are so large (McNally or Cedar Fires) that they would continue to burn through or around treatment areas. Analysis following the Angora Fire (USDA-Forest Service 2007), identified fire spread was facilitated in part by corridors provided in the no-treatment Streamside Environmental Zones.

## Spatial and Temporal Context for Effects Analysis

The aquatic analysis area consists of 14 HUC8 subwatersheds that contain the proposed project. effects to CWHR habitat are considered under this assessment of consequences, as well as effects to aquatic indicators. Direct effects are caused by action and occur at the same time and place. Indirect effects are those that are caused by the action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Cumulative effects result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions

## Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A list of past, present, and reasonably foreseeable actions considered under this affects analysis is provided in Chapter 3 of this DEIS.

## Alternative 1 – No Action

Alternative 1 is the no action alternative. Under the no action alternative, current approved management plans would continue to guide management of the aquatic analysis area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: roads and trails; plantation maintenance, cattle grazing, and recreation. The no action alternative, would not implement the project No project associated treatments would be implemented in any subwatershed as displayed in. Projected acres potentially affected habitat for herpetofauna is also displayed in Table 21

**Table 21. Activities proposed under Alternative 1**

| Subdrainage | 503.0056 | 503.0057 | 503.3002 | 503.3051 | 504.0011 | 504.0012 | 504.0013 | 504.0014 | 504.0015 | 504.0059 | 504.0060 | 504.0061 | 504.3001 | 504.4051 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tractor (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rx Fire (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mastication (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hand Thin (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subdrainage (ac) | 1211 | 1246 | 2472 | 1484 | 1972 | 3033 | 1369 | 1078 | 455 | 1866 | 2737 | 1262 | 1496 | 1534 |
| %Subdrainage | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Foothill yellow-legged frog** | 70 | 19 | 60 | 112 | 89 | 35 | 42 | 0 | 0 | 154 | 86 | 0 | 79 | 0 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Western pond turtle** | 138 | 38 | 114 | 221 | 178 | 56 | 75 | 0 | 0 | 304 | 151 | 0 | 156 | 0 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Mountain yellow-legged frog** | 0 | 0 | 65 | 4 | 0 | 264 | 48 | 81 | 18 | 0 | 113 | 188 | 0 | 30 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Yosemite toad** | 0 | 0 | 467 | 0 | 0 | 2146 | 584 | 170 | 50 | 0 | 0 | 179 | 0 | 1173 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Riverine/Lacustrine (mi)** | 1.8 | 0.5 | 3.2 | 2.9 | 2.2 | 5.6 | 2.3 | 2.1 | 0.5 | 3.9 | 5.1 | 4.8 | 2 | 0.7 |
| Adjacent to treatment unit (mi) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Wet Meadow (ac)** | 0 | 0 | 10 | 8 | 0 | 12 | 9 | 55 | 4 | 0 | 0 | 26 | 0 | 8 |
| Treatments within 100 ft wet meadow (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Direct Effects

There would be no direct effects on threatened, endangered, sensitive aquatic species or MIS habitat as a result of the implementation of Alternative 1. No fuels ladder reduction or underburning would occur under this alternative. No direct, indirect, or cumulative affects to riparian canopy cover would be anticipated from Alternative 1. Water temperature would meet the desired condition, while canopy cover would be expected to remain at current levels.

## Indirect Effects

There would be no anticipated indirect effects to special interest herpetofauna or MIS habitat as a result of the implementation of Alternative 1. Water temperature data collected from the project area in 2009 indicates it currently meets the desired condition. However, Pilliod et al. (2003) suggest that no action may have consequences for amphibians due to overgrown forests changing the quality of amphibian habitat and increasing susceptibility for a high severity fire. Roads maintained by the U.S. Forest Service would remain in poor condition and contribute sediment to aquatic systems.

## Cumulative Effects

Past, present, and reasonably foreseeable actions are detailed in Table 9. Known activities occurring spatially and temporally within the within the analysis area are recreational use (campgrounds and off-highway vehicle routes), roads and trails; vegetation and fuels projects, cattle grazing, and fires.

Recreation: There are approximately 35 miles of inventoried OHV routes within the aquatic analysis area, some which cross habitat for FSS herpetofauna. Slow moving species (such as reptiles and amphibians) are more susceptible to vehicle mortality because their life histories often involve migration between wetland and upland habitats (Trombulak and Frissell 2000). Bury et al. (1977) reported declines in individuals, diversity, density and biomass related to areas of off highway motor vehicle use. Alterations to terrestrial habitat may include, but are not limited to: reductions in riparian vegetation cover, introductions of non-native plant species and impacts to meadow hydrology. Alterations to aquatic habitat may include, but are not limited to: increased sedimentation, altered hydrology, and geomorphology. The Sierra National Forest has completed a Travel Management Plan (USDA – Forest Service 2010) that would eliminate cross-country travel by OHVs, designate routes approved for OHV use, and establish a season of use. Approved routes require improvements to protect resources. This analysis considers the 21 miles of approved routes within the analysis area, under the Record of Decision for the Travel Management Plan. Approximately 1 mile of approved routes traverses potential habitat for all four species, representing less than 1 acre of direct overlap. Approximately 14 miles would be expected to continue to have effects within the short-term (10-year period).

Within the project analysis area there are three developed campgrounds, and several overflow camping areas. These facilities total approximately 30 acres. Some of the campgrounds and overflow areas are located adjacent to water, thus are within habitat for amphibians (approximately 23 acres MYLF habitat). Recreation activities include use of motor vehicles and dispersed camping. These activities have the potential to affect aquatic/riparian habitat through changes in hydrologic regime; site compaction; sediment contribution; loss of vegetation; or direct mortality (Bury et al. 1977). Amphibians and reptile species adjacent to campgrounds may be subject to handling; collection; consumption; or translocation (Maxwell and Hokit 1999). Increased mortality rates may result from pets accompanying recreationists, along with mortality associated with use areas from pets or predators (ravens, skunks, raccoons, coyotes or foxes) that may occur at greater frequency at these sites due to refuse. Ashton et al. (1997) note that areas of

human influence can drive out larger predators. Thus, the numbers of small predators (such as ravens) may be supported at artificially high numbers near areas of increased human activities. Rainbow trout are stocked by the California Department of Fish and Game at several sites along Big Creek. The Sierra National Forest is consulted on CDFG stocking sites, which is discontinued on sites known to be occupied by aquatic/riparian TES amphibians.

Vegetation and Fuels Projects: Approximately 570 acres within the aquatic analysis area were masticated in 2010 under the Greys Mountain Plantation and Wild Stand Mastication Project to thin, release, and remove fuel ladders in densely vegetated stands. Stands were precommercially thinned within 20-40 year old plantations, with some segments of non-plantation included. Mastication occurred within approximately 2 acres of MYLF, and 120 acres of YT habitat. Use of heavy machinery can result in compaction and potentially stream channel disturbance. Mastication typically traverses a layer of treated vegetation that reduces potential effects related from compaction. Application of SMZs and implementation of BMPs reduces the risk of compaction, or project-associated erosion being transported to stream channels.

Roads: The existing NFTS (approximately 100 miles in the aquatic analysis area) could result in mortality to aquatic/riparian species in a variety of ways including collisions and introduction of non-native species, and parasites or disease vectors. Forest system roads intercept approximately 40 miles of habitat, representing four acres of FYLF; 11 acres of WPT; nine acres of MYLF; and 52 acres of YT habitat. Slow moving species (such as reptiles and amphibians) are more susceptible to road mortality because their life histories often involve migration between wetland and upland habitats (Trombulak and Frissell 2000). Linear features, such as roads, represent both physical barriers as well as sites of direct morality. Collisions with vehicles have been documented in numerous different aquatic and riparian dependant species and they may even be particularly vulnerable to it (Trombulak and Frissell ibid).

Cattle grazing: The aquatic analysis area includes portions of the Soquel, Central Camp, and Beasore allotments. There are approximately 1,520 acres of Primary Use Areas within the analysis area, which represents available forage. Primary Use Areas were defined as meadows (approx. 245 acres) buffered by 250 feet. The grazed meadows represent potential habitat for FYLF (two ac); WPT (six ac.); MYLF (42 ac.); and YT (53 acres). The stock drive to move cattle between lower elevation allotments to higher elevation areas traverses approximately 7.7 miles through the project area. There is approximately 0.3 miles of the stock drive passing through potential habitat for MYLF. Periodic work of the stock drive to reduce vegetation on the edges of the stock drive is not anticipated to affect habitat.

Numerous effects on aquatic habitat and species have been attributed to “prolonged use” of riparian areas by cattle. Mention of these effects does not indicate that they are currently occurring or anticipated. Literature suggests potential effects from cattle grazing relating to channel function, water quantity, hydrologic alteration, and water quality. All of these factors could result in negative effects to habitat for herpetofauna. Some of the effects described in literature are noted as resulting from “heavy” or “overgrazing”.

Cattle grazing is administered under U.S. Forest Service permits, which include compliance with standards and guidelines from the Sierra National Forest Land and Resources Management Plan (USDA – Forest Service 1992; 2001; 2004). The three allotments have completed NEPA analysis within the past five years. It is expected that cattle grazing is locally resulting in exposed streambanks and erosion. The project hydrology report (Stone 2011) describes current stream bank stability as generally in being in fair or better condition.

Climate Change: Climate change has been suggested as a contributing agent in the decline of amphibians (Pounds and Crump 1994; Stewart 1995; Pounds et al. 1999). The Species Survival Commission (2008) notes that over 50% of the amphibians may be potentially susceptible to climate change. Reaser and Blaustein (in Lannoo 2005) summarize that site specific review of

amphibian declines indicate possible global changes, and that regional warming, increasing ultraviolet radiation, and diseases are a potential result of global change. California anticipates warmer temperatures, accompanied by altered patterns of precipitation and runoff related to climate change (DWR 2007). Annual runoff in the San Joaquin River basin has declined by 19% over the past 100 years, and projected precipitation alterations could reduce the snowpack by 25% by the year 2050.

It is expected that air temperatures and precipitation patterns may change within the aquatic analysis area over time. The project is within an elevational zone characterized as having warm/hot summers (varies by elevation) and cool winters. Most precipitation above 5500 feet falls in the form of snow from fall through spring. Change is expected to be reflected through an increase in daily maximum, minimums, and mean air temperatures, along with altered rainfall patterns. Meyer and Safford (2010) examined fire trends presented in Miller et al. (2009), and incorporated long-term weather stations within or adjacent to the Sierra National Forest to illustrate that mean annual temperature at Huntington Lake has increased by 1.8º F, with a mean minimum (nighttime) increase of 4º F since 1915. Utilizing information projected by Meyer and Safford, mean annual temperature increases by 0.3 º F; mean annual minimum temperature increases by 0.4 º F; and mean annual maximum temperature increases by 0.19 º F over the 10-year period at Huntington Lake (7000 feet).

Thompson (2005) summarizes that direct solar radiation has the greatest influence on water temperature, thus managing to maintain or improve shade is important to reduce heat flux. Precipitation changes would be expected to reflect a great deal of variability. Information from Meyer and Safford (ibid) project an increase in annual precipitation of 2.1 inches at Huntington Lake over the 10-year period, but the projections at Grant Grove in Kings Canyon National Park project no change. The North Fork Willow Creek drainage in the project area is influenced by snowmelt runoff. Spring runoff is occurring earlier in the year and fraction of runoff occurring in the spring is decreasing. With less snowfall expected to result from elevated air temperatures associated with climate change, it is likely that less water would be available during the late summer and that the water would be warmer than current conditions. An increasing snow level would reduce the amount of shallow pools during the springs which provide breeding habitat for YT. A similar effect to shallow lakes would reduce the suitability of habitat for MYLF, which could result in localized extirpations in a species with a high degree of site fidelity.

Lind (2008) notes that amphibian and reptile populations respond to changes and variability in air or water temperature, precipitation, and the hydro-period of their environments. Over the short-term (annually), these factors can influence reproductive success rates and survival to metamorphosis. Over the long term, the frequency and duration of extreme temperature and precipitation events can influence the persistence of populations and structure of meta-populations on the landscape. The net effect of less water and higher temperatures would be a reduction in the quantity and quality of aquatic/riparian habitat. Herpetofauna would likely be concentrated at sites where water is available, increasing their susceptibility to predators at these sites. The changing conditions of habitat would provide conditions more favorable for invasion by species currently occurring at lower elevational sites, and possibly an increase in non-native species.

Alteration of the fire return interval: The USDI-USFWS (2002a) identified that “Fire suppression, and changes in fire frequency and hydrology, has probably contributed to the decline of YT through habitat loss caused by conifer encroachment on meadows. Under natural conditions, conifers are excluded from meadows by fire and soils too saturated for their survival. But as conifers begin to encroach on a meadow, if they are not occasionally set back by fire, they transpire water out of the meadow, reducing the saturation of the soils, and facilitating further conifer encroachment. Therefore, some vegetation treatment may be needed to maintain or restore YT habitat.”

The Greys Mountain Project is being proposed to reduce or modify the intensity and spread of wildland fires across the landscape and near communities, in this case Greys Mountain. Nakamura et al. (2007) noted some success with reducing crown fire after thinning and burning for the Cone and Megram Fires. They also note that some fires are so large (McNally or Cedar Fires) that would continue to burn through or around treatment areas.

In the event of a wildfire there could be varied response depending on size and severity. A large, high severity fire could disrupt flow regime and alter stream channel dynamics. Soil water storage; base flow; streamflow regime; peak flow; water quality (sediment, temperature, pH, ash slurry); and chemical characteristics can be affected by wildfire (Neary et al. 2005). If a wildfire followed by a large precipitation event occurred, accelerated erosion and increased sedimentation would occur and sediment would be transported to the stream system via overland flow from burnt slopes and roads. Accumulations of sediment could reduce habitat for BMI. Vieira et al. (2004) also reported that a 100-year flood following the Dome wildfire (New Mexico) resulted in an almost total loss in density and taxon richness.

Meyer and Safford's (2010) review of fire literature indicates increases on fire frequency, size, total area burned and severity in the Sierra Nevada over the past 20-30 years. Since 2002 (year of Vegetation Typing), there has been not been any fire within the analysis area. There has been no overlap within potential habitat within the analysis area for any aquatic/riparian sensitive species since 1920.

CWE Analysis: The CWE analysis in the Greys Mountain Hydrology Report notes that all of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. The Project Hydrology Report also identifies that "Maintenance level 2 ("native surface") roads throughout the project area are in moderate to poor condition and are hydrologically connected to the watersheds in which they are constructed. Many of these roads lack adequate drainage and have partially to completely blocked culverts that would require replacement." No changes to Flow would be anticipated from Alternative 1.

Table 22 indicates that greatest potential effects to species habitat in the analysis area results from roads, cattle grazing and mastication. As noted under occurrences in the species accounts, there are no known sites occupied by FYLF, WPT, or YT within the aquatic analysis area. There would be no anticipated cumulative effects to these species as a result of the implementation of Alternative 1. Lacustrine/riverine and wet meadow habitats would be expected to remain stable. There are two known locations of MYLF within the analysis area. Project design criteria developed during NEPA analysis of the grazing allotments have been implemented to reduce potential conflicts between MYLF and effects from cattle grazing.

**Table 22. Acres of habitat cumulatively affected under Alternative 1. (*lacustrine/riverine miles converted to acres assuming 9 ft wide stream)**

| Species | Potential habitat (ac) | Grazing Meadows (ac) | Rec/OHV Effected (ac) | Bass Lake Mast. (ac) | Fire (ac) | Roads (ac) | Greys Mountain (ac) | Cum. Effect (ac) | % Habitat Affected |
|---|---|---|---|---|---|---|---|---|---|
| Foothill yellow-legged frog | 745 | 2 | 0 | 0 | 0 | 4 | 0 | 6 | 1% |
| Western pond turtle | 1429 | 6 | 0 | 0 | 0 | 11 | 0 | 17 | 1% |
| Mountain yellow-legged frog | 811 | 42 | 23 | 2 | 0 | 9 | 0 | 76 | 9% |
| Yosemite toad | 4769 | 53 | 0 | 121 | 0 | 53 | 0 | 227 | 5% |
| Lacustrine/riverine * | 40.5 | 4 | 1 | 0 | 0 | 0 | 0 | 5 | 12% |
| Wet meadow | 132 | 132 | 0 | 0 | 0 | 2 | 0 | 132 | 100% |

# Alternative 2 – Proposed Action

Table 23 summarizes gross acres from proposed activities (net treatment acres would be less due to Controlled Areas; portions of treatment units lacking access or not requiring treatment).

| Subdrainage | 503.0056 | 503.0057 | 503.3002 | 503.3051 | 504.0011 | 504.0012 | 504.0013 | 504.0014 | 504.0015 | 504.0059 | 504.0060 | 504.0061 | 504.3001 | 504.4051 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thin or precommercial thin (ac) | 160 | 0 | 11 | 19 | 120 | 235 | 187 | 88 | 248 | 73 | 982 | 301 | 50 | 74 | 2548 |
| Rx Fire (ac) | 190 | 0 | 0 | 0 | 0 | 13 | 84 | 0 | 0 | 0 | 233 | 0 | 0 | 0 | 520 |
| Mastication (ac) | 55 | 14 | 0 | 0 | 82 | 20 | 18 | 0 | 0 | 0 | 126 | 0 | 0 | 3 | 318 |
| Hand Thin (ac) | 24 | 0 | 13 | 15 | 0 | 0 | 10 | 0 | 0 | 40 | 19 | 0 | 4 | 0 | 125 |
| Subdrainage (ac) | 1211 | 1246 | 2472 | 1484 | 1972 | 3033 | 1369 | 1078 | 455 | 1866 | 2737 | 1262 | 1496 | 1534 | 23215 |
| %Subdrainage | 35% | 1% | 1% | 2% | 10% | 9% | 22% | 8% | 55% | 6% | 50% | 24% | 4% | 5% | 15% |
| **Foothill yellow-legged frog (ac)** | 70 | 19 | 60 | 112 | 89 | 35 | 42 | 0 | 0 | 154 | 86 | 0 | 79 | 0 | 745 |
| Ac. Treated | 1 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 23 |
| **Western pond turtle (ac)** | 138 | 38 | 114 | 221 | 178 | 56 | 75 | 0 | 0 | 304 | 151 | 0 | 156 | 0 | 1429 |
| Ac. Treated | 11 | 0 | 0 | 0 | 0 | 27 | 10 | 0 | 0 | 5 | 21 | 0 | 0 | 0 | 74 |
| **Mountain yellow-legged frog (ac)** | 0 | 0 | 65 | 4 | 0 | 264 | 48 | 81 | 18 | 0 | 113 | 188 | 0 | 30 | 811 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 1 | 0 | 16 | 13 | 0 | 0 | 38 |
| **Yosemite toad** | 0 | 0 | 467 | 0 | 0 | 2146 | 584 | 170 | 50 | 0 | 0 | 179 | 0 | 1173 | 4769 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 25 | 28 | 0 | 10 | 0 | 0 | 31 | 0 | 77 | 170 |
| **Riverine/Lacustrine (mi)** | 1.8 | 0.5 | 3.2 | 2.9 | 2.2 | 5.6 | 2.3 | 2.1 | 0.5 | 3.9 | 5.1 | 4.8 | 2 | 0.7 | 37.3 |
| Mi. adjacent | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.3 | 0.1 | 0.0 | 0.1 | 2.0 | 0.3 | 0.0 | 0.0 | 4.2 |
| **Wet meadow** | 0 | 0 | 10 | 8 | 0 | 12 | 9 | 55 | 4 | 0 | 0 | 26 | 0 | 8 | 132 |
| Treatments within wet meadow SMZ (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.8 | 3.6 | 0 | 0 | 6.1 | 0 | 0 | 12.5 |

**Table 23. Alternative 2 activities (acreages approximations generated by GIS). Riverine/Lacustrine and wet meadow habitats have Class I SMZ buffers (100 feet) with no direct affects anticipated. Affected miles or acres reflect treatments in the outer 50 feet**

| Subdrainage | 503.0056 | 503.0057 | 503.3002 | 503.3051 | 504.0011 | 504.0012 | 504.0013 | 504.0014 | 504.0015 | 504.0059 | 504.0060 | 504.0061 | 504.3001 | 504.4051 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thin or precommercial thin (ac) | 160 | 0 | 11 | 19 | 120 | 235 | 187 | 88 | 248 | 73 | 982 | 301 | 50 | 74 | 2548 |
| Rx Fire (ac) | 190 | 0 | 0 | 0 | 0 | 13 | 84 | 0 | 0 | 0 | 233 | 0 | 0 | 0 | 520 |
| Mastication (ac) | 55 | 14 | 0 | 0 | 82 | 20 | 18 | 0 | 0 | 0 | 126 | 0 | 0 | 3 | 318 |
| Hand Thin (ac) | 24 | 0 | 13 | 15 | 0 | 0 | 10 | 0 | 0 | 40 | 19 | 0 | 4 | 0 | 125 |
| Subdrainage (ac) | 1211 | 1246 | 2472 | 1484 | 1972 | 3033 | 1369 | 1078 | 455 | 1866 | 2737 | 1262 | 1496 | 1534 | 23215 |
| %Subdrainage | 35% | 1% | 1% | 2% | 10% | 9% | 22% | 8% | 55% | 6% | 50% | 24% | 4% | 5% | 15% |
| **Foothill yellow-legged frog (ac)** | 70 | 19 | 60 | 112 | 89 | 35 | 42 | 0 | 0 | 154 | 86 | 0 | 79 | 0 | 745 |
| Ac. Treated | 1 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 23 |
| **Western pond turtle (ac)** | 138 | 38 | 114 | 221 | 178 | 56 | 75 | 0 | 0 | 304 | 151 | 0 | 156 | 0 | 1429 |
| Ac. Treated | 11 | 0 | 0 | 0 | 0 | 27 | 10 | 0 | 0 | 5 | 21 | 0 | 0 | 0 | 74 |
| **Mountain yellow-legged frog (ac)** | 0 | 0 | 65 | 4 | 0 | 264 | 48 | 81 | 18 | 0 | 113 | 188 | 0 | 30 | 811 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 1 | 0 | 16 | 13 | 0 | 0 | 38 |
| **Yosemite toad** | 0 | 0 | 467 | 0 | 0 | 2146 | 584 | 170 | 50 | 0 | 0 | 179 | 0 | 1173 | 4769 |
| Ac. Treated | 0 | 0 | 0 | 0 | 0 | 25 | 28 | 0 | 10 | 0 | 0 | 31 | 0 | 77 | 170 |
| **Riverine/Lacustrine (mi)** | 1.8 | 0.5 | 3.2 | 2.9 | 2.2 | 5.6 | 2.3 | 2.1 | 0.5 | 3.9 | 5.1 | 4.8 | 2 | 0.7 | 37.3 |
| Mi. adjacent | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.3 | 0.1 | 0.0 | 0.1 | 2.0 | 0.3 | 0.0 | 0.0 | 4.2 |
| **Wet meadow** | 0 | 0 | 10 | 8 | 0 | 12 | 9 | 55 | 4 | 0 | 0 | 26 | 0 | 8 | 132 |
| Treatments within wet meadow SMZ (ac) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.8 | 3.6 | 0 | 0 | 6.1 | 0 | 0 | 12.5 |

## Design Features and Mitigation Measures

It is expected that the project design features described below would provide protection to both MIS habitat types and for aquatic/riparian special interest species.

Table 24 displays habitat potentially directly affected by the proposed action. There are approximately13 acres of proposed treatment adjacent (within 100 feet), but not within wet meadows. Similarly, there are approximately 4 miles of proposed treatments within Class I SMZs along perennial stream channels.

**Table 24. Overlap of Proposed Treatment Areas and Potential Habitat for species. Thinned includes hand thin. (*lacustrine/riverine miles converted to acres assuming approximately 9 ft wide stream)**

| Species | Potential Habitat (ac) | Habitat thinned (ac) | Habitat masticated (ac) | Habitat underburned (ac) | Total ac. Habitat Treated |
|---|---|---|---|---|---|
| Foothill yellow-legged frog | 755 | 13 | 0 | 10 | 23 |
| Western pond turtle | 1429 | 52 | 1 | 21 | 74 |
| Mountain yellow-legged frog | 811 | 23 | 3 | 12 | 38 |
| Yosemite toad | 4769 | 151 | 19 | 0 | 171 |
| Lacustrine/riverine* | 40.5 | 0 | 0 | 0 | 0 |
| Wet Meadow | 132 | 0 | 0 | 0 | 0 |

Foothill yellow-legged frog: There are approximately 745 acres of potential FYLF habitat within the aquatic analysis area. Alternative 2 would affect approximately 23 acres of potential habitat. Most of the effected acres would be subject to thinning (13 acres) and prescribed fire (10 acres). FYLF was not detected during surveys in the analysis area and the project area is not within dispersal distance of any known population.

Western pond turtle: There are approximately 1,430 acres of potential WPT habitat within the aquatic analysis area. Alternative 2 would affect approximately 74 acres of potential habitat. Most of the effected acres would be subject to thinning (52 acres) and prescribed fire (21 acres). WPT was not detected during surveys in the analysis area and the project area is not within dispersal distance of any known population.

Mountain yellow-legged frog: There are approximately 810 acres of MYLF potential habitat within the aquatic analysis area. Alternative 2 would affect approximately 40 acres of potential habitat. MYLF was detected at two sites within the analysis area, but not within any treatment area. Most of the effected acres would be subject to thinning (23 acres) and prescribed fire (12 acres). The species breeds in streams and ponds, both of which are protected with project design measures.

Yosemite toad: There are approximately 4,769 acres of potential YT habitat within the aquatic analysis area. Alternative 2 would affect approximately 170 acres of potential habitat. Most of the effected acres would be subject to thinning (152 acres) and prescribed fire after thinning. YT was

not detected during surveys in the analysis area and the project area is not within dispersal distance of any known population.

## Direct Effects

There is overlap between timing of proposed activities and potential effects on FYLF , WPT, MYLF and YT. Project design measures would be expected to protect breeding and rearing sites from direct effects, thus subadult and adult lifestages remain potentially directly affected. Hand thinning, including felling of encroaching conifers in meadow; hand removal of noxious weeds; reforesting understocked areas; vegetation removal at historic and prehistoric resource sites; and grazing stock drives would not be anticipated to result in direct effects. Restoration of an OHV route across meadow 503M7 that was not approved as part of the Forest Travel Management Plan (USDA- Forest Service 2010) is not within potential habitat for any of the special interest herpetofauna and no direct effects would be anticipated by 0.5 miles of trail restoration.

Proposed tractor thinning, tractor piling, or mastication overlaps units M-3, T-9, T-16, T-27, T-29, T-30, T-33, T-34, T-35, T-37, and T-38. The potential for direct effects from crushing would be expected to be limited under the Proposed Action. Project design measures include the Old Forest Linkage corridors for Pacific fisher. These migration corridors extend 150 feet from both streambanks along the perennial streams within the project area. There are no proposed treatments within the inner 50 feet from each streambank. The outer 50-feet would implement hand treatments to remove the understory ladder fuels < 12'' dbh. No heavy equipment would be allowed within 100 feet of the streambank within these corridors. During primary periods of project operations (July – Oct) it is expected frogs and turtles would remain near aquatic habitat due to presence of water; the microclimate provided; and riparian connectivity, except during rainy periods. The possibility of direct effects from crushing would be most likely during rainy periods when species may move away from aquatic areas. Operation of heavy equipment ceases during periods of prolonged precipitation to prevent compaction. Adult YT leave breeding meadows for foraging sites where they spend the majority of the summer, which would make them more susceptible to direct effects than other TES herpetofauna evaluated under this analysis.

Introduced fire (both prescribed and pile burning) could directly affect herpetofauna. Some species may use slash piles for cover or for estivation. The possibility of direct effects on individual animals from burning piles within the Old Forest Linkage Corridors would be reduced by implementing the project design measure to light piles on one side to allow an escape from the pile. Underburning may also represent a direct effect to herpetofauna. Underburning is proposed adjacent to perennial streams in units Rx-1 Rx-2, T-4, T-9, T-16, Rx-24, T-28-30, T-34-35, and T-37-38 potentially affecting MYLF, FYLF , and WPT. Prescribed burning would be expected to occur during the spring or fall. During spring, amphibians may be moving to breeding sites or dispersing after breeding. During the fall, herpetofauna may be moving to overwintering sites or estimating within areas to be burned. Allowing fire to creep into the SMZ (as opposed to active introduction) would provide opportunity for herpetofauna to move away from areas burning, but not eliminate the possibility of mortality.

Direct effects to FYLF, WPT, and YT would not be anticipated from implementing Alternative 2 due to Project Design Measures; non-detection of listed species during surveys; and nearest known occupied sites are not within dispersal distance of project treatment areas. The nearest known occupied YT site is more than 1,200 meters from the nearest proposed treatment unit. MYLFs were detected in the analysis area (Figure 17), but not within or adjacent to any treatment unit. Breeding and rearing sites for the frog would be protected by project design measures. The frog is closely associated with water, which is buffered by streamside management zones that would be anticipated to protect the frog from direct effects. No project activities would take place until after June 15 in adjacent treatment units to protect frog movement to breeding sites.

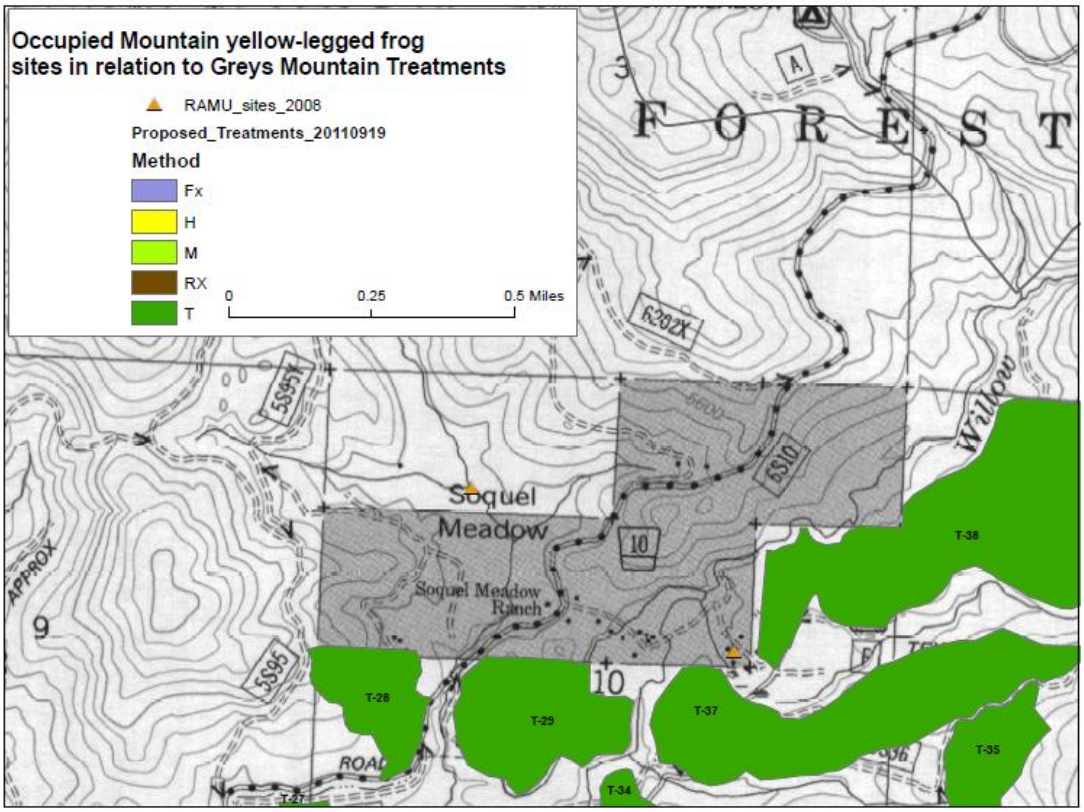



**Figure 17. Occupied mountain yellow-legged frog (brown triangles indicating RAMU) in relation to Greys Mountain project treatment units.**

## Indirect Effects

Thinning to reduce ladder fuels would occur over approximately 2,550 acres under this alternative. Underburning (both post-thinning and unthinned sites) could occur over approximately 2500 acres, hand thinning on 125 acres, and mastication on 320 acres. Reduction in stand densities could affect canopy cover (indirectly affecting micro-climate and water temperatures), macroinvertebrate community, and changes to water yield (indirectly affecting stream channel stability). Most of the potential indirect effects to herpetofauna would be related to habitat alteration. Thinning are proposed within the ponderosa pine and Sierra mixed-conifer CWHR types. The primary changes may reduce size groups and reduce density for a 20-30 year period. Canopy cover would be maintained at 60% or greater to maintain habitat for Pacific fisher. CWHR habitat quality would remain unchanged for all species based on projected stands following thinning. Changes to microclimate (such as increased air temperatures, reduced soil moisture, and lower relative humidity) within treated areas may not be accounted for at the CWHR scale. Meadow restoration (35 acres) in meadows 503M7, 503M8, 504M132, 504M198, 504M208, 504M209, 504M211, 504M220, 504M292, and 504M293 may result in short-term increases in sediment through stream bank exposure during treatment. It is expected that meadow treatment sites would recover within several years and overall site stability would increase and sediment contribution would decline at these sites.

Riparian Canopy Cover: Proposed management actions have the potential to directly alter stream shading (solar radiation). Pilliod et al. (2003) identify that amphibians may be directly affected by fire (mortality), and indirectly affected through alteration of habitat. Naiman et al. (2000) note that riparian forests strongly influence stream microclimate; including air, soil, and surface temperatures; relative humidity; and solar radiation. Streamside shading affects the amount of solar radiation that filters to the surface of the water, and Matlack (1993) indicates that aspect also exerts influence on microclimate. Cushman (2006) identifies the importance in habitat connectivity for amphibian dispersal, suggesting juvenile dispersal as a possible limiting factor. Water temperature affects various life activities, such as breeding and rearing time, for amphibians. If forest harvesting occurred in streamside areas there could be an increase in solar radiation to the stream channel, affecting water temperature. Additionally, underburning could result in tree mortality and openings within the riparian canopy.

Aquatic invertebrates serve as food source for various life stages of herpetofauna. Kattelmann (1996) notes several studies have demonstrated that communities of aquatic invertebrates changed significantly in response to upstream logging, with some of these effects persisting for two decades. Much of the food base for stream ecosystems is derived from adjacent terrestrial ecosystems with litter fall from deciduous stands exceeding that of coniferous stands. Deciduous input (leaves) generally breaks down in less than half the time necessary for the breakdown of coniferous input (needles; Gregory et al. 1991). Buffer strips 30 meters (98.4 feet) wide are noted as protecting invertebrate communities from logging induced changes (Gregory et al. 1987; EPA 1991).

Dwire et al. (2006) suggest that prescribed fire may top-kill some riparian trees and shrubs. A study at Blodgett Forest in northern California introduced prescribed fire into the riparian zone and found that a 4.4% mortality rate resulted, occurring in trees 11 – 40 centimeters (4.5 - 15.7 inches) dbh (diameter at breast height; Bêche et al. 2005). Prescribed fire is not proposed for introduction into the perennial SMZs for this project, but it would be allowed to creep within the SMZ. Pilliod et al. (2003) suggest that prescribed burning could benefit amphibians by reducing forest canopy cover and providing breeding habitat, if reduced transpiration increased baseflow. However, habitat could be negatively affected if sediment was increased as a result of the burning.

Perennial stream channels are included under the Old Forest Linkage (Riparian Migration Corridor). These corridors extend 150 feet from both streambanks along the perennial streams within the project area. There are no proposed removal of commercial conifers within the inner 50 feet from each streambank. The outer 50 feet would implement hand treatments to remove the understory ladder fuels. No alteration of the existing stream shading is anticipated from the proposed action

Water temperature: Elevation, aspect, stream width, channel roughness coefficient, riparian shading, solar radiation, air temperature, cloud cover, and stream discharge levels can affect water temperature. Of these elements, solar radiation has the most effect on water temperature (Beschta 1987; USGS 2002). Shading effects from forest canopies are important during the summer months due to high levels of radiation (high sun angles, long days, clear skies) accompanied by low stream discharges (Beschta et al. 1987). Solar radiation through forest canopies depends on the heights of the crowns and density, along with the foliage (Moore et al. 2005). If forest harvesting occurred in streamside areas there could be a direct increase solar radiation (reduction in canopy cover) to the stream channel. However, in evaluating possible project direct effects to canopy cover it was noted that changes in overhead canopy from stands adjacent to perennial streams would not be anticipated. There would no commercial harvesting under any prescription within the inner 50-feet of the Class I SMZ. In the outer 50-feet of treated SMZs there is a possible increase of open space within the understory component of the treated

stand (trees <= 12" dbh may be hand thinned). This provides limited opportunity for increased solar radiation.

The mean summer (7/15 – 9/15) and maximum daily mean water temperatures during the 2009 monitoring period were presented in Table 19. Water temperatures met the Desired Condition (< 21º C). The period monitored represents that of highest air temperatures and lowest stream flow, thus most stressful on aquatic/riparian species. It is anticipated that the majority of the trees would be retained and the inner 50-foot No-Treatment zone would intercept solar radiation and there would be no change to water temperatures. Wilkerson et al. (2006) found that a 23 m (75 feet) buffer resulted in no change to water temperature, while a 11 m (36 ft) buffer (>60% canopy retention) resulted in an increased weekly maxima of 1.0 -1.4° C. No alterations to current water temperatures would be anticipated to result from the Proposed Action.

Flow: Of the remaining elements that may affect aquatic habitat, only stream discharge level could be affected by the proposal. Stream flow may increase as basal area (and evapotranspiration) declines, and peak flows can be indirectly affected by vegetation removal (Kattelmann 1996). Troendle (2001) indicated increased water yields following timber harvest, although treatments were primarily clearcuts rather than thinnings that are being proposed for Greys Mountain. Alteration of the hydrologic regime (timing, duration or magnitude of flows) from the combined effects of silviculture and underburning could affect success of amphibians that breed in the spring. Should such an alteration occur, it could also result in channel downcutting, bank instabilities and degradation of aquatic habitat through additional accumulations of sediment in pool habitat and filling of interstitial spaces. In snow-dominated areas, nearly all of the change in flows would occur during spring runoff, and spring runoff may occur slightly sooner if reductions in canopy allow faster melting of the snowpack

Changes to stream discharge would be an indirect effect from the proposal. If more water were available as baseflow during the late summer, there would be a possible reduction in stream temperature and an increase in available habitat. Potential increases in peak flows are related to changes in snow accumulation and snow melt. In the Rocky Mountains, any reduction in stand density will increase snowpack accumulation. Troendle et al. (2006) state that the potential for thinning to have an effect on streamflow due to reduced evapotranspiration depends on the amount of precipitation. In wet summers, there may be surplus water contributing to increased stream flow, while in dry years it is likely that the residual stand would use all of the available water. In snow-dominated areas such as the Greys Mountain analysis area, nearly all of the change in flows would occur during spring runoff, and spring runoff may occur slightly sooner if reductions in canopy allow faster melting of the snowpack. Proposed meadow restoration would protect water table levels in disturbed meadows. Removal of encroaching conifers at these sites may locally decrease the amount of evapotranspiration, but it is not clear that Flow would increase over the long term.

Late summer, when solar radiation potential is greatest, air temperatures are warmest, and stream flows are lowest, is the period when canopy cover is essential in moderating water temperatures. Typically only perennial channels flow during this period, thus concerns over water temperature focus on these stream channels. Forest thinning projects have the potential to affect water quantity through changes in interception of precipitation, changes in snow accumulation and snowmelt (important in snow-dominated areas but less so in rain-dominated and 'warm snow' zones such as the project area), and changes in available soil moisture due to decreased evapotranspiration. The Project Hydrology Report notes that any changes in Flow resulting from thinning would be unlikely to persist beyond 10 years.

## Cumulative Effects

Past, present, and reasonably foreseeable actions within the project areas are displayed in Chapter 3 of the DEIS for the Greys Mountain Project. Known activities occurring spatially and

temporally within the analysis area are recreational use (campgrounds and off-highway vehicle use), vegetation and fuels projects, roads, cattle grazing, and fires.

Alternative 2 has a risk of compacting soil (tractor thinning, mastication, and machine piling of slash), which could result in both short and long-term sediment delivery to riparian and aquatic habitats. Compaction has the potential to increase erosion through overland flow; alteration to flow regime; and alteration of stream channel equilibrium. Increased sediment could decrease available pool habitat and breeding habitat for amphibians. According to Reid (2006), the impacts of mechanical treatments on erosion and sediment yield are likely to result from direct soil disturbance where these activities affect swales and low-order stream channels. In this project, swales and Class V channels have no SMZs – mechanized access is not prohibited and could occur. Class IV channels have a 25-foot SMZ where equipment is excluded. BMP 1-19 prescribes practices to mitigate the potential effects, including requiring that stream crossings on Class IV and V streams be agreed to by the sale administrator. Unscoured swales that are dry during operations receive no special protection. Activities that would be accomplished by hand, such as felling and leaving trees, noxious weed removal, vegetative clearing at historic and prehistoric sites or stock drives, hand piling, and planting, are assumed to have no effect on hydrology or water quality. Roads maintenance (50 miles) and reconstruction (20 miles) would reduce hydrologic connectivity and reduce sediment from existing sources.

Sediment: The CWE analysis in the Greys Mountain Hydrology report indicates that all of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %. However, subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%. Bringing system roads up to maintenance level 3 standards should address most of these watershed degradation issues, but additional measures (i.e., rocking) should be used in subdrainage 503.0056 to mitigate the very high potential for CWE response. Restoration of 0.5 miles of OHV trail through meadow 503M7 may further reduce sediment contribution in this subwatershed. Restoration would include ripping of the trail to reduce compaction and restore soil porosity.

There are approximately 70 acres of FYLF and 140 acres of WPT habitat within subwatershed 503.0056. Of this total, approximately 1 acre of FYLF and 11 acres of WPT habitat would be treated under Alternative 2. Observations within this subwatershed indicate instability is currently occurring resulting in an excess amount of sediment in pools. Implementation of Alternative 2 may further increase the amount of sediment beyond the ability of the stream system to transport resulting in further reduction in aquatic habitat quantity and quality in this drainage.

Most of the Forest Service actions over the past decade, along with those proposed in the next decade, relate to cattle grazing, fuels reduction (including mastication), or forest thinning. These actions have Best Management Practices (USDA – Forest Service 2000), along with Forest standards and guidelines to restrict off-site erosion and activities within Streamside Management Zones. Literature has shown BMPs to be effective in minimizing the erosion in treatment areas and at preventing sediment from reaching streams. In a study of sediment redistribution after harvesting, Wallbrink and Croke (2002) found that sediment derived from skid trails was deposited both within the treated area and the stream buffers (23-30 m). BMPs are expected to protect stream channels from sediment for treatments areas near streams. Monitoring of BMP on Forest Service lands in California has shown that, when implemented, timber management BMP are 95-98% effective (USDA- Forest Service 2004a).

Stream Shading**:** Past, present and foreseeable actions were evaluated under cumulative effects in Alternative 1. It is expected that riparian canopy cover would be maintained at current levels as described under Indirect Effects.

Flow and Water Temperature**:** Changes to Flow would be similar to those described under Indirect Effects. Changes to timing and magnitude of Flow that might negatively affect aquatic/riparian habitat would be restricted to subwatershed 503.0056. Riparian canopy cover would be anticipated to remain at current levels based on use of Class I SMZs (minimum 100 ft) that include no removal of commercial conifers within the inner 50 ft, thus a cumulative effect to water temperature through implementation of Alternative 2 would not be anticipated.

### Summary of Effects

Table 25 summarizes overlap of potential habitat by other Actions and the Greys Mountain project. Under Alternative 2, approximately 0.5 miles of unapproved off-highway vehicle trails could be restored to reduce compaction effects from continuing use. Effects from actions not part of the Greys Mountain Project were previously disclosed under Alternative 1 and effects from those actions would be similar to those discussed under the No Action Alternative.

**Table 25. Acres of habitat cumulatively affected under Alternative 2. (*lacustrine/riverine miles converted to acres assuming 9 ft wide stream)**

| Species | Potential habitat (ac) | Grazing Meadows (ac) | Rec/OHV Effected (ac) | Bass Lake Mast. (ac) | Fire (ac) | Roads (ac) | Greys Mountain (ac) | Cum. Effect (ac) | % Habitat Affected |
|---|---|---|---|---|---|---|---|---|---|
| FYLF | 745 | 2 | 0 | 0 | 0 | 4 | 23 | 29 | 3.9% |
| Western pond turtle | 1429 | 6 | 0 | 0 | 0 | 11 | 74 | 91 | 6.4% |
| Mountain yellow-legged frog | 811 | 42 | 23 | 2 | 0 | 9 | 38 | 114 | 14.0% |
| Yosemite toad | 4769 | 53 | 0 | 121 | 0 | 53 | 170 | 397 | 8.3% |
| Riverine/ Lacustrine* | 40.5 | 4 | 1 | 0 | 0 | 0 | 2 | 7 | 17% |
| Wet Meadow | 132 | 132 | 0 | 0 | 0 | 2 | 0 | 132 | 100% |

It is not anticipated that the Greys Mountain Project (Alternative 2), in addition to other activities in the Project Area subwatersheds, would contribute to cumulative effects to MYLF or YT. While approximately 4.2 miles of BMI habitat are within or adjacent to a treatment unit, overall habitat would be expected to be maintained through project design measures (SMZs).

Existing trend in the riverine/lacustrine habitat or aquatic macro invertebrates across the Sierra Nevada bioregion would not be expected to be altered under any project alternative. There would be no changes anticipated in wet meadow habitat within the Greys Mountain Project Area. Of the 132 acres indicated to be wet meadow, 2 acres have been altered by roads and an additional 13 acres are within the outer 50 feet of the SMZ surrounding wet meadows (not part of the wet meadow acreage). Wet meadows would be expected to be protected by project design measures. The project would not be expected to alter the existing trend in the habitat, nor will it lead to a change in the distribution of Pacific tree frogs across the Sierra Nevada bioregion.

## Alternative 3 (Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

In Alternative 3, treatment areas would remain the same as in Alternative 2. Treatments would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) to achieve fire and fuels objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only partially address stand density and forest health objectives. This alternative was developed based, in part,

using the significant issues. A higher degree of canopy cover would remain after treatment and stand densities would remain higher than in the proposed action (Alternative 2). In wild stand treatment areas, the break-up of crown continuity would not be the main focus, but the ability to raise the height of the canopy base (the average height of the bottom layer of branches) where fire/fuels objectives are met. This includes the need to remove some material that is considered pre-commercial sized (i.e. less than 10 inches dbh). Maintenance and/or reconstruction of forest roads that were determined to not meet Forest Service standards will be brought back up to standard. Meadow restoration treatments Restore hydrologic function by 36 acres of meadow stabilization in meadows 503M7, 503M8, 504M132, 504M198, 504M208, 504M209, 504M211, 504M220, 504M292, and 504M293 would be completed as planned as funds become available. Prescribed burning only treatment areas would be completed as planned. Other actions include planting or understocked areas, vegetative clearing at historic and prehistoric sites, vegetative clearing along stock drives, removal of noxious weeds, restoration along a user-defined off-highway vehicle route (0.5 mile) through meadow 503M7 that was not approved under the Forest Travel Management Plan.

This alternative would receive treatment only to achieve fire and fuels objectives and limit treatments to mechanical clearing of ladder and surface fuels. As such, all design criteria and SNFPA ROD (USDA- Forest Service 2004) standards and guidelines associated with Pacific Fisher would be implemented with this alternative. Of the 9700 total acres within the project boundary, approximately 3450 acres were analyzed as areas where some form(s) of treatment are proposed (so named as treatment areas). The remaining 6250 acres have no treatments proposed due to slopes greater than 35 percent, standard and guideline limitations on treatment and/or no treatment is needed to meet the purpose and need. Table 8 for Alternative 2 would also represent treatments by subwatershed. Table 9 from Alternative 2 also represents overlap of treatments and species habitat for Alternative 3.

## Design Features and Mitigation Measures

Project design measures would be detailed under Alternative 2.

## Direct Effects

As previously noted, there is overlap between timing of proposed activities and potential effects on FYLF, WPT, MYLF and YT. Potential direct effects could occur from crushing of individual animals by tractor thinning, or mastication, or from burning of animals. Direct effects from hand thinning, including felling of encroaching conifers in meadow; hand removal of noxious weeds; reforesting understocked areas vegetative clearing at prehistoric and historic sites; ripping of a user-defined off-highway vehicle route to reduce compaction; and vegetative clearing along stock drives would not be anticipated. Project design measures would be expected to protect breeding and rearing sites from direct effects, thus sub adult and adult life stages would remain potentially affected similar to Alternative 2.

Introduced fire could directly affect herpetofauna similar to Alternative 2. Allowing fire to creep into the SMZ (as opposed to active introduction) would provide opportunity for herpetofauna to move away from areas burning, but not eliminate the possibility of mortality.

Similar to Alternative 2, direct effects from Alternative 3 to FYLF, WPT, and YT would not be anticipated due to Project Design Measures; non-detection of listed species during surveys; and nearest known occupied sites not being within dispersal distance of project treatment areas. MYLFs were detected within the aquatic analysis area (Figure 17), but not within or adjacent to any treatment unit. Breeding and rearing sites for the frog would be protected by project design measures. The frog is closely associated with water, which is buffered by streamside management zones that would be anticipated to protect the frog from direct effects. No project activities would

take place until after June 15 in adjacent treatment units to protect frog movement to breeding sites.

## Indirect Effects

Thinning to reduce ladder fuels, mastication, and underburning would occur on over the same acreage analyzed under Alternative 2. Table 25 in Alternative 2 identifies that treatment areas represent approximately 23 acres of FYLF, 74 acres of WPT, 38 acres of MYLF; and 170 acres of YT habitat. Alternative 3 has a risk of compacting soil (tractor thinning or mastication), which could result in both short and long-term sediment delivery to riparian and aquatic habitats. Implementation of Best Management Practices (USDA – Forest Service 2000); streamside management zones; road maintenance/reconstruction; and project design criteria are expected to reduce the potential for sedimentation and protect aquatic habitat (Project Hydrology Report: Stone 2011).

As noted under Alternative 2, reduction in stand densities could potentially affect canopy cover (indirectly affecting micro-climate and water temperatures), macroinvertebrate community, and changes to water yield (indirectly affecting stream channel stability). Most of the indirect effects to herpetofauna would be related to habitat alteration. Thinnings are proposed within the Sierra mixed-conifer CWHR types. The primary changes may reduce size groups and reduce stand density for a 20-30 year period. CWHR habitat quality would remain unchanged for aquatic/riparian TES species based on projected stands following thinning. Changes to microclimate (such as increased air temperatures, reduced soil moisture, and lower relative humidity) within treated areas may not be accounted for at the CWHR scale, but the reduction in mid-canopy tree removal under Alternative 3 may represent reduced effects to microclimate relative to Alternative 2.

Stream Shading: Similar to Alternative 2, there would be no alteration to current stream shading anticipated.

Water temperature: Similar to Alternative 2, there would be no anticipated alterations to canopy cover, thus there would be no effects on water temperature expected from Alternative 3 anticipated.

Flow: Similar to Alternative 2, the Project Hydrology Report (Stone 2011) notes that any changes in flow resulting from thinning resulting from Alternative 2 would be unlikely to persist beyond 10 years. Any changes to timing and magnitude of Flow would be restricted to subwatershed 503.0056 where CWE is noted as likely to occur.

## Cumulative Effects

Past, present, and reasonably foreseeable actions within the project area are displayed in Chapter of the DEIS for the Greys Mountain Project. For the Greys Mountain aquatic analysis area, other known activities are mastication projects, cattle grazing, roads, and recreational use (both campgrounds and off highway vehicles). Acres of habitat potentially affected would be similar to Table 9 under Alternative 2. Effects to Stream Shading, Water Temperature, Flow, CWE, and sediment would be similar to Alternative 2.

## Summary of Effects

Most of the Forest Service actions over the past decade, along with those proposed in the next decade, relate to cattle grazing, fuels reduction or forest thinning. These actions have Best Management Practices (USDA – Forest Service 2000), along with Forest standards and guidelines to restrict off-site erosion and activities within Streamside Management Zones. Literature has shown BMPs to be effective in minimizing the erosion in treatment areas and at preventing sediment from reaching streams. In a study of sediment redistribution after harvesting,

Wallbrink and Croke (2002) found that sediment derived from skid trails was deposited both within the treated area and the stream buffers (23-30 m). BMPs are generally expected to protect stream channels from sediment for treatments areas near streams. Monitoring of BMP on Forest Service lands in California has shown that, when implemented, timber

Similar to Alternative 2, it is not anticipated that the Greys Mountain Project (Alternative 3), in addition to other activities in the Project Area subwatersheds, would contribute to cumulative effects to MYLF or YT. There is a high potential for cumulative effects to habitat for WPT and FYLF in subwatershed 503.0056 (affecting approximately 1.7 miles of stream or 2 acres of aquatic habitat).

Similar to Alternative 2, riverine/lacustrine and wet meadow habitat would be anticipated to remain stable across Sierran National Forests.

## Other Relevant Mandatory Disclosures

Table 26 and Table 27 display determination of effects on threatened, endangered, and sensitive herpetofauna based on known information on species, habitat available, literature review, and anticipated effects. Lacustrine/riverine and wet meadow habitats would be anticipated to remain stable under any of the Alternatives.

**Table 26. Effects from Greys Mountain Alternative 1 (No Action) on aquatic threatened, endangered, candidate, and sensitive species**

| Species | Determination | Rational for the Determinations for Proposed Action |
|---|---|---|
| **Foothill Yellow legged frog** | ***No Effect*** | No anticipated impacts to species or habitat |
| **Western pond turtle** | ***No Effect*** | No anticipated impacts to species or habitat |
| **Mountain yellow-legged frog** | ***No effect*** | No anticipated impacts to species or habitat |
| **Yosemite toad** | ***No effect*** | No anticipated impacts to species or habitat |

**Table 27. Effects from Alternatives 2 and 3 on aquatic threatened, endangered, and sensitive species.**

| Species | Determination | Rationale for the Determinations for Proposed Action |
|---|---|---|

| | | |
|---|---|---|
| **Foothill Yellow legged frog** | ***May affect individuals, but is not likely to lead to federal listing or loss of viability for the FYLF in the Sierra National Forest.*** | • Not detected within the aquatic analysis area during surveys<br>• Nearest known occupied site is 15 miles from any treatment area, which is beyond dispersal range of species.<br>• Available habitat is primarily (80%) Unsuitable or Poor based on CWHR.<br>• Proposed treatments occur over approximately 3% of potential habitat, and 4% cumulatively with other projects.<br>• Proposed treatments not anticipated to reduce quality of CWHR habitat. |
| **Western pond turtle** | ***May affect individuals, but is not likely to lead to federal listing or loss of viability for the WPT in Sierra National Forest.*** | • Not detected within the aquatic analysis area during surveys<br>• Nearest known occupied site is 2.3 miles from any treatment area, which is beyond dispersal range of species.<br>• Available habitat is primarily (89%) Unsuitable or Poor based on CWHR.<br>• Proposed treatments occur over approximately 5% of potential habitat, and 6% cumulatively with other projects.<br>• Proposed treatments not anticipated to reduce quality of CWHR habitat. |
| **Sierra Nevada yellow-legged frog** | ***May affect individuals, but is not likely to contribute to the need for Federal listing or in loss of viability for Sierra Nevada MYLF in the Sierra National Forest.*** | • Two occupied sites in the Aquatic Analysis Area.<br>• No occupied habitat detected within proposed treatment units.<br>• Treatment units adjacent to populations have No Treatment buffering that would protect breeding/rearing.<br>• Limited operating period after June 15th would reduce potential for frogs moving to breeding sites from being affected by project.<br>• Available habitat is primarily (81%) Unsuitable or Poor based on CWHR.<br>• Proposed treatments occur over approximately 5% of potential habitat, and 14% cumulatively with other projects. |

| | | |
|---|---|---|
| | | • Proposed treatments not anticipated to reduce quality of CWHR habitat. |
| **Yosemite toad** | ***May affect individuals, but is not likely to contribute to the need for Federal listing or in loss of viability for YT in the Sierra National Forest.*** | • Species was not detected during Forest-wide surveys between 2002-2004, or during 2010/2011project surveys.<br>• No meadows are occupied within aquatic analysis area subwatersheds<br>• Nearest occupied meadows (> 0.9 miles) from any proposed treatment unit are beyond dispersal distance of species (0.6 mi).<br>• Proposed treatments occur over approximately 4% of potential habitat, and 8% cumulatively with other projects.<br>• Proposed treatments not anticipated to reduce quality of CWHR habitat. |

# Range Management

## Affected Environment

### *Existing Condition*

The project area is within the boundaries of two grazing allotments: Central Camp and Soquel (Figure 18). Grazing by domestic livestock has occurred in the project area for over 100 years. The Forest Service began administration of grazing in 1905 and has continually modified and adjusted livestock grazing practices, numbers of animals and season of use up to the present. These allotments have been analyzed for compliance with NEPA and the decision was made to continue to authorize cattle grazing in these allotments. Therefore, the authorization of cattle grazing within the project is not the focus of this analysis. This analysis focuses on the condition of montane meadows within the project area and the effects of the restoration on meadow ecological status. Meadow restoration is proposed for a sub-set of meadows with the project area (Figure 18). Several meadows within the project area are key areas used for monitoring the effects of grazing.

Cattle use occurs throughout the project area. The primary use by livestock is in the montane meadows where the forage is most abundant and secondary use is in plantations (e.g. browse on buckbrush) or the forest where some understory where forage is found.

Historic overgrazing from past improper grazing management and other anthropogenic activities has resulted in impacts to meadows and riparian areas, some that are still evident. Ranching was the first industry in California and was expanded upon with the establishment of the Spanish missions. During this time cattle were valued for their hides and tallow that were exported back to Europe at considerable profit margin leading to very high and unsustainable stocking rates beyond the carrying capacity of the land. The Gold Rush of 1849 ushered in a shift toward beef production where cattle were used for meat. Summer grazing in the Sierra Nevada began during the droughts in the 1860s and 1870s. Sheep grazing was the dominant use of these meadows. Overgrazing in the late 1800s and early 1900s resulted in widespread deterioration of meadows. Effective control and regulation of the range did not begin until the Forest Reserves were created and when grazing permits were required by the Forest Service.

The Central Camp and Soquel allotments are managed under a deferred grazing system. Deferment involves delay of grazing in a pasture until the seed maturity of the key forage species, which permits the preferred forage plants to gain vigor and reproduce. The allotments are grazed primarily by elevation zone within each unit with the lower elevations receiving grazing pressure early in the season and then livestock drift or are driven to the mid-high elevations meadows. It is not a strict deferment, since there are no drift fences or pasture boundary fences to keep the stock from grazing throughout the allotment. The objective in managing these allotments is to delay use in the higher elevations and to achieve even distribution throughout the allotment as the season progresses. From this perspective, the use is considered a combination between deferred grazing and season long grazing, which implies that cattle graze a particular pasture or unit throughout the grazing season year after year. The gathering pastures are grazed under a high intensity-low frequency grazing system, since large numbers of stock are gathered into the pastures for a very short time (one-two nights) before they are driven or trucked off the allotment.

Livestock may congregate in riparian areas (e.g. meadows, seeps, springs and creeks) because of convenience of forage, water, terrain and cover. The preferred plants in these areas may receive excessive use as a result; therefore, a considerable amount of herding and trailing of cattle is required to keep stock in the lower elevations early in the season. This ensures even use and keeps the stock from moving upslope too quickly and from re-grazing areas to avoid over use. Proper livestock distribution that results in good animal distribution over the entire grazing area is a primary management goal to meet allowable forage utilization standards. Permittees use riding, herding and salting to achieve this objective.

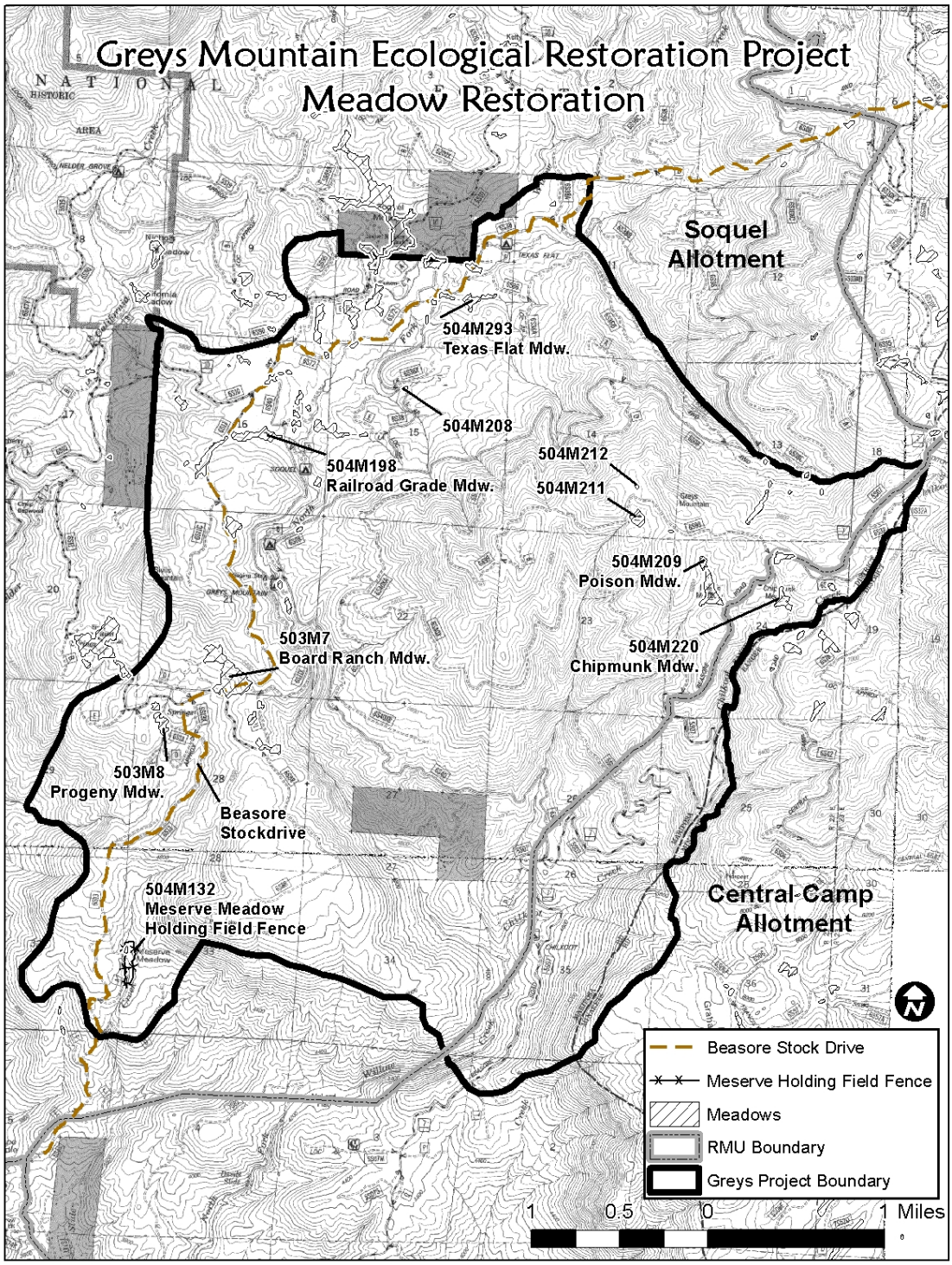



**Figure 18. Allotment boundaries and meadows with proposed restoration within the project area.**

## Meadow Condition

Meadows are wetlands or semi-wetlands that support hydrophytic and mesophytic vegetation including grasses, sedges, other grasslikes, such as rushes, and a variety of forb species. The meadows within the project area are managed for meadow stability and ecological health while providing a forage resource. The meadows identified in the proposed action have ground water tables have been lowered due to impacts from a combination of past logging, road building and grazing. These meadows have localized areas that are degraded and have compromised hydrologic function where portions of associated channel have areas of vertical and lateral instability. The resulting change in soil moisture conditions has resulted in conifer encroachment beyond the range of natural variability.

Several key area meadows within the project area have long term range condition and trend monitoring plots and long term meadow ecological condition and trend data has been analyzed as part of this analysis (Table 28). At these monitoring sites, vegetation, soil and general plot location information are collected. Plots are located in mesic sites that are likely in a lower ecological condition as opposed to being placed in the most hydric or wetter areas. Therefore the plots are established to best determine changes over time in the meadow by being placed in the areas likely to show change and transition due to management activities. The plot data shows that vegetation is in moderate ecological condition with overall high ecological condition with stable and upward trends respectively.

**Table 28. Summary of ecological status data collected at two key area meadows within to the Greys Mountain Project Area.**

| Allotment | Meadow Name (plot location) | Meadow Type | Vegetation Condition Class (ecological status) | Overall Condition Class (ecological status) | Vegetation Trend | Overall Trend | Moving Towards Desired Conditions? | Meets Desired Conditions? |
|---|---|---|---|---|---|---|---|---|
| Central Camp | Chipmunk Meadow | Moist Meadow | Moderate | High | Stable | Upward | Yes | Yes |
| Soquel | Poison Meadow | Wet Meadow | Moderate | High | Stable | Upward | Yes | No |

Mountain meadows have been susceptible to conifer encroachment during the past century. This may reflect a process of contraction following a disturbance such as wildfire or may reflect a change in land use such as the cessation of sheep grazing or a shift in climate. Meadow types vary in their susceptibility to encroachment. A transition from open meadow to large, older trees represents a stable relationship between the forested areas and meadows. Transition from an open meadow to scattered small trees to larger trees to large mature trees suggests instability from past effects (Ratliff 1985). Physically degraded meadows would often have lowered ground water tables, which in turn can lead to accelerated conifer encroachment outside the range of natural variability. A comparison of aerial photos from 1944 and 2008 and field analysis indicates varying degrees of conifer encroachment in meadows within the project area. The encroaching trees <12” dbh are proposed for removal.

Fire is a part of the natural environment and there is evidence that fire plays a significant role in the evolution and maintenance of meadows of the Sierra Nevada by influencing the forest and meadow boundary (Ratliff 1985). Forests burned from lightning and fires set by Native Americans and later by fires set by sheep and cattlemen to improve forage and conditions for livestock. Meadows are not likely to burn in years with normal or above normal precipitation, but may have burned when herbage was dry and during drought periods. Prescribed burning in forested areas (units) is part of the proposal, burning within the meadows is not proposed.

## Soquel Allotment

The Soquel Allotment was used by cattlemen prior to the formation of the Sierra National Forest. During the early period of livestock use, the allotment was overgrazed by cattle and sheep. Peak use occurred during the two world wars following a decline in use in post war years. The first available data recording use was in 1908 where the level of use was 375 animal months. Use rapidly increased and by 1918 the stocking was at 1,784 animal months. Following 1918, there were periodic increases and reductions. There were sharp rises in livestock use in 1926 to 1,556 animal months and again in 1944 to 2,112 animal months, which is the highest recorded use. This prolonged and heavy use resulted in considerable damage to vegetation and soil resources. Extensive resource rehabilitation and stocking reduction measures were employed to correct the overgrazed conditions. During the period of 1948 through 1953 animal stocking levels were reduced to levels commensurate with the estimated capacity of 943 animal unit months. In 1957, the allotment capacity at this time was determined to be a 736 animal unit months based on boundary changes and allotment condition. Subsequent measurements and monitoring studies indicated that further reductions were necessary. Therefore in 1967, the overall allotment capacity was reduced to 651 animal unit months. Additional stocking reductions have been put in place since the range analysis and NEPA decision from 2007.

Transitory range, or newly opened areas due to logging that support forage growth and production, was created through past logging and burning activities at the turn of the century. Today, the majority of forage is located in meadows and natural openings. The Soquel Allotment is a 44,000 acre allotment used as summer range by Mike and Sherrine Knapp of Lazy K Ranch, Chowchilla, CA. Table 29 below shows the number of cattle permitted to graze and the timing of use. The allotment is grazed by cow/calf pairs from June 1 through October 15 with 190 cow calf pair. The majority of cattle are gathered by mid-September, with straggler cattle sometimes remaining into October. A portion of the herd is trucked to the allotment from the base ranch to Sivels Meadow early in the season with the remaining cattle being trucked to Soquel Meadow where they are kept temporarily in the fenced holding field at this location prior to being dispersed throughout the allotment. The grazing system is generally considered a deferred season of use with lower elevation meadows used initially followed by higher elevations grazed as season progresses.

A portion of the Beasore Stock Driveway is also located within the Greys Mountain project area (Figure 18). The distribution of livestock in the allotment is considered season long grazing with deferred use of lower elevations followed by the higher elevations. Forage areas are predominantly in moist to wet meadow types with most grazing occurring in meadow areas although there is some hillside forage in forested areas and on open sandy slopes. The number of livestock and season of use is described in Table 29.

**Table 29. Current Permitted Numbers and Season of Use for Soquel Allotment.**

| LIVESTOCK | | | PERIOD OF USE | | Head Months (Animal Months) | Animal Unit Months |
|---|---|---|---|---|---|---|
| **NUMBER** | **KIND** | **CLASS** | **FROM** | **TO** | | |
| 100 | Cattle | cow/calf | 6/1 | 9/15 | 352 | 465 |
| 75 | Cattle | cow/calf | 7/1 | 10/1 | 229 | 302 |
| 15 | Cattle | cow/calf | 7/1 | 10/15 | 53 | 70 |
| *Total* | | | | | *634* | *837* |

### Poison Meadow (504M209)

Poison Meadow (Figure 18) is a key area meadow used for annual forage utilization monitoring. A permanent range condition and trend monitoring plot is also located in the meadow. The plot in Poison Meadow was analyzed using the vegetation frequency method in 2000, 2005 and most recently in 2010. Results from this analysis show the meadow to be in moderate ecological status for vegetation condition and high overall ecological condition (takes vegetation, soils, rooting depth and depth to water table into account) with a stable trend for vegetation and upward trend for ecological condition (Figure 18). There is a WIN site where rock structures were previously installed in the toe of the meadow that is no longer functional so reconstruction and repair of existing structures is proposed. There is a medium level of conifer encroachment in the northern portion of meadow approximately 0.86 acres (11%). Split rail fencing and signage is recommended to discourage OHV use along track ML91 of the meadow. This meadow receives little if any livestock use so enclosure fencing of the restoration site may not be necessary. Physical restoration and/or stabilization efforts would restore/preserve approximately 7.5 acres of this meadow.

### Texas Flat Meadow (504M293)

Texas Flat Meadow (Figure 18) is a key area meadow used for annual forage utilization monitoring. There are two main headcuts with several smaller knick points in the meadow. The east end of the meadow has very high conifer encroachment (approximately 1.25 acres). The headcuts and knick points in Texas Flat Meadow are proposed to be treated by constructing rock step pool structures. Although no OHV use into the meadow was noted during field observations, it is recommenced that split rail fencing be placed along FS Road 6S36 to discourage OHV use in meadow. There is an infestation of bull thistle in the northern portion of the meadow. Physical restoration and/or stabilization efforts would restore/preserve approximately 5 acres of this meadow.

### Meadow 504M211/504M212 (un-named meadows)

Meadow 504M211 (Figure 18) has two headcuts and rock step pools are proposed to address both headcuts The meadow has a negligible amount of encroachment so no conifer removal is proposed. The meadow shows 1.34 acres of encroachment from satellite and aerial photo review. Physical restoration and/or stabilization efforts would restore/preserve approximately 3 acres of meadow 504M211. Meadow 504M212 is located 0.1 miles north of meadow 504M211. There are no WIN sites identified in this meadow (thus no physical restoration is planned), but there has been 0.75 acres of conifer encroachment identified through satellite and aerial photo review.

### Meserve Meadow (504M132)

Livestock are driven via the Beasore Stock Driveway to the Beasore Allotment (not within the project area) from Bass Lake Corral off County Road 274. The fenced portion of Meserve Meadow (Figure 18) is adjacent to the stock drive and is used as a livestock holding field used to overnight cattle during the cattle drive. The holding fence right-of-way would be cleared and the barbed wire fence would be reconstructed under the maintenance terms of the grazing permit. The stock drive would be maintained by cutting out encroaching conifers and clearing stock drive tread. This meadow has three log structures and one rock structure. The log structure would be replaced under the proposal and the headcut between the bottom two log structures would be repaired with a rock step pool structure. Meserve Meadow has very high conifer encroachment (0.5 acres) and existing conifers (up to 12" dbh) would be removed, but no other woody vegetation is proposed for removal.

### Progeny Meadow (503M8)

Progeny Meadow (Figure 18) is a lower elevation meadow that has a mix of annual and perennial herbaceous species present, so it is somewhat of a transitional meadow with mesic and dry portions of the meadow supporting difference plant species. The primary WIN feature is located at the toe of the meadow, which consists of two headcuts. The channel along the west side of the meadow has several headcuts and two rock bowl restoration structures where the channel meets the meadow. Rock step pool structures are recommended to stop headward erosion of the headcuts. Conifer encroachment is high throughout meadow (approximately 3.5 acres) and the proposal is that these trees be removed. Split rail fencing is proposed along FS Road 6S13 to discourage damage to the meadow due to OHV use. An offsite livestock water development is recommended to minimize impacts to the associated channel.

### Meadow (504M208)

Meadow 504M208 (Figure 18) has a functional rock bowl in the upper part of the meadow, eight headcuts, and OHV tracks in the meadow south of 6S38. Rock structures (e.g. rock step pools and rock rundowns) are proposed to repair all the headcuts in the southern portion of the meadow. High conifer encroachment is noted above road (approximately 0.1 acres) with low to medium encroachment below road. Split rail fencing is also proposed along FS Road 6S38 to discourage OHV use in meadow. Physical restoration and/or stabilization efforts would restore/preserve approximately 0.3 acres of this meadow.

### Railroad Meadow (504M198)

Railroad Meadow (Figure 18) is a key area meadow used for annual forage utilization monitoring. A portion of the meadow is bisected by an old railroad grade bed that is altering water flow and the hydrology of this meadow. A breach in the railroad bed is used as a crossing by the cattle and is contributing to channel incision and erosion. Conifer encroachment is very high in the west end of the meadow near 6S11 (head of meadow) at approximately 2.4 acres (~50%). The hydrologist recommends obliterating the railroad bed and removing encroaching conifers to improve conditions in this meadow. There is a bull thistle infestation in this meadow on the railroad bed. Physical restoration and/or stabilization efforts would restore/preserve approximately 3.5 acres of this meadow.

### Board Ranch Meadow (503M7)

Board Ranch Meadow (Figure 18) is also a lower elevation transitional meadow with a mix of annual and perennial herbaceous species. An OHV track bisects the meadow and is impacting the hydrology. Localized OHV and cattle impacts have resulted in chiseling and vertical banks are evident at the toe of the meadow along the 6S13 Road and rock work is proposed to repair a headcut in this area. Split rail fencing is proposed to discourage access at this location. Conifer encroachment is very high in small pockets of the lower southeast and upper northwest ends of

the meadow (approximately 2.5 acres). Conifer encroachment removal is proposed in the upper portion of the meadow and in small pockets of the lower end of the meadow. There is an old fenced spring development in the southwestern portion of the meadow (just above the 6S13) that needs repair and maintenance which could be covered under administration of the grazing permit. Physical restoration and/or stabilization efforts will restore/preserve approximately 3.0 acres of the true meadow area.

## Central Camp Allotment

Although early records are sketchy and not too reliable, it is apparent that this allotment is similar in past history to many of those in the Sierra. Early records are not available but it is safe to assume that the area was probably grazed by sheep, as most of the forest area was, during the 1870s and 1880s. Sheep use was replaced by cattle use near the turn of the century. Use was heavy in the 1920s, decreased during the drought years of the 1930s, increased greatly during the war years, decreases slightly from 1948-1952 and remained constant for a period after. Grazing use was heavy until reductions were initiated in the 1940s and 1950s. Use was around 598 AUMs from 1963-1983. Further reductions occurred in 2008 with the reduction from 166 cow calf pair to 101 cow calf pair (468 AUMs) (Table 30).

The Central Camp Allotment is a 25,893 acre allotment used as summer range by Gary and Tawny Pamplin of Clovis, CA. Livestock are trucked to the Graham Meadow Corrals and are distributed throughout the allotment to the Gaggs Unit and Francis Junction Units. The higher elevations meadows in these Units, such as Morgan Meadow and Upper Francis Junction Meadow are used later in the season. Livestock are gathered into Graham Meadow at the end of the season and trucked home to Tollhouse, CA. Straggler cattle may be gathered into Upper Francis Junction Corral or Chipmunk Corral and trucked off the allotment. Along with riding and herding, salting is used to improve or maintain livestock distribution throughout the allotment. Salt is to be located more than 1/4 mile from streams, meadows, trails and young plantations. Salt blocks are not placed within or near known archaeological sites.

Only the northwestern most portion of the Central Camp allotment is located within the project area. Chipmunk Meadow is a key area meadow that is proposed for restoration (Figure 18). The distribution of livestock in the allotment is considered season long grazing with a deferred use of lower elevations followed by the higher elevations. Forage areas are predominantly in moist to wet meadow types. Most grazing occurs in meadow areas although there is some hillside forage in forested areas and on open sandy slopes Table 30 describes the current livestock numbers and season of use for Central Camp Allotment.

**Table 30. Current Permitted Numbers and Season of Use for the Central Camp Allotment.**

| **LIVESTOCK** | | | **PERIOD OF USE** | | **Head Months (Animal Months)** | **Animal Unit Months** |
|---|---|---|---|---|---|---|
| **NUMBER** | **KIND** | **CLASS** | **FROM** | **TO** | | |
| 101 | Cattle | cow/calf | 6/16 | 9/30 | 355 | 468 |
| *Total* | | | | | *355* | *468* |

### Chipmunk Meadow (504M220)

A permanent range condition and trend monitoring plot is located in the key area at Chipmunk Meadow. The plot in Chipmunk Meadow was analyzed using the vegetation frequency method in 1999, 2002, and 2004. Results from this analysis show the meadow to be in moderate ecological status for vegetation condition and high overall ecological condition with a stable vegetation trend and upward overall trend (Table 28). Chipmunk Meadow has a headcut at the

toe of the meadow and several small knick points in the middle and upper sections of the meadow. A rock step pool or possibly a log step fall structure would be constructed to repair the headcut. This meadow has negligible conifer encroachment. OHV damage has occurred in this meadow in the past and barriers have been placed at entry points to the meadow to discourage OHV use which seems to be working. Physical restoration and/or stabilization efforts would restore/preserve approximately 2.6 acres of this meadow.

## Desired Condition

### Applicable S&Gs

These land allocations incorporate S&Gs from the SNF (LRMP) (USDA-FS 1992), including amendments; *An Environmental Assessment of Utilization Standards for Determining Proper Use of Available Forage for Commercial Livestock* (USDA- FS 1995), and the *Sierra Nevada Forest Plan Amendment* (SNFPA) (USDA-FS 2001, 2004). The goal of protecting and restoring desired conditions is applied through following standards applicable to the proposed grazing management within the project area. These S&Gs are part of the action alternatives. Additional S&Gs have been incorporated into the alternatives to achieve and/or maintain desired conditions. Table 31 provides utilization standards for each vegetation community

**Table 31. Allowable utilization levels by vegetation community**

| Landscape | Vegetation type | Standards for rangeland in satisfactory condition or late ecological status | Standard for rangeland in unsatisfactory condition or early ecological status |
|---|---|---|---|
| Annual grasslands & oak woodlands with > 10 inches annual precipitation and ≤15% slope (1,000-2,500 feet elevation) | grass and grasslike plants and forbs | 700 lbs/acre Residual Dry Matter | 1,000 lbs/acre Residual Dry Matter |
| Annual grasslands & oak woodlands with > 10 inches annual precipitation and >15% slope (>2,500 feet elevation) | grass and grasslike plants and forbs | 1,000 lbs/acre Residual Dry Matter | 1,200 lbs/acre Residual Dry Matter |
| Meadows/riparian areas within annual grasslands, oak woodlands, montane and subalpine meadows | grass and grasslike plants and forbs | 40 % Use by Weight | 30 % Use by Weight |
| All rangeland types | hardwoods: including (oak/willow and other shrub seedlings/regeneration) | Allow browse on no more than 20% of current annual leader growth and advanced regeneration | Allow browse on no more than 10% of current annual leader growth and advanced regeneration |
| Annual Grasslands & Oak Woodlands | Annual Grasslands & Oak Woodlands/Uplands | Minimum of 60 percent cover | Minimum of 60 percent cover |

Desired conditions are for rangelands to be in satisfactory condition and all grazing activities occurring on the forest would have management strategies which achieve or maintain rangeland conditions in satisfactory condition.

Desired condition is upper moderate or high ecological condition where late successional species are well represented on the site (e.g. greater than 40% of the composition). Early successional species may be represented but are of low abundance. Sites with higher late seral species and low abundance of early successional species allow for satisfactory ecological health, biological diversity, and resilience.

Desired conditions for rangelands are summarized in Table 32.

**Table 32. Desired conditions for montane meadows and riparian conservation areas.**

| Desired Future Condition |
|---|
| Rangelands are to be in satisfactory condition and all grazing activities occurring on the Forest would have management strategies which achieve or maintain rangelands in satisfactory condition.<br><br>Satisfactory rangeland condition is defined in the Forest Plan as having either 1) a livestock forage condition rating of good or excellent or; 2) late seral ecological status greater than or equal to 60% similarity to potential natural community (PNC) (moderate ecological status), or; 3) a resource value rating of greater than or equal to 76% similarity to desired condition, and stable soils with continuous vegetative cover and rooting throughout available profile (1995 SNF LRMP Amendment: 2.2.4, Page 2-11).<br><br>Water quality meets the goals of the Clean Water Act and Safe Drinking Water Act; it is fishable, swimmable, and suitable for drinking after normal treatment (2004 SNFPA ROD Page 42).<br><br>Habitat supports viable populations of native and desired non-native plant, invertebrate and vertebrate riparian and aquatic dependent species. New introductions of invasive species are prevented. Where invasive species are adversely affecting the viability of native species, the appropriate State and Federal wildlife agencies have reduced impacts to native populations (2004 SNFPA ROD Page 42).<br><br>Ensure that characteristics of special aquatic features are, at a minimum, at Proper Functioning Condition, as defined in the appropriate Technical Reports (or their successor publications): (1) “Process for Assessing PFC” TR 1737-9 (1993), “PFC for Lotic Areas” USDI TR 1737-15 (1998) or (2) “PFC for Lentic Riparian-Wetland Areas” USDI TR 1737-11 (1994); (2004 SNFPA ROD S&G 117, Page 65).<br><br>Species composition and structural diversity of plant and animal communities in riparian areas, wetlands and meadows provide desired habitat conditions and ecological functions (2004 SNFPA ROD Page 43).<br><br>The distribution and health of biotic communities in special aquatic habitats (such as springs and seeps) perpetuates their unique functions and biological diversity (2004 SNFPA ROD Page 43).<br><br>Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filer precipitation and sustain favorable conditions of stream flows (2004 SNFPA ROD Page 43). |

A diversity of age classes of hardwood shrubs is present and regeneration is occurring (2004 SNFPA ROD Page 43).

Streams in meadows, lower elevation grasslands and hardwood ecosystems have vegetation and channel bank conditions that approach historic potential (2004 SNFPA ROD Page 42).

## Environmental Consequences

### Methodology

The Environmental Consequences chapter describes the predicted effects on meadows. This analysis focuses on the effects of restoration activities on meadow ecological status.

The boundary for the cumulative effects analysis is the project boundary where it overlaps the Soquel and Central Camp allotments. Cattle grazing is an ongoing activity which has occurred in the project area for over 100 years but as management has improved, there have been periodic and sustained reductions in livestock numbers and authorized grazing seasons resulting in improved conditions. Past activities in Soquel Meadow and the Nelder Grove areas adjacent to the project area include railroad logging (1889-1892) by the Madera Flume and Trading Company. More recent logging activity includes the Cedar Valley Timber Sale adjacent to the project area and also recent logging on private land in the Paradise Spring Resort and Soquel Meadow areas. Known recent and present activities within the analysis area are recreational and cultural uses, vegetation and fuels reduction projects, special uses (e.g. MID and apiaries) and cattle grazing. The present known recreational activities occurring within the analysis area include camping, off-highway vehicle use, horsebackriding, hunting, fishing and cultural uses. The project boundary includes roads for motorized use and trails for motorized use and non-motorized use (e.g. hiking and horsebackriding). Wildfire, although infrequent, includes past fire activity occurring between the 1920s and 1960s primarily due to slash burning from logging operations.

## *Alternative 1 – No Action*

### Direct, Indirect Effects

Under the No Action Alternative, meadow restoration or conifer encroachment removal would not occur. The project meadows would continue to have areas of exposed bank, headcuts and knick points that would remain unaddressed and the condition of these degraded areas could worsen causing additional instability, erosion and further meadow degradation. Successional encroachment or “reforestation” of meadows is a natural process, but in many cases anthropogenic stressors (e.g. fire suppression) have greatly accelerated this process beyond the range of natural variability. Conifer encroachment would continue expanding towards the interior of the meadow and this process would continue to negatively affect meadow ecological condition. The area of expanding conifers would reduce water availability for herbaceous species, potentially reducing vegetative cover and could accelerate drier conditions within the meadow resulting in a shift to a more xeric site. This shift could eventually convert the meadow area to a forest environment. Over time meadow condition and trend could move in a direction away from desired conditions.

### Cumulative Effects

The effects of not implementing structural vegetation restoration activities, channel stabilization and trail restoration on meadow ecological status may result in static deteriorated conditions due to past and present activities that have altered meadow conditions. If restoration is not

implemented then there would be a continuation of degraded conditions in stream channels that would adversely affect adjoining meadows from ongoing erosion. This deterioration would result in reduced water availability which may cause downward trend and reductions in the relative abundance of desired herbaceous species composition in meadows. There would be negligible additional effects from past activities and possible and likely localized effects from other ongoing activities in the project area to meadow ecological status (e.g. occasional unauthorized motorized use across meadows).

## *Alternative 2 – Proposed Action*

### Design Features and Mitigation Measures

Design features would be implemented to ensure success of restoration efforts. Excluding the restoration areas from cattle grazing with temporary fencing would be done for a period of no less than two years in order to allow vegetation to recover and to protect the area(s) from trampling damage. To help compensate for the potential loss of available stock water, offsite watering systems would be evaluated on a case-by-case basis and be installed in coordination with the range manager and permittee. As part of the proposed conifer removal, only trees up to 12" dbh would be felled, lopped-and-scattered, bucked in place, or bucked and carried to the meadow edge and left as biomass or used in the restoration structures. Existing stock trails would not be blocked and the material would be placed to discourage cattle from trailing or creating new trails in the meadow. The material would be placed to encourage livestock use of the forest or forested edge to travel. Native vegetation (e.g., sod plugs) removed during restoration activities would be saved and preserved for later planting to encourage re-vegetation of newly disturbed areas. Areas of bare soil in the floodplain would also be planted with native willows to expedite and enhance the stabilization process. Willows would be either cultivated or harvested locally from the same meadow(s) or meadows in the same watershed and at the same elevation range.

### Direct, Indirect Effects

Meadows provide the bulk of forage on grazing allotments. Ecological condition and hydrologic function of montane meadows afects water availability and storage which influences water quality and quantity, wildlife habitat and forage quality and production. The ecological condition and hydrologic function of the meadows and associated riparian channels would improve under Alternative 2. Improved ecological condition would be evident by high vegetative cover (>90%), species composition that reflects a high relative percentage of late seral species (>40% late seral species), improved plant vigor and possible increases in forage production. Vegetation trends would remain stable or move upward for sites with stable trends (Poison and Chipmunk Meadows) and sites with upward trends would continue on that trend which is desired condition. Meadows with moderate ecological status could move toward high ecological status with higher abundance of late seral herbaceous species. Direct benefits of the meadow restoration from repair of existing and installation of new rock structures to stabilize channels would be increased water storage and reduced erosion. The effect of this stabilization would further move sites towards desired conditions. The installation of enclosure fencing would avoid or minimize potential livestock impacts on the restoration sites while vegetation is re-establishing in these areas. Recovery of the degraded channels in the meadows would improve conditions cumulatively in the meadow. The effects of continued implementation of grazing S&Gs would also act to maintain or improve site conditions over time.

The most effective strategy for conservation and maintenance of meadow habitats targets conifer encroachment removal during the early stages of encroachment. Restoration efforts that target forest-meadow edges or small tree islands maximize the potential for improved dispersal of meadow species (Thompson 2007). Restoration attempts at later stages of encroachment may be

hindered by loss of meadow species from the vegetation, absence of soil seed bank for most meadow species and changes in soil properties that facilitate further recruitment of tree seedlings. Conifer encroachment removal and channel restoration under this alternative would increase the area covered by meadow or riparian vegetation. Trees that invade a meadow alter light and soil moisture available to herbaceous plants which can lead to undesirable changes in species composition and biomass productivity. A decrease in conifer seedling establishment would be expected as the meadow conditions would improve from increased water storage under the proposal and may result in saturated soil for a longer period in the growing season which would inhibit seedling establishment. Also, trees (12" dbh or less) within the meadow that are contributing to the seed source would be removed further delaying conifer seedling establishment.

The channel stabilization and conifer removal would improve hydrologic function of the meadows and would have a beneficial effect on the watershed. Meadow condition would move towards upper moderate or high ecological condition where late successional species are well represented on the site, which is the desired condition. Restoration effects in the long term may improve resiliency of the meadow and riparian vegetation in relation to climate change.

Fire in the surrounding watershed probably influenced meadow ecology more often that fires directly in meadows resulting in increased water flows and sedimentation (Ratliff 1985). Although prescribed fire is not proposed directly in meadows in the project area, it is proposed as a follow treatment to mechanically treated units. Prescribed fire is planned and implemented to limit burn intensity and severity (e.g. degree of tree mortality) with reduced effects when compared to those of wildfire. Fire exclusion has resulted in increased stand density and accumulation of downed wood and litter. Treatment by mechanical thinning and prescribed fire would help to physically open up the forest floor to allow livestock access and improved livestock distribution within the allotments.

The openings in the canopy combined with the follow-up entry with fire could benefit the production of herbaceous species and forage under the forested canopy. This effect may also attract livestock out of the meadow areas that are the primary forage areas and may reduce the impacts from livestock in meadows. Busse et al (2000) found that the total herbaceous vegetation cover and production were unaffected by burning, while species diversity increased slightly in a ponderosa pine forest in Central Oregon. The primary response on herbaceous plants was a slight increase in diversity and a change in relative abundance of graminoid species. The herbaceous plant community was otherwise unresponsive to low severity fire as neither forbs nor graminoid cover increased significantly as a result of burning. The primary factors contributing to the poor aboveground response of herbaceous plants were that the low severity fire had little effect on tree mortality and competition for soil and water nutrients between overstory and herbaceous plants was unaltered. Harris and Covington (1983) found that following a fall-prescribed fire in ponderosa pine in Arizona understory vegetation appears to have increased nutrient availability, stimulating understory production and increasing nutrient concentration thus improving forage quality for both livestock and wildlife.

Barrier fencing and signage to discourage unauthorized OHV use in meadows may discourage use to help prevent future impacts and allow affected meadows time to heal from past impacts.

## Cumulative Effects

The effects of structural vegetation restoration activities, channel stabilization and trail restoration on meadow ecological status would result in either maintenance of existing condition or become expressed as improvement in desired herbaceous species composition (move toward >40 % relative abundance of late seral species), vegetative cover (maintain cover at greater than 90%

cover), depth to water table and rooting depths. The cumulative effects of the proposed action on changes to factors affecting meadow ecological status would not be evident immediately after project implementation but may become evident over a longer timeframe that may take several to up to 10 years. There would be negligible additional effects from past activities and possible and likely localized effects from other ongoing activities in the project area to meadow ecological status.

## *Alternative 3*

### Direct, Indirect Effects

Alternative 3 would only partially address stand density and forest health objectives. The meadow restoration component would be the same as Alternative 2 so direct and indirect effects on meadow ecological status would be the same. Indirect or cumulative effects from thinning and associated benefits from increased water availability would be reduced from what is expected under Alternative 2. Since a higher degree of canopy cover would remain after treatment and stand densities would remain higher than in the proposed action the forest canopy would not be opened as much as under than Alternative 2. Stands would still be opened to allow better access by livestock, but stand density would be higher than Alternative 2. The effects of increased light, nutrients and reduced competition may benefit the production of herbaceous understory vegetation, but to a lesser degree compared to Alternative 2.

Monitoring Recommendations

Establishment of additional long term meadow condition and trend monitoring plots for Texas Flat Meadow and Progeny Meadow sites are recommended in order to assess meadow ecological status and trend and trend and also to determine the effectiveness of the channel restoration and conifer removal on these ecological factors.

### Cumulative Effects

Cumulative effects would be the same as alternative 2.

# Hydrology/Water Quality

## Affected Environment

### Watershed Summary

The majority of the Greys Mountain Project is located in the Willow Creek 5th-field HUC Watershed (Figure 19). The north fork of Willow Creek is the principal drainage in the project area and flows into Bass Lake, which is three miles south of the project area. NF Willow Creek tributaries with the SF Willow Creek approximately 6 miles downstream of Bass Lake, and the main stem of Willow Creek flows into the San Joaquin River approximately 0.5 miles downstream of Redinger Lake. The western edge of the project area is drained via Nelder Creek to the Fresno River. The main tributaries (i.e., 4th-order and higher streams) to NF Willow Creek within the project area include Chilkoot Creek and an unnamed perennial creek that originates from meadow 504M211 near Greys Mountain. Table 33 provides a summary of the affected drainages and associated water bodies in the project area (Figure 20).

There is a manmade diversion ditch (located near Soquel Meadow Ranch) called the Soquel "Siphon", that was installed in the early 1880's and was used to divert water from north fork of Willow Creek to the Willow Creek Mill and a flume that flowed to the California Mill #3 near Nichols meadow. After the historic mills in the area closed (probably around the turn of the century), the siphon was routed to an un-named 3rd-Order drainage network that eventually tributaries with California Creek. From California Creek, the diverted water makes its way into Nelder Creek, Lewis Fork, and eventually the Fresno River. The channels associated with the siphon have been severely down cut (in some cased by 30+ feet) and the impacts can been seen as far downstream as California Creek. Most of the down cutting occurred prior to 1950, and since then these systems have reached a somewhat more stable condition.

The MID secured the water right for the Soquel siphon diversion and is allowed to divert up to 50 cubic feet per second (cfs ) between July and October. The diverted water is used to irrigate agricultural lands in Madera County in the Central Valley of California. There is a U.S. Geological Survey (USGS) gauging station (11242350) located at the diversion with a period of record between 1969 and 1977. A 2011 survey of the siphon conduit (i.e., the connector between the historic siphon ditch and the un-named tributary feeding the Fresno River watershed) showed the cement conduit to be in poor condition; it should be repaired and cleaned before it is used again so streams in the vicinity are not damaged by leakage from the conduit.

**Table 33. Stream mile summaries for all 8th-field subdrainages potentially affected by project activities.**

| Main Stream System(s) | Watershed (5th-Field) | Subdrainages (8th-Field) | Stream miles | | | |
|---|---|---|---|---|---|---|
| | | | Perennial | Intermittent/Ephemeral | Ephemeral | Total |
| Fresno River | Fresno River (1804000701) | 503.0056<br>503.0057<br>503.3002<br>503.3051 | 37 | 100 | 225 | 362 |
| NF Willow Creek | Willow Creek (1804000611) | 504.0011<br>504.0012<br>504.0013<br>504.0014<br>504.0015<br>504.0059<br>504.0060<br>504.0061<br>504.3001<br>504.4051 | | | | |

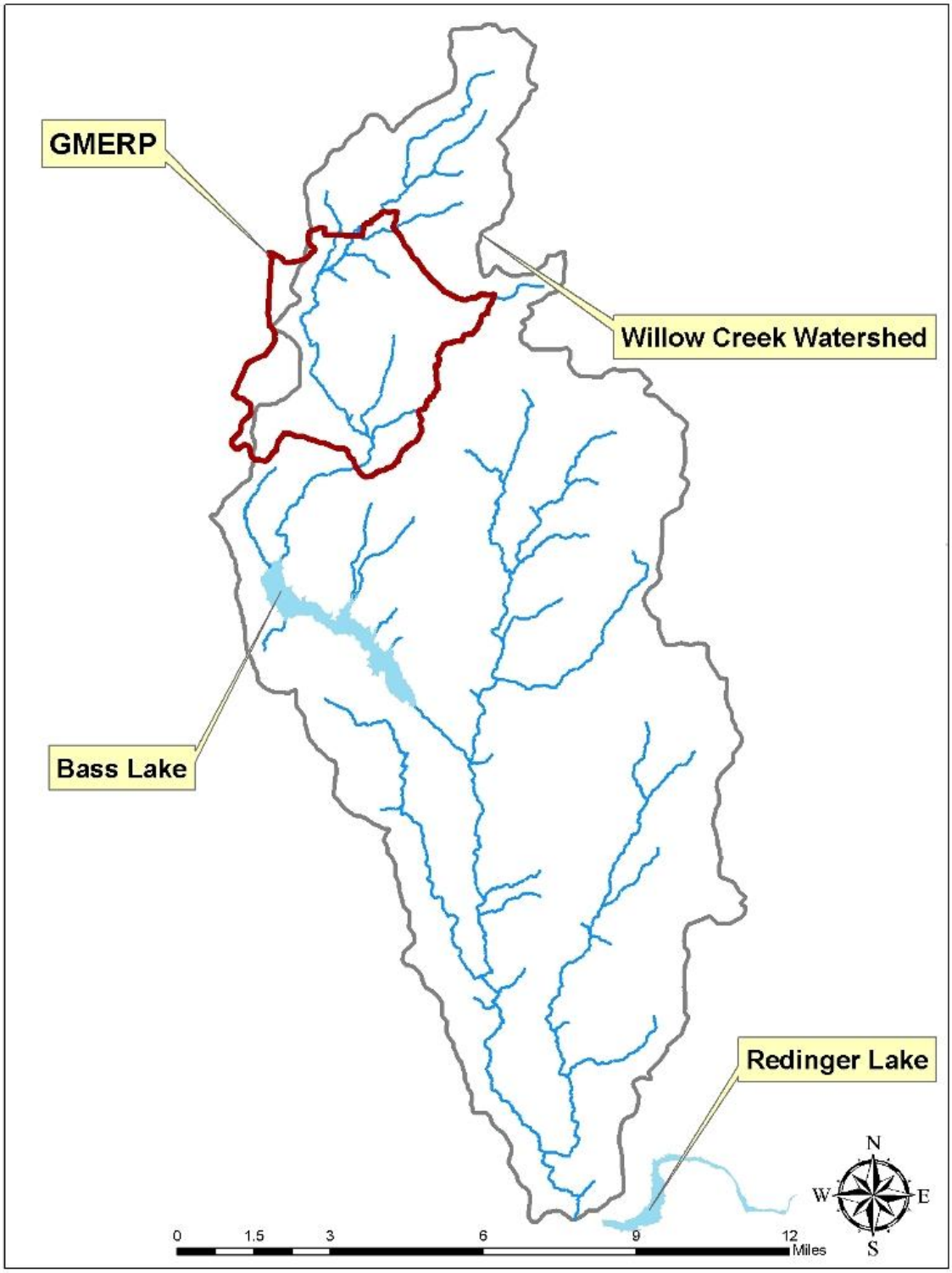



**Figure 19. Location of Greys Mountain Project in relation to the Willow Creek 5th-Field watershed.**

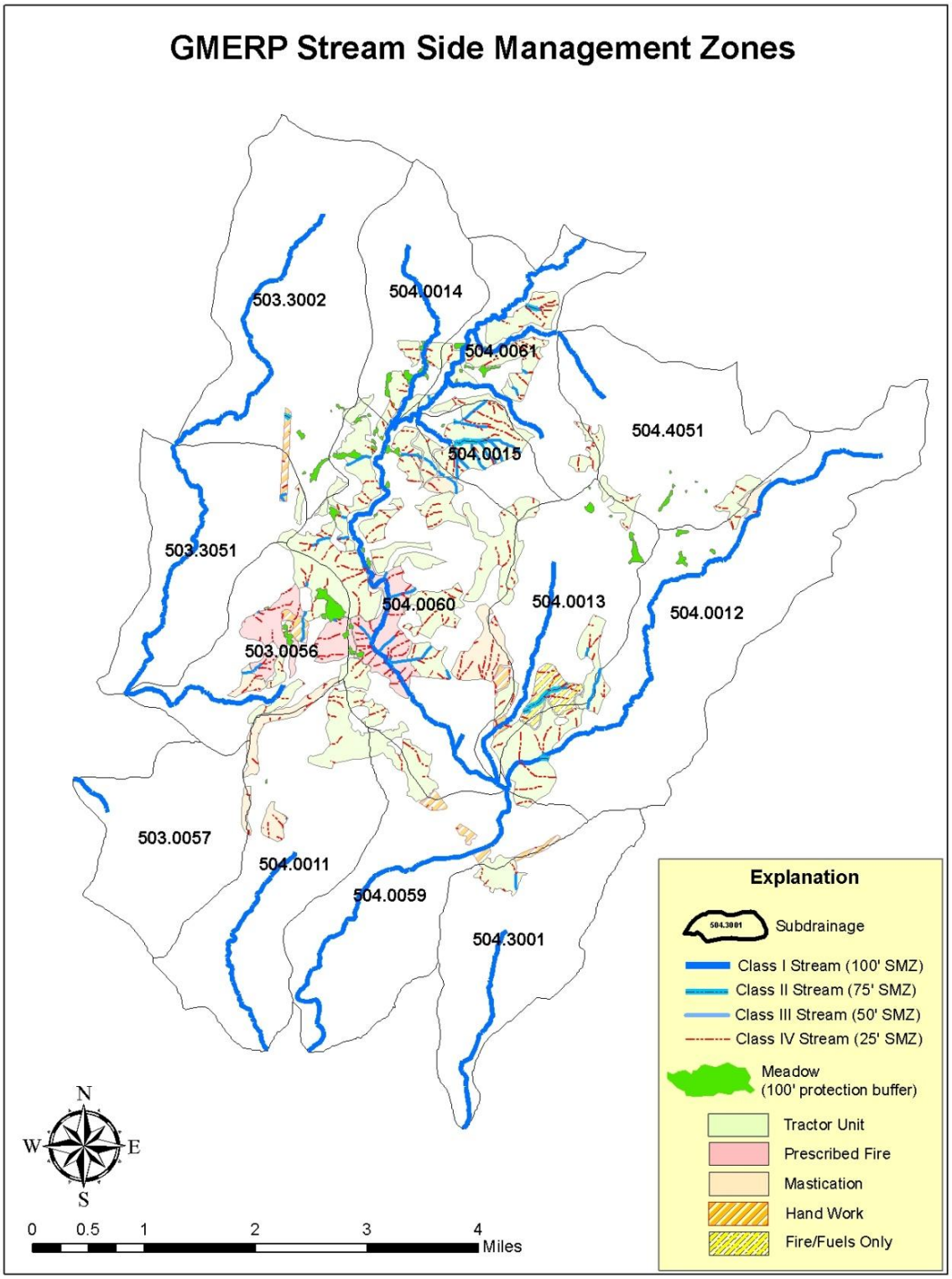



**Figure 20. Stream Side Management Zone (SMZ) and subdrainage map of the Greys Mountain Project Area. Color-coded lines represent different stream orders, which are offered a protection buffer based on designated class.**

## Climate Change: Future Predictions in Hydrology

Miller et al. (2003) modeled future hydrological changes in California as a function of two contrasting Global Climate Models (GCMs) (the same GCMs used in Hayhoe et al. [2004] and Lenihan et al. [2003; see below]) and a variety of scenarios intermediate to the GCMs. Miller et al. (2003) found that annual streamflow volumes were strongly dependent on the precipitation scenario, but changes in seasonal runoff were more complex. Predicted spring and summer runoff was lower in all of the California river basins they modeled, except where precipitation was greatly increased, in which case runoff was unchanged from today (Miller et al. 2003). Runoff in the winter and early spring was predicted to be higher under most of the climate scenarios because higher temperatures cause snow to melt earlier. Flood potential in California rivers that are fed principally by snowmelt (i.e., higher elevation streams) was predicted to increase under all scenarios of climate change, principally due to earlier dates of peak daily flows and the increase in the proportion of precipitation falling as rain. These increases in peak daily flows are predicted under all climate change scenarios, including those assuming reduced precipitation (Miller et al. 2003). The predicted increase in peak flow was most pronounced in higher elevation river basins, due to the greater reliance on snowmelt. If precipitation does increase, streamflow volumes during peak runoff could greatly increase. Under the wettest climate scenario modeled by Miller et al. (2003), by 2100 the volume of flow during the highest flow days could more than double in many Sierra Nevada rivers. This would result in a substantial increase in flood risk in flood-prone areas in the Central Valley. According to Miller et al. (2003), increased flood risk is a high probability outcome of the continuation of current climate change trends, because temperature, not precipitation, is the main driver of higher peak runoff. If climate change leads not only to an increase in average precipitation but also a shift to more extreme precipitation, then peak flows would be expected to increase even more.

Dettinger (et al., 2004) outlines import considerations and challenges facing land and resource managers in the Sierra Nevada. These include:

1. Climate model predictions are unanimous in calling for warming of at least a few degrees over the Sierra Nevada, and this warming may be increased over the range by orographic effects (that is, effects resulting from the presence of mountains).

2. Projections of future precipitation are much less consistent so that we do not yet know if the Sierra Nevada would be wetter or drier.

3. Even the modest climate changes projected by the GCM's (with a conservative value for warming and small precipitation changes) would probably be enough to change the rivers, landscape, and ecology of the Sierra Nevada, yielding: (1) substantial changes in extreme temperature episodes, for example, fewer frosts and more heat waves; (2) substantial reductions in spring snowpack (unless large increases in precipitation are experienced), earlier snowmelt, and more runoff in winter with less in spring and summer; (3) more winter flooding; and (4) drier summer soils (and vegetation) with more opportunities for wildfire.

4. GCM projections suggest that global warming at the accelerated pace that would characterize the 21st century is already about 30 years old; thus, changes in the recent past must also be considered in light of global change. For example, changes in stream flow timing are already known to be widespread across most of the Western states.

Climate change and shifting demographics influence the landscape and the social and economic systems of California and the Sierra Nevada. Climate change impacts are already evident, as seen in declining snowpacks, changes in runoff timing and intensity, increasing fire frequency and severity, increasing drought frequency and severity, and rising temperatures. Determining the changing relationships between climate, various ecosystem components, and social and economic system components is critical to identifying management's role in adapting to new climates and/or mitigating the effects of climate change. Past research and the majority of resource management approaches assumed an unchanging climate. Opportunities exist to explore the relationship of past climates with historical disturbances such as drought, insects and fire in the context of the novel future climates. The consequences of climate change are likely to be significant, but in light of current uncertainties about their nature, policies that promote flexibility and resilience seem most prudent.

Sustaining the health, diversity, and productivity of the Sierra Nevada would require adaptation and mitigation, as well as collaboration and cooperation across the organizational and geographic landscape. This can be best achieved through the adaptive management process, where elements under management control can be modified to mitigate impacts for those land use practices to better suit the evolution of the landscape in response to climate change; however, since there is no consensus on exactly how climate change would affect the Sierra Nevada, it will be crucial that annual hydrologic monitoring of the GMER project area be conducted to assess watershed condition and provide land managers with site-specific data in order to make informed decisions on management change as it relates to project activities.

## GMERP Road Survey

An inventory and hydrologic assessment of the project area road system and its impact to watershed function has been conducted for "maintenance level 2" (native surface) roads. Approximately 75 miles native surface roads were surveyed by a USFS Enterprise TEAM who evaluated and mapped road conditions and the degree of hydrologic connectivity and stream crossing bypass potential between the road network and the drainage network. Table 34 shows the key problem areas, identifies the problem and includes a suggested repair solution and Table 35 summarizes the general hydrologic connectivity problems by subdrainage and road. Road condition has also been noted while accessing areas for stream and subdrainage surveys. Most of the roads in the area are designated as "maintenance level 2", (native surface) roads, which require a high degree of maintenance, especially in steeper terrain and/or where the soils are more susceptible to erosion. Because of limited personnel and funding, the native surface roads in the project area have not been adequately maintained. Most of the roads are in moderate to very poor condition with drainage control in various states of disrepair or in need of relocation.

**Table 34. List of priority roads that area causing impacts to watershed function by hydrologic connectivity. AOP stands for Aquatic Organism Passage.**

| Road Number | Hydrologically Connected? | Length of Road (ft) Contributing Runoff/Sediment | Nature of Problem | Suggested Fix | UTM location of Problem Northing / Easting | |
|---|---|---|---|---|---|---|
| 05S095Y | Yes | 100+/- | Log(s) placed as cross-drain. | Remove log(s). Grade road, repair ditch, install culvert, 18 -24 in. dia. | 4145585.31 | 273281.53 |
| 06S002X | Yes | 200+/- | Partially plugged culvert. Eroding road bed. Possible flow under culvert. | Partially plugged culvert, clean culvert. | 4146073.10 | 274191.63 |
| 06S013 | Yes | 0 | Shot gun culvert, 10 ft. No AOP, fill bank erosion. | Change angle of culvert. Install OSD or slope drain with armoring. Grade / re-surface (steep) entire route. | 4140620.81 | 272227.16 |
| 06S013B | Yes | 1 acre +/- | Spring flowing down road and into plugged ditch. Entire area at end of route wet area. | Grade road, repair ditch, install cross-drain, 24 -36 in. dia. | 4137945.77 | 272204.63 |
| 06S013B | Yes | 0 | Flow under culvert. | Grade road, repair ditch, install culvert, 24 -36 in. dia. | 4138195.77 | 272051.49 |
| 06S013C | Yes | 250+/- | Failed rolling dip causing gully down road into stream channel. | Repair rolling dip(s). Install 24-36 in. dia. culvert. Re-surface over culvert. | 4137420.36 | 271504.88 |
| 06S036 | Yes | 250+/- | Spring flowing down road and into non-engineered OSD. | Grade road, repair ditch, install catch basin style cross-drain, 18 -24 in. dia. May need OSD too. Spring on cutbank. | 4144308.80 | 276216.29 |
| 06S036 | Yes | 250+/- | Spring flowing down road and into non-engineered OSD. Log(s) placed as cross-drain. | Remove log(s). Grade road, repair ditch, install catch basin style cross-drain, 18 -24 in. dia. May need OSD too. Spring on cutbank. | 4144309.38 | 276217.06 |
| 06S040 | Yes | 0 | Partially plugged culvert. Eroding road bed. Possible flow under culvert. | Repair ditch. Install catch basin style cross-drain, 18 -24 in. dia. | 4140335.07 | 274096.16 |
| 06S099A | Yes | 100 ft. +/- | Spring flowing down road and into non-engineered OSD. | Grade road, repair ditch, install catch basin style cross-drain, 18 -24 in. dia. May need OSD too. Spring on cutbank. | 4142936.26 | 275296.07 |

**Table 35. Points of hydrologic connectivity and stream crossings with high bypass potential. *A "Non-Functional Culvert" is one that has been identified as being ½ plugged to completely plugged or buried.**

| Subdrainage | Road | Drain Points Hydrologically Connected to Streams or Meadows | Stream Crossings with *Non-Functional Culverts |
|---|---|---|---|
| 503.0056 | 06S011 | 3 | 3 |
| | 06S013 | 6 | 0 |
| | 06S013Y | 4 | 0 |
| 503.0057 | 06S013F | 0 | 1 |
| | 06S013H | 2 | 1 |
| | 06S065 | 3 | 0 |
| 503.3002 | 06S011 | 0 | 1 |
| | 06S090 | 8 | 1 |
| 503.3051 | 06S011 | 3 | 7 |
| 504.0011 | 06S13B | 0 | 2 |
| | 06S13C | 2 | 0 |
| 504.0012 | 06S006 | 3 | 1 |
| | 06S018 | 4 | 1 |
| | 06S032 | 3 | 0 |
| | 06S040 | 1 | 0 |
| | 06S042 | 9 | 2 |
| 504.0013 | 06S040 | 1 | 2 |
| | 06S040X | 3 | 10 |
| | 06S099 | 0 | 6 |
| 504.0014 | 05S095 | 0 | 7 |
| | 05S095Y | 1 | 1 |
| | 06S002X | 0 | 2 |
| | 06S072 | 7 | 1 |
| | 06S072Y | 2 | 0 |
| 504.0015 | 06S008 | 0 | 3 |
| | 06S038 | 8 | 0 |
| | 06S099 | 0 | 3 |
| | 06S099A | 1 | 0 |
| 504.0060 | 06S008 | 1 | 2 |
| | 06S008B | 3 | 0 |
| | 06S011 | 0 | 3 |
| | 06S011C | 0 | 1 |
| | 06S011X | 2 | 1 |
| | 06S040 | 2 | 5 |
| | 06S040B | 4 | 0 |
| | 06S040D | 1 | 0 |
| | 06S040X | 1 | 1 |
| | 06S040XA | 1 | 2 |
| | 06S088 | 1 | 0 |
| | 06S099 | 0 | 2 |
| 504.0061 | 06S008 | 0 | 5 |
| | 06S036 | 1 | 0 |
| | 06S036A | 1 | 0 |
| | 06S038 | 7 | 4 |
| | 06S038C | 0 | 1 |
| | 06S072 | 2 | 0 |

| | | | |
|---|---|---|---|
| 504.4051 | 06S008 | 7 | 10 |
| | 06S010X | 1 | 0 |
| | 06S026X | 0 | 1 |
| | 06S036 | 12 | 0 |
| | 06S095 | 1 | 0 |

## Cumulative Watershed Effects

CWE are those effects resulting from the incremental impacts of the proposed action when added to past, present, and reasonably foreseeable future actions. Cumulative watershed effects can result from individually minor but collectively significant actions taking place over space and time. The objective of CWE analysis is to protect the identified beneficial uses of water from the combined effects of multiple management activities.

A CWE analysis was conducted following established protocol, consistent with Regional Methodology for CWE assessment described in Forest Service Handbook 2509.22. This method assumes that an acre of road represents the greatest (common) management disturbance, and normalizes all other activities to this standard, called Equivalent Roaded Acres (ERAs). Established coefficients are used to convert acres of other land disturbing activities into ERAs.

The "ERA %" is the percentage of the watershed that is impacted by roads or road-equivalent disturbance. ERA % is calculated by dividing the total ERA's by the watershed size (in acres). Watershed sensitivity is determined by evaluating various geological conditions (e.g., landslide potential, soil type, channel bifurcation ratio, etc.), which rates the watershed's Lower Threshold of Concern (or TOC %). For example, a 4% Lower TOC % is considered very sensitive to disturbance, 5% moderately sensitive, and 6% as having low sensitivity to disturbance. Thus, if the ERA % exceeds the Lower TOC %, then an IDT field evaluation is triggered to determine if a CWE response is occurring or could occur as a result of project activities. The upper limit for the TOC % is 14%. If a subdrainage has a total ERA % (with the Proposed Action and reasonably foreseeable future actions) equal to or greater than 14%, then ground disturbing activity (e.g., tractor logging) will be reduced, restricted, or modified, unless otherwise directed by the signing official.

Table 36 shows the CWE results for the Greys Mountain Project. Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%.

**Table 36. Calculated base ERA % and ERA % with the Proposed Action or Alternative 3.**

| Subdrainage | Subdrainage Acres | Lower %TOC | Allotment %ERA | Roads %ERA | Harvest %ERA | Total (Existing) Baseline ERA% | Proposed Action ERA% (Includes Tractor and Rx) | Total ERA% | CWE Potential |
|---|---|---|---|---|---|---|---|---|---|
| 503.0056 | 1,211 | 4 | 1.02 | 0.96 | 7.26 | 9.25 | 4.27 | 13.97 | Moderate to High |
| 503.0057 | 1,246 | 4 | 0.39 | 0.79 | 0.10 | 1.28 | 0.00 | 1.28 | Unlikely |
| 503.3002 | 2,472 | 5 | 0.62 | 0.99 | 1.94 | 3.55 | 0.11 | 3.66 | Unlikely |
| 503.3051 | 1,484 | 4 | 0.71 | 1.20 | 10.62 | 12.55 | 0.15 | 12.70 | Low |
| 504.0011 | 1,972 | 4 | 0.52 | 1.10 | 0.29 | 1.91 | 2.30 | 4.21 | Unlikely |
| 504.0012 | 3,033 | 5 | 0.66 | 1.05 | 0.60 | 2.32 | 0.44 | 2.76 | Unlikely |
| 504.0013 | 1,369 | 5 | 0.72 | 1.11 | 0.46 | 2.29 | 2.04 | 4.33 | Unlikely |
| 504.0014 | 1,078 | 5 | 1.02 | 1.57 | 1.34 | 3.93 | 1.31 | 5.24 | Unlikely |
| 504.0015 | 455 | 5 | 0.84 | 1.19 | 0.57 | 2.6 | 6.39 | 8.99 | Low |
| 504.0059 | 1,866 | 4 | 0.48 | 0.61 | 0.05 | 1.13 | 0.76 | 1.89 | Unlikely |
| 504.0060 | 2,737 | 4 | 0.64 | 1.43 | 1.45 | 3.52 | 7.27 | 10.79 | Low |
| 504.0061 | 1,262 | 5 | 0.88 | 1.37 | 1.14 | 3.39 | 3.91 | 7.30 | Low |
| 504.3001 | 1,496 | 4 | 0.61 | 0.51 | 0.68 | 1.81 | 0.88 | 2.69 | Unlikely |
| 504.4051 | 1,534 | 5 | 0.57 | 1.31 | 1.22 | 3.10 | 1.08 | 4.18 | Unlikely |

Post-harvest prescribed fire is proposed for many of the tractor units within the project area. Re-entry could occur any time after the logging operation is complete, but since it is difficult to predict when this might occur, a three year re-entry was estimated (i.e., 2015). As such, three years was used as a recovery factor for a CWE analysis of the post-harvest prescribed burn. Table 37 shows the CWE results.

**Table 37. CWE results for post harvest prescribed fire in 2015. The baseline ERA% is prorated (i.e., "recovered") for each year between actions. As a result, the baseline ERA% is somewhat reduced.**

| Subdrainage | Subdrainage Acres | Lower %TOC | Baseline ERA% | Proposed Rx ERA% | Total ERA% | CWE Potential |
|---|---|---|---|---|---|---|
| 503.0056 | 1,211 | 4 | 12.01 | 1.03 | 13.03 | Low to Medium |
| 503.0057 | 1,246 | 4 | 1.15 | 0 | 1.15 | Unlikely |
| 503.3002 | 2,472 | 5 | 3.29 | 0.04 | 3.33 | Unlikely |
| 503.3051 | 1,484 | 4 | 11.43 | 0.02 | 11.45 | Low |
| 504.0011 | 1,972 | 4 | 3.79 | 0.3 | 4.09 | Unlikely |
| 504.0012 | 3,033 | 5 | 2.48 | 0.36 | 2.84 | Unlikely |
| 504.0013 | 1,369 | 5 | 3.9 | 0.33 | 4.23 | Unlikely |
| 504.0014 | 1,078 | 5 | 4.71 | 0.06 | 4.77 | Unlikely |
| 504.0015 | 455 | 5 | 8.09 | 2.43 | 10.52 | Low |
| 504.0059 | 1,866 | 4 | 1.7 | 0.28 | 1.98 | Unlikely |
| 504.0060 | 2,737 | 4 | 9.71 | 1.34 | 11.05 | Low |
| 504.0061 | 1,262 | 5 | 6.57 | 0.68 | 7.25 | Low |
| 504.3001 | 1,496 | 4 | 2.42 | 0.11 | 2.53 | Unlikely |

| | | | | | | |
|---|---|---|---|---|---|---|
| 504.4051 | 1,534 | 5 | 3.76 | 0 | 3.76 | Unlikely |

Subdrainage 503.0056 still has a moderate to high potential for CWE response based on an ERA% of 13.03%. Actions may be necessary in this subdrainage post fire to ensure proper ground cover and erosion control. Design criteria have been developed to address this potential. See design criteria section of the document for more information.

## Summary of Conditions

Although there is evidence that past activities that have caused watershed degradation, overall the channels and subdrainages appear to be recovering and reaching a state of equilibrium. The current condition for most of the stream reaches is good or fair for channel stability using modified Pfankuch, after Rosgen (2004) and this has been corroborated with Stream Condition Inventory data. There are, however, several areas within the proposed project boundary that are unstable and sensitive to disturbance. Specifically, subdrainage 503.0056 has a very high potential for CWE response from project activities. As such, ground disturbance from mechanized equipment should be minimized in this subdrainage and harvest methodology should use a “light-on-the-land” approach

Maintenance level 2 (“native surface”) roads throughout the project area are in moderate to poor condition and are hydrologically connected to the watersheds in which they are constructed. Many of these roads lack adequate drainage and have partially to completely blocked culverts that would require replacement. Bringing system roads up to maintenance level 3 standards should address most of these watershed degradation issues, but additional measures (i.e., rocking) should be used in subdrainage 503.0056 to mitigate the very high potential for CWE response likely to occur as a result of the proposed action.

Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the proposed action, none exceeded the Upper TOC of 14%.

The main stem of Willow Creek has been listed on the State’s 303(d) list of impaired waters for temperature, source unknown. The establishment of a Total Maximum Daily Load (TMDL) is scheduled for 2019. It is important to note that, as of this writing, the North Fork of Willow Creek (and all other perennial drainages) in project are not included or proposed for the State’s 303(d) list of impaired waters.

# Environmental Consequences

## Alternative 1 - No Action Alternative

Lack of fuels treatments in the project area would result in a lost opportunity to reduce potential for uncharacteristic fire. This lost opportunity has the potential to affect not only the communities at risk; it also affects the riparian habitat and water quality in the project area. As described in the affected environment, riparian areas have large amounts of organic material throughout the drainages. This material is not lying on the forest floor; it is intermingled with standing material. In the event of a uncharacteristic wildfire, riparian habitat, channel characteristics and riparian vegetation would be adversely affected.

Under the no action alternative, no physical restoration or vegetation treatments would occur in the project meadows. Unstable areas within the meadows (such as gullies and headcuts) would continue to erode, decreasing water quality, compromising meadow riparian-aquatic habitat, and decreasing forage. Continued erosion and/or conifer encroachment could lower the ground water tables enough to cause an accelerated successional change from meadow to forest, which is outside the range of natural variability.

### Direct Effects and Indirect Effects

Effects of no action alternative would be continued increase of fuels and potential for uncharacteristic wildfire, continued degradation of unstable meadow systems, and continued watershed impacts from a highly degraded road network. There would be basin wide increases of fuels and potential for uncharacteristic wildfire and continued watershed and water quality impacts from a highly degraded road and unstable meadow systems.

### Cumulative Effects

Cumulative effects of no action would be displayed under the pre project condition of the CWE analysis (Table 36). Essentially the only watershed considered a candidate for CWE response is subdrainage 503.0056, which is 1,211 acres and is drained by an un-named tributary to Nelder Creek. Much of the water flowing through this subdrainage is sourced from a series of perennial springs near the Sivils Ranch. 28% of this watershed has proposed project activity including 148 acres of tractor logging, 113 acres of prescribed fire, 55 acres of mastication and 24 acres of hand thinning. An un-named stream (tributary to Nelder Creek) was inspected near the subdrainage outlet and was evaluated for CWE response potential by an IDT. Field observations showed that the channel is entrenched with approximately 1.0 - 1.5 meters of incision and terrace banks that are unstable in many locations. Sloughing of bank material and the “Jack-Strawing” of trees is common. The active channel within the entrenched area shows sign of equilibrium and a trend towards a more stable channel form, but the system is at present still unstable. Cursory depth measurements of fines in pools in relation to pool depth suggests an excess level of fines (>20%) is present and the channel has not achieved equilibrium subsequent to past disturbance. The presence of several large stumps on the bank and the age of the conifers in the stand suggest this area was widely cutover in the past, including the streamside management zone.The riparian zone is complex with multiple canopy layers and is well shaded. No SCI survey was conducted on this reach, but a Pfankuch survey classified and rated the channel as a G5 with a numeric score of 131 (i.e., a poor stability rating).

Baseline CWE (ERA %) for this subdrainage is high at 9.25%, which resulted from past timber harvest activity. With the no action alternative, no tractor related ground disturbance or

prescribed fire would occur, which, (given sufficient time), would allow the subdrainage to recover and stabilize.

## Alternative 2 - Proposed Action

**Table 38. Acres of activities proposed within project area subdrainages under Alternative 2 (approximate maximum acres generated by GIS).**

| Subdrainage | 503.0056 | 503.0057 | 503.3002 | 503.3051 | 504.0011 | 504.0012 | 504.0013 | 504.0014 | 504.0015 | 504.0059 | 504.0060 | 504.0061 | 504.3001 | 504.4051 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tractor** | 148 | 0 | 18 | 7 | 120 | 230 | 151 | 88 | 241 | 73 | 984 | 301 | 33 | 74 |
| **Rx Fire** | 216 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 230 | 0 | 0 | 0 |
| **Mastication** | 55 | 14 | 0 | 0 | 82 | 20 | 18 | 0 | 0 | 0 | 126 | 0 | 0 | 3 |
| **Hand Thin/Hand Rx** | 24 | 0 | 13 | 15 | 0 | 13 | 94 | 0 | 0 | 40 | 19 | 0 | 4 | 0 |
| **Subdrainage Acres** | 1211 | 1246 | 2472 | 1484 | 1972 | 3033 | 1369 | 1078 | 455 | 1866 | 2737 | 1262 | 1496 | 1534 |
| **%Subdrainage** | 28% | 1% | 1% | 1% | 10% | 9% | 19% | 8% | 53% | 6% | 50% | 24% | 2% | 5% |

Limited or no direct treatment would occur in SMZ's. In general, all vegetation and fuel treatments conducted in RCA's would focus on improving forest health, enhancing or maintaining hydrologic function and maintaining or enhancing the key attributes of riparian habitats. Attributes comprise cool, moist soil conditions; high water quality; retention of large snags and down logs in sufficient quantities to provide habitat and woody debris recruitment in stream channels; and retention of woody material to provide stability to riparian and aquatic habitats. Well-functioning channels have good riparian vegetation, good sediment transport, and stable streambanks. These characteristics work together to maintain channel function and stability.

A wide range of activity-specific BMP's (Appendix B) are designed to minimize detrimental soil disturbance, protect water quality, maintain physical stability, and hydrologic connectivity of riparian and aquatic habitats. There is little potential for the Proposed Action (Alternative 2) to adversely affect the geomorphic, hydrologic, or riparian characteristics and aquatic habitats in affected subdrainages because of the low-impact characteristics of the proposed stand treatments, the limitations that would be imposed on operations within RCA's and SMZ's, and the use of activity-specific BMP's (Appendix B). The proposed meadow restoration activity would reduce the amount of erosion and impacts on water quality for downstream beneficial use, and thus would be a proactive protective measure to watershed resources and forest health. The restoration and maintenance of project area stock drive trails, OHV routes, and systems roads would also improve watershed condition and move the watershed and its subdrainages toward desired condition.

The greatest potential for the proposed action (alternative 2) to affect the hydrologic connectivity of streams and aquatic habitat exists at stream crossings or in subdrainages that have the potential for a CWE response. To minimize the potential for project-related effects on hydrologic connectivity, existing crossings would be used whenever possible. In the event that it is necessary to construct a temporary crossing, the methods used for construction would be selected to avoid or minimize detrimental soil and vegetation disturbance and to maintain hydrologic connectivity between upstream and downstream features. All temporary crossings would be removed following the completion of project-related activities and would be treated as necessary to restore to pre-project conditions. Implementation of the activity-specific BMP's (Appendix B) would

further ensure that hydrologic connectivity in streams and special aquatic features are not adversely affected by the proposed action.

### Temporary Roads

Approximate 1500 feet of temporary road is proposed for construction in unit T-8. This T-unit is in subdrainage 504.0011, which has a low total ERA% (4.21%) and is unlikely to experience a CWE response from project activities. Construction of temporary roads would follow all Water Quality BMPs (BMP 2-22), and be closed and/or obliterated upon completion of project activities. As such, no direct, indirect or cumulative impacts are expected.

### Common to All Subdrainages

No new permanent system roads are proposed to be constructed as part of the Greys Mountain Project because there are sufficient numbers to provide the necessary access to each of the treatment units (except in unit T-8). The existing road system, however, is currently in poor condition and in need of maintenance. In their current state of disrepair, the roads in the project area are increasing hydrologic connectivity, contributing to increased sediment input and causing overall watershed degradation. As part of the Timber Sale contract, all the roads to be used for project activities will be brought up to a maintenance level 3 standard (BMP 2-22). This includes maintaining roads in a manner that provides for water quality protection by minimizing rutting, failures, sidecasting, and blockage of drainage facilities, all of which can cause erosion, sedimentation, and deteriorating watershed conditions. Roads needed for project activities would be brought to current engineering standards of alignment, drainage, and grade before use, and would be maintained through the life of the project. Roads would be inspected at least annually to determine what work, if any, is needed to keep ditches, culverts, and other drainage facilities functional and the road stable.

## Direct Effects

Direct effects are those occurring at the same time and place as the triggering action. The proposed action (Alternative 2) could directly affect aquatic resources, primarily as a result of vegetation removal, temporary road construction, slash piling, and prescribed fire immediately following treatment; such activities could lead to soil disturbance and its associated effects on aquatic habitats (e.g., accelerated erosion and sedimentation). Any soil displacement, compaction, or change in ground cover would cause a direct effect on watershed condition and aquatic habitat. Most treatment units have avoided crossing stream channels. The exception is Class V ephemeral draws. Fuels treatments have been laid out to utilize designated and/or existing crossings. Figure 20 displays SMZ's assigned to streams in the GMER project area. Stream courses are to be protected under Clause 6.5 of the Timber Sale Contract. Any additional streams identified during operations would receive protection appropriate for the stream and the treatment. As shown in Table 36 subdrainage 503.0056 is the only subdrainage with high CWE potential and therefore it is the only subdrainage that needs further discussion of potential effects.

### Subdrainage 503.0056

Subdrainage 503.0056 is 1,211 acres and is drained by an un-named tributary to Nelder Creek. Much of the water flowing through this subdrainage is sourced from a series of perennial springs near the Sivils Ranch. 28% of this watershed has proposed project activity including 148 acres of tractor logging, 216 acres of prescribed fire, 55 acres of mastication and 24 acres of hand thinning. An un-named stream (tributary to Nelder Creek) was inspected near the subdrainage outlet and was evaluated for CWE response potential by an IDT. Field observations showed that the channel is entrenched with approximately 1.0 - 1.5 meters of incision and terrace banks that are unstable in many locations. Sloughing of bank material and the "jack-strawing" of trees is

common. The active channel within the entrenched area shows sign of equilibrium and a trend towards a more stable channel form, but the system is a present still unstable. Cursory depth measurements of fines in pools in relation to pool depth suggests an excess level of fines (>20%) is present and the channel has not achieved equilibrium subsequent to past disturbance. The presence of several large stumps on the bank and the age of the conifers in the stand suggest this area was widely cutover in the past, including the streamside management zone.The riparian zone is complex with multiple canopy layers and is well shaded. No SCI survey was conducted on this reach, but a Pfankuch survey classified and rated the channel as a G5 with a numeric score of 131 (i.e., a poor stability rating).

Baseline CWE (ERA %) for this subdrainage is high at 9.25%, which resulted from past timber harvest activity. With the proposed action (i.e., tractor harvest and prescribed fire) the ERA% is 13.97%, which is high but still below the upper threshold of concern (14%), and, based on the current channel stability condition, the likelihood of a CWE response is considered moderate to high. A modified approach to traditional tractor logging may reduce the overall impact, which could include cut-to-length (CTL) harvesting, helicopter or cable logging; however, these methods or equipment may be unavailable or deemed cost-prohibitive.

Post-harvest prescribed fire is proposed for many of the tractor units within the project area. Re-entry could occur any time after the logging operation is complete, but since it is difficult to predict when this might occur, a three year re-entry was estimated (i.e., 2015) and used as a recovery factor for the CWE analysis. CWE response is low to unlikely for all subdrainages except 503.0056. Even with a three year recovery, the upper threshold of concern (14 percent) for 503.0056 is still being exceeded (15.83 percent). Thus, Subdrainage 503.0056 still has a moderate to high potential for CWE response. Additional mitigation measures may be necessary in this subdrainage post fire to ensure proper ground cover and erosion control. Please refer to the design measures section of the document for more information.

## Indirect Effects

Indirect effects are those that occur at a later time or at a distance from the triggering action. Indirect effects are expected to be minor. Conservation measures incorporated into the project would be implemented to control erosion and sedimentation. The implementation of BMP's (Appendix 1) would avoid or minimize potential increases in sediment loads to streams during project implementation such that prescribed fires are not expected to affect aquatic habitats. Over the longer term, potential adverse effects on water and soils from implementing the Proposed Action are expected to be minor, and substantially less than if an uncontrolled wildfire were to occur.

## Cumulative Effects

Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the Proposed Action, none exceeded the Upper TOC of 14%. A modified approach to traditional tractor logging in T-Units 7 and 16 may reduce the overall CWE impact. Moreover, addressing the hydrologic connectivity and stream bypass problems identified in the system roads survey (Table 36) would also move the subdrainage to a more stable condition.

Post-harvest prescribed fire is proposed for many of the tractor units within the project area. Re-entry could occur any time after the logging operation is complete, but since it is difficult to

predict when this might occur, a three year re-entry was estimated (i.e., 2015) and used as a recovery factor for the CWE analysis. CWE response is low to unlikely for all subdrainages except 503.0056. Even with a three year recovery, subdrainage 503.0056 is still somewhat high at (13.03%) but well below the upper threshold of concern of 14%. Additional mitigation measures may be necessary in this subdrainage post fire to ensure proper ground cover and erosion control. Please refer to the design measures section of the document for more information.

## Alternative 3 – Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

### Direct Effects

The direct effects would be less than those described under Alternative 2, in that there would be less impact because the thinning methodology would only concentrate on ladder and surface fuels within the lower and mid-canopy levels, and not include commercial thinning.

### Indirect Effects

Indirect effects of Alternative 3 are expected to be similar to Alternative 2 as the actions are similar related to actions that affect hydrologic resources.

### Cumulative Effects

Subdrainages over their lower TOC% have been inspected for CWE response potential in the field by an IDT or surveyed using various methods (e.g., SCI, Pfankuch). All of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The baseline or existing condition of most of the subdrainages is below the Lower TOC %, but subdrainages 503.0056 and 503.3051 are over their Lower TOC %. When adding in the Proposed Action, none exceeded the Upper TOC of 14%. A modified approach to traditional tractor logging in T-Units 7, 16, may reduce the overall CWE impact. Treatment methods could include cut-to-length (CTL) harvesting, helicopter or cable logging, however these methods or equipment may be unavailable or deemed cost-prohibitive.

# Riparian Conservation Objectives Consistency Analysis

A consistency review of the applicable Riparian Conservation Objective (RCO) S&Gs was conducted to ensure that project activities adhered to the 2004 SNFPA.. There may be an increase in hydrologic connectivity and watershed impact from roads under Alternative 1 (No Action), which would not be consistent with RCO S&G 100 and 101. RCO S&G 105 is not consistent under Alternative 1, and would leave conifer encroached meadows untreated, which is beyond the range of natural variability and desired condition. RCO S&G 111 would not be consistent under Alterative 1, and increase the risk of catastrophic wildfire in riparian areas. All other applicable RCO S&Gs are consistent with all alternatives. The complete RCO consistency analysis is available in the project file. Stone A, 11/2011

# Forest Vegetation/Silviculture

## Affected Environment

The Greys Mountain Project area has a history of past heavy logging activities. Between 1881 and 1892 a mill in the Soquel area operated by the Madera Flume and Trading Company harvested timber within the project area. A flume carried processed lumber through portions of the project area. In 1899, the Madera Sugar Pine Co. acquired the assets of the Madera Flume and Trading Company. Around 1926-1927 heavy railroad logging was carried out by the Madera Sugar Pine Co. through a sizeable portion of the project area. Logs from railroad logged stands were transported to the mill at Sugar Pine over its 140 miles of track. The mill operated for 32 years averaging a 40 million board foot cut each year. Seven locomotives and 100 log hauling cars were in use during its peak. In 1900, when the Madera Sugar Pine Co. first began logging, it owned 21,616 acres of timberland in Madera and Mariposa Counties including land near Wawona, now a part of Yosemite National Park. In subsequent years it purchased additional timberlands as well as Forest Service timber. A significant proportion of the lands within the project area were private timber holdings at the time they were railroad logged. (Johnson, 1974)

During the railroad logging at the beginning of the last century, logs were yarded by a system of cable settings. Deep gouging occurred in a number of places where logs dug into the soil as they were yarded to landings. As logs approached landings, more soil was generally displaced. In many cases, this reduced soil depths to almost bare rock. Settings can often be distinguished by a lack of conifer reproduction and an abundance of brush still today. However, between cableways, existing reproduction was often protected from damage. Logging slash was not treated following harvest. Today, much of this early reproduction remains as stands of generally 90 to 110 year old 6 to 24 inch dbh white fir, incense cedar, sugar pine, and ponderosa/Jeffrey pine. Scattered larger diameter trees left during the railroad logging days can be found through portions of these stands.

During the 1960s, a significant effort was made throughout California to reforest previously forested areas that were understocked. As a part of this effort to reforest understocked areas, several ponderosa/Jeffrey pine plantations were created within the project area towards the end of this time period. Between the 1960s era plantations and those created in the late 1980s to early 1990s, approximately 1450 acres of plantations are present within the project area.

In 1980, an approximately 24 acre forest genetics pine plantation was established within the project area. Genetically superior ponderosa pine trees representing elevations from 4300 to 5600 feet and several different seed zones were planted at varying spacings. Several light precommercial thinning treatments have since taken place within this plantation over the course of this study.

In order to accelerate the development of key habitat and old forest characteristics and reduce the risk of loss to wildland fire (SNFPA ROD (USDA-FS 2004b, p.49), precommercial thinning and release treatments have begun to be undertaken within certain plantations within the Greys Mountain project area. A 275 acre thinning and release mastication contract was awarded this past fall to treat a number of 20 to 25 year old plantations. An additional 400 acres of 20 to 40 year old plantations are planned to be thinned and released by mastication over the next several years.

Although pockets of older trees can be found scattered through the proposed project area, past railroad and other logging have resulted in little of the area being vegetated with trees older than 130 years. The natural stands proposed for thinning within the project area generally consist of

approximately 90 to 110 year old trees that were young, shade tolerant saplings growing beneath the overstory trees during the railroad logging era. The majority of wild stands are presently considered to be mixed conifer types. These stands, once heavy to more fire resistant, shade intolerant, ponderosa and sugar pine, have become very heavy to less fire and drought resistant fir and incense cedar. Plot data indicates that in many areas white fir and incense cedar comprise 40 to 80 percent of the basal area sampled. Mixed conifer aggregations and stands occupy areas near cooler, damper, draws and at the mid elevations within the project area. White and red fir stands are present at the higher reaches of the project area. Pine, mixed conifer and white fir stand basal area stocking varies from 120 ft2 per acre in more open areas to oak pockets to densely stocked pockets of 350-400 ft2 per acre or more. Conifer canopy cover varies substantially across the project area. Conifer canopy cover ranges from quite dense (80-100%) in overstocked areas to clumpy dense patches in less uniformly stocked areas to more moderate (50-70%) to fairly light in other locations. Brushfields, mainly the result of early logging, are found within the project area. Low site, rock outcrops, and past harvest activities have all contributed to stand heterogeneity present today.

Exclusion of fire from the vast majority of the area has resulted in the development of multi-layered stands. The understory layers consist of shade tolerant fir and incense cedar beneath young growth stands of incense cedar, white fir, sugar pine and ponderosa/Jeffrey pine with, in some cases, an additional layer of brush beneath or adjacent.

Climactic shifts tree ring studies have established that compared to the previous two centuries weather during the 20$^{th}$ Century was relatively moist without the decades-long droughts that occurred earlier (Ferrell, 1996). Beginning in the 1970's temperatures began to warm noticeably. This warming resulted in a greater fraction of the Sierra Nevada precipitation falling as rain rather than snow, earlier snowmelt and earlier streamflow peaks (van Mantgem, 2009)(Knowles, et al, 2006)(Stewart, et al, 2005). This shift appears to be the result from still longer term climate shifts (Knowles, et al, 2006). The combination of reduced stand vigor and excessive stocking combined with increasing temperatures and decreasing soil moisture availability is greatly increasing the threat of loss due to mortality from insect attack, diseases, competition, or fire (SNFPA 2004 ROD).

The wetter than normal 20$^{th}$ Century coupled with the exclusion of fire has set the stage for stands to become overcrowded with competing conifers, oaks and other vegetation. Wide swings in climatic conditions over the past thirty years have placed stress on many of these stands. Inter tree competition, drought, rising temperatures, and insect attacks are beginning to take a toll on both plantation and wild stand trees. White pine blister rust has also been killing a number of sugar pine over the past ten to fifteen years. Dead and down fuel loadings have been on the rise. These conditions are not unique to the project area. More extreme examples can be found in the Lake Tahoe Basin, San Bernardino National Forest and in Arizona and New Mexico where entire stands of trees are dying. In southern California the amount of ponderosa pine mortality associated with western pine beetle, D. brevicomis Le Conte, infestations reached unprecedented levels after years of extended drought (Fettig, 2007).

Recurrent droughts are characteristic of the Sierra Nevada climate. Summers are usually hot and dry, with the bulk of the precipitation occurring in winter, much of it as snow. But in addition to the dry summers, there have been droughts of one or more years' duration in every decade of this century. Increased mortality usually occurs first at the lower and middle elevations on both western and eastern slopes of the range and spreads to the upper elevations only if the drought is protracted. During droughts, lack of spring precipitation has a particularly large influence, not only by increasing the susceptibility of the trees, as indicated by their rates of growth and beetle-caused mortality, but also probably aiding dispersal of and host selection by the flying beetles. In the ponderosa pine type because of the relatively low elevation, water availability, not temperature, is the strongest factor limiting forest growth (Ferrell, 1996).

As stated previously, beginning in the 1970s temperatures began to warm noticeably. Seasonal snowmelt and streamflow is projected to occur a month earlier during the current century. By the end of the 21st Century, 30 percent less water is anticipated to arrive in reservoirs between April and July. Soil moistures would dry out earlier and by summer be more severely depleted. Substantial changes in extreme temperature episodes (fewer frosts, more heat waves) are anticipated (Dettinger, 2004). "Climate changes and, in particular, temperature, are playing a dominant role, as moderate temperature changes mostly affect mid elevation snowmelt-dominated basins most susceptible to melting" (Stewart, et al, 2005). Over the past 17 to 29 years noncatastrophic mortality rates were found to have doubled over a series of 76 western forest plots which sampled undisturbed, 200 year and older stands. Increasing mortality rates could result in substantial changes in forest structure, composition, and function. A persistent doubling of background mortality would cause a >50% reduction in average tree age in a forest, and a potential reduction in average tree size (van Mantgem, 2009). Current projections of warming climates provide a greater opportunity for fire ignitions due to longer fire seasons. A higher probability of fire starts coupled with the changes in forest fuel conditions that occurred over the past century lead many to predict that large, generally more intense fires would become more likely than occurred historically (Skinner and Stephens, 2004).

## Desired Condition

The SNF-LRMP as amended by the SNFPA, 2004 (SNFPA ROD, 2004) addressed the desired condition, management intent and management objectives for individual land allocations. These were brought forward in the Fresno River Landscape Analysis (July 2005) written for the area immediately north of the project area.

The project boundary encompasses many different land allocations, some with specific desired conditions, i.e. spotted owl/goshawk/pacific fisher habitat and some with generalized desired conditions. In effect, all center on the need to restore both the structure and processes of old forest habitat ecosystems as a long-term strategy and with short-term goals of reducing the adverse effect of wildfire and reducing stand susceptibility to insects/pathogens, competition and drought-related tree mortality through density management.

## Density Management Measures

### Basal Area Stocking Levels

"Normal" basal area stocking is considered to be that level at which mortality begins as additional growth takes place. Normal is generally described as basal area per acre and is the maximum amount of vegetation an acre can adequately sustain over time. For a short period of time, basal areas in excess of "normal" can be maintained in some areas. A normal stand—or fully stocked stand—is a stand that, so far as any practical consideration is involved, utilizes its site completely. Maximum stocking is not implied; it practically never exists over a continuous area of more than a few acres (Meyer, 1938). These "normal" stocking levels were calculated during the abnormally wet 20th Century and are most likely too dense to be maintained during the drier periods that are more likely the norm. Fairly recent studies have indicated that the exclusion of fire may have also resulted in normal basal area densities in excess of what would have been found during previous centuries.

Four different species specific yield tables, still used today, are being used to determine normal stocking within the project area:

- Yield of Even-aged Stands of Ponderosa Pine, Technical Bulletin No 630, Meyer, 1938 (Slightly Revised 1961).

- Preliminary Yield Table for Second-growth Stands in the California Pine Region, Technical Bulletin 354, Dunning and Reineke, 1933 (Mixed Conifer).
- Yield, Stand, and Volume Tables for White Fir in the California Pine Region, Bulletin 407, Schumacher, 1926.
- Growth Models for Ponderosa Pine: I. Yield of unthinned plantations in northern California, Research Paper, PSW-133, Oliver and Powers, 1978.

As stands approach 80 to 90 percent of normal stocking, growth rates begin to decline significantly, stand vigor begins to suffer, and susceptibility to insect and disease attacks and drought stress increases. To reduce growth losses, maintain more viable stands, and retain canopy covers less susceptible to crown fires, this project would thin stands to stocking levels that with growth would result in reaching 80 percent of normal in 15 to 20 years when the next thinning entry would need to take place. Utilizing basal area to describe desired stocking automatically takes into account varying diameters of trees within stands. For a given basal area, more trees per acre are retained in the residual stand in areas with smaller diameter trees than in areas of larger trees. The silvicultural prescriptions for ponderosa pine, mixed conifer and fir would be described utilizing basal area per acre.

The desired condition for stocking levels and the measure used for comparison of alternatives is:

- Average basal area in pine, mixed conifer, and white fir grouped by lightly and heavily stocked aggregations
- Average potential basal area growth
- Basal area following thinning—ponderosa pine—150 ft2 per acre (50% normal)
- Basal area following thinning—mixed conifer—210 ft2 per acre (60% normal)
- Basal area following thinning—white fir—240 ft2 per acre (60% normal)

## Stand Density Index

Another approach to stocking density management is Stand Density Index (SDI). This method compares stocking density to the maximum number of stems found by species which is substantially greater than that utilized for normal yield. Mortality studies completed in pine stands have been described using this density management approach rather than normal yield tables. Since SDI was used as a frame of reference for ponderosa pine in these studies, it would be used along with basal area to describe the silvicultural prescriptions for pine stands. SDI studies (Long, 2005) have determined that the onset of competition between trees begins when stands reach a SDI 100. Long's study suggests that at a SDI 150 the lower limit of full site occupancy begins. Oliver (1995) suggests that beetle kills from endemic populations can begin when stands reach a SDI 230—approximately 150 $ft^2$ basal area/acre. He defines a SDI 230 as the threshold for a zone of imminent bark beetle mortality within which endemic populations kill few trees but net growth is still positive. As pine stands approach a SDI 365 (approximately 240 $ft^2$ basal area/acre), Oliver states that stands usually suffer large losses from bark beetle epidemics—losses that equal or exceed periodic growth. Oliver defines this as the limiting SDI for ponderosa pine as defined by Dendroctonus bark beetles.

Studies have shown that the vigor of trees in a stand is related to their ability to quickly respond to thinning and their susceptibility to various pests (Larsson, 1983). A live crown ratio of at least 40 percent has been cited for a number of conifers as representing a generally acceptable level of individual tree vigor. "Reducing beetle-caused mortality is an important benefit from thinning, but thinning must be heavy enough to keep stand density below a certain critical threshold" (Cochran, 1999). Susceptibility to excessive tree mortality from bark beetles can be lessened by reducing stand density below 150 $ft^2$ per acre in basal area (Sartwell, 1976) (Oliver, 1995).

Larsson, 1983, states: "a basal area below 34 $m^2$/ha (150 $ft^2$/acre) provided most trees with a vigor level at which they could withstand at least moderate (insect) attack." Cochran's 1999 study states that the critical upper threshold density increases with site quality and is estimated to range from SDI 238 to SDI 270. To ensure prompt response to thinning, maintain crown ratios above 40 percent and minimize mortality, pine stands should be maintained between SDI 230-SDI 270 (approximately 150 $ft^2$-180 $ft^2$ per acre).

For this proposed project, forested stands would meet stocking (as measured by percent of "normal" for the given site) and the associated density levels (as measured by basal area for a given site) that would maintain or improve growth rates, would increase resistance to mortality agents (insects/pathogens/fire/drought) and would provide the potential to begin the perpetuation of both the structure and processes of old forest habitat ecosystems. This desired condition incorporates both short and long-term goals, but is focused on the need for continued maintenance of stands that are healthy and sustainable.

The desired condition for SDI and the measure used for comparison of alternatives is:

- SDI—ponderosa pine SDI 230 (approximately150 $ft^2$/acre)

## Methodology for Analysis

In determining the existing condition and analyzing the effects of the alternatives associated with the project, many sources of information were utilized. These included aerial photography interpretation, field verification of stand conditions, sample and cruise plot data validation, evaluation and summarization, (CWHR) site-specific vegetation type correction and verification, and experience in the implementation of similarly designed past projects. Scientific and research documentation was utilized to evaluate the potential effects of all alternatives and in determining the measures to be evaluated for meeting the purpose and need with regards to density management to sustain forest health.

The SNFPA 2004 describes the use of thinning from below as the primary silvicultural prescription to utilize in managing stand densities to provide resiliency and sustainability during drought conditions and climate variations. (SDI) and basal area ($ft^2$/acre) are used as common measures in determining the effects of management actions on coniferous stands. For retention of maximum growth and vigor, thinning entries should be timed to occur before growth rates in potential leave trees begin to slow. At this point, leave trees are still retaining substantial crown ratios and have the greatest potential for maximum growth. Thinning should be undertaken before crown ratios drop below 40 percent (Emmingham, 1983) (Long, 1985). As competition between trees increases, crown vigor decreases. A stand's ability to respond to thinning progressively declines the longer it remains in competition. Some stands proposed for treatment are currently at this maximum potential response level while others are beginning to decline and should have already been treated.

For this project, stand density (number of stems per acre) as well as basal area ($ft^2$/acre) are used to determine which stands/aggregations are considered overcrowded and in need of thinning (treatment area designation), at what stocking level the stand/aggregation needs to be (desired condition), the silvicultural prescription for each alternative and the associated short (immediate) and long-term (length of effectiveness of treatment) effects of design criteria (specifically those associated with old forest habitat dependent species), and the effects the S&Gs and land allocations have on meeting the purpose and need for forest health. A combination of SDI along with basal area ($ft^2$/acre) would be used for ponderosa and Jeffrey pine stands/aggregations while basal area per acre would be used to describe treatments for mixed conifer and fir stands/aggregations.

# Alternative 1 – No Action

## Direct Effects

With this alternative, no commercial or precommercial thinning would be accomplished. Understory incense cedar, white fir and brush cover would continue to increase in size and density. Fuel ladders and competition between trees would increase. Growth rates and vigor would continue to decline as stands, or portions of stands, continue to approach or exceed normal stocking. Plantations would become highly susceptible to insect and drought induced mortality. Shade intolerant pine and oaks would become less vigorous and continue to drop out of the stands. Understocked plantations would not be replanted.

## Indirect/Cumulative Effects

The indirect and cumulative effects on vegetation resulting from vegetation management are generally the result of the vegetation management that occurs within the stand/aggregation or sometimes the vicinity of the area under consideration. For the Silvicultural aspects of the Greys Mountain project, the Greys Mountain project boundary will be used to display indirect/cumulative for all alternatives. Wide swings in climatic conditions as has been experienced over the past thirty years would continue to place increased stress on these untreated stands. Mixed conifer and fir aggregations and stands with stocking levels approaching or exceeding normal would become increasingly susceptible to mortality especially in periods of below normal rainfall and increased temperatures. Excessive stand/aggregation densities in ponderosa pine stands would result in the likelihood of heavy mortality. Drought and insect induced mortality would escalate. Snags and jack-strawed down material would increase. Basal area tree growth of only 15 to 20 $ft^2$ per acre would occur over a 15 to 20 year period (if excessive mortality does not occur) in more densely stocked aggregations. Forest health in the area would decline and elevate the risk of loss due to wildfire. Not only would the potential for loss of these stands to insect attack and drought increase, but their ability to respond to future thinning would continue to decline as crown vigor deteriorated as treatment was postponed. As forest health declines, the likelihood of increased insect attack in these stands spreading onto adjacent private property would increase. Experience has shown that no action is not without consequence (Fettig, 2007). Doing nothing would result in forests that continue to deteriorate over time because wildfire today no longer operates in its historical fashion, that of frequent low-intensity surface fires (Fitzgerald, 2005).

Fuel continuity would not be broken up. Brushfields and over stocked precommercial size conifer pockets would not be treated. The threat of fire moving into or out of population centers within the WUI would increase, not decrease. The threat of loss of wildlife habitat designated as PACs, HRCAs and fisher conservation areas would increase. Agee, 2005, concludes in his report that the “no action” alternative is not a risk-free option, as dry climates regularly predispose forests to burn in a typical dry summer. He further states that the impacts of “ no action ” in dry forest ecosystems must recognize the likelihood of stand-replacing, intense fire where stand density has increased and dead fuel accumulated in excess of historical levels. Over the past 100 years a number of stand replacing fires have occurred within 10 air miles of the project area. Fires occurring in 1910, 1923, 1943, 1959, 2001, and the largest, the 43,000 acre Harlow Fire, in 1961 all required significant funding to reforest portions of the burned landscape. To obtain sufficient natural regeneration to reforest an area following a fire, an adequate number of relatively evenly distributed seed trees must be present. An adequate number of seed trees per acre often do not survive a stand replacing fire. If seed trees are not present, then planting will be required to return the landscape to its previously forested state. These plantations tend to be heavy to pine due to poor survival of other planted species in these large open sites. Costs required to adequately reforest an area often exceed $1000 per acre.

Lack of density management would result in an increased likelihood of mortality in these stands. Mortality would occur over a range of diameters. The need for additional roadside hazard tree sales to minimize risks to the public would increase.

Under all three alternatives, certain actions undertaken on nearby private property could have detrimental effects on the surrounding forest vegetation. Thinning of pines at the wrong time of year, trenching and land leveling during construction projects, piling of green pine slash as well as other vegetation disturbance could all adversely affect the surrounding vegetation. Activities such as these have resulted in significant conifer mortality in the past. Piling of green pine slash as well as cutting and leaving green pine logs on the ground during winter months has resulted in bark beetle attacks in the surrounding stands. Trenching and land leveling that disturbs roots of adjacent trees often results in increased stress and reduced vigor resulting in eventual mortality of these damaged trees and many times insect infestations that spread into the adjoining stand.

## Alternative 2 – Proposed Action

Under Alternative 2, the development of Strategically Placed Area Treatments (SPLAT's) would occur. Additional areas would be treated to provide a defensible fuels profile near key transportation corridors. In addition to those treatments needed to meet fire and fuels objectives, treatments would be undertaken to reduce stand densities (basal area and/or precommercially thin) to a level that maintains or improves the growth and vigor of remaining trees. Treatments included in this alternative are: thinning from below in conifer stands (either precommercially or commercially), and/or masticating excess vegetation (conifers and brush) to reduce lower, mid-level (suppressed, intermediates and codominants) canopy stand densities; masticating brush and shrub patches; prescribed burning, both understory and piles; manually reducing noxious weed infestations; and site preparing, planting and subsequently hand releasing openings.
As part of the proposed action, design measures common to all alternatives have been incorporated and are part of the proposed action. As such, analysis of the direct, indirect and cumulative effects of the action alternative addresses not only the proposed action, but the effects of these design measures as they relate to vegetation and silvicultural management in the project area.

### Direct Effects

Commercial thinning needs to be undertaken in portions of the approximately 90-110 year old young growth stands to reduce competition and provide room for crown expansion by removing the more poorly growing trees, excess trees, and fuel ladders from these stands before competition results in much additional reduction in growth or competition, insect, disease, drought or fire related mortality increases.

Studies have shown that active management through thinning is critical to maintaining healthy trees that are less susceptible to mountain pine beetle attack**.** A 1998 study assessed the effects of thinning from below (alone and in combination with prescribed burning) on tree growth, leaf physiology and several environmental factors in ponderosa pine on the Gus Pearson Natural Area in Arizona. Soil water content was greater in thinned treatments than in the unthinned control. Similar findings have been reported in northern Arizona and western Montana, and can be attributed to increased water availability resulting from decreased tree competition. Trees in thinned treatments had greater foliar nitrogen content, needle toughness and basal area increment. The results suggest that restoration treatments improved tree vigor, growth and decreased the likelihood of bark beetle attacks on individual trees. A similar study compared measures of tree susceptibility to bark beetle attack in thinned ponderosa pine plots in northern Arizona. Phloem thickness significantly increased with decreasing stand density. Duration of resin flow and 24 hr resin flow were significantly higher in thinned plots. Increases in these variables suggest

improved host vigor and reduced likelihood of bark beetle attack. An increase in predawn xylem water potential, net photosynthetic rate, foliar nitrogen concentration and bud and needle size resulting in increasing foliar growth and uptake of water and nutrients was reported in similar stands. It has been noted that phloem thickness and basal area increment were lower in unmanaged stands than in managed. Studies have shown that thinning significantly reduced the amount of ponderosa pine mortality caused by mountain pine beetle in northeastern California (Fettig, 2007) (Egan, 2010). The largest increase in photosynthetic rate and predawn water potential increases due to thinning was found to be during periods of drought (Feeney, 1998). Several studies have shown that thinning from below not only reduces ladder fuels and the risk of torching, but by reducing stand density tree vigor is improved and risk to bark beetle attack reduced (Fitzgerald, 2005). By reducing competition through thinning, mistletoe infected residual trees would experience increased height growth thus slowing the upwards spread of mistletoe into tree crowns (Ferrell, 1996). By increasing tree vigor, diseased trees would be better able to withstand the effects of drought or insect attack.

Cochran and Barrett (1995) concluded that mortality in high (ponderosa pine) stand densities may be severe and individual tree sizes would be lower than in stands managed at lower densities. They stated: "thinning from below to low densities would speed up the development of large trees in second growth stands." They further stated that "once stands reach commercial size, thinning to maintain low stand densities would be necessary to reduce the probability of serious problems with mountain pine beetles and perhaps western pine beetles (Dendroctonus brevicomis Le Conte)." In a follow-up paper, Cochran and Barrett (1999) concluded that mechanical thinning would result in greater stand and individual tree growth than would occur through bark beetle mortality that resulted in the same overall stand density. The conclusions stated that density management (in second-growth ponderosa pine stands) "is necessary to speed development of mid and late seral size and density conditions." They further concluded that a SDI 240 should be the upper management zone on a high site and "should lower the probability of serious mortality from mountain and perhaps western pine beetles." Their study also noted that ponderosa pine responds well to increased growing space even at advance ages and should continue to grow well until stands are very old.

Oliver (1995) found that Sartwell's threshold of 150 $ft^2$ basal area/acre above which density stands are susceptible to attack by bark beetles appears to be a reasonable average value for California. The Larsson, et al (1983) study stated that stocking at 150 ft2 BA/acre "provided most trees with a vigor level at which they could withstand at least moderate attack. Maintaining stands at still lower stocking levels, as recommended for intensive management by Barrett (1979), can ensure a greater margin of safety." The Larsson study further concluded that "the susceptibility of ponderosa pine stand forests to damage from mountain pine beetle is closely related to tree vigor, which has been demonstrated to respond to stocking control."

This entry would commercially thin wild stands on slopes generally less than 35% outside of PACs, and OFLs to stocking levels that, with current growth, would result in returning stands to 80 percent of normal basal area stocking 15 to 20 years following harvesting. Maintaining a stocking level that remains at 80 percent or less of full (normal) stocking would ensure a healthy rate of growth while retaining a level of stocking that would be better able to survive the lower levels of yearly precipitation that were common prior to the past century. Black oaks would be retained in treated stands longer by reducing competition and overtopping by nearby conifers. Treated stands would also be less susceptible to climatic fluctuations and longer summer dry spells which appears to be becoming more and more prevalent. Reentry in 15 to 20 years was chosen for several reasons: (1) reduce the number of entries into the stand, (2) increase the volume removed to make the entry more economically viable, (3) open the stand sufficiently to permit harvest operations with a minimum of damage to the residual stand, (4) treat the stand to a level where for a period of at least 10 years fires, except under the most extreme conditions,

would remain as ground fires and not become crown fires as directed by the National Fire Plan, (5) retain canopy covers that meet or exceed those directed under the SNFPA 2004 while opening the canopy to maintain or improve growth and vigor over 15 to 20 years, (6) plan for reentry at a point where stand growth would respond promptly to thinning and provide an opportunity to accomplish fuels maintenance treatments as needed.

To obtain some benefits from thinning, while retaining species specific canopy cover levels following harvest, thinning in wild pine stands is proposed to generally reduce stocking to leave basal areas of around 150 to180 $ft^2$ per acre depending on age, site, and existing crown condition (50-60 percent of normal--SDI 230-270). This entry would still result in the retention of basal areas substantially above the SDI recommendations for thinning. (150 $ft^2$ should be in locations where leave trees have full crowns. 180 ft2 per acre should be in areas with poorer crown leave trees, higher growing sites, older trees and in HRCAs.) (Normal stocking for this site and age is 270 to 290 $ft^2$ per acre.) Portions of stands with larger diameter trees present would generally have fewer residual trees per acre than those with smaller diameter trees. Because this entry would retain a higher basal area than the desired condition, to maintain stand resiliency, the next thinning entry may need to take place at 10 to 15 years in these pine stands rather than the planned 15 to 20 as the more limited growing space becomes reoccupied.

A shaded fuelbreak runs through the western portion of the project area. Thinning is proposed to establish or reestablish this fuelbreak in treatment areas T 5, T 8, T 15, T 16, T 21, T 22, and T 26. Leave basal areas within this approximately 300 foot wide fuelbreak would be 150 $ft^2$ per acre. No trees 30 inches dbh and larger would be removed with this entry.

The Progeny (Board Ranch) plantation (H 8) is planned to be returned to the district to be used as a seed orchard. Trees to be retained are labeled with metal tags displaying seed zone of origin and elevation. Seed collected from these genetically superior trees would be used to grow seedlings for district planting needs. Due to the need to protect the genetically superior residual trees within this stand, past precommercial thinning treatments have been relatively light. The precommercial thinning planned with this entry would consist of two light thinnings approximately 4 years apart. This would reduce the amount of pine slash created at one time resulting in a decreased chance of insect populations building up in fresh slash. Branches, tops and boles to 6 inches in diameter would be hand piled and burned. Boles 6 inches and larger would be cut into 4 foot lengths and left in place. Upon completion of the second treatment, residual basal area would be around 120 to 140 $ft^2$ per acre.

Where diameter restrictions permit, young growth, approximately 90-110 year old, mixed conifer and white fir stands would be thinned to around 55 to 65 percent of normal. Leave basal areas, depending on site index and age, would be around 210 $ft^2$ per acre (Mixed Conifer) and 240 $ft^2$ (White Fir). (Normal basal area stocking for 90 to 110 year old mixed conifer stands on similar sites ranges from 330 to 360 $ft^2$ per acre. Normal for white fir ranges from 420 to 445 $ft^2$ per acre). Canopy covers that meet or exceed those directed under the SNF LRMP as Amended by the Sierra Nevada Framework would be retained following treatment. To obtain maximum growth and reduce fuel ladders, trees less than 10 inches dbh trees not needed for stocking or cover for wildlife are planned to be removed with this entry within the treatment areas not designated as mastication or prescribed fire only areas. Except for mastication equipment, equipment use on slopes greater than 35 percent should be avoided.

Thinning to these target basal areas in these approximately 90-110 year old young growth stands should result in basal area increases of 70 to 80 ft2 per acre over 15 to 20 years. If thinning did not occur, this increase in growth over the same time period would be 15 to 20 ft2 per acre within the more heavily stocked aggregations if mortality does not occur.

As previously discussed, desired leave basal areas would vary by aggregation species composition. Pine aggregations would have a lower leave basal area than mixed conifer. Fir

would retain the highest. By recognizing the variation in species composition within treatment units and treating accordingly, stand heterogeneity would be maintained as varying stocking levels are retained across the stand. The North, et al, 2009 paper proposes leaving the highest density stocking near the bottom of the slope and the least near the ridgetops. Since fir and mixed conifer stands more readily occupy the lower, cooler, damper, locations on the slope, the proposed retention basal areas would generally result in heavier stocking on the lower slopes and lighter stocking as ridgetops are reached. Pine aggregations would retain the least basal area stocking.

Except where retained for wildlife purposes (see wildlife design criteria for descriptions), suppressed, intermediate, damaged and diseased then finally codominant trees, in order of removal, would be harvested until the prescribed stocking level has been reached. This is known as thinning from below as directed in the SNF LRMP as amended by the 2004 ROD and recommended in the North, et al, 2009 paper. The poorest quality trees are generally removed first, leaving, for the most part, the best trees in the stand. Thinning from below retains the majority of the crown cover and generally the largest trees. Many small, poor crowned trees are removed during the operation. Some poorer crowned codominant trees are removed, as needed, to create openings on one or more sides of other codominant and dominant trees. These openings provide room for crown expansion of the residual trees. Without room for expansion, remaining tree crowns would become less vigorous resulting in reduced photosynthesis and declining growth. Removal of only intermediate and suppressed trees results in “little more than the salvage of trees which would inevitably die” (Smith, 1962). Removal of some of the trees that compete for the limited water and soil nutrients would make more water and nutrients available for the remaining trees. Thinning also opens the stand’s crown canopy, making more light available for the remaining trees. The increased water, nutrients, and light that result from thinning increase photosynthesis in the remaining trees. More food is produced making more carbohydrate available for new cell formation and growth. After competition begins and the stand develops all crown classes, removing only intermediate and suppressed trees may not significantly reduce the competition faced by the larger dominant and codominant trees. Suppressed trees, in particular do not compete significantly with larger trees. Intolerant species (pines) require nearly full sunlight to thrive and grow. A successful low thinning removes all suppressed, most intermediates, many codominants, and even some dominant trees (Emmingham, 1983).

The effects of fuel treatments on tree based carbon storage are currently being studied. Healthy forests play an important role in carbon sequesterization. Studies indicate that “in wildfire-prone forests, tree-based C stocks were best protected by fuel treatments that produced a low-density stand structure dominated by large fire resistant pines (Hurteau, 2009). Average stand diameters increase significantly following thinning as smaller diameter trees are removed in favor of retaining larger trees. Concentrating removal on the smaller diameter trees also reduces fuel ladders and susceptibility to fire loss as average residual diameters and fire resistance increases. Follow-up treatments to remove precommercial size trees and brush would further reduce stress on the remaining stand. The majority of the stocking 10 inches in diameter and larger within the project area is comprised of white fir (around 39 percent); incense cedar (around 27 percent) is the next most prevalent species followed by ponderosa pine (16 percent) then sugar pine (13 percent). Black oak comprises around 5 percent. Incense cedar and white fir comprise almost all of the precommercial size trees within wild stands. Where choices exist, more fire resistant pines would be favored over fir and incense cedar as leave trees. In most areas, stand composition following treatment would consist of a greater percentage of more fire and drought resistant ponderosa and sugar pine as recommended in the North paper (2009). 30 inch harvest tree diameter limitations dictated by the SNF LRMP as amended by the SNFPA 2004 ROD would, in many areas, result in basal area retention levels in excess of proposed residual basal areas. In some cases in pockets of larger trees, no trees would be harvested. In these types of thinnings,

the smaller size of the product to be removed makes harvest operations much more expensive than those where larger trees are removed.

Thinning to the proposed basal areas would result in increased diameter growth and crown expansion on the remaining trees as the residual trees respond to reduced competition. Since increased diameter growth would occur over fewer stems per acre, substantial increases in diameter would result. Repeated thinning would result in larger diameter, taller, healthier crowned trees over much shorter time frames than in unthinned stands. Shade intolerant pines and oaks would be retained in a more vigorous condition as a result of more available sunlight due to reduced competition. As the diameters of the residual trees become larger and bark becomes thicker, they would become better able to survive a fire should one occur Thinning is an effective technique for creating stands that more closely represent those present prior to railroad and other extensive logging and the exclusion of fires during the 20$^{th}$ Century.

Hand and mastication thinning and release of natural stands/aggregations of conifers and plantation trees generally less than 10 inches dbh would be undertaken within treatment units as part of this proposal. These thinned aggregations would occupy large and small openings surrounded by larger trees as described in the North paper (2009). Depending on tree size these stands would be thinned to around 150 to 200 leave trees per acre. Hand thinning slash concentrations would generally be tractor piled and piles burned. Slash concentrations on steeper slopes would generally be hand piled and burned. Areas of only light slash (10-20 tons per acre) would be lop and scattered to 18 inches. Stand heterogeneity would be maintained through retention of these precommercially thinned clumps as well as untreated clumps on steeper slopes, the more dense clumps of larger diameter trees, SMZ's, archaeological sites, and the 2 to 3 untreated larger oaks per acre. An estimated 10-15 percent of the acreage in units actually designated for commercial thinning will not be commercially thinned due to these non treatment aggregations. In addition, shrub and understory diversity would be retained throughout the project area during follow-up treatments through the retention of 15-20 percent of the total understory growth in approximately 1/10$^{th}$ to ¼ acre pockets within wild stand treatment units.

Mastication precommercial thinning/release/fuels reduction treatments are proposed for 6 treatment areas. These proposed mastication areas range from a section of fuelbreak; to brushfields and conifer stands; to a red fir reproduction stand; to M 6, a 24 year old, 23 acre plantation (736-115). Except for M 3, the red fir stand, depending on tree size these stands would be precommercially thinned and released to around 150 to 200 leave trees per acre. Stocking may be less in areas of larger diameter trees. M 6 would be thinned to around 260 to 300 leave trees per acre. Mastication provides a mulch layer which helps retain additional soil moisture that can be utilized by the residual stand. Brush seed requires heat scarification to germinate. Since white leaf manzanita is a non sprouting species, in those areas where large white leaf manzanita has been masticated below the lowest live limb, reestablishment of manzanita brushfields would mostly need to occur through germination of manzanita seed. The masticated mulch layer covering the ground would reduce soil temperatures which would assist in keeping brush seed dormant and reduce the likelihood of brushfield reestablishment in whiteleaf dominated brushfields. In most cases, areas that have been masticated should not be underburned.

In addition to the Progeny plantation which is proposed for hand thinning, 7 other hand thin areas are proposed for treatment. These have been proposed in locations that would connect other treatment areas. Several are adjacent to private property. H 1 would connect T 39 to completed treatments within the Graham Mountain project that connect to the Francis Junction Fuelbreak. H2, H 3, and H 4, form a DFPZ connecting the fuelbreak in T 8 to T 39. Thinning within these H stands would be confined to trees 10 inches dbh and less. Spacing of residual trees, depending on size, would generally be around an average of 18 ft (130 trees per acre). Thinning in pine should not take place before July 1$^{st}$ or after October 30$^{th}$. Green pine slash should remain on the ground for at least 30 days to allow for drying before piling reducing the risk of insect infestation.

Three campgrounds (Greys Mountain, Texas Flat, and Chilkoot) are located within the proposed project area. Hazard tree removal along with some light thinning are proposed in these areas. Standard insect and disease measures following Regional direction would be followed during treatments. Precommercial thinning to reduce aggregation densities may also be undertaken. Slash concentrations would be spot hand piled and burned. Lighter areas of slash would be lop and scattered.

An existing young 31 acre plantation (736-101) is present within the western portion of proposed treatment area T 9. The proposed treatment for this plantation is mastication thin and release. This plantation should not be included in the underburn treatments proposed for T 9 due to the young age and investment made in this stand.

Underburning is proposed in a number of T treatment areas as well as in Rx underburn treatment areas. Treatment areas Rx 1 and Rx 2 are proposed for potential fall underburning as well as spring. All other proposed underburning is proposed for spring underburning only. Rx underburn stands Rx 3, 4, 5, 6, 7, 15, 22, 23, & 24 consist of previously commercially thinned stands where follow-up treatments of either hand precommercial thinning and spot piling of slash concentrations or mastication precommercial thinning were done. Although slash concentrations were previously treated, duff and slash material adjacent to residual trees was left intact. Studies have shown that to minimize damage to the residual stand, spring is the best time for prescribed underburning when fire is being reintroduced into an area with excessive fuel and duff accumulations due to past fire suppression activities (Hood, 2010). Several years ago an area of advance reproduction was precommercially thinned by mastication in the upper portion of treatment area Rx 3. In order to minimize damage to this younger thinned aggregation, underburning should be avoided in this area.

Hood's 2010 report states that "it is speculated that fire exclusion has allowed fine roots to grow into accumulated duff on some sites where frequent fires would typically limit duff development and contain roots mostly to the mineral soil horizons (Jain and Graham 2004; Wade1986). The presence of fine roots in the duff is an important observation when determining potential tree mortality from prescribed burning." It further states that duff consumption near the tree bole during prescribed fire was significant in predicting white fir, sugar pine and ponderosa pine mortality. The report stated that cambium is killed at approximately 140 degrees F. "Long-term heating of this kind only occurs when there is a large amount of fuel burning near the tree, such as a stump, log or deep duff. In long-term unburned areas, duff depth typically increases dramatically near the base of the tree, forming a basal mound. The long-term smoldering combustion of this fuel accumulation can increase cambium injury even for species with thick bark (Ryan and Frandsen 1991). Girdled trees caused by burning may take several years to die because the xylem is intact and can continue to transport water to support the crown, but photosynthate cannot be transported down to roots. The root system is eventually depleted of stored carbohydrate reserves and stops producing fine roots, which absorb soil water. Therefore, the tree dies from water stress (Greene and Shilling 1987; Michaletz and Johnson 2007)." In addition to the deeper duff layer around the boles of trees, the duff layer is generally drier under tree crowns than between them due to the interception of precipitation by tree crowns resulting in less moisture reaching the duff beneath. It further states that bark beetles are attracted to burned areas and cause post-fire mortality beyond what is expected from fire injury alone.

To minimize damage to the residual stand, spring burning should be completed before trees are actively growing. Hood's report states: "burning during the dormant season may reduce bud kill more than burning during the growing season when buds are actively growing and ambient air temperature is lower." During burning, pine needles help to shield young pine buds from damage from heat until buds elongate to a point where they are about to grow beyond the surrounding needles. Fir and oak new growth is much more susceptible to heat related damage than pine. To minimize bud damage, underburns should be completed prior to new buds and leaves reaching

this stage of development. Burning before active tree growth occurs would increase the likelihood of additional spring rains occurring after ignition. This would help to minimize prolonged smoldering and consumption of the duff layer near residual trees.

Existing slash concentrations within proposed burn units should be spot piled and burned prior to underburning to minimize damage to the residual stand. Where needed, trees less than 10 inches dbh forming fuel ladders should be felled prior to underburning.

Proposed treatment areas Rx 2, T 21 and T 8 adjoin the PSW Vista long term soil productivity stand. This stand is one of a series of study areas across the United States studying the effects of various treatments on long term soil productivity. Extreme precautions need to be taken to protect this stand from damage due to proposed adjacent underburning.

As previously stated, the proposed treatments for Units Rx 1 and Rx 2 are underburn only. Due to the location of these two stands, mechanical treatments are not practical. Underburning is the most practical method to provide connectivity of fuels treatments in this area. Expected mortality of residual trees resulting from underburning would be greater in these two stands than in those with only one proposed spring underburn. To minimize damage to the existing stand, two underburn treatments are planned to reduce accumulated fuels in increments as a part of this proposal for these two units. The first would be a light spring underburn followed by either another light spring or light fall treatment several years later. The initial treatment would reduce some of the accumulated down fuels and the depth of the duff layer which would result in reducing the likelihood of vegetation injury due to long term heating from smoldering duff. Waiting several years before undertaking the second underburn in these stands would provide time for feeder roots of trees within the stand to move deeper into the duff layer or mineral soil before the follow-up burn thus reducing potential root damage during the second underburn. This recovery time frame would also provide time for trees to recover from stress resulting from the initial underburn as well as time for more down fuels to accumulate to carry fire to ensure a successful second underburn treatment. Following the second underburn treatment, these stands would be better able to withstand the effects of a wildfire.
"Carefully restoring fire to long-underburned forests that historically burned frequently would reduce accumulated fuel and duff, retain old trees, and perpetuate these fire-dependent forests" (Hood 2010). Through a combination of spot piling and burning of slash concentrations and light spring underburning utilizing the previously discussed measures, more fire resilient stands can be obtained. The Silviculturist and Fuels Officer should coordinate all areas to be underburned prior to undertaking underburning.

## Indirect Effects and Cumulative Effects

Of the 9600 acres within the proposed project boundaries 3575 acres are being analyzed for potential treatments. In addition to the 3575 acres being analyzed, a mastication contract was recently awarded to precommercial thin and release 275 acres of 20 to 25 year old plantations. Over the next several years mastication thinning and release is planned on another 400 acres of 20 to 40 year old plantations within the project boundaries. This project proposes to commercially thin approximately 1768 acres, precommercially thin approximately 1023 acres by hand felling and tractor piling or mastication, precommercially thin/release/reduce fuels on another approximately 318 acres by mastication, light underburn on approximately 1951 acres of the proposed commercially and/or precommercially thinned areas, and light underburn on another 341 acres of underburn only areas.

The remainder of the project area is not proposed for treatments and would retain its present CWHR classifications. Within HRCAs and OFLs the aim as stated in the SNFPA 2004 is to retain 60 percent or greater canopy cover, where available. (The intent of the project is to retain canopy cover of 60 percent or greater in CWHR 4 and 5 size classes where it presently exists.)

Very little change in CWHR classification is anticipated due to the proposed thinning treatments. Follow-up light spring underburning before trees are actively growing should not result in significant additional canopy cover reduction which would result in a CWHR change. Within those portions of Spotted Owl and Goshawk PACs where thinning is proposed, the aim is to retain 70 percent or greater canopy cover, where available. The vast majority of the project area would not be treated as a result of these past or proposed treatments. Under this alternative, vegetation present in these untreated areas would remain the same as presently found.

In addition to the denser canopy cover proposed for OFLs, groups or patches of five or more larger trees, generally 30 inches and larger, are planned to be retained through the project area. These small groups would have residual basal areas of 240 $ft^2$ or more for mixed conifer and 210 $ft^2$ or more for pine and in many instances may reach 300 to 400 $ft^2$ per acre. Excess trees up to 20 inches dbh would be removed during thinning, however, no precommercial thinning treatments would occur within these pockets. Approximately two to three black oaks 20 inches dbh and larger per acre would also have a 35 foot buffer, measured from the bole, around them where no fuels treatment would occur.

Retention of these higher basal areas to provide denser canopy cover would result in not fully meeting the silvicultural objectives for maintaining or improving forest health. The impact would not be as great in mixed conifer and fir stands as it would be in pine. Retaining 60 percent or greater of normal basal area in pine stands (180 $ft^2$/ac) leaves them at a level where stand density index studies have shown them to be susceptible to insect attack. Pine stands with basal area stocking levels at 60 percent or greater begin to exceed a SDI 270 which Cochran's 1999 study considers to be the critical threshold level for density management (upper management zone, Cochran, 1994) above which serious beetle induced mortality can begin to occur. Oliver, 1995, stated that a SDI 365 (approximately 240 $ft^2$/acre), defines the threshold for a zone of imminent bark beetle mortality where pine stands suffer large losses from bark beetle epidemics. These losses can equal or exceed periodic growth. Subsequent growth of these stands would add further to the problem. Sufficient thinning would occur in some of the proposed scattered clumps to provide a short term benefit to stand vigor while in other clumps little, if any, thinning would occur resulting in a continued decline in clump vigor. Pine clumps left at these higher basal area retention levels would continue to be at a very high risk of loss due to insect, disease, competition, and/or drought induced mortality. A 2004 report found that plots infested by mountain pine beetle had significantly higher total basal area, ponderosa pine basal area, stem density and stand density index (Fettig, 2007). Heavily stocked pine clumps attacked by insects have the potential to serve as infection centers for increased mortality in the surrounding pine stands as insect populations build and move into adjacent stands. To maintain more vigorous, drought and insect resistant stands, a shorter reentry period would be needed. The reentry time frame within HRCA, PAC, and OFL pine stands and these more heavily stocked clumps would likely be reduced by 5 or more years.

Since the vast majority of the crown covers and ground cover would remain in place following thinning operations, properly conducted thinning has only a minor short term affect on the environment. Leave trees would continue to contribute needles as well as small branches to the forest floor. Little soil movement and little, if any, increased runoff should occur as a result of this entry. SMZs would be maintained with any thinned trees being endlined out of the SMZs. Therefore, stream course stability would not be adversely affected. Long term affects would be to maintain or increase growth and vigor of treated stands, accelerate development of old forest characteristics in plantations, and improve the protection of human communities from wildland fires as well as minimize the spread of fires that might originate in urban areas. Over the past 18 years, the district has planned and completed several projects, treating several thousand acres, similar to the proposed action. Canopy cover retention following harvest has met or exceeded expectations. Residual crowns have rapidly filled in openings created by harvest treatments.

In addition to the benefits obtained through density management several other benefits have been noted in treated stands. Several studies have shown that in addition to increasing residual tree vigor, increasing temperatures and windspeeds are common in recently thinned stands. This may accelerate development of certain bark beetle species and force them to overwinter in stages that are more susceptible to freezing or cause turbulences that disrupt pheromone plumes used for recruiting conifer species during initial phases of host tree colonization (Fettig, 2008). Moderate thinnings may result in less potential extreme fire behavior compared to unmanaged stands. Greater fuel depths, mid–flame wind speeds and lower fuel moistures in heavily treated stands (>60 percent basal area reduction) might increase potential fire behavior compared to unmanaged stands. Thinning followed by sufficient treatment of surface fuels usually outweighs changes in fire weather factors (wind speed and fuel moisture) resulting in an overall reduction in expected fire behavior (Jenkins, et al, 2008). Thinning followed by tractor piling and burning or whole tree yarding have been shown to be effective in reducing fire severity under severe fire weather conditions. Thinning from below where the largest trees are retained within the stand contributed to increased fire resistance (Stephens, 2009). Thinning makes fire suppression more efficient. Once heavy fuels are removed, the residence time (duration) of the fire is reduced, often resulting in a non-lethal surface fire (Fitzgerald, 2005). The thinning proposed within the project is designed to reduce existing basal area by generally 30 percent or less. Follow-up treatments are designed to remove fuel ladders as well as slash concentrations. This relatively light level of thinning should both realize the benefits of thinning stands to reduce the adverse effect of bark beetles and competition while reducing expected potential fire behavior.

Upon completion of the planned plantation thinning and release work and work planned under this alternative, stand vigor will be improved making these stands more resilient to the effects of insect attack, drought conditions and climatic variances.

## Alternative 3

This alternative proposes to only remove precommercial size fuel ladders/fuels and precommercially thin throughout the portions of the treatment areas proposed for commercial thinning under Alternative 2. Other proposed treatments would remain the same as described in Alternative 2.

### Direct Effects

No density management would be accomplished with this alternative in wild stands. Fuel ladder removal would occur on suppressed and a very few intermediate trees only. No codominant trees would be removed. 100 % of the existing basal area 10 inches dbh and larger would remain. The percentage of less drought resistant, more fire prone incense cedar and fir 10 inches dbh and larger would remain the same as existing. The average stand diameter would not change. Shade intolerant pine and oaks would become less vigorous and continue to drop out of the stands. Individual tree growth rates would decline. Post treatment stocking levels would be too dense to withstand the stresses of drought and climatic variances. The risk of bark beetle induced mortality in pine stands would continue to rise as competition continued to increase.

As stated previously, Smith, 1962, stated that removal of only intermediate and suppressed trees results in “little more than the salvage of trees which would inevitably die”. Emmingham, 1983, stated that a successful thinning from below requires the removal of many codominants as well as most intermediates and suppressed trees. Under this alternative, fuel ladder reduction only dealing with precommerical trees would not remove any significant levels of competition to meet density management objectives. Removal of only some suppressed trees and little to no intermediates would not provide any significant increase in nutrient or water availability to the residual stand. Not only would there not be a significant increase in available nutrients or water, failure to remove some of the codominants and intermediates growing into the bottom portion of

the codominant layer of the stand would not create openings in the canopy to provide room for crown expansion of the residual trees. Shade intolerant oaks and pines would not be able to benefit from increased light and rates of photosynthesis as well as reduced competition provided by openings created in the canopy cover. This alternative does not meet the purpose and need for density management emphasized in the SNFPA, 2004 decision and being examined as a part of this project.

## Indirect and Cumulative Effects

Since stand densities would continue to increase, wide swings in climatic conditions as has been experienced over the past thirty years would continue to place increased stress on these untreated stands. Mixed conifer and fir aggregations and stands with stocking levels approaching or exceeding normal would become increasingly susceptible to mortality. Excessive stand/aggregation densities in ponderosa pine stands and ponderosa pine plantation aggregations would result in the likelihood of heavy mortality. Drought and insect induced mortality would escalate. Snags and jack-strawed down material would increase. Basal area tree growth of only 15 to 20 $ft^2$ per acre would occur over a 15 to 20 year period (if excessive mortality does not occur) in more densely stocked aggregations. Forest health in the area would decline and elevate the risk of loss due to wildfire. Not only would the potential for loss of these stands to insect attack and drought increase, but their ability to respond to future thinning would continue to decline as crown vigor deteriorated as treatment was postponed. Experience has shown that even a course of no action is not without consequence (Fettig, 2007). Doing little to nothing to reduce stand density would result in forests that continue to deteriorate over time.

No revenues would be generated under this alternative. All work proposed would need to be funded through very limited appropriated sources. The majority of the proposed vegetation management/fuels reduction work would likely not be funded or undertaken. Under burning is planned to be conducted in a number of the treatment areas. Since no density management would take place, many of the smaller diameter trees which would have been removed under alternative 2 would be killed as a result of underburning. Others would suffer increased stress and would be less resistant to bark beetle attack, diseases or drought conditions for several years following burning. "Many bark beetle species are attracted to burned areas and cause post fire tree mortality beyond what is expected from fire alone" (Hood, 2010). These smaller diameter fire stressed trees would serve as potential sources for increased bark beetle activity resulting in the increased likelihood of mortality in the surrounding stand. Dead and down fuels would increase after the first underburn entry.

As mentioned previously, the lack of density management would result in an increased likelihood of mortality in these stands. Mortality would occur over a range of diameters. Additional roadside hazard tree sales would need to be undertaken to minimize risks to the public.

# Fire/Fuels

## Affected Environment

### Existing Condition

Fire represents both one of the greatest threats and one of the strongest allies in efforts to protect and sustain human and natural resources in the Sierra Nevada. Residents and visitors alike are well aware of the threats posed by summer wildfires. A growing density of homes and other structures coupled with the increased amount and continuity of fuels resulting from twentieth-century fire suppression have heightened concern about threats to life and property, as well as the health and long-term sustainability of forests, watersheds, and other natural resources. Yet fire has been an integral part of the Sierra Nevada for millennia, influencing the characteristics of ecosystems and landscapes. Today, state, federal and local agencies put enormous resources into efforts to reduce fire occurrence while at the same time advocating the need to use fire to promote healthy ecosystems. The challenge faced is how to restore some aspects of a more natural fire regime while at the same time minimizing the threat wildfire poses to human and natural resources and values Sierra Nevada Ecosystem Project (SNEP, 1996).

***Fire Suppression***

Fire is recognized as a keystone process that has influenced the composition, structure, and heterogeneity of forested landscapes in the western North America for millennia (Swetnam, 1993, Whitlock et al. 2003, Scholl and Taylor 2010) Fire's role in shaping forest structure and composition changed in the mid-to-late 19th century with Euro-American settlement and then implementation of a federal policy of suppressing fire in 1905 (Agee 1993).The effects of reduced fire frequency have been greatest in forests with surface fires that had burned frequently. Excluding fires has increased forest density and surface and aerial fuels, increasing the risk of high-intensity fire, including crown fire (Scott and Reinhardt 2001).

***Fire Regime***

Fire plays a pivotal role in reshaping and maintaining mixed-conifer ecosystems (North, M. et. al., 2009). The role fire plays in an ecosystem is characterized by the fire regime attributes that describe the pattern of fire occurrence, behavior, and effects. Temporal attributes include seasonality and fire return interval. Spatial attributes are fire size and spatial complexity of the burns. Magnitude attributes are fire intensity, fire severity, and fire type. Many species and most communities show clear evidence of adaptation to recurrent fire, further demonstrating that fire has long been a regular and frequent occurrence. This is particularly true in the chaparral and mixed conifer communities, where many plant species take advantage of or depend on fire for their reproduction or as a means of competing with other biota. In many areas frequent surface fires are thought to have minimized fuel accumulation, keeping understories relatively free of trees and other vegetation that could form fuel ladders to carry fire into the main canopy Sierra (SNEP, 1996).

Variation in fire severity has an important influence on forest heterogeneity because fires may kill all trees in some stands and few in others. Stand development after high-severity fire leads to even-aged or several-aged stands, while forests that experience low- or moderate severity fires have trees in many age classes because few trees are killed in a stand (Agee 1993, Scholl and Taylor 2010).

Scientific studies done on the Yosemite National Park has shown that canopy gaps created by severe prescribed burning and patch sizes of similar aged trees in the reference forest (100–2000

m2) are consistent with low-severity fire, tree regeneration in gaps created by torching of single trees or groups of several trees, and the self-limiting nature of the historical fire regime. Although more severe fire effects can restore density and basal area to reference conditions more quickly (Miller and Urban 2000, Fu´ le et al. 2004), there was no clear evidence of high-severity fire effects in our forest. Thus, application of high-severity prescribed fire would create novel conditions compared to fire effects over the last four hundred years. (Scholl and Taylor 2010).

As stated in numerous peer-reviewed scientific documents that striking changes in structural and functional components of the Sierra Nevada ecosystems have occurred since 1860, largely due to alterations in the pre-Euro-American settlement fire regime (Caprio and Graber 2000). The Greys project has twodifferent fire regimes characteristics. The southwest area of the project is characterized as sierra ponderosa pine mixed conifer (lower montane); historically this forest ecology zone displayed a low-intensity and frequent fire regime. The northeast area of the project is characterized as red fir (upper montane), historically a mixed intensity and frequency fire regime (Sugihara et al, 2006). Presently the Fire Regime Condition Class (FRCC) for the Greys project consists of;

| Percentage of project area | Condition Class | Fire Regime |
|---|---|---|
| 10% | 1 | Fire regime is within historical range and the risk of losing key ecosystem components is low. |
| 9% | 2 | Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals. |
| 80% | 3 | Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. |
| 1% | 9 | These areas consist of unburnable material (rock outcropping). |

***Fire History***

During the period before significant Euro-American influence, natural fires and anthropogenic burning occurred frequently and were low intensity with return intervals ranging from 5 to 10 years in these vegetation types. These types of fires produced fire effects of low to moderate severity throughout this ecosystem. Occasional patches of high severity fire effects did occur where pockets of heavier surface fuel loads and ladder fuels aligned with favorable slope, wind and aspect during drought conditions to induce mortality in larger conifer pockets. Areas surrounding Soquel was burned by the Native Americans and later years by ranchers (Anderson 2006).

Since the 1930s the forest and within the project area have become densely overstocked. Wildfires that burn in these areas today, burn at such levels that high magnitude of resource

damage occur, especially to soil layers. Once these soils are heavily damaged by fire, ecosystem components can take longer to recover especially trees which are a key component in forest ecosystems. Recent examples of this can be seen locally in the 2001 North Fork Fire the 2003 Source Point fire and the 2008 Oliver Fire.

Wildfire history cartographic data beginning in 1910 show that between 1917 and 1988 there have been 16 fires greater than 10 acres within 3 miles of project area. These fires were mostly human caused and ranged in size from 28 to 8,313 acres. Most of these wildfires started and burned from the lower elevations around the Oakhurst Basin and Bass Lake area up towards the project area.

In 1916, a 74 acre fire started southeast of the Greys Mountain Campground, causing unknown damage to the forest. Since 1916, there have been 42 fires contained at 10 acres or less within the project boundary. Given the proper burning conditions as documented fire history around the project area shows a fire could have the potential to burn with such severity that could result in resource damage that would be greater than the ecosystem could sustain.

Table 39 and Table 40 show the Fire History Records (fires >10 Acres) within and outside of the project area. Map 1 in the appendix of this document shows the approximate perimeters of these fires and their proximity to the community of project and the project area.

**Table 39. Fire History within the Project Boundary**

| Year | Size/Acres | General Location |
|---|---|---|
| 1916 | 74 | ½ mile southeast of Greys Meadow Campground |

**Table 40. Fire History Outside of the Project Boundary (within a 3 mile radius)**

| Year | Size/Acres | | Year | Size/Acres |
|---|---|---|---|---|
| 1917 | 399 | | 1928 | 302 |
| 1917 | 189 | | 1934 | 3,930 |
| 1920 | 508 | | 1930 | 701 |
| 1920 | 99 | | 1934 | 8,313 |
| 1924 | 106 | | 1942 | 359 |
| 1924 | 1,056 | | 1915 | 187 |
| 1926 | 4,395 | | 1952 | 115 |
| 1926 | 540 | | 1988 | 28 |

***Logging History***

From 1852 to 1925 various lumber mills processed timber harvested from the area within the project boundary. Timber harvested during this era has resulted in most of the forested areas with trees that are less than 130 years of age. Timber harvested after 1925 has generally consisted of salvage/sanitation, regeneration harvests and commercial thinning, with most occurring from 1970 to 1995. Fire exclusion from the vast majority of the area since the 1920's, has resulted in

development of dense fuel ladders in the natural regeneration areas along with areas that escaped early day logging.

Today, hundreds of small trees per acre are common beneath these stands of white fir, sugar pine, incense cedar, and ponderosa/Jeffrey pine in the lower elevations and red fir in the higher elevations. These stems consist of mostly shade tolerant incense cedar and white fir. Ponderosa pine and incense cedar have naturally reseeded into small portions of fire impacted areas where they are severely overstocked, creating significant fuel ladders. Due to drought and beetle infestation in the late eighties and nineties logging was used in some areas to salvage pockets of dead and dying trees. Activity fuels were treated with machine piling and pile burning.

***Fire Behavior in current Fuel Loading***

Ground and surface fuels within the project area vary throughout the project. The project area has three dominant arrangements of fuels that influence fire behavior. These are: ground, surface and crown fuels. Ground and surface fuels can be described utilizing Rocky Mountain Research Station Fuel Models (Scott and Burgan, 2005) for estimating fire behavior. This is used to aid in describing the type and average amount of fuel given a particular fuel type and the prediction of the type of fire behavior expected under certain weather and topographic conditions. Crown fuels are generally described in relationship to the density of crowns (canopy bulk density) and their height above the surface fuels (canopy base height).

***Ground and Surface Fuels***

***Timbered Stand Areas -*** The ground and surface fuels within the mixed conifer and true fir stands that do not have brush as the main understory component fall into four Fuel Models TL3 (conifer needle litter) and TL8 (long needle pine litter), TU5 (conifer litter with shrub understory), and SB2 (activity fuels and scattered blowdown from wind damage with many trees still standing). The difference between these four fuel models comes from the increasing amounts of ground and surface fuels.

1. ***True Fir Stands (Upper Montane) -*** Fuel Model TL3 is described as having lighter amount of ground and surface fuels associated with it and is used to describe the true fir stands in the higher elevations of the project area that have not started to deteriorate from drought stress and/or overcrowding and the trees have not begun to fall on their own. Estimated surface fuel loadings average is between 5 and 10 tons per acre.

2. ***Mixed Conifer Stands (Lower Montane) -*** Fuel models TL8 describes areas where there is a moderate fuel load small saplings and suppressed trees have begun to fill in the understory of larger trees. The surface fuels are of smaller size, mostly less than 3” in size. Estimated surface fuel loadings average is between 10 and 20 tons per acre.

   Fuel Model TU5 and SB2 are used to describe conifer stands where natural fuel and activity generated accumulations of ground and surface fuels are beginning to increase. These surface fuels are of larger size, mostly 3+” in size and can increase the intensity of surface fires within the area. These fuels include not only the branches and needles of fallen trees, but also include the boles, increasing the tons/acres of natural fuels on the ground rapidly. Surface fuel loadings in the project area that are representative of Fuel Model TU5 average between 12 and 25 tons per acre and 15 and 30 tons per acre of Fuel Model SB2.

3. ***Brush/Scrubs Areas -***The ground and surface fuels within areas where poor regeneration, fuelbreaks, and areas consisting of mixed conifer stands and mixed chaparral located on

the south and southwest facing slopes of the lower reaches of the project area can be best described using a Fuel Model SH2. A Fuel Model SH2 is described as dry climate woody shrubs' and shrub litter with moderate fuel load. Surface fuel loadings in the project area that are representative of Fuel Model SH2 average between 5 and 25 tons per acre

***Crown Fuels***

The crown fuels in the project area can be described in two ways, crown fuels that can lead to the propagation of a crown fire and the crown fuels available to sustain a crown fire. There are two elements that need to fall into place for a crown fire to start and for it to sustain itself, fuel ladders (vegetation that "stair-steps" up in height and can allow a fire to reach the crowns of trees) and canopy density (in simple terms, how close together individual tree crowns are, usually given as a percentage of space taken up by the tops of trees).

In white fir and incense cedar stands the project area, fuel ladders are heavy and continuous, consisting of regeneration of conifers, brush and of natural regeneration of conifers. These fuel ladders start at the surface layer and have grown to the point of having a continuous "stair-step" of available fuels into the bases of the canopy trees.

The canopy fuels in the project area are varied from open to heavily closed (approximately 100% canopy closure). Areas where there is a combination of heavy, continuous fuel ladders and canopy closure is closed (interlocking of crowns in the canopy) the potential for initiation and sustainability of a crown fire is the greatest.

***Wildland Urban Intermix (WUI)***

The project is located within the defense and threat zones of the WUI and situated adjacent to residential areas of Redwood Creek to the southwest, Paradise Springs to the northwest, and Soquel Meadows to the north. These areas are a priority for fuels treatment. Followed by areas where Defensible profile Zones (DFPZ) and fuelbreaks are identified, proceeded by treatment areas that have been strategically identified placed for treatment. Standards and guidelines for Southern Fisher Conservation Area apply in known home range outside the WUI.

Communities surrounding the Greys Project include Bass Lake to the south, Sugar Pine and Cedar Valley to the west. Calvin Crest Christian Camp and Nelder Grove Historical Area of giant sequoia also lie to the west of the project. With the continuity of the fuels within the project area, a wildland fire originating from within the WUI or Forest Service designated roads, under the right conditions, has the potential to spread into the project.

## Applicable S&Gs

In the recent past several fire policies and initiatives have been enacted to address the national wildfire problem in the United States. These include, but are not limited to the U.S. National Fire Plan, Ten-Year Comprehensive Strategy and Implementation Plan, and Healthy Forest Restoration Act (Stephens, S. et. al., 2009). These have provided the basis of management goals, intents and directions that are within the Forest Land and Resource Management Plans. By implementing the Greys Project fire policies and forest plans would be met.

The Sierra National Forest LRMP as amended by the SNFPA ROD provides the management direction, goals, and objectives and S&Gs for the action alternatives for the protection of resources and the application of the fuels and prescribed fires.

## Desired Condition

The SNF LRMP as amended by the 2004 SNFPA ROD establishes a desired condition for each land allocation. In particular, the desired condition for each land allocation incorporates how and what type of vegetation complexes are desired for each. These are referenced in short and long term conditions and are influenced by the temporal and spatial influences of fire. One of the broad scale goals is to actively restore fire-adapted ecosystems by making demonstrated progress in moving acres out of unnaturally dense conditions (in other words, moving acres from the Fire Regime Condition Class (FRCC) 2 or 3 to FRCC 1. The land allocations and their specific desired conditions used for this project include:

**Wildland Urban Interface:** (SNFPA ROD, 2004; page 40-41)
**Defense Zone**

- Stands are fairly open and dominated primarily by larger, fire tolerant trees.
- Surface and ladder fuel conditions are such that crown fire ignition is highly unlikely.
- The openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of sustained crown fire.

**Threat Zone -** Under high fire weather conditions, wildland fire behavior in treated areas is characterized as follows:

- flame lengths at the head of the fire are less than four feet;
- the rate of spread at the head of the fire is reduced to at least 50 percent of pre-treatment levels;
- hazards to firefighters are reduced by managing snag levels in locations likely to be used for control prescribed fire and fire suppression consistent with safe practices guidelines;
- production rates for fireline construction are doubled from pre-treatment levels; and
- Tree density has been reduced to a level consistent with the site's ability to sustain forest health during drought conditions.

Fuels treatments outside of the WUI and within other land allocations are to establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior (SNFPA ROD, 2004; page 35). There are specific means and conditions by which treatments can be conducted within some land allocations because of maintaining habitat needs as well as perpetuating such conditions (i.e. old forest emphasis areas).

The Forest Service's primary responsibility and objective for structure fire protection is to suppress wildfire before it reaches structure. (Forest Service Manual, 5137.02). The spatial arrangement of stands and homes is crucial to the success of fuel management activities in changing the effects of large fires either at the local or landscape scale. (Finney and Cohen, 2003). Thinning trees to produce gaps in the flame front significantly reduces radiant exposure, and that a firefighter's maximum radiant exposure is well below exposures necessary for piloted wood ignitions.

The defensible space requires more vegetation fuel hazard reduction than fuels reductions required for preventing piloted wood ignitions. (Cohen and Butler, 1996). Agency WUI fuel treatment largely do not address home ignitability but rather areas outside the home ignition zone. Fuel treatment in the vicinity is expected to protect homes by creating conditions that enable successful fire suppression if a wildfire would to occur. As experienced during the Wallow Fire (2011), half (½) mile wide fuels treatment units located above the community of Alpine slowed this crowning fire by causing the blaze to drop from up in the trees to the surface level. The fire rate of spread dramatically slowed and flame lengths were low enough to allow firefighters' to safely attack the fire and protect homes and property. Also during this incident, a small

strategically placed fuel treatment served as a successful and effective 'anchor point" to that enabled firefighters to actively engage in fire suppression operation to protect many structures in the community of Greer. Many structures survived the fire because of prior fuels treatment, as well as stewardship construction and landscaping completed by the land owner. (Bostwik et. al., 2011).

Preventing WUI fire disasters require the problem be framed of home ignition potential. Because this principally involves the home ignition zone, the home ignition zone primarily falls within private ownership; the responsibility for preventing home ignition largely falls within the authority of the property owner (Cohen, 2008).

**Southern Sierra Fisher Conservation Area:** (SNFPA ROD, 2004; page 41)

1. Within known or estimated female fisher home range outside the WUI, a minimum of 50% of forested area has greater than or equal to 60% canopy cover.
2. Where home range information is lacking, use HUC 6 watershed as the analysis area for this desired condition.

## Environmental Consequences

Fire not only interacts with the physical, but the living components of the ecosystem (Sugihara, N., et. al., 2006). The only portion of the fire behavior "triangle" that can be intervened with is fuels by managing vegetation (Sugihara, N., et. al., 2006). Increased stand density, decreased overall tree size, and increased surface fuel loads are well documented for many forests of this type (Stephens, S. et.al, 2009). These changes concern fire managers because the increased fuel loads and altered forest structure have made forest vulnerable to fire intensities and severities outside of the desired conditions and outside of historic fire regimes for these ecosystems. But how can fire be placed back into the ecosystem, if the potential resultant fire (whether management ignited as prescribed fire or natural-caused) is of higher intensity and severity than it was historically because of the unnatural accumulations of fuels? Although there is relatively little understanding of the ecological effects of fuel treatments, in particular the extent to which mechanical treatments might emulate natural ecological processes such as fire (Stephens, S., 2009), they can be effective tools to modify stand structure and influence subsequent fire severity and extent. Mechanical treatments are often a required first treatment in forests containing excessive fuels loads (North, M., 2009).

## Methodology

The following subsections discuss the scope of analysis, methodology, and indicators to assess the environmental consequences of the alternatives on fire/fuels.

***Assessment of Fuel and Forest Structure -*** Aerial photography (2007) of the project area was initially used to determine fuel type (shrub, brush, timber litter, and slash/windblown) within the project area. Due to the variability of conditions throughout the project area, The Rocky Mountain Research Station Fuel Models (Scott and Burgan, 2005) was used to determine which stratum of surface fuel was most likely to carry the spreading fire. These fuel models were used to represent the average conditions within each fuel type represented in the area. Because these fuel models have associated fuel loading for each time lag fuel category (1, 10, 100-hour fuels) the Brown's planar intercept method was used to collect fuel-loading data by fuel size classes within the Forest Inventory and Analysis (FIA) plots.

***Predicted Fuel Model Conversion*** - In assessing the effects of future conditions in the no action alternative and the action alternatives, fuel models were chosen to represent the predicted fuel group and average post treatment conditions by fuel group being treated. It was assumed that treatments would move existing conditions from one fuel model to another, but remain within the

same fuel group (i.e. a Fuel Model TU1, Timber Group would post treatment convert to a Fuel Model within the Timber Group). For the shrub group, dependent on the type of treatment, it may be converted from the shrub group into any of the fuel groups. Studies within the Sierra Nevada range and similar to those existing and resulting from the treatments proposed (Kaufman, 2002; Stephens, S., 2009; USDA Forest Service, PSW, 2001) were used to determine and verify the fuel models chosen as well as field verification in areas on the district where similar treatment prescriptions have been implemented.

***Crown Fire Prediction*** - In order to determine the potential for crown fire initiation and/or the type of crown fire (if initiated), average canopy bulk density as well as average canopy base height were needed for stands within the project area. Tree list were developed utilizing timber cruise sample plot data collected within the project area and processed through the Forest Vegetation Simulator (FVS) program for verification. The collected data was for trees measured over 10 inches at dbh only. Utilizing studies conducted within the Sierra Nevada Range and in similar conditions as that within the project area (Kaufman, 2002; Stephens, S., 2009; United States Department of Agriculture (USDA) Forest Service, Pacific Southwest (PSW), 2001) average existing and post treatment canopy characteristics were determined. Average canopy base heights were based on measured tree heights, stand position and field verification for both existing and post treatment condition.

***Modeling for Potential Fire Behavior and Fire Effects*** -Modeling of potential fire behavior and the resultant intensity and severity of such fire behavior requires several inputs for calculation. These include, but are not limited to fuel, weather and topography conditions of the area being analyzed. These conditions can change slowly over time and space or can change rapidly. For this analysis, conditions (except for fuel model) were held constant and were based on what are considered 90$^{th}$ percentile weather conditions for the project area. 90$^{th}$ conditions, as used here, is representative of the high fire weather conditions under which wildfire behavior in treated areas is to be characterized for desired conditions (SNFPA ROD, 2004; page 46).

Fire Family Plus (a program used for analyzing historic weather and fire danger rating records) was used to determine what 90$^{th}$ percentile weather conditions are from representative Remote Automated Weather Station (RAWS) historic weather records. Twenty years of recorded weather data (1990-2010) from the Batterson and Minarets RAWS were analyzed. Conditions analyzed and used were: 1-hour, 10-hour and 100-hour dead fuel moistures, live fuel moistures, air temperature, and wind speed. Because treatments are proposed on slopes generally less than 35 percent, an average slope of 20 percent was used for fire behavior modeling. It is assumed that with an increase in slope percentage, fire spread and intensity would increase.

Fire behavior was modeled, for existing, short term conversions and post activity treatments, using BEHAVE Plus 5 BEHAVE Plus 5 was used to model surface fire behavior for the initial fuel models selected for existing, short term conversions and post activity treatment conditions as well as the predicted mortality of conifers within the stands given the constant weather conditions and the representative fuel bed. The modeled results were compared to observations made of past wildfires burning under the same conditions and same fuel models to determine if modeled results were representative and/or realistic. The inputs utilized for this analysis are;

**Fuel Models:** SH2, TL3, TL8, TU5, and SB2 (for existing conditions)

**1-hour Fuel Moisture (%):** 3

**10-Hour Fuel Moisture (%):** 4

**100-Hour Fuel Moisture (%):** 6

| | |
|---|---|
| **Live Woody Fuel Moisture (%):** | 80 |
| **Foliar Moisture (%):** | 80 |
| **Air Temperature (%):** | 80 |
| **20 foot Windspeed (mph):** | 15 |
| **Wind Reduction Factor:** | 0.3 |
| **Canopy Bulk Density (lb/ft3):** | 0.0119 and 0.0874 |
| **Canopy Base Height (feet):** | |
| | 10 and 20 For timber 0.1 and 5 For brush |
| **Slope (%):** | 20 |

## Indicators

***Analysis Indicators Measured -*** The SFNPA ROD 2004 includes specific characteristics (indicators) of fire behavior as desired conditions for fuels treatments. These are used as the "indicators" in this analysis. These include Fire Behavior Characteristics Indicators based on existing and resultant of:

- Fuel Model
- Crown Fire Potential
- Average Rate of Spread(ROS)\Resistance to Control
- Average Flame Length (FL)
- Average Tons per Acre of Surface Fuels
- Average Fireline Intensity
- Average Mortality in Ponderosa Pine, red and white fir conifers (range of average size existing 10" dbh; for post treatment 30" dbh).

When interpreting fire behavior and predictions, guidelines or "trigger-points" have been established to determine the most effective means or resources that should be used on fires based on rates of spread, flame length and fireline intensity that are observed or predicted for given conditions. Intuitively, a resource(s) used to suppress a fire must have line building capability faster than the rate of spread to be effective in stopping the fire's spread. Rate of Spread, flame length and fireline intensity determine which type of resources and how "close" to the fire they can attack it. These effects result to the resistance to control or the difficulty to control a fire. Resistance to control relates the difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. Because every fire is different these are used as general guidelines in assisting fire managers in determining appropriate tactical decisions. Table 41 and Table 42 displays trigger points for assisting in making these decisions.

**Table 41. Adapted from How to Predict the Spread and Intensity of Forest and Range Fires. Richard C. Rothermel, 1983 and Rocky Mountain Research Station Fuel Models, Scott and Burgan, 2005**

| ROS (Ch/h) | Flame Length (Feet) | Fireline Intensity (Btu/ft/s) | Interpretations |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 0 - 5 | <4 | <100 | Fire generally can be attacked directly at the head or flanks by using hand tools. Use of hand crews with tools is effective.<br>Hand line should hold fire. |
| 5-20 | 4-8 | 100-500 | Fires are too intense for direct attack at the head of the fire by persons using hand tools.<br>Hand line cannot be relied on to hold fire.<br>Equipment such as fire engines, dozers, and aerially delivered fire retardant can be effective in control efforts on the fire. |
| 20-50 | 8-11 | 500-1,000 | Fires may present serious control problems as the following can be expected in forests: torching of trees, initiation and spread via a crown fire, and the occurrence of spot fires up in front of the main fire.<br>Control efforts at the head of the fire would probably be ineffective. |
| 50-150 | >11 | >1,000 | Crowning, spotting, and major fire runs are probable. Fire usually spreads via rapid runs in surface fuels and crown fires in timber stands. Major fire spread and spotting 1 to 2 miles in front of the main fire is expected.<br>Control efforts at the head of the fire are ineffective. |

To measure the degree of change between existing and resultant conditions between alternatives, the table above and an adjective class guide below was used as a guide to quantify the spread rates, FL, fireline intensity and resistance of control. These guide the ROS, and FLs for predicted fire behavior and are referred as being very low, low, moderate, high, very high, and extreme. Because every fire responds differently to various environmental conditions and topography actual predictions may be slightly high or lower.

**Table 42. Rocky Mountain Research Station Fuel Models, Scott and Burgan, 2005**

| ROS (Ch/h) | FL (Ft) | Adjective Class |
|---|---|---|
| 0-2 | 0-1 | Very Low |
| 2-5 | 1-4 | Low |
| 5-20 | 4-8 | Moderat*e* |
| 20-50 | 8-12 | High |
| 50-150 | 12-25 | Very High |
| >150 | >25 | Extreme |

# Alternative 1 – No Action

## Direct Effects

There are no treatments to reduce the potential extreme fire behavior under the no-action alternative and therefore, no direct effects. However, natural fuel accumulations would continue to increase as more trees begin to succumb to overcrowding, drought, insect and pathogens. This would increase the amount of ground and surface fuels within the area. This increase in ground and surface fuels would gradually begin to shift the potential fire behavior in the area, to a more severe stature if a wildfire were to start. This increase would be to a more severe surface fire as the type of fuels changed from branches and needles (0-1" material) to the larger size material (3+"). This change is best represented by fuel model changes or conversions mixed conifer areas that begin as Fuel Model TL8 would convert to Fuel Model TU5. As accumulated natural surface fuel loadings increased, a further conversion from Fuel Model TU5 to Fuel Model SB2, similar to that of a moderate slash fuel loading could occur in some areas.

Fuel Model SH2 is used to present the surface fuel conditions in existing in bush/shrub areas and some mixed conifer stands. Under Alternative 1, this would not change, but additional accumulations of larger diameter branch wood, twigs and perhaps boles of trees could increase the average tons/acre of surface fuels, increasing the fireline intensity and resistance to control. Firefighters with hand tools or water from fire engines would become less effective. Crown fire (a fire that advances from the top to top of trees or scrubs more or less independent of surface fire) potential would also remain high because none of the elements needed to propagate and sustain a crown fire would be removed (fuel ladders and canopy density). Because of the increased amount of surface fuels and the increased fire behavior associated with them, these potential crown fires would have the potential to propagate over a larger area. The Table 43shows the indicators for current existing conditions and those associated with the conversions in Fuel Models under Alternative 1. Some helpful definitions to understand Table 43 include:

**FL** - Average Flame Length
**ROS** - Average Rate of Spread
**FLI** - Average Fireline Intensity
**Crown** - Crown Fire Potential
**Resistance to Control** - Resistance to Control Average
**Fuel Loading** - Average Fuel Loading
**Mortality** - Mortality in White Fir / Ponderosa Pine

**Table 43. Indicators for Fuel Models in Timbered Brush/shrub Covered Areas.**

| **Fuel Model** | **FL** (ft) | **ROS** (ch/hr) | **FLI** (Btu/ft/s) | **Crown** (transition and fire type) | **Resistance to Control** (low, mod., high) | **Probability of Mortality** (%) WF/PP |
|---|---|---|---|---|---|---|
| **Sierra Mixed Conifer** | | | | | | |
| Existing Conditions– TL8 | 4.0 | 7.6 | 117 | Yes;Crowning | Moderate | 7/7 |
| Future Conditions – TU5 | 8.6 | 11.3 | 606 | Yes;Crowning | Mod/High | 34/44 |
| Further Future - Conditions -SB2 | 7.3 | 19.4 | 431 | Yes;Crowning | High | 21/22 |
| **Brush/Shrub Areas** | | | | | | |
| Existing Conditions– SH2 | 5.3 | 8.4 | 217 | Yes/Crowning | Moderate | 12/9 |

| Fuel Model | FL (ft) | ROS (ch/hr) | FLI (Btu/ft/s) | Crown (transition and fire type) | Resistance to Control (low, mod., high) | Probability of Mortality (%) WF/PP |
|---|---|---|---|---|---|---|
| Future Conditions – SH5 | 15.7 | 68.0 | 2,259 | Yes/Crowning | Extreme | 99/80 |

It is assumed that mortality in the brush species would be from stand replacing (100%) or patchy dependent on the percent of the brush cover. For mortality to occur in the scrub there needs to be enough fire to girdle the main stem. With the predicted fire behavior, as shown above it is anticipated that in the Fuels model SH2 as currently exists, there would be mortality, but not as great as in Fuel Model SH5 (heavy shrub load covering at least 50% of the site), because of the lower amount old dead woody material found on the brush.

The above tables give an indication of what type of fire behavior could be expected if a fire were to occur within these fuel beds as they currently exist and in the anticipated fuel beds into the future with no management action taken. Because of the variability in the three facets needed to predict fire behavior; fuel, weather and topography that exist within the project area, there would be variations in the conditions and results of wildfire. On northern aspects, conditions would be expected to be cooler than southern aspects, lending to slightly slower and slightly less intense fires. Lower fuel loadings could produce slower rates of spread and intensities than predicted above. There are conditions that could produce higher rates of spread and intensities than in the above tables as well. These would include increased slopes, wind conditions, greater surface fuel loadings (both small and large down-woody debris) and increased density of ladder fuels.

## Indirect Effects

In choosing the no action alternative the SNF managers would be accepting the risk and effects of possible severe wildfire to the watersheds, the WUI communities, and the Pacific fisher. There would be very limited to no potential for the utilization of prescribed fire as a form of restoration treatment or allow fire to play its natural role on the landscape. The risk of escape and the consequential effects associated with utilizing fire without some form of management activity to reduce current surface fuel loadings and ladder fuels would be too great. Although prescribed fire could be implemented under more “controlled” conditions than those conceivably present during the summer fire season, it would be a very narrow prescription window that could produce reasonable outcomes that would be beneficial versus detrimental. Just like wildfire, prescribed fire produces air quality concerns, risk of escape, potential negative impacts to resources (from control lines and fire itself), resource commitments and political/social impacts.

## Cumulative Effects

Fire danger that exists in the Greys project areas does not stop at the project area boundary. As described in the “Affected Environment” section, the fire hazard is considerable and spreads throughout the national forests of the Sierra Nevada Mountains. Because the problem is so large, it is necessary to concentrate fuels treatments on high priority areas where important forest ecosystems and the human environment coexist. Because of the large scale of the fire hazard and the potential spread of wildfire from outside the project area, the landscape scale is used as the geographic boundary for cumulative effects analysis. The ongoing and foreseeable vegetation management projects identified in table 8 within the Greys project area is of limited scope in reducing hazardous fuel conditions but conditions would intensify as described in table 5.

***Fire Suppression***

As surface fuels continue to accumulate naturally, with no additional management actions, suppression efforts would gradually become more difficult, whereby direct attack could no longer be used in suppressing a fire, but have to be changed to more indirect tactics, whereby more area

has the potential to be affected by fire, in some cases high intensity and more severe fire. With the increases in fire behavior generated by these surface fuel changes, fire suppression forces would have higher resistance to control due to fuel loading and by fire behavior. Aerial retardants would be less effective due to closed continuous canopy. If fire were to start in or burn into the project area, ground and aerial initial attack operations as well as extended attack would become less effective and firefighter and public safety would be difficult to ensure.

***Fire Effects***

Fire influences many portions of a fire dependent ecosystem by either its presence or even its absence. Forest stand structures, wildlife habitat, aquatic communities, watersheds, plant communities and soil conditions, to name a few can be influenced. Without frequent fire to clean the understory of stands, excessively dense stands lead to drought stress and bark beetle outbreaks, resulting in wide spread mortality of trees in many areas and the potential for extensive mortality. This leads to a large increase in the amount and continuity of both live and dead forest fuels, resulting in a substantial increase in the probability of large, severe wildfires (Weatherspoon, C.P., 1996). These are directly correlated to the conversions of Fuel Models discussed in the Existing Conditions section.

With increased rates of spread, flame lengths, and fireline intensities there is potential for greater fire effects to occur. Because of existing changes in tree species composition, from fire resistant to fire susceptible, tree mortalities would increase with small incremental changes in wildfire intensity. This, in combination with drought or insect/pathogen induced mortality in overstocked stands, could greatly increase the amount of surface fuel loading, thus increasing fire behavior and intensity of subsequent wildfires. Under Alternative 1, there would be no reduction in surface and ladder fuels; to raise mean canopy base heights and/or decrease canopy bulk densities as has been suggested in the desired condition for creating fire resilient stands. Vertical continuity of fuels from the forest floor to the crowns of overstory trees would be present and with sufficient radiant/convective heat could produce crown fire. Some studies and models, however, suggest a crown fire entering a stand is rarely sustained (i.e., sustained only under extreme weather conditions) (North, M., et.al, 2009). Calculated and predicted crown fire potential (Table 44) show that conditions are present in the project area to produce the potential for crown fire. This could be in the form of torching single trees, groups of trees and/or active crown fire dependent on weather, fuels and topography of where the fire were to occur.

Crown fires remove much of the entire tree canopy in a particular area, essentially resetting the successional and growth processes of stand and forests. These fires typically, but not always kill or temporarily reduce the abundance of understory shrubs and trees. Crown fires have the largest immediate and long-term ecological effects and the greatest potential to threaten human settlements near wildland areas (Graham, R., et.al, 2004). For wildlife species dependent on diverse forested landscapes (heterogeneity) characteristics for habitat, this successional "set-back" could pose negative consequences.

Although crown fires would be considered of higher consequence of negative effects, surface and ground fires with higher intensities similar to those predicted and anticipated in this alternative, can also have negative impacts. While surface fires can reduce vegetation and woody, moss, lichens and litter strata, ground fires that consume large amounts of woody fuels and organic soil horizons can produce disproportionately large amounts of smoke. Ground fires reduce the accumulation of organic matter and carbon storage and contribute to smoke production during active fires and long after flaming combustion has ended. These fires can also damage and kill large trees by killing their roots and the lower stem cambium. Because ground fires are often of long duration, they may result in greater soil heating than surface or crown fires, with the potential for reducing organic matter, volatilizing nutrients, and creating a hydrophobic layer that

contributes to erosion. Areas where the ground cover is removed and severely burned would likely see decreased infiltration of water, increased surface runoff and peak flows, and the formation of pedestals, rills and gullies (Graham, R., et.al, 2004).

Depending on the setting (in particular topography and soil), perennial streams downstream from fires can be impacted by large volumes of sediment. Depending on the recovery of the hill slopes, these fire effects can be long lasting, and relatively little can be done to stop the problem. Large amounts of sediment can be delivered to reservoirs, reducing water storage capacity and potentially affecting fish and macro invertebrate habitat (Graham, R., et.al., 2004).

**Summary of Effects**

Alternative 1 would not meet the purpose and need for this project. There would be no thinning; commercial and precommercial thinning accomplished. Forest health in the area would continue to decline. No connection and augmentation of fuel treatments within and adjacent to the WUI would be completed. No DFPZ and fuelbreak work would be completed.

The predicted rate of spread, flame length, and fireline intensity would increase due to fuel accumulation if left untreated. Full suppression would continue to be the management direction for the Greys Project area. Because of the continued and potential increased threat to life and property, under Alternative 1, firefighting resources would focus strategies and tactics on reducing the impacts on communities, protecting infrastructure and private property as the highest priority followed by protection of natural resources. The resistance to control would increase from Low/Moderate to Moderate to Very High. Aerial fire suppression would not support ground forces due to the inability of retardants to reach ground fuels because of closed canopy cover.

## Alternative 2 – Proposed Action

### Design Features and Mitigation Measures

Treatments are proposed to reduce surface fuels, ladder fuels, and some aerial fuels to meet the purpose and need of reducing stand densities to restore forest structure and composition towards heterogeneity and biodiversity, and reduce the potential for uncharacteristically severe wildfire. This is to occur, if one of these alternatives were chosen, through the use of mechanical methods as well as management ignited fire in the form of prescribed fires such as pile burning, and understory burning. Prescribed fire would be applied to the project area for three purposes: 1) as a final “cleaning” after vegetation management treatments to further reduce 1, 10 and 100 hour fuels (those fuels that have the greatest influence on fire spread); 2) to maintain the lower levels of the 1, 10, and 100 hour fuels; 3) to reintroduce the fire element back into a fire dependent ecosystem.

First treatment areas were designed to create SPLAT’s to reduce the intensity and spread of wildfires in and around WUI. Treatment areas near key transportation corridors and within the defense zone of the WUI were designed next then followed by linear DFPZs and fuelbreaks located near roads and along ridges used as a line of defense or control point for fire suppression activities. Treatment areas were further designed to not only focus on those treatments needed to meet fire and fuel objectives (treatments defined for fire/fuels are designed to reduce the ladder and surface fuels and occur within the lower and limited mid-level canopy) but areas where the stands were considered overstocked with conifers and are in higher levels than can be sustained with changing environmental conditions and are vulnerable to loss from insect, disease and wildfire (ecological and forest health objectives) (treatments defined for ecological restoration are designed to reduce basal area and stocking to such a level that the stands are resilient to changing environmental conditions, increase growth and are vigorous with reduced susceptibility to insect and disease attack and wildfire. These treatments occur within the lower and mid-level canopy).

The utilization of prescribed fire only as a form of restoration treatment would be conducted in treatment areas identified as "Rx" units. These units would have at least two prescribe fire entries within the lifespan of the project. Utilization of prescribed fire after structural restoration treatments have been completed would be conducted in treatment areas identified as "H" and "T". These units may include pile burning, understory burning or a combination of both.

## Direct Effects

Under this alternative, thinning from below, through precommercial and/or commercial means would focus first on the smaller trees for removal gradually moving through the lower canopy levels with the potential to remove trees within the mid-level canopy to reach a silvicultural prescribed basal area and stocking level. Through the treatments in Alternative 2, the recommendations in Table 1 are accomplished by reducing surface and ladder fuels, increasing canopy base height, decreasing crown density, retaining larger trees and retaining fire resistant tree species.

### *Fuel Model Changes*

Under Alternative 2, the existing fuel model would be converted to another fuel model, typically a fuel model with lower surface fuel loadings and reduced fire behavior. In areas currently represented by Fuel Model SH2, mastication would be used to convert it to a Fuel Model SB1 (light dead and down activity fuel) and/or SB2. Mastication in effect does not remove the fuel from the site, but changes the structure of the fuel from a vertical orientation to a horizontal orientation. Small chips, shredded material and/or crushed fuels (dependent on masticator head) are left on site. A fuel model that represents an increase in fuel loading in the 10 and 100-hour time lag categories is needed to show this. SB1 and SB2 are used as base fuel models with increases in 10 and 100-hour fuel loadings to approximately 10- 30 tons per acre each and the removal of live woody fuel loading to approximate this conversion.

In timbered stands represented as Fuel Model TL3 and TL8, there would be or no conversion to a different fuel model. In stands represented by Fuel Model TU5 and SB2, would convert them to a Fuel Model TL8 dependent on the overstory and surface fuels remaining. In some cases, a short-term conversion to a Fuel Model SB2 or TU5 may occur until post activity treatments were completed, then a conversion to a Fuel Model TL8 would result.

The fuel model conversions shown are used to depict the conditions anticipated in the surface fuel bed changes as a result of the treatments proposed in this alternative. This alternative is also anticipated to raise canopy base heights, with the thinning or removal of ladder fuels from an average of 0-10 feet to an average of 20 feet. Canopy bulk density would also be decreased through the thinning of lower and mid-level canopies. It is estimated that, on average the canopy bulk density would be changed from 0.0119 lb/ft$^3$ to 0.00874 lb/ft under Alternative 2.

### *Surface and ladder fuels*

The removal and/or thinning of the lower canopy in effect removes the ladder fuels that can provide the means for surface fires to "climb" into the overstory canopy. In areas where there is a significant amount of ladder fuels present, combination of tractor or hand piling and burning would be used to remove excess material. In areas where brush species are the dominant vegetation cover, masticators would be used to in effect change the vertical continuity of the fuel. While mastication does not actually remove fuel from the area, it does change the structure from a vertically oriented fuel (ladder fuel) to a horizontal fuel potentially making fire suppression resistance to control lower and fire effects less in most cases. In areas where there are lower

amounts of ladder fuels and/or smaller areas, mastication and/or hand cutting would be used to open or separate the lower canopy from the mid to upper level canopy. Typically, these areas have lower levels of surface fuels existing (smaller amount of trees/vegetation, less amounts of naturally accumulated or activity generated surface fuels).

Dependent on the type of harvest system used for removal of excess commercial-sized material, it is anticipated there may be a short-term increase in surface fuel loading or no significant increase. Whole-tree yarding, used as a harvesting system, can minimize the amount of activity generated fuels (Stephens, S., 2009). If whole tree yarding is not used, additional post harvest treatments would be needed to reduce surface fuel loadings that are in excess of 20 tons/acre (SNFPA ROD, 2001). These post activity treatments would include dozer and/or hand piling and burning and/or broadcast/jackpot burning.

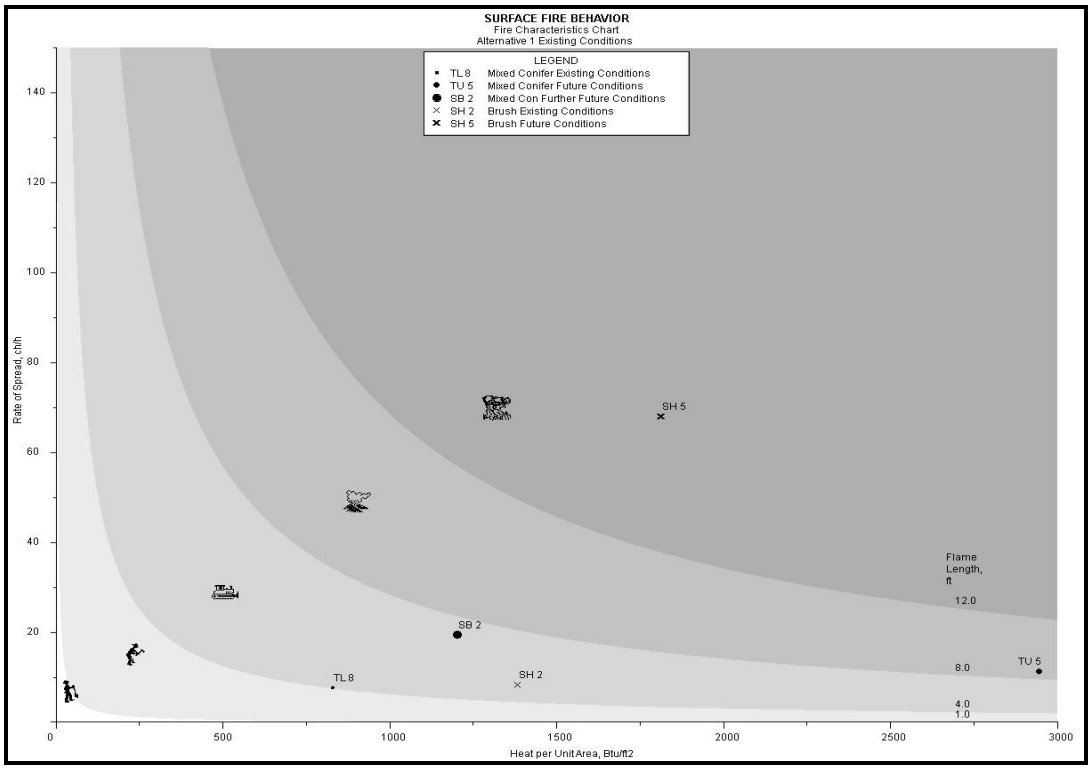
### *Fire Behavior / Fire Effects*

**Table 44. Shows the predicted results of fuel model conversions anticipated with this Alternative.**

| Fuel Model | FL (ft) | ROS (Ch/hr) | FLI (Btu/ft/s) | Crown (Transition and fire type) | Resistance to Control (Low/Med/ High) | Probability of Mortality (%) WF/PP |
|---|---|---|---|---|---|---|
| **True Fir** (above 6,000 ft) | | | | | | |
| Existing Conditions- TL3 | 1.3 | 2.2 | 9 | No/CondCrown | Low | 0/0 |
| Short Term Conversion- TL5 | 2.6 | 5.7 | 44 | No/CondCrown | Low/Mod | 4/6 |
| Future Condition -TL1 | .7 | 1.2 | 3 | No/Surface | Very Low/Low | 0/0 |
| Future Condition - TL3 | 1.3 | 2.2 | 9 | No/Surface | Low | 0/0 |
| | | | | | | |
| **Sierra Mixed Conifer** (moderate fuel loading w/some brush) | | | | | | |
| Existing Conditions- TL8 | 4.0 | 7.6 | 117 | Yes/Crown | Low/Mod | 7/7 |
| Short Term Conversion- TL5 | 2.6 | 5.7 | 44 | No/CondCrown | Low/Mod | 4/6 |
| Short Term Conversion- SB2 | 7.3 | 19.4 | 431 | Yes/Crowning | Moderate | 21/22 |
| Future Condition - TL1 | 0.7 | 1.1 | 3 | No/Surface | Very Low/Low | 0/0 |
| Future Condition - TL8 | 4.0 | 7.6 | 117 | No/Surface | Low/Mod | 0/0 |
| | | | | | | |
| **Sierra Mixed Conifer** (moderate-heavy fuel loading) | | | | | | |
| Existing Conditions- TU5 | 8.6 | 11.3 | 606 | Yes/Crowning | Mod/High | 34/44 |
| Short Term Conversion- SB2 | 7.3 | 19.4 | 431 | Yes/Crowning | Moderate | 21/22 |
| Short Term Conversion- TU5 | 8.6 | 11.3 | 606 | Yes/Crowning | Mod/High | 34/44 |
| Future Condition - TL8 | 4.0 | 7.6 | 117 | No/Surface | Low/Mod | 0/0 |
| | | | | | | |
| **Sierra Mixed Conifer** (heavy fuel loading) | | | | | | |
| Existing Conditions- SB2 | 7.3 | 19.4 | 431 | Yes/Crowning | Moderate | 21/22 |
| Short Term Conversion- SB2 | 7.3 | 19.4 | 431 | Yes/Crowning | Moderate | 21/22 |
| Future Condition - TL8 | 4.0 | 7.6 | 117 | No/Surface | Low/Mod | 0/0 |
| | | | | | | |
| **Brush/Shrub** (includes some mixed conifer stands with brush understory) | | | | | | |
| Existing Conditions-SH2 | 5.3 | 8.4 | 217 | Yes/Crowning | Moderate | 12/9 |
| Future Condition - SB1 | 3.7 | 8.0 | 100 | No/Surface | Low/Mod | 0/0 |
| Future Condition - TU1 | 2.0 | 3.3 | 27 | No/Surface | Low | 0/0 |
| Future Condition - SB2 | 7.3 | 19.4 | 431 | No/Surface | Low/Mod | 17/14 |

Table 44 gives an indication of what type of fire behavior could be expected if a fire were to occur within these fuel beds as they currently exist, short term conversion after the treatment but before the disposal of activity created fuels, and anticipated future condition fuel beds after disposal of activity created fuels were to occur. The range of fuels models in the future condition are based on mitigation measures in mixed conifers areas and brush density in plantations. Because of the variability in the three facets needed to predict fire behavior; fuel, weather and topography within the project area, there would be variations in the conditions and results of wildfire. On northern aspects, conditions would be expected to be cooler than southern aspects,

lending to slower and less intense fires. Lower fuel loadings could produce slower rates of spread and intensities than predicted above. There are conditions that could produce higher rates of spread and intensities than in the above tables. These would include increased slopes, wind conditions, greater surface fuel loadings (both small and large down-woody debris) and increased density of ladder fuels. Figure 21 graphically displays the modeled fire behavior changes with each alternative.



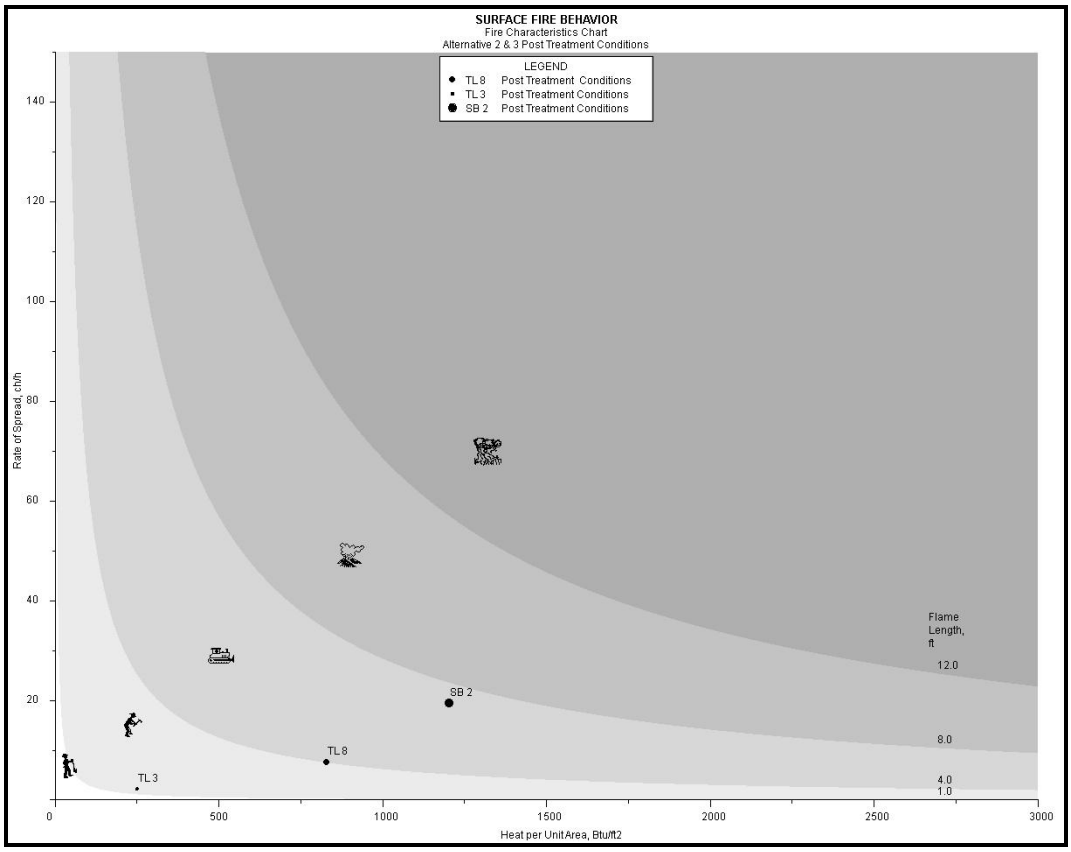



**Figure 21. Hauling Chart displaying modeled surface fire behavior by fuel models for each project alternative.**

## Indirect Effects

Past and present actions for the project area, along with fire management policy of full suppression at the smallest size (97 percent of all fires will be controlled at 10 acres or less from SNF LRMP, 1996) have contributed to the current existing condition for the project area and are used to depict the existing condition and the resultant fire behavior within the project area.

## Cumulative Effects

### Past, Present and Reasonably Foreseeable Activities

Table 45 summarizes the effects that the past, present, and reasonably foreseeable action would have on fire behavior within and outside the project area. These effects cumulatively show both reduction and increase of potential wildfire behavior and associated effects on resources (wildlife habitat, soil, aquatic habitat). Not all projects affect fire behavior and fuels but would have an overall effect of improving the resiliency of the forest to severe wildfire.

**Table 45. Cumulative Effects: Past, Present and Reasonable Foreseeable Activity, summary.**

| Activity Type | Description | Year-Timeframe | Cumulative Effects on Project Area |
|---|---|---|---|
| Cedar Valley Thinning Project | Thinning and pile burning to reduce the potential for severe fire. Located east of the project area. | 2006 Past | Treatments reduce density also reduce fire severity. Increases area that is more fire resilient |
| Redwood Creek Project | Thinning and pile burning to reduce the potential for severe fire. Located southeast of the project area. | 2008 Past | Similar to Cedar Valley Project. |
| Bass Lake RD Fuelbreak Projects; Granddad, Sivels, Chepo | Create and maintain 3 fuelbreaks and maintain 1 existing fuelbreaks in the Grey Project. | Past, present, foreseeable | Treatments that reduce density, surface and ladder fuel loads also reduces fire intensity and severity. Increases area that is more fire resilient. |
| Timber Sales | Timber management projects. | 1970 - Present | Similar to Cedar Valley Project. Fuels continue to accumulate over time and would cause increases in fire behavior and resistance to control. |
| Roadside Hazard Tree Removal | Removal of damaged, rotten, dead trees to abate roadside hazard. | 1990 Past, present, foreseeable | Biomass removal reduces resistance to control. |
| Plantation Maintenance | Thinning, hand release, chemical release, mastication, and planting in plantations. | Past | Similar to Bass Lake RD Fuelbreaks. |
| Cultural Resource | Past mitigation treatments and practices - flag and avoid cultural resource sites. | Past - Present | Increased fuel load and density may increase fire severity and higher resistance to control. |
| Private Land residential development | Subdivision, timberland conversion to housing tract. | Foreseeable | Increases level of risk due to increase in WUI from general forest. |
| Private Land – One Mind Parcel | Unknown history of vegetation management. | Ongoing | Increases level of risk due to fire ignition from private property to general forest. |
| Campgrounds - Texas Flat, Chilkoot, Greys Mountain | Improve and maintain campground facilities and surroundings. | Past, present , foreseeable | No effect on facilities but pest management through biomass removal reduces resistance to control. |
| Motorized Recreation Trails | 4X4, Off Road Vehicle (OHV), travel on designated routes. Continued trail maintenance. | Ongoing, Past, present , foreseeable | Treatments reduce density also reduce fire severity. Increases area that is more fire resilient |
| PG&E Transmission Line | Right of way maintenance. | Ongoing Past, present , foreseeable | Vegetation Management. – PG&E Transmission Line |
| Livestock Grazing | Grazing of light fuels. | Ongoing Past, present , foreseeable | Livestock Grazing could reduce rate of spread and resistance of control. |
| Roads | Maintenance of existing roads (grading, brushing and cleaning of culverts) | Ongoing Past, present , foreseeable | Lack of maintenance could cause a delay in response to fire suppression activities or escape. |

### *Fire Suppression*

Alternative 2 reduces ladder fuels which in turn increases canopy base height. Canopy density (in the form of canopy bulk density) would be decreased through the thinning of the mid-level canopy, and to a small extent through the reduction in fuel ladders. These, in combination, reduce rates of spread, flame length, fireline intensity, resistance to control and the potential for a fire to transition into crown fires. Decreasing crown density may increase surface winds (less canopy to reduce winds before they reach the ground) and surface fuels may be drier (more sunlight reaching the ground). These do have the potential to increase fire behavior. It is estimated that Alternative 2 would not open canopies to the extent needed to realize these concerns. It is estimated that in most areas, canopies would remain at 60 percent or greater in the overstory even after treatment. This change would not be significant enough to change the amount of wind reaching the surface. There would be small amounts of increased sunlight to dry fuels, but not significant enough to dramatically change fire behavior.

If full fire suppression continues as the management strategy for unplanned ignitions within the project area, fire suppression resources would have an increased capacity to control fires at initial attack with minimized risk to their safety (and the public) and increased ability to keep these fires small in size with the use of direct attack tactics versus indirect tactics. Fires would typically drop from the crowns to the forest floor. Aerial firefighting resources would be better able to penetrate the canopy to aid ground resources with reduced canopy density, even moderate amounts as an indirect effect of treatments in Alternative 2.

Design features used to minimize effects and/or retain habitat structures preferred by wildlife species such as; grouping of larger trees, oak retention with ladder fuels retained under them and OFLs with limited treatments would have lower potential for loss since there would be treated areas between them and are not continuous. This would be similar to the variability in forest conditions produced by frequent fire (North, 2009).

In utilizing mechanical treatments, as in Alternative 2, stand structures are modified quickly and more precisely than with prescribed fire alone (North, 2009). Under this alternative, treatments are effective in breaking up the horizontal and vertical continuity of live fuels in the lower canopy layers and/or in effect pre-treating the stands to more readily allow prescribed fire to be introduced. Silvicultural cuttings can only partially substitute for fire (Weatherspoon, 1996). This alternative allows increased potential to utilize prescribed fire as either a maintenance treatment and/or in conjunction with mechanical treatments as a follow-up process to achieve forest resilience. Fire could mimic the natural ecosystem functions of frequent low-to-moderate severity fire. Under this alternative, prescribed fire, whether burning of piles and/or broadcast burns can be implemented with less risk of escape, with a broader range of acceptable conditions and in some cases less impacts to air quality (Weatherspoon, 1996).

### *Fire Effects*

With the removal of what is considered the suppressed, intermediate and some co-dominates within a stand, the vegetation considered ladder fuels would be removed. Conifer species such as Ponderosa Pine and Sugar Pine, which are considered more fire resistant, would be favored to remain in a stand over shade tolerant and fire sensitive species, such as incense cedar and white fir. Incense cedar and white fir make up the largest percentage of conifers found in the understory of stands in the project area (based on sampled plot data). These species also tend to have increased susceptibility to wildfire as well tend to have limbs that stay closer to the ground providing increased ability to take surface fires into the crowns in the form of single tree torching

or group torching. With species composition favored towards the more fire resistant, shade intolerant species and fire behavior modified, effects to stands (mortality) would be decreased.

As part of this alternative, treatments would be implemented to reduce surface fuels, where needed. In most cases, as been experienced in past projects similar to this alternative, these areas are not continuous over the entire treatment area. If a fire was to start in an area where these surface fuels have not been reduced, fire behavior would be increased (as represented by Fuel Model SB2). The results of wildfire impacts on areas treated only with mechanical methods are mixed. Some burned with higher intensity, than those where mechanical treatments were followed by prescribed burning, though with lower severity than untreated control areas (Stephens, S. 2009). The timing and sequence of these "clean-up" treatments are dependent on several factors, such as adequate funding and completion of harvesting operations. Those treatment areas closest to WUI would be treated first and then would progress into other areas from there. As stated earlier the surface fuel load changes would be largely based on harvesting system used. If whole-tree yarding is used, post treatment areas where natural fuel accumulations are above 20 tons/acre would be the areas where secondary treatment would be used. These are areas expected to be less (acres) in need of surface fuel reduction.

With reduction in fire behavior, the effects of fire on other ecosystem components would be reduced and perhaps enhanced. Many are resistant or often have favorable responses to low to moderate fire intensity and severity. The idea of preemptive work that restores historic fire regimes has not been widely discussed, considered, or used to address both the ecological and social issues surrounding fires and watershed resources. The same can be said for many of the wildlife species that live and depend on the forested ecosystem. At-risk species, and the ecological functioning systems they depend on, cannot be sustained or recovered without the immediate and longer-term ecological functioning provided by fire. In Alternative 2, integrating fire and fuels management objectives and forest health restoration with at-risk species conservation and protection are made. This is needed to provide both the viability of human communities and at-risk species where both overlap (Sugihara, N., et.al. 2006).

### *Climate Change and Fire Severity Relationships*

As stated earlier, weather has a large influence on fire behavior and is also the most difficult to predict. High-severity fire in California mixed-conifer forests has increased in extent in recent decades because of the effects of climate change, particularly temperature, on burning conditions in these fuel-rich forests (Miller et al.2009). Associated with the purpose and need to reduce stand densities to levels where trees would be more resilient to drought conditions, reducing surface and ladder fuels to reduce wildfire intensity and spread, can also produce benefits in drought conditions. Research suggests global mean minimum temperatures may have already begun to rise. One effect of this change for western forests would be earlier spring melt of mountain snow packs. An analysis of western U.S. fire season length over the last 50 years suggests that during the last two decades, fires begin earlier in the spring and occur later in the fall possibly due to this trend in elevated nighttime minimum temperatures. Though there are variations in predictions and models, one point of consensus is that most agree the climate would become more extreme, suggesting oscillations between wet and drought conditions would be more common (North, 2009).Climate projections with increased atmospheric carbon dioxide and general circulation models predict continued warming in California into the 21st century (Hayhoe et. al. 2004).

Climate change heightens the risk of stand-replacing fire in these highly altered forests. Restoration of the self-limiting fuel–fire–forest structure mosaic that characterized these forests before fire suppression with prescribed fire would reduce the risk of unusual high-severity fire. . (Scholl 2010). Changing climates in the next several decades may further complicate fire

management by increasing temperatures and fire season length (Stephens, S. et.al, 2009). Fires now occur less frequently and cover much less area, but are likely to be large and severe when they do occur (SNEP, 1996).

Managing forests under these conditions would be challenging. In the face of uncertainty, adaptive strategies should focus on three responses; resistance (forestall impacts and protect highly valued resources), resilience (improve the capacity of ecosystems to return to desired conditions after disturbance), and response (facilitate transition of ecosystems from current to new conditions) (North, 2009). All of these are focuses that Alternative 2 attempts to address through changes in forest structure capable of surviving climate changes and reduction in fuels to adapt fire behavior that occurs under current climate and ignition conditions (North, 2009).

### Summary of Effects

Under Alternative 2, ladder and surface fuels are reduced to levels that would meet the purpose and need for fire and fuels. The development of Strategically Placed Area Treatments (SPLAT's) which reduces the risk of wildfire and modifies fire behavior over the broader landscape would occur. Additional areas would be treated to provide a fuelbreaks and defensible fuels profile near key transportation corridors and within the defense zone of the wildland urban intermix. By decreasing fuel ladders, which raises canopy base heights and reducing surface fuels, fuelbeds are converted from ones that produce moderate to high fire behavior to fuelbeds that produce moderate to low fire behavior. In addition to those treatments needed to meet fire and fuels objectives, treatments would be created to reduce stand densities (basal area) to such a level as to improve the growth and vigor of remaining trees.

## Alternative 3

In Alternative 3, treatment areas would remain the same as in Alternative 2, treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. Under Alternative 3 there would be no additional treatments (i.e. additional thinning in the mid-level canopy) to fully address stand density and forest resiliency.

### Direct Effects

Under Alternative 3, there would be no significant change in the direct effects from those listed under Alternative 2. There is a potential for a decreased amounts of additive surface fuel loading within all "T" treatment areas resulting from less conifers being removed. As stated in Alternative 2, resultant increases or decreases in surface loadings from harvesting operations are dependent on the type of harvesting operations that are used. By increasing canopy base heights and reducing surface fuel loadings, fire and fuels objectives are met.

### Indirect Effects

Under Alternative 3, there would be no significant change in the indirect effects from those listed under Alternative 2. There is a potential for aerial firefighting resources to be less effective in all "T" treatment areas with no reduction in mid-level canopy densities. Increased crown densities in the den site area would make it difficult for retardant and/or water dropping from helicopters to penetrate to the ground. In assuring the reduction in ladder fuels to raise canopy base heights from 0-10 to 20 feet and reducing surface fuel loadings, fire intensity and spread are reduced to desired condition levels and meet the fire and fuels objectives stated in the purpose and need of the project.

There is little to nothing done to reduce forest stand densities within the Fisher den site area though with this alternative and could produce losses from drought induced mortality, insect and

disease. Long-term, these types of disturbances could induce increases in surface fuel loadings and/or increased snag levels producing conditions similar to those already existing in the project area with resultant fire behavior (intensity and spread rates) similar to those predicted in Alternative 1, with the exception of crown fire potential. It is assumed that with the reduction in ladder fuels, there would be increases in rates of spread; increase flame lengths, increased fireline intensity, and increased resistance to control, similar to that seen in Fuel Model TL8 in Alternative 1, but this would be as a surface fire with potential for crown fire reduced and/or eliminated. Fire intensities could cause the potential for single or group tree torching because of the increased number of fire susceptible trees such as white fir and incense cedar left in the stand, but this is expected to be less than in Alternative 1

## Cumulative Effects

Under alternative 3, there would be no significant change in cumulative effects from those listed under alternative 2.

## Summary of Effects

An alternative 3 reduces ladder and surface fuels to levels that would meet the purpose and need for fire and fuels. But Alternative 3 does little to nothing for the multi-objective purpose and need of the project which includes reducing stand densities to create a resiliency.

# Air Quality

## Introduction

This report analyzes the direct, indirect and cumulative effects to Air Quality and visibility from the alternatives proposed to meet this purpose and need as well determines the General Conformity of these actions to the Clean Air Act. The direct, indirect and cumulative effects to air quality and visibility are summarized from the Air Quality Report for the Greys Mountain Project (Smith, G. 2010).

## Overview of Issues Addressed

Fire is an important part of California ecosystems, but it also produces combustion by-products that are potentially harmful to human health and welfare. Carbon dioxide and water are the two products of complete combustion and generally make up 90 percent of the total emissions from wildfire. In incomplete combustion that occurs under wildfire conditions, smoke is composed of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, and other organic compounds, nitrogen oxides, trace minerals and several thousand other compounds. Particulate matter is the principle pollutant of concern to human health from wildfire smoke for the short-term exposures typically experienced by firefighters and the public. Studies indicate that 90 percent of smoke particles emitted during wildland burning are particles that measure less than ten microns in size ($PM_{10}$), and about 90 percent of these are less than 2.5 microns in size ($PM_{2.5}$). Hydrocarbons and nitrogen oxides from large wildfires contribute to increased ozone formation (which causes injury to plants) under certain conditions (Ahuja 2006).

## Issues Relevant to Air Quality

There are two general strategies to managing wildfire smoke: (1) emission reduction and (2) emission redistribution. All pollutants except nitrous oxide are negatively correlated with combustion efficiency, so actions that reduce one pollutant result in the reduction of all. Emission redistribution techniques may effectively keep smoke impacts away from sensitive areas, but does little to reduce the amount of emissions produced. But optimal use of reduction techniques can reduce emissions by approximately 20 to 25 percent, assuming all other factors (vegetation types, acres, etc.) were held constant and land management goals were still met. Emission reduction techniques can include reducing the area burned, reducing fuel loading, reducing fuel production, reducing fuel consumption, and scheduling burning before new fuel appears and increasing combustion efficiency (Ahuja 2006). These reduction techniques, which can include prescribed fire, mechanical harvesting (which includes road work, cutting, and hauling of material) and vegetation management treatments (mastication and mechanical piling) can produce emissions that can affect human health and visibility.

## Affected Environment

The project is within two air basins that are regulated by two air districts: San Joaquin Valley Air Pollution Control District (SJVAPCD) for Madera County and Mountain Counties Air Pollution Control District for Mariposa County. Each are responsible for implementing and regulating sources that degrade air quality and are responsible for meeting Federal and State air quality standards. The Air Resources Board (ARB) has oversight authority to monitor performance of district programs. The affected environment (geographic area) in this analysis includes areas that would or could experience degradation as a result of the actions proposed. SJVAPCD and the

Mountain Counties Air Pollution Control District are considered the air basin downwind from the project and are the air basins direct, indirect and cumulative impact analysis is focused on.
The community of Fish Camp borders the west boundary of the Greys Mountain Project. Within this project are three Forest Service campgrounds, a State Snow Play area and a county refuge transfer site. There is also a special use permit for a wilderness pack station and horseback riding. Also within the project is a 244 room hotel situated on 35 acres with numerous out buildings and guest cottages. State Highway 41, borders the western boundary of the project and is the southernmost route into Yosemite National Park. Vehicular traffic increases during the summer months with visitors travelling into the park, but is also used to access Badger Ski Area in the park during the winter months.

Communities, State highways, Class I airsheds, and recreation sites are considered smoke sensitive receptors where smoke and air pollutants can adversely affect public health, safety and welfare. These areas could be affected by smoke if weather patterns produce a stable air mass and smoke is unable to vent into the upper atmosphere. Since $PM_{10}$, $PM_{2.5}$and ozone are public health hazards, prescribed burns would be planned during periods of unstable air, which would allow for proper ventilation and temperatures less than 95 degrees. However, since prescribed underburns could last for several days or weeks there is the potential for recurring shifts in air masses toward more stable conditions. For this reason, all prescribed fire activities are coordinated with Mountain Counties Air Pollution Control District and the SJVAPCD and would be implemented under optimum conditions using best available control measures (listed in Chapter 2 under Air Quality [Fuels]) to prevent smoke concentrations from affecting local communities. Sensitive receptors were considered within 100 kilometers (10 miles) of the project area and are listed in Table 46 below

**Table 46. Sensitive receptors identified within 10 miles of the Greys Mountain Project**

| Sensitive Receptor Type | Location |
|---|---|
| Towns, Communities | Fish Camp, Yosemite Mountain Ranch, Oakhurst, Wawona, Bass Lake |
| Recreation Areas | Miami Motorcycle Trails, Westfall Day Use, Lewis Creek Natural Scenic Trail, Goat Meadow Winter Sports Area, Yosemite Sugar Pine Railroad, Yosemite Pack Station, Bass Lake |
| Campgrounds | Nelder Grove, Big/Little Sandy, Kelty Meadow, Fresno Dome, Summerdale, Summit, Soquel, Westfall, Greys Mtn., Bass Lake C.G.s |
| FS Work Center/Ranger Station | Westfall, Batterson, Oakhurst Visitor Information Center |
| Roads | State Highway 41, Forest Service and County Roads |
| Class I Federal areas | See Table 38 for Class I areas |
| Other | Private lands within and adjacent to the project area |

## Existing Condition

The air quality in the San Joaquin Valley is among the poorest in the state. On average, the San Joaquin Valley experiences 35–40 days when it exceeds the federal health-based standards for ground-level ozone, and more than 100 days when it exceeds the state ozone standard. While

levels of airborne particulates exceed the federal standard less than five times annually, the state standard is set at a lower and more protective level. The valley exceeds the state particulate standard an average of 90–100 days per year (www.arb.ca.gov; Trends Summary).

## Desired Condition

The desired condition for air quality and visibility in the project area is to comply with federal, state and local air quality laws, including a program that achieves the Clean Air Act (CAA) responsibilities.

**Regulatory Frameworks**
The SNF LRMP as amended provides the S&Gs for the proposed action. It states that "Forest activities would be managed so air quality is compatible with federal, state and local laws; including a program that achieves the CAA responsibilities" (SNF LRMP 1992, pg. 4-2). The SNF LRMP has Standards and Guidelines for Air Quality (SNF LRMP 1992, pgs. 4-25) have been incorporated into the action alternatives as described in the Design Criteria Common to All Action Alternatives.

**Federal Conformity Requirements -** The CAA require that all projects receiving federal funds must conform to the appropriate State Implementation Plan (SIP). Federal actions are subject to either the Transportation Conformity Rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the General Conformity Rule (40 CFR 51[W]), which applies to all other federal actions. Because the project is not a federal highway or transit project, it is subject to the General Conformity Rule.

**General Conformity Rule Requirement -** The purpose of the General Conformity Rule is to ensure that federal actions conform to applicable SIPs so that they do not interfere with strategies employed to attain the National Ambient Air Quality Standards (NAAQS). The rule applies to federal actions in areas designated as nonattainment, or in some cases maintenance, for any of the six criteria pollutants. The rule applies to all federal actions except:

- Programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule.
- Projects with associated emissions below specified *de minimus* threshold levels.
- Certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed federal action's total direct and indirect emissions fail to meet one of these two conditions:

- Emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the NAAQS are below the *de minimus* levels indicated in Table 36.
- Emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the NAAQS are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant).

If either of these conditions is met, the requirements for general conformity do not apply because the proposed action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required. If neither of these conditions is met, a general conformity determination must be performed to demonstrate that total direct and

indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

The project is within two different air basins, the San Joaquin Valley (Madera County) and Mountain Counties (Mariposa County).Currently, the San Joaquin Valley is classified by both the federal and state standards as *severe non-attainment* for ground-level ozone and as *maintenance status* for PM10. The valley is designated as *in attainment* for all other criteria pollutants. (www.valleyair.org). The Mariposa County Federal attainment status for Criteria Pollutants is in non-attainment for 8-hour ozone and is unclassified for each of the other criteria pollutants. The two air basins are considered in attainment for all other criteria pollutants.

The Environmental Protection Act (EPA), for determining conformity, has developed *de minimus* levels for each of the criteria pollutants based on an air basins attainment status for each pollutant. Table 47 below shows these *de minimus* level thresholds and are bolded based on air basin status.

**Table 47. Federal de minimus Threshold Levels for Criteria Pollutants based on Air Basin attainment status.**

| Pollutant | Area Type | Tons/Year |
|---|---|---|
| Ozone ($NO_x$ or VOC) | **Extreme nonattainment (SJV Air Basin)** | **25** |
| | **Other $O_3$ Nonattainment Area Outside an $O_3$ Transport Region (Mountain Counties)** | **100** |
| Carbon monoxide, SO2 and NO2 | All nonattainment & maintenance | 100 |
| PM-10 | Serious nonattainment | 70 |
| | **Moderate nonattainment and maintenance (SJV Air Basin)** | **100** |
| Lead (Pb) | All nonattainment & maintenance | 25 |

**Note: Federal *de minimus* threshold levels in bold type are those where status is non-attainment or maintenance.**

**California Clean Air Act -** Responsibility for achieving California's air quality standards, which are more stringent than federal standards, is placed on the ARB and local air districts, and is to be achieved through district-level air quality management plans that are incorporated into the SIP. In California, the EPA has delegated authority to prepare SIPs to the ARB, which in turn has delegated that authority to individual air districts.

The ARB has traditionally established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving SIPs.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by California Environmental Quality Act (CEQA).

The California Clean Air Act (CCAA) of 1988 substantially added to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning

agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement control measures. The CCAA focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods are more stringent than the comparable federal standards.

The CCAA requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The CCAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for CO, sulpher dioxide ($SO_2$), $NO_2$, or ozone. These air quality attainment plans are specifically designed to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. Where an air district is unable to achieve a 5% annual reduction in district-wide emissions of each nonattainment pollutant or its precursors, the adoption of "all feasible measures" on an expeditious schedule is acceptable as an alternative strategy (Health and Safety Code Section 40914(b)(2)). No locally prepared attainment plans are required for areas that violate the state $PM_{10}$ standards, but the ARB is currently addressing $PM_{10}$ attainment issues.

The CCAA requires that the state air quality standards be met as expeditiously as is practicable but, unlike the federal CAA, the CCAA does not set precise attainment deadlines. Instead, the CCAA establishes increasingly stringent standards for areas that would require more time to achieve the standards.

**Local Air Pollution Control Districts -** Local APCDs are given the responsibility to develop programs and plans for achieving both Federal and State air quality standards and are given the authority to implement control measures to reduce emissions of each nonattainment pollutants or its precursors. This is implemented through the use of Rules and Regulations.

**Smoke Management**

In accordance with the California Code of Regulations, Title 17, all persons or entities subject to subchapter 2 Smoke Management Guidelines for Agricultural and Prescribed Burning would comply with the requirements therein and those requirements adopted by applicable districts in local smoke management regulations. Such persons or entities proposing to conduct prescribed burning must submit a Smoke Management Plan (SMP) to the air district of jurisdiction and: 1) receive a permit to burn, 2) receive authorization to burn on a given day, and 3) maintain communication with the local air district and report on the status of the burn until it is concluded.

**San Joaquin Valley Air Pollution Control District -** As agreed upon by SJAPCD staff and the Southern Sierra Interagency Smoke Management Group, all land managers planning to implement prescribed fire treatments would follow the Unified Guidelines and Procedures for Smoke Management, which includes the submission of a required Prescribed Fire Burn Plan and Smoke Management Summary. These are reviewed by district personnel and are conditionally approved. Burners are required to register prescribed burns prior to the fall burn season and authorization to burn is required prior to ignition based on air quality conditions and forecasts. For Prescribed Understory burning, seven days prior to ignition a Prescribed Fire Ignition Advisory (PIFA) form must be completed and submitted to district meteorology and compliance staff to begin receiving forecast for burn day potential. Participation on daily smoke management conference calls for burn project coordination is also required on a daily basis prior to and during implementation. On the day of ignition, final approval must be received from the compliance officer at the district. Pile burning approval is received through the calling the Hazard Reduction Burning phone number on a daily basis. A burn fee is applied to the total blackened acres accomplished on a yearly basis. These conditions are enforced through Air District Rules and Regulations (Rule 4103, Rule 4106).

**Mountain Counties Air Pollution Control District** - A SMP is required for all prescribed burns, upon review and approval a burn permit would be issued with a fee for issuance. For Prescribed Understory burning, seven days prior to ignition a Controlled Burn form (CB-3) must be completed and submitted to the district compliance staff and to California Air Resources' Meteorology to begin receiving forecast for burn day potential. Participation on daily smoke management conference calls for burn project coordination is also required on a daily basis prior to and during implementation. On the day of ignition, final approval must be received from the compliance officer at the district. Pile burning approval is received through the Prescribed Fire Information Reporting System (PFIRS) website on a daily basis.

**Prevention of Significant Deterioration -** The Prevention of Significant Deterioration (PSD) provisions of the CAA require measures to "preserve, protect and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic or historic value." The most stringent requirements for air quality apply to those established as Class I areas. These include international parks, national wilderness areas greater than 5,000 acres, national memorial parks greater than 5,000 acres, and national parks greater than 5,000 acres, and national parks greater than 6,000 acres established prior to August 7, 1977.

There are no Class I airsheds within the project area. However, there are Class I airsheds nearby that must be considered and protected. These airsheds are listed in the Table 48 below

**Table 48. Class I airsheds near the Greys Mountain Project area.**

| Class I Airshed | Proximity to Project Area |
|---|---|
| Yosemite National Park | Southern Park boundary borders the North boundary of project area. |
| Ansel Adams Wilderness Area | Western wilderness boundary approximately 9 miles East of project boundary. |

**Visibility Protection -** Visibility is an air-quality related value that is protected in all federal Class I areas. Since 1984, states have been required to protect the visibility in national parks and wilderness areas, as mandated by the 1977 Clean Air Act Amendments. The 1977 amendments established a national goal for the "prevention of any future and the remedying of any existing impairment of visibility in mandatory Class I federal areas which impairment results from manmade pollution." The regulations specifically require states to consider strategies for reducing visibility impairment from prescribed burning.

# Environmental Consequences

## Methodology

For each alternative proposed for the project, associated emissions are calculated. This is used to determine if any alternatives total direct and indirect emissions fail to be (1) below Federal *de minimus* thresholds, in this case thresholds for ozone (precursors $NO_x$ and VOC) and PM-10, or (2) considered regionally insignificant (less than 10% of the area's total emissions inventory for that particular pollutant). If any alternative's estimated emissions do not meet either of these conditions, a General Conformity Determination must be performed to ascertain how the proposed action would conform to the applicable SIP.

**Smoke Emissions Modeling -** Four pieces of information are needed to calculate potential emissions produced from either wildfire or prescribed fire; acres burned, fuel loading, fuel type and type of burning (pile, understory or wildfire) that can determine the amount of fuel

consumed. The actions proposed by each alternative are used to estimate these as well as information within the Fire/Fuels Report-Fish Camp Project. Associated emissions for criteria pollutants are derived utilizing an emissions spreadsheet developed and approved for prescribed fire emission reporting purposes. This form was developed and built by the Interagency Smoke Management Group and SJVAPCD staff from emission formulas from publications (EPA, AP-42).

**Vegetation Harvesting Equipment Emissions Modeling -** Information needed to calculate associated emissions produced by vehicular traffic from road work and mechanical treatments included in Alternatives 2 and 3 (thinning operations, mastication and dozer piling) are; type of equipment and the number of hours this equipment is expected to run. The actions proposed by each are used to estimate these. Equipment hours are based on average production rates from similar projects. Equipment typically used for this type of work includes; heavy duty diesel-powered vehicles (tractor-trailers log trucks), wheeled skidders and loaders, track type dozers/masticators, road graders, and smaller gasoline powered engines such as chainsaws. Emission factors for criteria pollutants are from "A Desk Reference for National Environmental Policy Act (NEPA) Air Quality Analysis" (CH2Hill 1995) and converted to total tons of pollutant.

**Fugitive Dust Emissions -** The Forest Service routinely requires timber sale operators to abate dust during use of the forest development roads. This is required for several reasons among which are: retaining road surface fines which help keep the larger supporting aggregate together; reduce dust visibility traffic hazards; reduce environmental dust plumes; and minimize loose fine material accumulations which can create muddy, road rutting conditions. (Lowe, 1994)

Fugitive (visible) dust emissions (VDE) by general vehicle movement are calculated at 10 pounds per day for five vehicles per day on unpaved roads. This figure is reduced to 3.63 pounds per day per mile of VDE after dust abatement. This is accomplished through watering of roads or other dust abatement measures which are incorporated into the project design. Dust abatement is required for roads below 3000 feet in elevation in the San Joaquin Valley Air Basin. The project is above 3,000 feet in elevation and is exempt from Regulation VIII, Rule 8011 General Requirements (www.valleyair.org), though dust abatements is still required by the Forest Service.

Because of this exemption and the use of abatement measures when they are not a requirement, specific calculations for fugitive dust emissions are not used in the analysis of potential emissions from this project, but are considered part of the direct, indirect and cumulative effects.

**Modeling Used in Analysis -** Associated emissions for criteria pollutants are derived utilizing an emissions spreadsheet developed and approved for prescribed fire emission reporting purposes. This form was developed and built by the Interagency Smoke Management Group and SJVAPCD staff from emission formulas from publications (EPA, AP-42).

- **Forest Vegetation Simulator with the Fire/Fuels Extension** was used to model PM2.5 emissions to show a comparison between the action and no-action alternatives. PM2.5 was used as a surrogate for PM10 emissions. FVS models a fire in the year 2022, 10-years after treatments.

## Incomplete and Unavailable Information

**Assumptions -** This determination assumes that prescribed burning would occur under optimal atmospheric conditions for the transport of smoke and pollutants away from the San Joaquin Valley as regulated by SJVAPCD. Burning of natural and activity created dead and down woody

material would occur under Best Available Control Measures (BACMs) for air quality as defined in Chapter 2.

## Spatial and Temporal Context for Effects Analysis

### Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

**Past Activities -** Air quality in the San Joaquin Valley air basin is among the poorest in the State. With the hot, dry summers, the San Joaquin Air Basin, in 2009, experienced 98 days above the federal standard for 8-hour ozone and 122 days above the state standard. Madera County, by itself, was above the federal 8-hour ozone standard 13 days and 27 days above the state standard (www.arb.ca.gov ; Trends Summary). For $PM_{10}$ in 2009, the estimated days over the federal standard was two, with 123 days estimated over the state standard. For $PM_{2.5}$ in 2009, the annual average days over the federal standard were 23, with 21 days over the state standard (www.arb.ca.gov ; Trends Summary).

**Present Activities –** Mariposa County is considered in nonattainment for both federal and state standards for ozone, Madera County is considered in nonattainment for state $PM_{10}$, $PM_{2.5}$ and ozone standards. The air basin is in federal attainment (maintenance level) for $PM_{10}$, but is in federal nonattainment for $PM_{2.5}$ and is expecting a reclassification from serious to extreme nonattainment for 8-hour ozone.

The BLRD's prescribed fire program continues to be part of the district program of work. The cumulative effect of smoke emissions and degradation of visibility may occur if prescribed burns were to continue during stable atmospheric conditions that are present when wildfires occur. For this reason, all prescribed fire activities are coordinated with SJVAPCD and would be implemented under optimum conditions using best available control measures to prevent smoke concentrations from affecting local communities.

**Foreseeable Activities –** Foreseeable projects on the BLRD that could contribute to cumulative effects include the afore-mentioned district prescribed burn program, the Yosemite National Park prescribed fire program, Sugar Pine Adaptive Management, Cedar Valley and Fish Camp projects, cattle grazing, special use permits, vegetation management within plantations (mastication), hazard tree sales, (OHV) use, and private land management activities.

Projects that could and possibly would contribute to air quality cumulative effects from exhaust emissions and/or fugitive dust through vehicle and heavy equipment can be expected from mechanical treatment for the Sugar Pine Adaptive Management and Cedar Valley project, vegetation management (mastication) within plantations, hazard tree sales, and OHV use. It is unknown how much heavy equipment use and vegetation management may occur on private property.

Projects that could and possible would contribute to air quality cumulative effects from particulate matter $PM_{10}$ and $NO_x$ include Yosemite National Park prescribed fire program, BLRD's prescribed fire program, vegetation treatments through prescribed fire for the Sugar Pine Adaptive Management project. It is unknown how much prescribed burning may take place as part of the Yosemite National Park burning program. All prescribed burn activities on private and public lands follow the same general conformity rules and are governed by the decisions of the Mountain Counties APCD, SJVAPCD and the SNF.

In conjunction with the typical period when prescribed burn implementation occurs, is an increased use of wood burning stoves and hazard reduction burning by local residences in the area. There are restrictions in place on the valley floor (residences below 3000 feet in elevation) to limit the use of wood burning stoves during poor dispersion days, but because older residences above 3000 feet in elevation typically only have wood burning stoves as their sole source of heat, there are little restrictions above 3000 feet elevation. Hazard reduction burning is regulated by a permitting process as well as burning only on "affirmative" burn days when meteorological conditions are adequate for good dispersion and dilution of pollutants. These affirmative burn days are fairly sporadic and can lead to high numbers of residences burning on the same day, especially during weekends. The SJVAPCD has created an educational program for the public on how to burn "cleaner" and presented some of the BACMs for hazard reduction burning activities.

## Alternative 1 – No Action

No actions would be taken to reduce stand densities to improve forest health and reduce the intensity and spread of wildland fires The opportunity would be loss for undertaking treatments to reduce the impacts that a wildland fire, starting in hot dry conditions, would cause the environment; both the forest environment and the airshed.

### Direct Effects

No direct effects from management actions to air quality or visibility would occur under this alternative since no treatments would be completed outside of that which is already permitted or authorized.

### Indirect Effects

The indirect effects include the potential for unplanned ignitions and uncontrolled wildfires to occur in the area. The resultant smoke caused by these would have large amounts of emissions released and could potentially be of long duration. Values measured such as PM10 and visibility range used to determine the Health-Protective Value would be in the ranges assumed to be Unhealthy. Values associated with this rating are PM10 ranging from 176 to 300 µg/m³ and visibility of 1.24 to 2 miles (considered moderate smoke conditions). This would be considered the lower of the Health-Protective Values a wildfire would produce, if it occurred in the area. It is anticipated that for short periods of time the values may rise to the levels considered Very Unhealthy or perhaps Hazardous. The Statewide Emission Inventory in 2002 reported emissions (tons/day, annual average) from wildfires (Ahjua 2006) and is demonstrated in Table 49.

**Table 49. Statewide Emission Inventory for Natural Sources-Wildfire**

| Emissions | Total Organic Gases | Reactive Organic Gases | Carbon Monoxide | Nitrogen Oxides | Sulfur Oxides | $PM_{10}$ |
|---|---|---|---|---|---|---|
| Natural Sources: Wildfire | 6,522 | 3,046 | 17,474 | 3,441 | 302 | 2,418 |

Total Organic Gases (TOG) and Reactive Organic Gases (ROG) are similar to Volatile Organic Compounds (VOC) and all are used by the air resources board to describe gases that lead to ozone formation.

The high summer temperatures and light wind speeds that occur during the summer months, places a cap on valley air with no means for cleansing itself by dispersion or transport. Because of the poor air quality associated with the SJAQCB it does not take large amounts of additional emissions to degrade air quality into unhealthy ranges especially in the summer and fall months, where storm systems are less likely to occur and disperse smog and emissions. Emissions from a wildfire could potentially have long lasting impacts beyond the initial burning period because of

this. Uncontrolled wildfires are clearly responsible for the most widespread, prolonged, and severe periods of air quality degradation (Ahuja,. 2006). For comparison purposes with the purposed alternative, Table 50 below demonstrates the emissions produced from a wildfire if the acres in the project were affected by an uncontrolled wildfire during typical fire season.

**Table 50. Potential emissions if a wildfire were to burn within the entire Fish Project boundary.**

| Emissions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fuel Type | Total Acres | Fuel Loading (Tons/ acre) | Total tons | Tons $PM_{10}$ | Tons $PM_{2.5}$ | Tons $No_X$ | Tons $SO_2$ | Tons VOC | Tons CO |
| Forest | 5440 | 20 | 108800 | 1332.80 | 1196.00 | 190.4 | 5.4 | 788.80 | 12675.2 |

## Cumulative Effects

The BLRD underburns approximately 350 acres per year, this program would continue unaffected by the alternative chosen. The district's underburn program covers approximately 25,000 acres. None of these are within the project area. The underburns are in ponderosa pine or mixed conifer vegetation and most have had at least one entry of prescribed fire. Most of the underburns are considered to be in maintenance status and would continue to be burned on a rotational schedule. Cumulative effects may also be the occurrence of respiratory or pulmonary distress if a wildland fire were to occur in the area while a prescribed fire was being conducted. This would be a rare occurrence. Table 51 displays the tons of estimated emissions from the BLRD underburns each year. The 56.1 tons of $PM_{10}$ emissions is the cumulative effect for the underburn program by project. It reflects the potential smoke emissions affecting residents of the local communities.

**Table 51. Tons of Estimated Pollutants per Individual Project—Annual Underburn Program of Work**

| $PM_{10}$ | $PM_{2.5}$ | $NO_x$ | $SO_2$ | VOC | CO |
|---|---|---|---|---|---|
| 56.1 | 50.9 | 15.0 | 0.2 | 36.1 | 520.0 |

PM10 = Particulate matter <10 microns in size, PM2.5 = Particulate matter <2.5 microns in size, $NO_X$ = Nitrous oxide, $SO_2$ = Sulfur dioxide, VOCs = Volatile Organic Compounds, CO = Carbon monoxide Past analysis has shown that emissions associated with thinning operations and road use is minimal due to contractual dust abatement requirements.

## Common to Alternative 2 and 3

Treatments are proposed to reduce surface, ladder fuels and some aerial fuels to meet the purpose and need of reducing the intensity and spread of wildland fires as well as reduce stand densities. This is to occur, if these alternatives were chosen, through the use of mechanical methods (thinning from below and mastication) as well as management ignited fire in the form of prescribed fires such as pile burning, understory burning and/or broadcast burning. Prescribed fire would be applied to the project area for three purposes: (1) as a final "cleaning" after vegetation management treatments to further reduce 1, 10 and 100 hours fuels (those fuels that have the greatest influence on fire spread); (2) to maintain the lower levels of the 1, 10, and 100 hours fuels; (3) to reintroduce the fire element back into a fire dependent ecosystem.

Emissions from smoke produced by prescribed fire implementation are estimated using the number of acres to be burned, the surface fuel loading of the area being burned and the amount of consumption.

Within the treatment areas and based on the criteria provided in the Fire/Fuels Design Criteria Common to all Alternatives, there is a total of 432 acres that is proposed to utilize prescribed fire as the primary treatment type (RX treatment areas). This treatment involves the application of prescribed fire over a broad area and would need to have specific conditions prior to ignition. It is estimated that, as conditions permit, these types of prescribed fires could take up to 10 years to fully implement and would be used, as needed, to maintain surface fuel loadings at or below 10 to 20 tons/acre.

Dependent on where and how prescribed fire treatments are being utilized, the fuel loading can range from 3 to 30 tons per acre and be in the form of machine or hand created piles and/or in concentrations across a broad area such as the case in understory burning. On average the fuel loading for an area requiring prescribed fire as a primary treatment, maintenance and/or post activity treatment would be 20 tons/acre.

The main focus of prescribed fire implementation is to reduce surface fuel loadings that contribute to fire behavior rates of spread and flame length the greatest. These are the 1, 10 and 100 hour time lag categories (mainly needles, twigs and branches less than 3 inches in diameter). Prescribed fire burn plans set objectives for what percent consumption of these fuels are to be accomplished by the implementation of the prescribed fire. For pile burning, burn plan objectives typically set the objective at 75 to 80 percent consumption. Pile burning is conducted when the fuels have had a period of time to dry and are no longer green. For understory burning, burn plan objectives typically set the objectives at 60 to 70 percent consumption (or reduction) of these fuels, though this would not be across the entire burn area. A typical understory burn is implemented to create a “mosaic” burn pattern, leaving patches of unburned areas amongst burned areas.

## Alternative 2 – Proposed Action

Associated emissions from mechanical equipment used in thinning and hauling operations and emissions produced from burning are shown inTable 53. Hazard fuels treatments, including prescribed fire, proposed for this proposed action can be found in Chapter 2 – Alternatives Considered in Detail of the Greys Mountain Environmental Impact Statement

### Design Features and Mitigation Measures

The following are BACMs for prescribed fire as required under Section 190 of the Clean Air Act, as amended in 1990. The U.S. EPA developed implementation strategies and BACMs for areas that are designated serious non-attainment for particulate matter less than 10 microns (PM10) in 1992. Specific techniques to reduce fire emissions include the following: These have been incorporated into the action alternatives as described in Design Criteria Common to all Action Alternatives.

### Direct Effects

**Smoke Emissions -** This alternative proposes to accomplish up to1,367 acres of prescribed fire; both underburning and pile burning combined. If feasible, there could be the option to dispose activity fuels through masticate thus reducing the need of pile burning in some areas. When completed, prescribed fire activities proposed under this action would create the following emissions.

**Table 52. Total Emissions from All Prescribed Fire Treatments Proposed in this Action (in tons)**

| Treatment Type | Tons per acre | Total Acres | PM10 | PM2.5 | NOx | SO2 | VOC | CO |
|---|---|---|---|---|---|---|---|---|
| Dozer Pile | 20 | 966 | 75.35 | 70.52 | 50.23 | .10 | 60.86 | 637.56 |
| Underburn Only | 20 | 401 | 98.25 | 82.22 | 14.04 | 0.40 | 58.15 | 934.33 |

PM10 = Particulate matter <10 microns in size, PM2.5 = Particulate matter <2.5 microns in size, $NO_X$ = Nitrous oxide, $SO_2$ = Sulfur dioxide, VOCs = Volatile Organic Compounds, CO = Carbon monoxide

The following table is a product of FVS modeling. It compares the estimated PM2.5 emissions from the no action and action alternatives of a simulated wildfire occurring approximately 10 years after the completion of all project activities. After ten years the effects on air quality of the proposed treatments are still noticeable. Under Alternative 1 the wildfire produces approximately 1196 tons per acre of PM2.5. Under Alternatives 2 and 3, wildfire produces approximately 70.52-82.22 tons per acre.

**Vegetation Harvesting Equipment** - Equipment hours are based on average production rates from similar projects on the BLRD. Most of the material would be thinned by chainsaw and skidded. Piling and mastication of activity created slash and brush would be with a track type tractor. For this analysis, all emissions are based upon use of wheeled skidders and loaders, heavy duty diesel powered highway truck and track type dozer or dozer with mastication head.

**Table 53. Total tons of emissions for mechanical treatments and road maintenance-reconstruction activities for the completion of operations in Alternative 2.**

| Type of Equipment | Number of Hours | PM Factor | Total PM | EH Factor | Total EH | Nox Factor | Total Nox | Sox Factor | Total SO2 | CO Factor | Total CO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wheeled tractor | 1344 | 0.136 | 0.09 | 0.188 | 0.13 | 1.269 | 0.85 | 0.09 | 0.06 | 3.69 | 2.48 |
| Wheeled loader | 378 | 0.058 | 0.01 | 0.098 | 0.02 | 0.827 | 0.16 | 0.076 | 0.01 | 0.201 | 0.04 |
| Heavy duty diesel powered truck | 7404 | 0.256 | 0.95 | 0.192 | 0.71 | 4.166 | 15.42 | 0.454 | 1.68 | 1.794 | 6.64 |
| Track type tractor | 14000 | 0.112 | 0.78 | 0.121 | 0.85 | 1.26 | 8.82 | 0.137 | 0.96 | 0.346 | 2.42 |
| Motor Grader | 77 | 0.061 | 0.00 | 0.04 | 0.00 | 0.713 | 0.03 | 0.086 | 0.00 | 0.151 | 0.01 |
| Misc. (chipper) | 90 | 0.131 | 0.01 | 0.152 | 0.01 | 1.691 | 0.08 | 0.143 | 0.01 | 0.675 | 0.03 |
| Total | 23293 | | 1.84 | | 1.71 | | 25.36 | | 2.72 | | 11.62 |

**Fugitive Dust Emissions** - The Forest Service routinely requires timber sale operators to abate dust during use of the forest development roads. This is required for several reasons, including retaining road surface fine particles, which helps keep the larger supporting aggregate together;

reducing dust visibility traffic hazards; reducing environmental dust plumes; and minimizing loose fine material accumulations which can create muddy, road rutting conditions (Lowe 1994 as cited in USDA Forest Service 2008).

VDE [$PM_{10}$] by general vehicle movement are calculated at 10 lbs per day for five vehicles per day on unpaved roads. This figure is reduced to 3.63 pounds per day per mile of VDE after dust abatement through watering of roads or other dust abatement measures, which are incorporated into the project design features. For the proposed action, 3.63 pounds per day x 22 days to haul = 79.86 pounds, which is below *de minimus*. *De minimus* is set at 100 pounds per day for 50 vehicle trips on unpaved roads as shown in Table 53. Dust abatement is required for roads below 3,000 feet in elevation. The project area is above 3,000 feet in elevation and is exempt from Regulation VIII, Rule 8011 General Requirements, though dust abatement is still required by the Forest Service.

**Table 54. Emissions conformity to General Conformity Rule for Criteria Pollutants**

| TOTAL Emissions (smoke and equipment) | PM10<br>612.4 | PM2.5<br>553.1 | NOx<br>148.9 |
|---|---|---|---|
| **Percent of Areas Total** | **1.45%** | **0.5%** | **0.08%** |

**Criteria Pollutants are those that determined by EPA to have *de minimus* levels**

## Indirect Effects

The community of Fish Camp, state highways, Class I airsheds, and recreation sites are considered smoke sensitive areas. These areas could be affected by smoke if weather patterns produce a stable air mass and smoke is unable to vent into the upper atmosphere. Since $PM_{10}$ and ozone are public health hazards, prescribed burns would be planned during periods of unstable air, which would allow for proper ventilation of smoke and temperatures less than 95 degrees. However, since prescribed underburns could last for several days or weeks there is the potential for recurring shifts in air masses toward more stable conditions. For this reason, all prescribed fire activities are coordinated with SJVAPCD and would be implemented under optimum conditions using best available control measures (listed in the proposed action) to prevent smoke concentrations from affecting local communities.

## Cumulative Effects

Annual trends in ozone and PM air pollution are decreasing largely due to State regulations for vehicle emissions. This is expected to continue as technology and regulations to reduce emissions are implemented. In addition, mechanical treatments (harvesting) contribution to air pollution in particular appears to be on a downward trend likely due to decreased logging activity. The incremental effects of Alternative 2 when added to past, present and foreseeable future activities, are not likely to influence this trend of reduced logging associated emissions.

From past implementation of prescribed burning on the BLRD and in particular prescribed burns within the vicinity of the project, mitigations limiting the number of acres burned per day, burning during optimal transport wind directions/speeds, higher mixing heights and the quantity of other prescribed fires being conducted are considered prior to air district final approval to reduce potential impacts to sensitive receptors. This has been extended into limiting the number of days burning can occur, and requiring all active ignitions to end by late afternoon to reduce

smoke production at night time and to limiting the number of consecutive days burning can occur to reduce the amount of emissions produced at any one time. Close communication with the APCD compliance staff before and during implementation and monitoring smoke conditions would aid in determining if there are impacts on sensitive receptors and Class I airsheds in the area are beginning and additional mitigations are required.

Cumulative effects can be caused by outside influences not associated with the project itself. Because of the rural surroundings, many residences utilize wood burning stoves as their main source of home heating. Hazard reduction burning is also permitted in rural communities in Madera and Mariposa counties. This can lead to cumulative impacts if prescribed fire is conducted on what is considered a marginal dispersal day when added to wood stove smoke and increased numbers of hazard reduction burns within the communities in or surrounding the project area.

## Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The conformity decision for the CAA prohibits federal agencies from permitting or approving any activity that does not conform to the SIP. The CARB under the General Conformity Rule regulates actions that require conformity determinations for specific pollutants. The CARB rules indicate that projects would be determined to conform to the applicable SIP if it meets the following criteria. The total direct and indirect emissions from the action are in compliance with all requirements of SIP, because the actions meet one or more of the following:

1. The emissions from the action are identified and accounted for in the applicable SIPs attainment or maintenance demonstrations.

2. The emissions are offset based on air quality monitoring, the actions do not:
    a) Cause or contribute to any new violation of any standard in any area, or
    b) Increase the severity or frequency of any existing violations of any standard,
3. The state commits to modify SIP in accordance with the EPA rules, or

4. Where the EPA has not approved a revision of the relevant SIP, the total emissions do not exceed the historical level (based on the calendar year 1990 or other appropriately agreed to year).

5. Title 17 of the California Code of Regulations – Subchapter 2, Smoke management Guidelines for Agriculture and Prescribed Burning

6. San Joaquin Valley Unified Air Pollution Control District Rule 3160 (Prescribed Burning Fee), Rule4106 (Prescribed Burning and Hazard Reduction Burning), and the District's Smoke Management Program, Rule 4103 (Agricultural Burning)

7. Wildland Fires Coordination and Communication Protocol as it applies to the Current Smoke Management Program

8. Public Resource Code 4291 – for hazard Reduction Burning in the foothill and mountain areas of the District.

### Other Relevant Mandatory Disclosures

Exhaust hydrocarbons and pollutant levels produced from thinning activities are lower than historical levels of logging and similar activities for the SNF. Historical timber harvesting and thinning operations were at all time highs in 1987 with 154 million board feet of timber harvested. This alternative only thins to 2.5% of that historical level

### Summary of Effects

This project meets the General Conformity Rule; it does not interfere with the strategies employed to attain NAAQS. The emissions from this project are considered regionally insignificant (total emissions are less than 10%) of the area's total emissions inventory for $PM_{10}$ and $NO_x$. This conformity is accomplished by maintaining burn ignitions and acres within rules and guidelines developed by the SJVAPCD, as provided for by the CARB, under the Unified Guidelines for Smoke Management as developed by the Southern Sierra Interagency Smoke Management Group. These guidelines and rules are based on the requirements found in the following:

Based upon meeting the SIP standards of CARB, the Unified Smoke guidelines discussed above and SJVUAPCD rules, the project is determined to be in compliance with SIPs General Conformity Rule and Title 17 of the California Code of Regulations. It is important when considering the determination that compliance with SIP is based upon meeting rules and guidelines managed by SJVUAPCD. These rules and guidelines are designed to meet historical emissions levels and keep projects from violating the SIP. The alternatives propose activities that would meet the rules and guidelines. Rules and guidelines along with daily SJVUAPCD direction control acres and ignitions. Meeting the acres and ignition rules and guidelines meets conformity with the SIP emission standards.

## Alternative 3 – Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

### Design Features and Mitigation Measures

Design features would remain the same as described in Alternative 2.

### Direct Effects

Alternative 3 would not alter the number of acres where ladder and surface fuels are to be reduced through treatments, but would potentially have lower amounts of post activity surface fuels (tons/acre). As in Alternative 2, prescribed burning would be utilized to reduce surface fuel loading as either an initial treatment (understory/broadcast) or as a post activity treatment (pile burning). Mastication and road reconstruction/maintenance would continue with Alternative 3. With no commercial thinning operations, emissions from mechanical treatments would be reduced significantly from Alternative 2 and would have the potential of reducing the amount of acres in which pile burning would be needed reducing the amount of emissions from prescribed burning. Understory burning would remain the same as in Alternative 2. Thus the direct effects of Alternative 3, would be the similar to Alternatives 2, but would be to a lesser degree.

### Indirect Effects

Indirect effects in this alternative are the same to those described in Alternative 2.

## Cumulative Effects

The cumulative effect of this alternative is similar to those under Alternative 2. The changes in the amount of thinning among the alternatives alter the amount of trees removed under each alternative. These changes alter the amount of emissions that would be generated by prescribed fire. The differences in each alternative are represented by the amount of smoke that would be produced by a wildfire.

## Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 3 would compliance with the SNF-LRMP, Regulatory Frameworks, and Air Quality regulations and Policies.

## Summary of Effects

The incremental effects of smoke, dust and emissions created by the proposed actions in Alternative and 3 when added to the past, present and foreseeable future activities are not expected to 1) cause or contribute to any new violation of any standard in any area; 2) increase the frequency or severity of any existing violation of any standard in any area; or 3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area. (CAA Sec 176 (c) (1)) as further defined by SJVAPCD Rule 9110-General Conformity, §51.853 and is expected to conform to the State Implementation Plan for the associated criteria pollutants of $NO_x$, VOC, $PM_{10}$ and $PM_{2.5}$. This determination would be in compliance with the SNF LRMPs goals as well as meet the S&Gs written for air quality and visibility.

# Engineering / Transportation

## Introduction

Roads within the project area provide needed access for public use of the National Forest and access to private lands. Most roads receive low traffic volume but are considered important by their users for dispersed recreation experiences of many types. Maintenance level 2 roads are generally open to legal OHV use. These roads also provide needed access for Forest Service administrative uses including fire suppression, fuels reduction, recreation administration, timber harvest, reforestation, and assessment of biological resources.

Reduced funding and road maintenance activities by timber sales have limited opportunities to maintain the road system to proper standards. It is estimated that 80% of the road system fails to meet current road maintenance standards.

## Regulatory Framework

All road maintenance, reconstruction and new construction would follow the SNF LRMP S&Gs. BMPs developed for road maintenance activities would be incorporated into the design of this proposed project.

### Existing Condition

The existing transportation system for the project consists of approximately 77 miles of National Forest System Roads (NFSR). The transportation system for the analysis area is complete. Small areas may be identified during project planning where a minor amount of new temporary road construction is needed.

Of these 77 miles there is 56.5 miles of NFS native and aggregate surfaced roads and approximately 20.5 miles of paved roadway. These native surfaced roads are not suited for wet weather use due to erosive soils and lack of armoring.

Most system roads are in poor condition and are experiencing erosion problems due to limited road maintenance, wet weather use, and erosive soils. Many of the local roads have received little to no maintenance over the years and would require heavy maintenance and/or reconstruction to eliminate resource damage and to meet acceptable standards established in the Forest Service Handbook 7709.58.

This relatively low traffic volume road system has received less maintenance in recent years. These roads, mostly maintenance level 2, comprise most of the miles of the road system. Many of them are brushing in and washing out. The results are negative effects on access and environmental resources and loss of the infrastructure investment.

Existing road densities, in general, are acceptable from a wildlife perspective. Any system roads or unclassified roads not needed should be decommissioned to enhance wildlife habitat and reduce road densities to a more desired level.

There are multiple recorded archeological and historical sites within the project area. A preliminary map review of the location of recorded sites and specified roads shows several road/site conflicts. These road/site conflicts are of concern because of the impact of the continued use of the roads, the significance of the sites, or the conflicts are not easily mitigated.

### Desired Condition

Desired conditions for BLRD road management is safety for the traveling public and employees and improvement and restoration of roads with resource or access needs.

# Environmental Consequences

### Mitigation

The following road related design activities would be required for the Greys Mountain Ecological Restoration project.

#1) Maintain all NFS roads to standards established in the Forest Service Handbook 7709.58. Perform road maintenance, reconstruction and new road construction activities to support project access needs. Insure drainage structures are functional and stable to prevent potential resource damage and degradation of water quality. (S&G #78, #79, #124, #206 and BMPs)

#2) Perform a final field review of project roads to determine reconstruction needs prior to project activities. Where economically feasible, place aggregate on existing native surface roads located in areas with High and very High Soil Erosion Hazard ratings. (S&G #129)

#3) Close all temporary roads required for unit access upon completion of use; remove all culverts, rip and ditch landings, construct waterbars, block the entrance with a log and dirt berm, and disguise the entrance with brush to discourage additional traffic.

## Alternative 1 – No Action

### Indirect Effects

Under the no action alternative, no project activities would take place. Existing road maintenance and reconstruction needed to eliminate resource damage and support equipment access would not take place. No road reconstruction activities would take place on local roads and no new road construction would be needed. The transportation system for the area would not be updated and improved by this project to meet current access management direction.

### Cumulative Effects

Under Alternative 1, proposed road maintenance and reconstruction needed to mitigate resource damage and support equipment access would not take place. The transportation system for the area would not be updated and improved by this project to meet current access management. This would lead to further degradation of the transportation system and continuing contribution to additional resource damage.

## Alternative 2 – Proposed Action

### Direct and Indirect Effects

The project is proposing to perform road maintenance and/or road reconstruction activities on all or portions of roads planned road reconstruction and road maintenance activities for the project would be reviewed by the District Archeologist to develop mitigation requirements for archeological /road site conflicts prior to work activities.

The logging systems plan has identified approximately 0.25 miles of temporary road construction for unit access. These roads would be closed upon completion of use.

### Cumulative Effects

Under Alternatives 2 and 3, proposed road maintenance and reconstruction would take place. This would mitigate current resource damage, help in mitigating future resource damage and improve general access within the project area.

## Alternative 3 – Lower and Limited Mid-level Canopy Treatments, All Treatment Areas

### Direct and Indirect Effects

In Alternative 3, treatment areas would remain the same as in Alternative 2. Effects would be the same as in Alternative 2 because the alternatives affect the transportation system in identical ways.

### Compliance with the Forest Plan and Other Regulatory Direction

Road maintenance and reconstruction would be required for identified roads that do not meet acceptable standards for the proposed service level and transportation system. This work may include installation of culverts, rolling dips, water bars; and aggregate surfacing where soil erosion is evident; riprap at outlets of culverts, dips and water bars when needed; and minor clearing and widening to a twelve-foot road width for equipment access. NFS Roads used for this project would be kept open for public use during sale and post sale activities. Existing landings, skid trails, and temporary roads would be used for timber access when available.

# Economics

The Greys Mountain Ecosystem Restoration Project area was selected for treatment based on the need for ecosystem restoration in the upper Willow Creek watershed. Restoration activities include the use of thinning, mastication, and prescribed fire to reduce stand density and the build-up of hazardous fuels. The area also supports many recreation opportunities on the SNF, including special use permits issued by the forest. Treatments are needed to prevent similar situations that occurred in the last decade in Arizona and New Mexico and on the San Bernardino National Forest, where thousands of acres of trees died from insect mortality due to over-stocked conditions, as well as catastrophic wildfires. Fuel reduction and density management treatments proposed would: (1) generate sawtimber volume, (2) help stimulate the economy through the utilization of forest projects, and (3) maintain jobs in the local timber and vegetation management industries.

Currently (2011) the Sierra NF is providing timber for three remaining sawmills, Sierra Forest Products (SFP), Terra Bella, CA, and Sierra Pacific Industries (SPI), at Chinese Camp, CA, and at Standard, CA. The SFP mill is the last remaining sawmill in California south of Yosemite National Park. This mill also operates a wood-fired electrical power plant co-located with its mill, which utilizes a portion of its lumber manufacturing waste product. Lumber manufacturing waste products are also utilized in several other markets including landscaping. SFP is a qualifying Small Business and SPI is a Large Business in computations for Small Business Administration market share monitoring purposes. SFP is approximately 80% dependent upon raw material from Federal Lands. Conversely, the Sierra, and Sequoia National Forests are almost 100% dependent upon the SFP milling infrastructure to process and give value to excess tree inventories in the woods when considering fuels and fire management, forest health maintenance, and wildlife habitat restoration. In order to implement the types of projects considered in this analysis, an economically viable infrastructure is necessary now and into the future. Maintenance of such an infrastructure is voiced as a concern by some segments of the public.

Local sawmills are in dire need of forest products to keep them open and their employees employed. If these mills close, the ability to utilize forest products in the future and offset treatment cost will be lost. The district finds that at the present, the cost of the proposed treatment is higher than the value of the sawtimber and will require appropriated funds to fulfill the objectives. Treatments prescribed were developed with regard to those activities necessary to reduce the intensity and spread of wildfire and reduce stand density, not to provide positive economic returns. An economic analysis is required to comply with NEPA guidelines and can generally be helpful in selecting an alternative by showing comparative costs and\or revenues between alternatives. However, economics will not be a deciding factor for selecting any action alternative for the Greys Mountain Ecosystem Restoration Project. Instead, alternative selection will be based on the alternative that best accomplishes the purpose and need of the project. This economic analysis will give the public an approximate comparison of costs between alternatives.

The economic analysis for the Greys Mountain Ecosystem Restoration Project is divided into three sections. The first section is the net value of harvested sawtimber taking into account the value of the sawtimber minus the stump to mill cost. The second section is the cost of other prescribed treatments within the project area that address non-commercial vegetation treatments. The final section is an analysis of employment benefits both directly and indirectly based on the relationship between employment and harvesting in California. Besides the above described cost

and benefits, other fixed costs are associated with the proposal. The cost of producing the environmental document is approximately $95,000. Prior to project implementation there are project preparation costs of $11.80/ccf. During project implementation there are contract administration costs of $10.80/ccf.

Table 55 and Table 56 display the comparison of both action alternatives for product value, implementation costs, and employment benefits. Both action alternatives would require appropriated dollars to complete the work. Alternative 2 would require less appropriated dollars to complete the work at a cost of $294,493. Alternative 3 would require $613,119 more in appropriated funds than Alternative 2 to complete work. The employment benefits for Alternative 2 would be approximately $3,836,340 more than Alternative 3. The economic costs for Alternative 3 are higher overall to implement and it would not treat the 1,650 acres for density management, providing improved stand vigor and creating a more resilient forest to density induced mortality. The density management treatments also create more stand heterogeneity by promoting oak growth with the removal of larger trees that are overtopping oaks and by influencing the selection of tree removal over a greater extent. Biomass operations would cost approximately $64,107.68 for both action alternatives, with a value of $111 total. This figure would not change between alternatives 2 and 3 as any unmerchantable timber (less than 10" diameter) would be removed.

Fire and fuel objective treatments in the project area would reduce fire risk and provide public benefit. Measurement of this benefit is outlined in the paper *Investment in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits (*Mason et al, 2006). For both action alternatives, fire risk would be reduced in units proposed for commercial thinning (1,650 acres) and those treatment areas where hand thinning/tractor pile/burn pile, mastication, and underburn take place outside of Alternative 2 cut units. The fire reduction benefit could be as much as $1,618,820 in either action alternative.

This analysis compares the project value based on product value, implementation cost, and employment benefits for the action alternatives. The no action alternative does not have any product value or implementation costs, but has the cost of producing the environmental document and the benefit of providing Forest Service employment. The no action alternative is neutral in respect to this analysis because its cost equals its benefit.

The employment benefit of implementing product removal and fuel reduction treatments is an important aspect in project economics. Whenever you have a project that puts people to work and provides a product to the free market, there are societal benefits derived. Woods workers, truck drivers, and mill workers are directly employed and the taxes they pay benefit both Federal and State Government. Yield taxes are collected from Purchasers upon cutting sawtimber and are paid to the State. Processed materials from mills eventually reach retail stores and provide jobs for retail workers and income and sales tax to Federal and State Government. These societal benefits are a by-product of the prescribed treatments designed to meet the purpose and need of this project. When greater amounts of forest products are removed from a project, more societal benefits are realized. Alternative 2 would provide the greatest societal benefits. Generally, for each million board feet of product removal, approximately 13 jobs are supported both directly and indirectly. This ratio can range from 10 jobs to 18 jobs depending on location and the type of products removed. In addition to product removal, other vegetation treatments in the project area help support the local economy. Table 57 displays the anticipated number of full time jobs supported by vegetation treatments other than product removal.

**Table 55. Greys Mountain economic analysis for alternative 2**

| **Value - Sawtimber[1]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Acres = 1671 | | | | | | | | |
| PP 10 inch - 29.9 inch sawtimber | 16% | 2456 | ccf | x | $134.79 | /ccf | | $331,044 |
| SP 10 inch - 29.9 inch sawtimber | 12% | 1842 | ccf | x | $143.65 | /ccf | | $264,603 |
| WF 10 inch - 29.9 inch sawtimber | 37% | 5680 | ccf | x | $178.11 | /ccf | | $1,011,665 |
| IC 10 inch - 29.9 inch sawtimber | 34% | 5219 | ccf | x | $259.56 | /ccf | | $1,354,644 |
| LP 10 inch - 29.9 inch sawtimber | 1% | 154 | ccf | x | $150.37 | /ccf | | $23,157 |
| **Total Value** | | **15351** | **ccf** | | | | | **$2,985,113** |
| Biomass | | 442.0 | ccf | x | $0.25 | /ccf | | $111 |

| **Stump to Mill Cost** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Stump to truck Cost | 15351 | ccf | @ | $60.83 | /ccf | | **$933,801** |
| Other Cost | 15351 | ccf | @ | $3.92 | /ccf | | **$60,176** |
| Road Reconstruction Cost | 15351 | ccf | @ | $8.76 | /ccf | | **$134,475** |
| Road Maintenance Cost | 15351 | ccf | @ | $2.96 | /ccf | | **$45,439** |
| Temp Road Cost | 15351 | ccf | @ | $0.12 | /ccf | | **$1,842** |
| Haul Cost | 15351 | ccf | @ | $80.58 | /ccf | | **$1,236,984** |
| Sawtimber Scale | 1919 | trips | @ | $1.60 | /trip | | **$3,070** |
| Biomass | 442<br><br>2211 | ccf<br>tons<br>tons | @<br><br>@ | $145.04<br><br>$28.99 | /ccf<br><br>ton | | **$64,107.68** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Advertise Rate Sawtimber | 15351 | ccf | @ | $2.86 | /ccf | | **($43,904)** |
| **Total Other Cost** | | | | | | | **$2,435,991** |
| **Net Value** | | | | | | | **$549,122** |
| **Forest Service Agency Responsibility** | | | | | | **Full-time jobs[3]** | |
| Mastication | 318 | acres | x | $545 | /acre | 1 | **$173,310** |
| Hand/T Units Thin | 124 | acres | x | $170 | /acre | 4 | **$21,080** |
| Hand Units Pile | 124 | acres | x | $900 | /acre | 4 | **$111,600** |
| Hand Units Burn Piles | 124 | acres | x | $75 | /acre | 2 | **$9,300** |
| Tractor Pile | 325 | acres | x | $280 | /acre | 1 | **$91,000** |
| Underburn T units | 1833 | acres | x | $150 | /acre | 1 | **$274,950** |
| Underburn Rx units | 460 | acres | x | $300 | /acre | 1 | **$138,000** |
| Burn Tractor Piles | 325 | acres | x | $75 | /acre | 2 | **$24,375** |
| | | | | | | 16 | jobs |
| **Total Non Harvest Cost** | | | | | | | **$843,615** |
| **Total Project Value** | | | | | | | **($294,493)** |
| Fire Reduction Benefits[2] | | | $620 | /acre | 2611 | acres | **$1,618,820** |
| Harvest Employment[3] | | | | | | 100 | jobs |
| **Total Full Time Jobs** | | | | | | | **116** |
| **Total Employee-Related Income** | | | | | | | **$4,631,260** |

**Table 56. Greys Mountain economic analysis for alternative 3**

| **Value - Sawtimber[1]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Acres = | 1943 | | | | | | | |
| PP 10 inch - 29.9 inch sawtimber | 0% | 0 | ccf | x | | /ccf | | $0 |
| SP 10 inch - 29.9 inch sawtimber | 0% | 0 | ccf | x | | /ccf | | $0 |
| WF 10 inch - 29.9 inch sawtimber | 0% | 0 | ccf | x | | /ccf | | $0 |
| IC 10 inch - 29.9 inch sawtimber | 0% | 0 | ccf | x | | /ccf | | $0 |
| LP 10 inch - 29.9 inch sawtimber | 0% | 0 | ccf | x | | /ccf | | $0 |
| Biomass | | 442.0 | ccf | x | $0.25 | /ccf | | $111 |
| **Total Value** | | **442** | **ccf** | | | | | **$111** |
| **Stump to Mill Cost** | | | | | | | | |
| Stump to truck Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Other Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Road Reconstruction Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Road Maintenance Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Temp Road Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Haul Cost | | 0 | ccf | @ | | /ccf | | **$0** |
| Sawtimber Scale | | 0 | trips | @ | | /trip | | **$0** |
| Biomass | | 442<br><br>2211 | ccf<br>tons<br>tons | @<br><br>@ | $145.04<br><br>$28.99 | /ccf<br><br>ton | | **$64,107.68** |
| Advertised Rate Sawtimber | | 0 | ccf | @ | | /ccf | | **$0** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Total Other Cost** | | | | | | | **$64,108** |
| **Net Value** | | | | | | | **($63,997)** |
| **Forest Service Agency Responsibility** | | | | | | **Full-time Jobs[3]** | |
| Mastication | 318 | acres | x | $545 | /acre | 1 | **$173,310** |
| Hand/T Units Thin | 124 | acres | x | $170 | /acre | 4 | **$21,080** |
| Hand Units Pile | 124 | acres | x | $900 | /acre | 4 | **$111,600** |
| Hand Units Burn Piles | 124 | acres | x | $75 | /acre | 2 | **$9,300** |
| Tractor Pile | 325 | acres | x | $280 | /acre | 1 | **$91,000** |
| Underburn T units | 1833 | acres | x | $150 | /acre | 1 | **$274,950** |
| Underburn Rx units | 460 | acres | x | $300 | /acre | 2 | **$138,000** |
| Burn Tractor Piles | 325 | acres | x | $75 | /acre | 2 | **$24,375** |
| | | | | | | 17 | jobs |
| **Total Non Harvest Cost** | | | | | | | **$843,615** |
| **Total Project Value** | | | | | | | **($907,612)** |
| Fire Reduction Benefits[2] | | | $620 | /acre | 2611 | acres | $1,618,820 |
| Harvest Employment[3] | | | | | | 3 | jobs |
| **Total Full Time Jobs** | | | | | | | **20** |
| **Total Employee-Related Income** | | | | | | | **$794,920** |

[1]Quality Value from R5 Transactional Evidence Appraisal Spreadsheet

[2]C. Larry Mason et al. Jan/Feb 2006. Investment in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits. Journal of Forestry:27-31 (total of firefighting cost avoided and timber loss avoided)

[3]Based on historical relationships between employment and harvest in California during the 1980's, each million board feet harvested supports 6.5 year-around jobs (1 in logging, 4 in sawmill, and 1.5 in US Forest Service employment). In regional economic models of employment for California and the Pacific Northwest, an estimate of one indirect or induced job for every direct timber job is added. Indirect jobs result from the employment created by the local purchase of materials for the sawmill,

local expenditures by workers, and the demand for local government employees. Each million board feet harvested supports a total of 13 jobs that are timber related. The restoration and fuel work would support additional direct and indirect employment. There are approximately 1.4 indirect jobs for every full time field job. All jobs are equivalent to year-around employment.

**Table 57. Full time Job relationship to specific project tasks**

| Task | # of Workers | Production | | Acres of Treament | Direct full time jobs | Indirect full time jobs | Total Full time Jobs |
|---|---|---|---|---|---|---|---|
| Mastication | 2 | 4 | ac./day | 201 | 0.4 | 0.6 | 1 |
| Hand/T Units Thin | 1 | 1 | ac./day | 769 | 3.0 | 4.2 | 7 |
| Hand Units Pile | **2** | **2** | ac./day | 119 | 0.5 | 0.7 | 1 |
| Hand Units Burn Piles | **7** | **5** | ac./day | 119 | 0.7 | 0.9 | 2 |
| Tractor Pile | **2** | **5** | ac./day | 393 | 0.6 | 0.9 | 1 |
| Underburn T Units | 10 | 30 | ac./day | 1943 | 2.5 | 3.6 | 6 |
| Underburn Rx units | 10 | 30 | ac./day | 341 | 0.4 | 0.6 | 1 |
| Burn Tractor Piles | 7 | 15 | ac./day | 650 | 1.2 | 1.7 | 3 |

# 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).

Maintenance and enhancement of long-term productivity is accomplished through restoration treatments that reduce basal area and number of stems (stand density) in over crowed stands. Stands that exist presently are no longer sustainable or resilient to changing environmental conditions that can and are occurring now and into the future. Drought induced stress, insect or disease attacks and wildfire all can have detrimental effects on the forest of today. Short-term activities described in the action alternatives are intended to lead to the enhancement of long-term productivity by beginning to restore forest conditions that resilient to disturbances.

Actions described in Chapter 1 lead to enhancement of long-term productivity, especially:

- The need to increase the proportion of large trees across a landscape,
- The need to increase the proportion of fire resistant species such as pines,
- The need to reduce wildfire intensity and spread across the landscape, and
- The need to reduce stand density.

# Unavoidable Adverse Effects

No unavoidable adverse effects would occur in the project area.

# 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.

Approximately 0.25 miles of temporary road construction is proposed for the project. Road construction results in removal of surface soils and subsoil and complete loss of soil productivity within the road prism.

The 0.25 miles of road is approximately 0.45 acres of ground with total loss of soil productivity. The direct effect of this new road construction is irreversible and irretrievable. Erosion on newly constructed roads is usually higher immediately after the road is constructed. There is potential that accelerated erosion could occur off the road prism and reduce soil productivity off site and after the road is constructed. Applicable soil and water conservation BMPs would be implemented, including erosion control measures, such as water bars, straw mulching of fills and fertilization of soils to re-vegetate the bare soils. Road reconstruction and road maintenance operate within the road prism and have little effect to the soil resource. However, there can be a positive effect to the soil resource outside of the road prism from road reconstruction by restoring proper drainage features of the road. Restoration of drainage features would result in less surface erosion and soil loss that leads to loss in soil productivity.

# Legal and Regulatory Compliance

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies would prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." The proposed action and alternatives must comply with the following regulation.

## Principle Environmental Laws

The following laws contain requirements for protection of the environment that apply to the proposed action and alternatives.

### Endangered Species Act

The Forest Service is directed to comply with this Act and does so through Biological Assessments and Evaluations that are used to analyze the effects of the proposed alternatives. These assessments and evaluations make determinations on Federally-listed endangered, threatened, candidate and proposed species and their habitat. The analysis was conducted in part to determine whether formal consultation or conference is required with the USFWS, pursuant to this act.

The project, through the inclusion of design criteria established for all action alternatives for species covered under this Act as well as the completion of BE/BAs for Botanical, Aquatic and Terrestrial species, is in compliance with this act.

### Clean Water Act

The project would comply with this Act by adoption of Best Management Practices and other design criteria established for all action alternatives as detailed in Chapter 2.

### Clean Air Act

Under the General Conformity Rule the project has been determined to comply with this Act and the California SIP through the implementation of treatments following Best Available Control Measures BACMs for prescribed burning as well as Rules and Regulations established by the SJAPCD and Mountain Counties APCD as required under section 190 of this Act, as amended in 1990.

### National Historic Preservation Act (NHPA)

The USDA Forest Service is directed to identify, evaluate, treat, protect, and manage historic properties by several laws. However, the NHPA of 1966, as amended (16 U.S.C. 470 et seq.) provides comprehensive direction to Federal agencies about their historic preservation responsibilities.

Section 106 of the NHPA and the ACHP implementing regulations, *Protection of Historic Properties* (36 CFR Part 800), require that Federal agencies take into account the effect of their undertakings on historic properties, and that agencies provide the ACHP with an opportunity to comment on those undertakings. Programmatic agreements (36 CFR 800.14(b)) provide alternative procedures for complying with 36 CFR 800. Pacific Southwest Region 5, USDA Forest Service has such an agreement: *Programmatic Agreement among the U.S.D.A. Forest Service, Pacific Southwest Region, California State historic Preservation Officer, and Advisory Council on Historic Preservation Regarding The Identification, Evaluation and Treatment of Historic Properties Managed by the National Forest of the Sierra Nevada, California* (Sierran PA). This agreement provides specific standards for conducting cultural resources inventory, evaluation, and management, including Forest Heritage Program requirements, identification

standards, standard procedures for protecting cultural resources, reporting and public participation.

Cultural resource design criteria are established for all action alternatives and are based on stipulations within the Sierran PA. All alternatives would be in compliance with historic preservation law, policy and regulation, as this project meets the stipulations of the Sierran PA.

### National Forest Management Act (NFMA)

The NFMA (16 U.S.C. 1604) and the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528–531) gives direction to National Forests to develop National Forest Land and Resource Management Plans that (A) insure consideration of the economic and environmental aspects of various systems of renewable resource management, including the related systems of silviculture and protection of forest resources, to provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish; (B) provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and for steps to be taken to preserve the diversity of tree species. As set forth by these Acts, the SNF LRMP, as amended by the SNFPA in 2004, set specific S&Gs which are to be followed during project level planning and implementation.

By the inclusion of design criteria as part of all action alternatives to minimize or eliminate significant environmental effects from proposed management actions as well as the inclusion of S&Gs from the SNF-LRMP and SNFPA ROD (USDA-FS 2004b) used to design this project, this project would comply with this act.

### Soil Productivity

Soil resource management is achieved by maintaining soil productivity using Regional Soil Quality Standard and Guidelines and management direction provided in the LRMP (USDA-FS 1992). The Geology/Soils section, in Chapter 3, analyzes the existing soil productivity and effects of alternatives on soil productivity.

### Management Indicator Species (MIS)

The bioregional scale monitoring strategy for the SNF MIS is found in the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (ROD) of 2007. Bioregional scale habitat monitoring is identified for all twelve of the terrestrial MIS. In addition, bioregional scale population monitoring, in the form of distribution population monitoring, is identified for all of the terrestrial MIS except for the greater sage-grouse. For aquatic macro invertebrates, the bioregional scale monitoring identified is Index of Biological Integrity and Habitat. The current bioregional status and trend of populations and/or habitat for each of the MIS is discussed in the Sierra Nevada Forests Bioregional Management Indicator Species (SNF Bioregional MIS) Report (USDA-FS 2008).

### Other S&Gs, especially those dealing with Water Quality

BMPs would be applied to all action alternatives and are listed in Appendix B of this document. Design criteria listed in Chapter 2 incorporate additional protection measures to minimize and/or eliminate impacts to water quality.

## Executive Orders

The following executive orders provide direction to Federal agencies that apply to the proposed action and alternatives:

**Indian Sacred Sites, Executive Order 13007 of May 24, 1996**, applies to the proposed action alternatives because of historic and prehistoric uses known in the area. This is specifically

addressed in Chapter 3 under Heritage Resources and Tribal Relations. All project alternatives comply with this order.

**Protection and Enhancement of the Cultural Environment, Executive Order 11593 of May 13, 1971,** directs Federal agencies to inventory cultural resources under their jurisdiction, to nominate to the National Register of Historic Places all Federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and to assure that Federal plans and programs contribute to preservation and enhancement of non-Federally owned properties.

Cultural resource design criteria are established for all action alternatives and are based on stipulations within the Sierran PA. All alternatives would be in compliance with historic preservation law, policy and regulation, as this project meets the stipulations of the Sierran PA.

**Invasive Species, Executive Order 13112 of February 3, 1999**, applies to the proposed action alternatives. A risk of introducing invasive species does exist. Measures need to be in place to prevent the spread of these species. The proposed action alternatives comply by providing measures to prevent the introduction and spread of invasive species.

**Recreational Fisheries, Executive Order 12962 of June 6, 1995**, applies to the proposed action alternatives. Action alternatives comply with this order by implementing Best Management Practices and other design criteria and correcting existing resource problems. These design criteria are detailed in Chapter 2 and the list of specific Best Management Practices associated with this project are included in Appendix B of this document.

**Migratory Birds, Executive Order 13186 of January 10, 2001**. Under the National Forest Management Act (NFMA), the Forest Service is directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives (P.L. 94-588, Sec 6 (g) (3) (B))." The January 2000 USDA Forest Service (FS) Landbird Conservation Strategic Plan, followed by Executive Order 13186 in 2001, in addition to the Partners in Flight (PIF) specific habitat Conservation Plans for birds and the January 2004 PIF North American Landbird Conservation Plan all reference goals and objectives for integrating bird conservation into forest management and planning.

> In late 2008, a Memorandum of Understanding (MOU) between the USDA Forest Service and the USFWS to Promote the Conservation of Migratory Birds was signed. The intent of the MOU is to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the USFWS as well as other Federal, State, tribal and local governments. Within the National Forests, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities.

The SNF is proposing to manage lands on the BLRD that are located in the Willow Creek and Fresno River watersheds. Proposed management is intended to implement direction contained within the SNF-LRMP (LRMP, USDA-FS 1992) as amended by the SNFPA ROD (USDA-FS 2004b). Opportunities to promote conservation of migratory birds and their habitats in the project area were considered during development and design of the project (MOU Section C: items 1 and 11 and Section D: items 1 and 3).

Within this project area special considerations have been given to maintaining higher levels of biodiversity through actions such as delineating OFLs surrounding perennial streams (see DEIS and BE/BA for a description of OFLs). Higher levels of biodiversity and heterogeneity have also been planned for by marking retention groups of large diameter trees. These tree groups are composed of a cluster of three or more trees, 30-inch dbh or greater, with touching crowns, and would benefit those species which utilize dense groupings of large trees. Another project design measure which would maintain biodiversity is the identification of retention areas around large

oaks within treatment units. Two to three large oaks per acre were identified and marked with paint. These oaks would retain a zone of no activity measuring 35 feet, or dripline circumference around the oak (whichever is greater). The delineation of OFLs, retention of large tree groups, and oak no treatment zones would ensure a heterogeneous post treatment landscape resulting in the continued accessibility of both hiding cover and prey availability within these areas of biodiversity.

Likely impacts to habitats and select migratory bird populations resulting from the Greys Mountain Project have been assessed in detail within the project MIS report and impacts to select TES birds and their habitats have been analyzed in the project BA and/or BE.

The project would not adversely impact migratory landbird species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of LRMP S&Gs as well as Design Criteria common to All Action Alternatives. These define the retention levels for snags/down woody debris, activities occurring within riparian management areas which include SMZs, OFLs, how to minimize ground disturbance and maintenance of canopy cover. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Specific project design criteria include: canopy cover would be maintained at 50 to 60% or greater where available; ground disturbance would be limited to those guidelines with the LRMP as amended; vegetation species diversity and composition would be maintained; management activities would be limited in designated riparian management areas; and retention of snags and downed logs would be retained at levels defined in the Design Criteria Common to All Action Alternatives. All riparian management areas within the project have been identified and buffers established. In addition, no operations would occur during the wet weather season.

**Floodplain Management, Executive Order 11988 of May 24, 1977,** does not apply because of exclusions and buffers that are in place through design criteria for the action alternatives and are found in detail in Chapter 2.

**Protection of Wetlands, Executive Order 11990 of May 24, 1977,** does not apply because of exclusions and buffers that are in place through design criteria for the action alternatives and are found in detail in Chapter 2.

**Environmental Justice, Executive Order 12898 of February 11, 1994**, applies to the proposed action alternatives. Compliance has been attempted by making this document understandable and accessible.

**Use of Off-Road Vehicles, Executive Order 11644, February 8, 1972,** does not apply to this proposal. No off road use is being proposed nor existing use changed in this document.

# Special Area Designations

The selected alternative would need to comply with laws, regulations and policies that pertain to the following special areas.

## Research Natural Areas

No research natural areas are located in the project area. This project would comply with applicable laws, regulations and policies for research natural areas.

## Inventoried Roadless Areas

No Inventoried Roadless Areas are located in the project area. This project would comply with applicable laws, regulations and policies for Inventoried Roadless Areas.

### Wilderness Areas

No Congressionally-designated wilderness areas are located in the project area. This project would comply with applicable laws, regulations and policies for wilderness areas.

### Wild and Scenic Rivers

No Congressionally-designated wild and scenic rivers occur in the project planning area.

### Municipal Watersheds (FSM 2540)

No municipal watersheds occur in the project planning area.

## 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."

Species surveys, review of recent literature, and professional judgment have been incorporated into determinations of possible effects on species. Surveys provide information on species presence and habitat on a local scale. An element of uncertainty exists for effects on species with distributions beyond the project or Sierra N.F. boundaries. The Pacific fisher and YT are Forest Service sensitive species that have also been designated by the USFWS as candidate species for listing under the ESA. A candidate species is determined by the USFWS Service through a 12-month finding as warranted for listing. The listing process is precluded by other priorities. The Sierra N.F. requested and received technical advice from the USFWS to address uncertainty related to these candidate species. Their advice is integrated extensively throughout the Terrestrial and Aquatic Species sections of Chapter 3 as well as in the design criteria for all action alternatives.

# Chapter 4. Consultation and Coordination

## 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 document:

### ID Team Members

**Burt Stalter**, District Fuels Specialist; Interdisciplinary (ID) Team Leader

**Gloria Smith,** District Fuels Specialist; Fire/Fuels Analysis, Core Team Member

**David Smith**, District Silviculturist; Vegetation/Silvicultural Analysis; Core Team Member

**Anae Otto**, District Wildlife Biologist-Terrestrial; Biological Assessment/Biological Evaluation for Terrestrial Wildlife; Core Team Member

**Keith Ballard,** District Timber Management Officer; Data Collection/Analysis; Core Team Member

**Denise Tolmie**, Forest Fuels Officer;

**Phillip Strand**, Fisheries Biologist; Aquatics-Riparian Analysis; ID Team Member

**Keith A. Stone**, Hydrologist; Hydrology Analysis; ID Team Member

**Joanna Clines**, Forest Botanist; Botanical Biological Assessment/Biological Evaluation/Noxious Weed/Invasive Species Analysis; ID Team Member

**Marie Mogge/Erin Potter**, District Archeologist; Archeology Analysis; ID Team Member

**Andy Hosford**, District Engineer; Transportation Analysis; ID Team Member

**Alan Gallegos/Kellen Takenaka**, Soils; /Soils Analysis; ID Team Member

**Karen Nooney**, District Lands/Special Uses; Special Uses Analysis; ID Team Member

**Linda McPhail**, Recreation Specialist; ID Team Member

**Judi Tapia**, NEPA Coordinator and Technical Reviewer

### Federal, State, and Local Agencies

Although no formal or informal consultation was required for this project, personnel communications with Federal, State and Local Agencies including, but not limited to; USFWS, California Department Fish and Game, and Cal-Fire.

### Tribes

North Fork Mono Rancheria; Picayune Rancheria of the Chukchansi Indians; Mariposa Indian Council; Mono Nation; California Indian Basketweavers Association.

# Distribution of the Environmental Impact Statement

This draft environmental impact statement 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, State and local governments, and organizations:

- Advisory Panel on Historic Preservation
- USDA-Animal and Plant Health Inspection Service
- USDA-Natural Resources Conservation Service
- USDA-National Agricultural Library
- National Oceanic and Atmospheric Administration
- National Marine Fisheries Service
- South Pacific Division-US Army Engineer
- Region 9-Environmental Protection Agency
- US Department of the Interior
- US Coast Guard
- Western Pacific Region-Federal Aviation Administration
- US Department of Energy
- Federal Highway Administration
- USFWS
- California Department of Fish and Game
- North Fork Mono Rancheria
- Picayune Rancheria of the Chukchansi Indians
- Mono Nation
- Madera County Board of Supervisors
- San Joaquin Valley Air Pollution Control District
- High Sierra Chapter of Society of American Foresters
- Eastern Madera Fire Safe Council
- Coarsegold Resource Conservation District
- Sierra Forest Legacy
- National Chapter and Tehipite Chapter-Sierra Club
- ,John Muir Project
- California Indian Basketweavers Association
- Regional Water Quality Control Board
- Willow Creek Collaborative

# Glossary

**Adaptive Management:** A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions provides information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

**Aggregation:** The smallest homogeneous unit recognized when describing vegetation. Different management is required than surrounding vegetation. Due to its small size, it is not a mapping or record keeping unit. Several aggregations can make up a stand.

**Air Shed:** A geographical area that shares the same air mass due to topography, meteorology, and climate.

**Analysis Area:** A collection of land area, not necessarily contiguous, sufficiently similar in character that they can be treated as if they were identical.

**Aspect:** A position facing a particular direction, usually expressed as a compass direction in degrees or cardinal directions.

**Bark Beetle:** A member of the family Scolytidae (*Coleoptera*). Adults and larvae tunnel in the cambial region (either in the bark only or in the bark and xylem) of living, dying and recently dead or felled trees and utilize these areas for food and shelter.

**Basal Area**: The area of the cross section of a tree trunk near its base, usually 4½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

**Baseline:** Starting point for analysis of environmental consequences. A baseline may be conditions at a point in time or collected over a specified period of years.

**Best Management Practices (BMPs):** Practices determined to be the most effective and practicable means of controlling pollutants at levels compatible with environmental quality goals. BMPs were conceptualized in the 1972 FUS Federal Water Pollution Control Act. BMPs as defined in the USDA Forest Service Soil and Water Conservation Handbook.

**Biomass thin:** Used in this document to describe the cutting of vegetation (conifers) that may or may not have a market value, but are removed from site after cutting. For this document this is considered a conifer approximately 4-10 inches in diameter.

**Breast Height (as referred to as dbh):** A standard height from ground level, generally 4.5 feet for recording diameter, circumference or basal area of a tree.

**Broadcast Burn:** A type of prescribed fire allowed to burn over a designated area within defined boundaries to achieve land management objectives.

**Buffer:** A land area designated to block or absorb unwanted impacts to the area inside the buffer.

**Bulk Density:** The weight per unit volume of a measured material. Bulk density of plants is measured at a specified moisture tension.

**California Wildlife Habitat Relationship System (CWHR):** A wildlife information and predictive system for mammals, reptiles, and amphibians. This system is considered a state-of-the-art information system for California's wildlife. The system provides the most widely used habitat relationship models for California's terrestrial vertebrate species. CWHR is operated and

maintained by the California Department of Fish and Game, in cooperation with the California Interagency Wildlife Task Group (CIWTG).

**Canopy:** Foliar cover in the forest stand consisting of one or several layers.

**Chaparral:** Dense growth of mostly small-leaved evergreen shrubs. Found in the foothills of California.

**Classified Roads:** Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access including State roads, County roads, privately owned roads, National Forest Transportation System roads, and roads authorized by the Forest Service that are intended for long-term use.

**Clump:** An isolated, generally dense, group of trees.

**Codominant:** Tree species in a forest that are about equally numerous and exert the greatest influence.

**Cohort:** A group of trees developing after a single disturbance, commonly consisting of trees of similar age. A considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance can be included.

**Commercial thin:** Used in this document to describe the cutting and removal from site of vegetation (conifers) that typically has a market value. For this document this is considered a conifer over approximately 10 inches in diameter.

**Corridor:** Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

**Cover:** Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to rest, feed, and escape from predators.

**Crown:** The upper part of a tree that carries the main branch system and foliage.

**Crown Closure:** The point at which the vertical projections of a crown's perimeter within a canopy touches.

**Crown Density:** The amount and compactness of foliage for trees or shrubs.

**Crown Fire –**A fire that advances from top to top of trees or scrubs more or less independent of a surface fire. Crown fires are sometimes classed as running or dependent to distinguish the degree of independence from the surface fire.

**Cumulative Effects:** Combined effects resulting from sequential actions on a given area.

**Damaged (Ecosystem)**: The acute or obvious changes in an ecosystem.

**Degraded (Ecosystem)**: The subtle or gradual change that reduces ecological integrity and health.

**Den Tree:** A tree that contains a weather tight cavity for wildlife.

**Defensible fuels profile(s), Defensible Fuel Profile Zone(s), DFPZ(s):** A strategically located strip(s) of land where the vegetation has been modified to a less dense fuel type. These are typically located along ridgetops and roads and are areas where fire fighters would make a stand to contain a fire. The width is based on potential fire behavior based on available fuels, weather and wind, and topography. They are not designed to stop an oncoming wildfire by themselves, but rather to provide a safe location to facilitate fire suppression efforts and provide an anchor point for prescribed burning projects. The DFPZ strategy initially treats a lower proportion of the

landscape; treatments are located to protect specific values and are typically placed in wildland urban intermix areas. After a network of DFPZs is established, area fuel treatments (SPLATs) can be placed to enhance DFPZ effectiveness and increase the likelihood tat the overall landscape strategy would reduce wildfire intensity and size.

**Destroyed (Ecosystem)** : Severe degradation or damage removes all macroscopic life and drastically alters the physical environment as well.

**Diameter Class:** Intervals into which a range of diameters of tree stems or logs may be divided for classification or use.

**Disturbance:** A force that results in changes in the structure and composition through natural events such as wind, fire, flood, avalanche, or mortality caused by insect or disease outbreaks or human events (e.g. timber harvest).

**Duff:** Organic material covering the forest floor (includes fresh litter from plants and older, well developed humus).

**Ecological Restoration:** The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed.

**Ecosystem:** An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within the ecosystems.

**Elevation:** Vertical distance of measure displayed in feet above sea level.

**Endangered Species:** A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

**Endemic Species:** Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

**Environmental Effects:** Includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health whether direct (which are caused by action and occur at the same time and place), indirect (which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable), or cumulative (results from the incremental impact of the action when added to other past, present or reasonably foreseeable future actions).

**Environmental Impact Statement (EIS):** A document prepared by a Federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. Federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. An impact statement includes: (1) the environmental impact of the proposed action, (2) any adverse impacts which cannot be avoided by the action, (3) alternatives courses of actions, (4) relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity, and (5) a description of the irreversible and irretrievable commitment of resources which would occur if the action were accomplished.

**Ephemeral Stream:** A stream or portion of a stream that flows only in direct response to precipitation, receiving little or no water from springs and no long continued supply from snow or other sources and whose channel is at all times above the water table.

**Erosion:** The wearing away of land surface by rain, running water, wind, ice, gravity, or other natural agents including gravitational creep and tillage.

**Feasibility:** Capability and suitability for specific use.

**Fire Behavior:** The over-arching means by which to describe how an ignited fire reacts to the influences of fuels, topography and weather when combined together. Typical terms used when describing fire behavior include rate of spread (how fast a fire travels over a given distance in a given period of time); flame height (as measured in feet from ground through middle of flame); intensity (BTUs given off from flaming front); fire type (surface vs. crown) to name a few. Computer based models are used to predict fire behavior for given environmental and fuel conditions.

**Flow:** The movement of a stream of water or other mobile substances from place to place. The movement of water and the moving water itself. The volume of water passing a given point per unit of time.

**Forage:** All browse and non-woody plants that are eaten by wildlife.

**Forb:** A grouping or category of herbaceous plants which are not included in grass, shrub or tree groupings, generally smaller flowering plants. Forbs contain little or no woody material.

**Forest:** An ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands of varying in characteristics such as species composition, structure, age class, and associated processes. Commonly includes meadows, streams, fish and wildlife.

**Forest Health:** The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function and vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that make up the forest, and the appearance of the forest at a point which influences the perception and interpretation of forest health.

**Forest Plan:** Also referred to as a Land and Resource Management Plan (LRMP). A signed document that is the source of management direction for an individual National Forest that specifies activity and output levels for a period of 10-15 years. Management direction in the Forest Plan is based on issues identified at the time of Plan development.

**Forestry:** The profession embracing the science, art and practice of creating, managing, using and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs and values.

**Forest Type:** A category of forest usually defined by its vegetation, particularly its dominant vegetation as based on percentage cover of trees.

**Fragmentation:** The process by which a landscape is broken into small islands of forest within a mosaic of other forms of land use or ownership.

**Frequency:** 1. biometrics: the number of occurrences of a given type of event of the number of members of a population falling into a specified class; 2. ecology: the number of individuals in a community.

**Fuelbreak:** A wide strip or block of land on which the native vegetation has been modified so that fires burning into it can be more readily suppressed. Usually strategically build in conjunction with a roadway (for access) and along ridgelines. Terms like shaded fuelbreak is used to differentiate the amount or type of vegetation that is removed to create the fuelbreak.

**Fuel Model –** A fuel model is a set of numerical values that describe the fuel inputs for Rothermel's mathematical model that predicts surface fire spread.

**Geographic Information System (GIS):** A system of computer maps with corresponding site-specific information that can be electronically combined to provide reports and maps.

**Habitat:** The place where an animal, plant or population normally lives and develops.

**Habitat capability:** The ability of a land area or plant community to support a given species of wildlife.

**Headcuts:** Land erosion at the head of a stream, creek, or river.

**Headwater:** The source of a stream. The upper tributaries of a drainage basin.

**Herb:** A non-woody, vascular plant.

**Herbaceous:** A class of vegetation dominated by no-woody plants known as herbs.

**Horizon (soil):** A layer of soil approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical and biological properties or characteristics such as color, structure, texture, consistency, kinds and number of organisms present, degree of acidity or alkalinity.

**Indigenous:** Native to a specified area or region.

**Indirect Effects:** Effects that are caused by an action and occur at a later time, or at another location, yet are reasonably foreseeable in the future.

**Insect:** A member of the class Insecta characterized by a body segmented into three distinct regions (head, thorax, abdomen), by a head with one pair of antennae, by a thorax with three segments each with a pair of legs, and usually one or two pairs of thoracic wings.

**Interdisciplinary Team (IDT):** A group of specialists assembled to solve a problem or perform a task.

**Invasive Plants:** Plant species that are introduced into an area in which they did not evolve and in which they usually have few or no natural enemies to limit their reproduction and spread. These species can cause environmental harm by significantly changing ecosystem composition, structure, or processes and can cause economic harm or harm to human health.

**Ladder fuels or fuel ladders:** Arrangement of vegetation (trees, brush, etc.) that provides vertical continuity from the forest floor to the crowns of overstory trees. Example would be similar to steps on a ladder.

**Land and Resource Management Plan (LRMP)**: See Forest Plan

**Landscape:** A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate and human impacts. Landscapes are often used for coarse grain analysis.

**Maintenance:** The work of keeping something in proper condition or standard.

**Masticate or Mastication:** Means by which vegetation is mechanically "mowed" into small pieces and changed from a vertical to horizontal arrangement.

**Management Indicator Species (MIS):** Animals or plants identified in Forest Land and Resource Management Plans (LRMPs or forest plans) developed under the 1982 Planning Rule,

that are selected because their population changes are thought to indicate the effects of Forest Service management activities.

**Mechanical Methods:** Utilization of machinery such as bulldozers and skidders for tractor logging; helicopter logging, skyline cable logging, mechanical harvesters and shredders/masticators.

**Merchantable:** Having the size, quality and condition suitable for marketing under a given economic condition.

**Mitigation:** Actions taken to avoid, minimize or rectify the impact of a land management activity.

**Model:** A representation of reality used to describe, analyze or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization or a highly abstract set of mathematical equations. A model has limits to its effectiveness and is used as one of several tools to analyze a problem.

**Mortality:** Trees dying from natural causes, usually by size class in relation to sequential inventories or subsequent to incidents such as storms, wildfire or insect and disease epidemics.

**Mosaic:** A pattern of vegetation in which two or more kinds of communities are interspersed in patches, such as clumps of shrubs with grassland between.

**National Environmental Policy Act (NEPA):** Congress passed in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

**Native Species:** Indigenous species normally found as part of a particular ecosystem.

**Natural Fuel:** Term used to describe vegetation, live or dead, in a given area that is not associated with being created by management activities. It is usually described in terms of natural fuel accumulations or build-up from naturally falling leaves, branches and/or logs from fallen snags.

**Notice of Intent (NOI):** A notice printed in the *Federal Register* announcing that an Environmental Impact Statement would be prepared. The NOI must describe the proposed action and possible alternatives, describe the proposed agency scoping process and provide a contact person for further information.

**Noxious Weeds (Plants):** An undesirable, non-native plant that is difficult to control and is on either the California Department of Food and Agriculture Noxious Weed list or the California Invasive Plant Council Inventory of invasive plants in California.

**Old-growth (forest):** Old forests often containing several canopy layers, variety in tree sizes and species; and standing and dead woody materials.

**Patch:** An area of homogeneous vegetation, in structure and composition.

**Pathogen:** A parasitic organism directly capable of causing disease.

**Perennial Stream:** A stream that has running water on a year-round basis under normal climatic conditions.

**Pre-commercial thin:** Used in this document to describe the cutting of vegetation (conifers) that does not typically have a market value and not removed from site after cutting. For this document this is considered a conifer approximately 4-10 inches in diameter.

**Prescribed burning (fire):** With a given range environmental condition (air temperature, fuel moisture, windspeed and direction, etc.) and approved plan, a fire that is management ignited to meet specific resource management objectives. This can include dozer/hand pile; understory and broadcast burning.

**Rate of Spread:** The relative speed with which a fire increases in size usually expressed in chains (66 feet) per hour.

**Reclamation:** The stabilization of the terrain, assurance of public safety, aesthetic improvement, and usually a return of the land to what, within the regional context, is considered to be a useful purpose.

**Record of Decision (ROD):** An official document in which a deciding official states the chosen activity (alternative) that would be implemented from a prepared EIS.

**Reforestation:** The restocking of an area with forest trees, by either natural or artificial means, such as planting.

**Regeneration:** The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

**Residual:** A tree or snag remaining after an intermediate of partial cutting of a stand.

**Resilience:** The ability of an ecosystem to maintain diversity, integrity and ecological processes following a disturbance.

**Resistance:** The ability of a community to avoid alteration of its present state by a disturbance. The ability of plants to avoid, suppress, prevent, overcome, or tolerate insect or pathogen attack.

**Responsible Official:** The Federal employee who has the delegated authority to make and implement a decision on a proposed action.

**Riparian Area:** The area along a watercourse or around a lake or pond.

**Riparian Ecosystem:** The ecosystems around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

**Riparian Conservation Areas (RCAs):** These are land allocations that are managed to maintain or restore the structure and function of aquatic, riparian and meadow ecosystems. The intent of management direction for RCAs is to (1) preserve, enhance, and restore habitat for riparian-and aquatic-dependent species; (2) ensure that water quality is maintained or restored; (3) enhance habitat conservation for species associated with the transition zone between upslope and riparian areas; and (4) provide greater connectivity within the watershed.

**Risk:** The relative probability of any of several alternative outcomes as determined or estimated by a decision maker when the outcome of an event or series of events is not known.

**Road Maintenance:** The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objectives.

**Road Reconstruction:** Activities that result in road realignment or road improvement.

**Sample:** A part of a population selected and examined as a representative of the whole.

**Sediment (sedimentation):** Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice or air; may be moved and deposited away from their original position and eventually would settle to the bottom.

**Sensitive Species:** Plant or animal species which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of threatened or Endangered Species made by the U.S. Fish and Wildlife Service.

**Shade tolerant:** When used to describe a conifer, the trees prefers to grow in the shade.

**Silvicultural System:** The cultivation of forest; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

**Silviculture:** The art and science that promotes the growth of single trees and the forest as a biological unit.

**Simulation:** An operations research technique that represents physical, natural, social and economic systems by models in order to study the factors affecting the system and to aid decision making.

**Site:** The area in which a plant or a stand grows, considered in terms of its environment, particularly as this determines the type and quality of the vegetation the area can carry.

**Site Preparation:** Removing unwanted vegetation, slash, roots and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

**Skid Road (skid trail):** A road access cut through the woods for skidding of logs.

**Skidder:** A self-propelled machine (cable, clam-bunk or grapple) used for dragging trees or logs.

**Skidding:** Hauling logs by sliding, not on wheels, from stump to a collection point.

**Slash:** Residue left on the ground after timber cutting or left after a storm, fire or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

**Snag:** A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

**Soil Compaction:** Reduction of soil volume. The weight of heavy equipment, for example, on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

**Species:** The main category of taxonomic classification into which genera are subdivided, comprising a group of similar interbreeding, individuals sharing a common morphology, physiology and reproductive process.

**Stand:** A group of trees that occupies a specific area and is similar in species, age, and condition.

**Stand density:** A quantitative measure of stocking expressed either absolutely in terms of number of trees, basal area, or volume per unit area or relative to some standard condition. A measure of the degree of crowding of trees within stocked areas commonly expressed by various growing space ratios.

**Stand Structure:** The physical and temporal distribution of plants in a stand. Silviculture the horizontal and vertical distribution of components of a forest stand including the height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags and down woody material.

**Standards and Guidelines:** Direction outlined in the Forest Land and Resource Management Plan (LRMP) for specific aspects of project planning and analysis.

**Stocking:** An indication of growing-space occupancy relative to a pre-established standard.

**Strategically Placed Landscape Area Treatments:** Wildland fire modification strategy (created from research conducted by Dr. Mark Finney (1999)) by which a fire is forced to go around areas where fuels have been reduced or otherwise modified. The treated areas function as "speedbumps" on the landscape to slow the spread and reduce the intensity of oncoming fires and thereby reduce damage to both treated and untreated areas.

**Streamside Management Zones (SMZs):** Management Zones established to protect and maintain water quality, site productivity, channel stability, wildlife habitat, and riparian vegetation.

**Structure:** Sizes, shapes and/or ages of the plants and animals in an area.

**Surface Fuels:** Vegetation, either dead or live, that is on the surface, which includes dead branches, blowdown timber, leaves, and low vegetation, as contrasted with *crown fuels*.

**Thinning from below:** A silvicultural technique by which cutting is done in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees. From below describes the incremental cutting of trees based on its position in the stand. First starting with suppressed, then intermediates, then co-dominates to reach a desired or prescribed basal area for the stand.

**Threatened Species:** Plant or animal species likely to become endangered throughout all or part of their range in the foreseeable future. Designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

**Understory:** The trees and woody shrubs growing beneath the overstory in a stand of trees.

**Viability:** The ability of a population of a plant or animal species to persist for some specified time into the future. Viable populations are populations that are regarded as having the estimated numbers and distribution of reproductive individuals to ensure that its continued existence is well distributed in a given area.

**Watershed:** The entire region drained by a waterway (or into a lake or reservoir). More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at the point.

**Weed:** A valueless, troublesome or noxious plant often exotic, growing wild especially on growing profusely. A plant growing where it is not wanted.

**Wildfire:** Any wildland fire that is not a prescribed fire.

**Wildland:** Land other than that dedicated for other uses such as agriculture, urban, mining or parks.

**Wildland Urban Intermix (WUI):** The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

**Wildfire Intensity:** Describes the buildup of heat within a fire, both in amount and in rate of transmission-a function of heat release. Usually described as low, moderate or high intensity fires.

**Wildlife:** All non-domesticated animal life.

**Woodland:** A forested area; a plant community in which, in contrast to a typical forest, the trees are often small, characteristically short-boled relative to their crown depth and forming an open canopy with the intervening area being occupied by lower vegetation, commonly grass

# Literature Cited


Agee, J.K. 1993. F ire Ecology of Pacific Northwest forest, Island Press, Washington, D.C., USA.

Agee, J.K., Skinner, C. N.; 2005**.** Basic principles of forest fuel reduction treatments. Forest Ecology and Management; Volume 211: (pages 83-96).

Ahuja, S. 2006. Fire and Air Resources, Chapter 21, Fire in California Ecoystems; Suighara, N. Pages 481-498.

Allen, A. W. 1982. Habitat suitability index models: Marten. United States Fish and Wildlife Service, FWS/OBS-82/10.11, Fort Collins, CO, USA.

Anderson, H.E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report, INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 22p.

Anderson, Kat, M., 2005. Tending the Wild. Native American Knowledge of California's Natural Resources. 526 p.

Bateman, Paul C. 1976. Geologic Map of the Bass Lake Quadrangle, Central Sierra Nevada, California. U.S. Geological Survey.

Beche, Leah A., Scott L. Stephens and Vincent H. Resh. 2005. Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone. Forest Ecology and Management, 218(2005):37-59.

Benavides-Solorio, Juan, and Lee H. MacDonald. 2001. Post-fire runoff and erosion from simulated rainfall on small plots, Colorado Front Range. Hydrological Processes, 15:2931-2952.

Bossard, C.C.; Randall, J.M.; Hoshovsky, M.C. 2000. Invasive plants of California's wildlands. Berkeley, CA: University of California Press. Online via: www.cal-ipc.org

Bostwick, P., et.al.., 2011. How Fuel Treatment Saved Homes from The 2011 Wallow Fire, 2011.

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. Coarse woody debris: Managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRSGTR-105. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p.

Busse, Matt D., Simon, Steven A., and Greg M. Riegal. 2000. Tree growth and understory responses to low-severity prescribed burning in thinned *Pinus ponderosa* forests of Central Oregon. Forest Science 46 (2):258-268.

Caprio, A. and D. Graber. 2000**.** Returning Fire to the Mountains: Can We Successfully Restore the Ecological Role of Pre-Euroamerican Fire Regimes to the Sierra Nevada? In *Proceedings: Wilderness Science in a Time of Change.* Rocky Mountain Research Station, RMRS-P-000. Ogden, UT.

CDFG (California Department of Fish and Game). 1995. Fish Species of Special Concern, 2nd Edition. Rancho Cordova, California.

CDFG. California Interagency Wildlife Task Group. 2002. California Wildlife Habitat Relationships version 8.0 personal computing program. Sacramento, California.

CDFG (California Department of Fish and Game). 2005. California Department of Fish and Game and California Interagency Wildlife Task Group. California Wildlife Habitat Relationships (CWHR) version 8.1. personal computer program. Sacramento, California. On-Line version. http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp. (Accessed: January 3, 2008).

California Invasive Plant Council. 2006. California invasive plant inventory**.** Berkeley, CA: California Invasive Plant Council, publication 2. Online via: http://www.cal-ipc.org/ip/inventory/index.php

Central Valley Regional Water Quality Control Board. 2009. Water Quality Control Plan for the Tulare Lake Basin, second Edition. Available via: http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/

CHM2HILL. 1995. A Desk Reference for NEPA Air Quality Analysis, USDA Forest Service.

Clark, Bob. 2001. Soils, water, and watersheds. Chapter V in: Fire Effects Guide. National Wildlife Coordinating Group, Fire Use Working Team. Available via: http://www.nwcg.gov/pms/RxFire/FEG.pdf

Clines, Joanna. 2011a. Biological assessment/biological evaluation for Threatened, Endangered, and Sensitive plants for the Greys Mountain Ecological Restoration Project, Bass Lake Ranger District, Sierra National Forest. USDA Forest Service. (Unpublished).

Clines, Joanna. 2011b. Noxious weed risk assessment for the Greys Mountain Ecological Restoration Project, Bass Lake Ranger District, Sierra National Forest. USDA Forest Service. (Unpublished).

Cochran, P.H.; Et Al.; 1994. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington. Pacific Northwest Research Station; USDA Forest Service; PNW-RN-513.

Cochran, P.H.; Barrett, James W.; 1995. Growth and Mortality of Ponderosa Pine Poles Thinned to Various Densities in the Blue Mountains of Oregon. Pacific Northwest Research Station; USDA Forest Service; PNW-RP-483.

Cochran, P.H.; Barrett, James W.; 1998. Growth of Ponderosa Pine Thinned to Different Stocking Levels in Central Oregon; 30-Year Results. Pacific Northwest Research Station; USDA Forest Service; PNW-RP-508.

Coe, Drew B. 2006. Sediment production and delivery from forest roads in the Sierra Nevada, California. MS Thesis, Colorado State University, Fort Collins, CO.

Cohen, J.D, 2008. The Wildland Urban Interface Fire Problem, Fire History Today

Cohen, J.D and Bulter, B.W., 1998**.** Modeling Potential Structure Ignitions from Flame Radiation Exposure with Implications for Wildland/Urban Interface Fire Management, 13th Fire and Forest Meteorology Conference, Australia

Cooper, D.J. and E.C. Wolf. 2006. Fens of the Sierra Nevada, California. Report prepared for USDA Forest Service, Pacific Southwest Region. Available online at: http://www.rigelstuhmiller.com/evan/CooperWolfSierraFensFinalReport2006.pdf.

Dettinger, Michael D., Cayan, Daniel R., Knowles, Noah, Westerling, Anthony, and Tyree, Mary K., 2004. *Recent Projections of 21st-Century Climate Change and Watershed Responses in the Sierra Nevada*, USDA Forest Service, General Technical Report, Pacific Southwest Research Station, PSW-GTR-193.

Dettinger, M. D. 2005. From climate-change spaghetti to climate-change distributions for 21st century California. San Francisco Estuary and Watershed Science Vol. 3, Issue 1, (March 2005), Article 4. http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art4.

DiTomaso, J.M. and E.A. Healy. 2007. Weeds of California and other Western States. University of California Agriculture and Natural Resources Publication 3488. Vol. 1.

Dunning, Duncan; Reineke, L.H.; 1933. Preliminary Yield Tables for Second-growth Stands in the California Pine Region, Technical Bulletin No. 354, U.S. Department of Agriculture, Washington, D.C.

Egan, Joel M.; Et Al.; 2010. Forest Thinning and subsequent bark beetle-caused mortality in Northeastern California. Forest Ecology and Management. (pages 1832-1842).

Emmingham, W.H.; Elwood, N.E. 1983 (Reprinted 2002). Thinning: An Important Timber Management Tool. Oregon State University, Washington State University and University of Idaho Extension System, Pacific Northwest Research Center; General Technical Report #184.

Environmental Protection Agency. AP-42, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Fifth Edition.

Evan, A.M., Everett,S.L.,Stephens, S.L., Youtz, J.A., May 2011, Comprehensive Fuels Treatment Practices Guide for Mixed Conifer Forests: California, Central and Southern Rockies, and the Southwest. Forest Guild US Forest Service, 112 p.

Federal Register. 2002. Proposed rule to list critical habitat for Vernal Pool invertebrates. Volume 67, Number 185. September 25, 2002.

Feeney, S. R.; Et. Al.; 1998. Influence of thinning and burning restoration treatments on presettlement ponderosa pines at the Gus Pearson Natural Area. Canadian Journal of Forest Research, Volume 28 (pages 1295-1306).

Ferrell, G.T.; 1996. The Influence of Insect Pests and Pathogens on Sierra Forests. Pacific Southwest Research Center; USDA Forest Service; Sierra Nevada Ecoystem Project. Vol II.

Fettig, C. J.; Et. Al.; 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. Forest Ecology and Management. 238: (pages 24-53).

Fettig, C. J.; Et. Al.; 2008. Blacks Mountain Experimental Forest: bark beetle responses to differences in forest structure and the application of prescribed fire in interior ponderosa pine. Canadian Journal of Forest Research; 38(5)(pages 924-935).

Finney M.A and Cohen J.D., Expectation and Evaluation of Fuel Management Objectives, RMRS-P-29

Fites-Kaufman, J., et.al., 2002. Prescribed Fire and Fuel Treatment Effectiveness and Effects-Monitoring Pilot, 2002 Detailed; Fire and Aviation Management, USFS-PSW, USFS Adaptive Management Services Enterprise Team.

Fitzgerald, S. A.; 2005. Fire ecology of ponderosa pine—fire resilient ponderosa pine ecosystems. Pacific Southwest Research Center; USDA Forest Service; General Technical Report; PSW-GTR-198.

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab8, S.L. Grant. 9/2005. Stream Condition Inventory Technical Guide. USDA Forest Service, Pacific Southwest Region - Ecosystem Conservation Staff. Vallejo, CA. 111 pg.

Fúle, P.Z., A.E. Cocke, T.A., Heinlein and W.W. Covington, 2004. Effects of Intense Prescribed Fire: Is it Ecological Restoration? Restoration Ecology 12:220 -230

Giger, David R., 1993. Soil Survey of Sierra National Forest Area, California. US Department of Agriculture, Forest Service. Open File Report, Clovis, CA. 150 p.

Graham, R., et.al., 2004. Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. USDA Forest Service, General Technical Report, Rocky Mountain Research Station, RMRS-GTR-120, January 2004.

Gucinski, Hermann, Michael J. Furniss, Robert R. Ziemer, and Martha H. Brookes, eds. 2001. Forest roads: a synthesis of scientific information. PNW-GTR-509. Pacific Northwest Research Station, Portland, OR. 103p.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2008. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2007: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). June, 2008. 29pp.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2009. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2008: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). April 2000. 29pp.

Gutiérrez, R.J., D.J. Tempel, and W. Berigan. 2010. Population ecology of the California spotted owl in the Central Sierra Nevada: Annual Results 2009: Region 5, USDA Forest Service (CR Agreement: 06-CR-11052007-174). March 2010. 29pp.

Gutowski, W. J., Z. Pan, C. J. Anderson, R. W. Arritt, F. Otieno, E. S. Takle, J. H. Christensen, and O. B. Christensen. 2000. What RCM data are available for California impacts modeling? California Energy Commission Workshop on Climate Change Scenarios for California, 12-13 June, 2000. California Energy Commission, Sacramento, CA, USA.

Hakkarinen, C., and J. Smith. 2003. Appendix I. Climate scenarios for a California Energy Commission study of the potential effects of climate change on California: summary of a June 12-13, 2000, workshop. *In* Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy. EPRI (Electric Power Research Institute), Palo Alto, CA, USA. 38 pp.

Harmon, M.E., J.F. Franklin, F.J. Swanson, P. Sollins, S.V. Gregory, J.D. Lattin, N.H. Anderson, S.P. Cline, N.G. Aumen, J.R. Sedell, G.W. Lienkaemper, K. Cromack, Jr. and K.W. Cummins, 1986. Ecology of Coarse Woody Debris in Temperate Ecosystems. Advanced Ecological Research. Volume **15:** 133–302.

Harris, Gary R. and W. Wallace Covington. 1983. The effect of a prescribed fire on nutrient concentration and standing crop of understory vegetation in ponderosa pine. Canadian Journal of Forest Research 13 :(3) 501-507.

Hatchett, B., Michael P. Hogan, and Mark E. Grismer. 2006. Mechanical mastication thins Lake Tahoe forest with few adverse impacts. California Agriculture 60(2):77-82.

Hayhoe, K., et al. (18 co-authors). 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences 101: 12422- 12427.

Hevron, William, E. 1989. The Reproductive Ecology of *Collomia rawsoniana*. Unpubl. Master's Thesis. California State University, Fresno. 51 pp.

Hickman, J.C. 1993. The Jepson Manual – Higher Plants of California. James C. Hickman, Editor. University of California Press, Berkeley.

Hilton, Sue, and T.E. Lisle. 1993. Measuring the fraction of pool volume filled with fine sediment. Research Note PSW-RN-414-WEB. Pacific Southwest Research Station, Albany, CA. 11p.

Hood, Sharon M.; 2010. Mitigating Old Forest Tree Mortality in Long-Unburned, Fire-Dependent Forests: A Synthesis. Rocky Mountain Research Station; USDA Forest Service; General Technical Report; RMRS-GTR-238.

Hurteau, M.; North, M.; 2009. Fuel treatment effects on tree-based forest carbon storage and emissions under modeled wildfire scenarios. Frontiers in Ecology and the Environment; In press.

Jenkins, M. J.; Et.Al.; 2008**.** Bark beetles, fuels, fires, and implications for forest management in the Intermountain West. Forest Ecology and Management; Volume 254; (pages 16-34).

Johnson, Hank; 1974. Thunder in the Mountains. Trans-Anglo Books. Corona del Mar, Ca.

Jones, J.A., and G.E. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resources Research, 32(4):959-974.

Knowles, Noah; Et Al; 2006. Trends in Snowfall versus Rainfall in the Western United States. Journal of Climate Vol. 19, Issue 18: (pages 4545-4559).

Korte and MacDonald. 2005. Road Sediment Production and Delivery in the Southern Sierra Nevada, California. American Geophysical Union, Fall Meeting 2005, abstract #H51E-0416. Available via: http://adsabs.harvard.edu/abs/2005AGUFM.H51E0416K

Larsson, S.; Et Al.; 1983. Attacks of Mountain Pine Beetle as Related to Tree Vigor of Ponderosa Pine. Forest Science; Volume 29; (pages 395-402).

Lenihan, J. M., R. Drapek, D. Bachelet and R. P. Neilson. 2003. Climate change effects on vegetation distribution, carbon, and fire in California. Ecological Applications 13: 1667-1681.

Lesh, M., Cornwell, K. and Holer, T. 2009. Evaluation of lodge pole pine tree removal on the storage potential of a shallow aquifer in a mountain meadow. American Geophysical Union, Fall meeting 2009, abstract #H21C-0874

Lewis, J., S.R. Mori, E.T. Keppeler, and R.R. Ziemer. 2001. Impacts of logging on storm peak flows, flow volumes, and suspended sediment loads in Caspar Creek, California. In: M.S. Wigmosta and S.J. Burges, eds., Land use and watersheds: human influence on hydrology and geomorphology in urban and forest areas. Water Science and Application Volume 2, p.85-125. American Geophysical Union, Washington, D.C.

Liskey, Eric N. 1993. Effects of Disturbance on *Collomia rawsoniana.* Unpubl. Master's Thesis. California State University, Fresno. 42 pp.

Lisle, T.E., and S. Hilton. 1992. The volume of fine sediment in pools: an index of sediment supply in gravel-bed streams. Water Resources Bulletin, 28(2):371-383.

Lisle, T.E., and S. Hilton. 1999. Fine bed material in pools of natural gravel bed channels. Water Resources Research, 35(4): 1291-1304.

Long, J.; 1985**.** A Practical Approach to Density Management. Utah State University; The Forestry Chronicle (pages 23-27).

Long, John N.; Shaw, John D.; 2005. A Density Management Diagram for Even-aged Ponderosa Pine Stands. Western Journal of Applied Forestry 20 (4) (pages 205-215).

Lowe, Tom. 1994. Fugitive Dust Analysis for Timber Haul on Unpaved Roads, Sierra National Forest, 6 pp.

Luce, C.H.; Black, T.A. 1999. Sediment production from forest roads in western Oregon. Water Resources Research. 35(8): 2561-2570.

MacDonald, L.H and M. Kuitu, 2009. Estimated conifer encroachment into meadows in the Sierra National Forest using sequential aerial photographs and GIS.

MacDonald, L.H., and J.D. Stednick. 2003. Forests and water: a state-of-the art review for Colorado. CWRRI Completion Report No. 196. Colorado State University, Fort Collins, CO.

MacDonald, L.H., Drew Coe and Sandra Litschert. 2004. Assessing cumulative watershed effects in the Central Sierra Nevada: hillslope measurements and catchment-scale modeling. Proceedings, Sierra Nevada Science Symposium, Ocyober 7-10, 2002, Kings Beach, CA. PSW-GTR-193: 149-157.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp. http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp

Meyer, W. H.; 1938 (slightly revised April 1961). Yield of Even-aged stands of Ponderosa Pine, Technical Bulletin No. 630, U.S. Department of Agriculture, Washington, D.C.

Meyer, M., and H. Safford. 2010. A summary of current trends and probable future trends in climate and climate-driver processes in the Sierra National Forest and the neighboring Sierra Nevada.

Meyers, T.J. and Swanson, S., 1992. Variation of stream stability with stream type and livestock bank damage in Northern Nevada. Water Resources Bull. AWRA, 28(4): 743-754.

Miller, C. and Urban D.L., 2000**.** Connectivity of Forest Fuels and Surface Fire Regimes. Landscape Ecology 15:145-154

Miller, N. L., K. E. Bashford and E. Strem. 2003. Potential impacts of climate change on California hydrology. Journal of the American Water Resources Association 39: 771-784.

Miller, J. D., H. D. Safford, M. Crimmins, and A. E. Thode. 2009. Quantitative Evidence for Increasing Forest Fire Severity in the Sierra Nevada and Southern Cascade Mountains, California and Nevada, USA. *Ecosystems* 12(1):16–32.

Miles, S.R, and C.B. Goudey. 1997. Ecological Subregions of California, Section and Subsection Descriptions. USDA, Forest Service. Pacific Southwest Region. Prepared in cooperation with: USDA, Natural Resources, Conservation Service; USDI, Bureau of Land Management. R5-EM-TP-005. http://www.fs.fed.us/r5/projects/ecoregions/

Moriarty, K.M. 2009. American Marten Distributions over a 28 Year Period: Relationships with Landscape Change in Sagehen Creek Experimental Forest, California, USA. Thesis for Master of Science, Oregon State University; Presented August 19, 2009, Commencement June 2010. 108pp.

Moser, S., G. Franco, S. Pittiglio, W. Chou, D. Cayan. 2009. The future is now: An update on climate change science impacts and response options for California. California Climate Change Center Report CEC-500-2008-071, May 2009. California Energy Commission, Sacramento, CA.

Moyle, P.B. 2002. Inland Fishes of California, Revised and Expanded. University of California Press. London, England.

Neary, D.G., P.F. Ffolliott, and J.D. Landsberg. 2005. Fire and streamflow regimes. Chapter 5 in: Neary, D.G., K.C. Ryan, and L.F. DeBano, eds., Wildland fire in ecosystems: effects of fire on soil and water. RMRS-GTR-42-vol 4. USDA Forest Service Rocky Mountain Research Station, Fort Collins, CO. 250p.

Norman, Steven P. & Taylor, Alan H. 2005. Pine forest expansion along a forest-meadow ecotone in northeastern California, USA. Forest and Ecology Management 215 pgs. 51-68.

Norris, Vol. 1993. The use of buffer zones to protect water quality: a review. Water Resources Management, 7:257-272.

North M., Stine P., O'Hara K., Zielinski W., and Stephens, S., 2009. An ecosystem Management Strategy fo Mixed Conifer Forests. USDA Forest Service. General Technical Report, Pacific Southwest Research Station, PSW-GTR-220, March 2009.

Oliver, W.; 1995**.** Is Self-Thinning in Ponderosa Pine Ruled by Dendroctonus Bark Beetles? Pacific Southwest Research Center; USDA Forest Service; Forest Health Through Silviculture the proceedings of the 1995 National Silvicultural Workshop; (pages 213-218).

Oliver, W. and Powers, R; 1978. Growth Models for Ponderosa Pine: I. Yield of unthinned plantations in northern California. Pacific Southwest Forest and Range Experiment Station; USDA Forest Service; Res. Paper PSW-133.

Pfankuch, Dale J. 1975. Stream reach inventory and channel stability evaluation. U.S. Department of Agriculture, Forest Service, R1-75-002. Government Printing Office #696-260/200, Washington, D.C.; 26 pg.

Piper, G.L. 2000. St. Johnswort. Chapter in: Biology and Management of Noxious Rangeland Weeds. Ed: R.L. Sheley & J.K. Petroff. Oregon State University Press.

Randall, J. 2000. *Cirsium vulgare* – Chapter in: Carla C. Bossard, John M. Randall, Marc C. Hoshovsky, Editors 360 pages, 133 color photos, 76 line illustrations, 79 maps. University of California Press, 2000

Ratliff, Raymond D. 1985. Meadows in the Sierra Nevada of California: state of knowledge. Gen. Tech. Rep. PSW-84, Pacific Southwest Region, Sierra National Forest, USDA Forest Service.

Reid, Leslie M. 2006 (March 21, last update). Channel erosion, mass wasting, and fuels treatments. Chapter 6 in: Elliot, W.J., and L.J. Audin, eds. Draft Cumulative Watershed Effects of Fuels Management in the Western United States. Available online: http://forest.moscowfsl.wsu.edu/engr/cwe/

Reid, Leslie, and Thomas Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research 20(11):1753-1761.

Reinhardt, E.D, Crookston, N.L., 2003, The Fire and Fuels Extension to the Forest Vegetation simulator. USDA Forest Service, RMRS-GTR-116

Robichaud, P.R., J.L. Beyers, and D.G. Neary. 2000. Evaluating the effectiveness of postfire rehabilitation treatments. RMRS-GTR-63. USDA Forest Service Rocky Mountain Research Station, Fort Collins, CO. 85p.

Robichaud, P.R., L.H. MacDonald, and R.B. Foltz. 2006 (March 21, last update). Fuel management and erosion. Chapter 5 in: Elliot, W.J., and L.J. Audin, eds. Draft Cumulative Watershed Effects of Fuels Management in the Western United States. Available online: http://forest.moscowfsl.wsu.edu/engr/cwe/

Rosgen, D. L. 1994. A Classification of Natural Rivers, Published Elsevier, Catena 22 (1994) pages 169 – 199.

Rosgen, D.L. 1996. Applied River Morphology. Copyright 1996 by Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO.

Rosgen, D.L. 2001. A Stream Channel Stability Assessment Methodology, Proceedings of the Seventh Federal Interagency Sedimentation Conference, Vol. 2, pp. II - 18-26, March 25-29, 2001, Reno, NV.

Russell, John, Ph.D.; 2006, "Values, Attitudes and Beliefs Toward National Forest System Lands, The Carson National Forest", pgs 19, 22 & 24.

Sartwell, Charles; Stevens, Robert E; 1975**.** Mountain Pine Beetle In Ponderosa Pine prospects for silvicultural control in second-growth stands. Journal of Forestry; (pages 136-140).

Schnackenberg, E.S., and L.H. MacDonald. 1998. Detecting cumulative effects on headwater streams in the Riutt National Forest, Colorado. Journal of the American Water Resources Assoc., 34(5):1163-1177.

Schumacher, Francis X.; 1926. Yield, Stand, and Volume Tables for White Fir in the California Pine Region. Bulletin 407, Agricultural Experiment Station, University of California, Berkeley, California.

Scott, J. and Burgan, R., 2005. Standard Fire Behavior Models: A Comprehensive Set for use with Rothermel's Surface Fire Spread Model. USDA Forest Service, General Technical Report, Rocky Mountain Research Station, RMRS-GTR-153, June 2005.

Scott, J.H., Reinhardt, E.D., 2001. Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior. USDA Forest Service RMRSRP-29

Scholl A.E. and Taylor A.H, 2010. Fire Regimes, Forest Change, and Self-Organization in an Old –Growth Mixed-Conifer Forest, Yosemite National Park, USA, Ecological Society of America, 2010

Shakesby, R.A., and S.H. Doerr. 2006. Wildfire as a hydrological and geomorphological agent. Earth-Science Reviews, 74(2006):269-307.

Skinner, C. N.; Stephens, S.L., 2004**.** Fire in the Sierra Nevada. Pacific Southwest Research Center, USDA Forest Service; General Technical Report; PSW-GTR-193.

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: http://www.prbo.org/calpif/htmldocs/sierra.html.

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Sierra Nevada Research Center. 2008. Plumas Lassen Study 2007 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 310pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2007.pdf

Sierra Nevada Research Center. 2009. Plumas Lassen Study 2008 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 223pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2008.pdf

Sierra Nevada Research Center. 2010. Plumas Lassen Study 2009 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 184pp. http://www.fs.fed.us/psw/programs/snrc/forest_health/plas_annual_report_2009.pdf

Smith, D.M.; 1962. The Practice of Silviculture. John Wiley & Sons, Inc., New York, New York**.** 7th Edition.

Society for Ecological Restoration International Science & Policy Working Group. 2004. The SER International Primer on Ecological Restoration. www.ser.org & Tucson: Society for Ecological Restoration International.

Southern Sierra Smoke Management Group and San Joaquin Valley Air Pollution staff. Unified Guidelines and Procedures for Smoke Management, March 2009.

Stephens, S.L.; Et.Al.; 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications; 19(2); (pages 305-320).

Swetnam, T.W., 1993. Fire History and Climate Change in Giant Sequoia Groves, Science 262:885-889.

Stewart, I.T., D. R. Cayan, and M. D. Dettinger. 2005. Changes toward earlier streamflow timing across western North America. Journal of Climate 18: 1136-1155.

Suihara, N.G.; J.W. van Wagtendonk; K.E. Shaffer; J. Fites-Kaufman; A.E. Thode, 2006. Fire in California's Ecosystems. ©2006 by the Regents of the University of California.

Swetnam, T.W., 1993. Fire History and Climate Change in Giant Sequoia Groves, Science 262:885-889.

Thompson, Jonathan. 2007. Mountain meadows – here today, gone tomorrow? Meadow science and restoration. Science Findings: Pacific Northwest Research Station. Issue ninety four. June 2007. 6p.

Troendle, C.A., L.H. MacDonald, and C.H. Luce. 2006 (May 22, last update). Fuels management and water yield. Chapter 7 in: Elliot, W.J., and L.J. Audin, eds. Draft Cumulative Watershed Effects of Fuels Management in the Western United States. Available online: http://forest.moscowfsl.wsu.edu/engr/cwe/

UC Berkeley, 2010. Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/).

USDA Forest Service. 1962. Range Management Plan – Central Camp Allotment. 2210 Range Management Planning File, Sierra National Forest, Pacific Southwest Region, Forest Service. January 23, 1962.

USDA Forest Service. Sierra National Forest, 1983, Soil Survey of the Sierra National Forest, California, p.60.

USDA Forest Service. 1984. Range Management Plan – Central Camp Allotment. 2210 Range Management Planning File, Sierra National Forest, Pacific Southwest Region, Forest Service. July 20, 1984.

USDA Forest Service. 1989. Range Management Plan – Soquel Allotment. 2210 Range Management Planning File, Sierra National Forest, Pacific Southwest Region, Forest Service. March 27, 1989.

USDA Forest Service. 1989. Sierra National Forest. 2509.22 Soil and Water conservation Practices Handbook, Sierra National Forest Supplement No.1

USDA Forest Service. 1991. Sierra National Forest Land and Resource Management Plan. Sierra National Forest, Clovis, CA; Pacific Southwest Region.

USDA Forest Service. 1995. Sierra National Forest Land and Resource Management Plan Amendment: An Environmental Assessment of Utilization Standards for Determining Proper Use of Available Forage for Commercial Livestock.

USDA, Forest Service, 2000. Water Quality Management for National Forest System Lands in California, Best Management Practices.

USDA Forest Service. 2001. Record of Decision for the Sierra Nevada Forest Plan Amendment Environmental Impact Statement. January 12, 2001. USDA Forest Service, Pacific Southwest Region. Vallejo, CA.

USDA Forest Service. 2004. Best Management Practices Evaluation Program, 1992-2002 Monitoring Results. Pacific Southwest Region, Vallejo, CA. 76p.

USDA Forest Service. 2004. Sierra Nevada Forest Plan Amendment Record of Decision and Final Supplemental Environmental Impact Statement. USDA Forest Service, Pacific Southwest Region. Vallejo, CA. 492pp + 72 pp (ROD).

USDA Forest Service. 2005. A landscape analysis for the Fresno River watershed.

USDA Forest Service. 2010. Region 5 Ecological Restoration Leadership Intent, Pacific Southwest Region, Vallejo.

USDA Forest Service. 2011. Approximate conifer encroachment on meadows in the Greys Mountain project area in the Sierra National Forest using aerial photographs and GIS analysis. Unpublished data by Natalie Rossington, Soil Science Intern, reviewed by Alan Gallegos, Forest Geologist and Soil Scientist. Sierra National Forest, Clovis, CA; Pacific Southwest Region.

USDA Forest Service. 2011. Forest Service Manual 2500, Region 5 Supplement – Watershed and Air Management, Chapter 2550 – Soil Management, Amendment No.: 2500-2010-1, In Progress. Clovis, California, Sierra National Forest Supervisors Office, U.S. Department of Agriculture, Forest Service

USDA Forest Service 2011a, Otto, Anaé. Biological Evaluation/Biological Assessment for Threatened, Endangered, and Sensitive Terrestrial Wildlife for the Greys Mountain Ecological Restoration Project.

USDA Forest Service 2011b. Otto, Anae. Greys Mountain Ecological Restoration Project Migratory Bird Document

USDA Forest Service 2011c. Smith, Gloria. Greys Mountain Ecological Restoration Project Fuels Report.

USDA Forest Service 2011d. Smith, Dave. Greys Mountain Ecological Restoration Project Silvicultural Report

USDA Forest Service 2011e. Stone, Keith Andy. Greys Mountain Ecological Restoration Project Hydrology Report

USDA Forest Service 2011f. Strand, Philip. Greys Mountain Ecological Restoration Project Aquatic Wildlife Biological Evaluation/Biological Assessment

USDA Forest Service, Manual. Title 5100: Fire Management, Section 5137 and 5137.02

USFWS. 2005. Guidance on Site Assessments and Field Surveys for California Red-legged frog. Portland, Oregon.

USFWS. 2006. Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the California **Spotted Owl** (*Strix occidentalis occidentalis*) as Threatened or Endangered. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17. Federal Register: May 24, 2006, Volume 71, Number 100, pages 29886-29908.

Van Mantgem, P. J.; Et. Al. 2009. Widespread Increase of Tree Mortality Rates in the Western United States. Science. Volume 323: (pages 521-524).

Van Wagner, C. E. 1993. Prediction of Crown Fire Behavior in Two Stands of Jack Pine. Canadian Journal Forest Research 23:442-449.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gutierrez, G.I. Gould, Jr., and T.W. Beck., tech. coord. 1992. The California Spotted Owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133, US Forest Service, Albany, CA. http://www.fs.fed.us/psw/rsl/projects/wild/gtr_133/gtr133_index.html

Wallbrink, P.J., and Croke, J. 2002. A combined rainfall simulator and tracer approach to assess the role of Best Management Practices in minimizing sediment redistribution and loss in forests after harvesting. Forest Ecology and Management 170:217-232.

Weatherspoon, C. P., 1996. Sierra Nevada Ecosystem Project; Chapter 44, Fire-Silviculture Relationships in Sierra Forests, pp. 1167-1175.

Wemple, Beverly C., Julia A. Jones, and Gordon E. Grant. 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Water Resources Bulletin, 32(6):1195-1207.

Wilson, B.L., J. Clines, and V.D. Hipkins. 1999. Counting *Collomia rawsoniana* (Polemoniaceae): Is a patch an individual? Draft manuscript on file at Bass Lake Ranger District, North Fork, CA.

Wondzell, Steven M. and John G. King. 2003. Post-fire erosional processes in the Pacific Northwest and Rocky Mountain regions. Forest Ecology and Management 178(2003):75-87.

www.epa.gov, Website for Environmental Protection Agency.

www.arb.ca, Website for California Air Resources Board.

www.valleyair.org, Website for the San Joaquin Valley Unified Air Pollution Control District.

Zwolinski, Malcom. 2000. The role of fire in management of watershed responses. In:USDA Forest Service Proceedings RMRS-P-13.

# Index

aquatic ..... 41, 269, 282
California spotted owl..... xi, 2, 10
coniferiii, xi, 37, 125, 276, 277, 282, 283
crowns ..... 270, 280
cultural resources ..... 268, 270
desired conditions ..... 10
disease ..... xi, 267, 278, 279, 281
ecosystem ..... xi, 1, 279, 280, 281, 282
endangered ..... 268, 284
fuels....iii, xi, xii, 1, 6, 10, 30, 60, 78, 89, 165, 277, 279, 280, 284, 294, 295
Management Indicator Species 140, 269, 280
MIS .. 123, 124, 125, 126, 127, 128, 269, 271, 280
Pacific fisher ..... xi, 2, 272
plants .... 70, 78, 276, 278, 279, 280, 281, 282, 284
prescribed burning ..... iii, 268, 277
riparian ..... 271, 282, 284, 287
sensitive..... 78, 272
soil .... 33, 34, 88, 89, 267, 269, 280, 283, 293
SPLATs..... xi, 278
stand density..... xii, 30, 165, 184, 267
thinning ..... xii, 30, 33, 47, 165
threatened ..... 268, 283
wildfires ..... xi, xii, 6
WUI..... xii, 1, 6, 10, 284

# Appendices

## Appendix A – Map Package for Greys Mountain Project

See Map Package

# Appendix B – Best Management Practices Associated with Greys Mountain Project _____

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 1-1 Timber Sale Planning Process: To incorporate water quality and hydrologic considerations into the timber sale planning process. | Implemented through the Riparian Conservation Objectives/Forest Plan Consistency report, specification of operational BMPs, Environmental Analysis including interdisciplinary team office and field discussions, and incorporation of water quality protection measures in the Timber Sale Contract for the GRERP EIS. |
| BMP 1-4 Use of Sale Area Maps (SAM) and/or Project Maps for Designating Water Quality Protection Needs: To ensure recognition and protection of areas related to water quality protection delineated on a SAM or project map. | The sale administrator and purchaser will review these areas on the ground prior to commencement of ground disturbing activities. Examples of water quality protection features that will be designated on the project map include:<br>1) Location of stream courses and riparian zones to be protected, including the width of the protection zone for each area.<br>2) Wetlands (meadows, lakes, springs, etc.) and other sensitive areas (such as shallow soils) to be protected.<br>3) Boundaries of harvest units, specified roads and roads where hauling activities are prohibited or restricted, areas of different skidding and/or yarding methods, including post-harvest fuels treatments, and water sources available for purchaser's use. |
| BMP 1-5 Limiting the Operating Period of Timber Sale Activities: To ensure that the purchasers conduct their operations, including erosion control work, road maintenance, and so forth, in a timely manner, within the time frame specified in the Timber Sale Contract. | The purchaser's contract operation period will be limited to contract-specified periods when adverse environmental effects are not likely. The Sale Administrator will close down operations due to rainy periods, high water, or other adverse operating conditions in order to protect resources. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 1-8 Streamside Management Zone Designation: To designate a zone along riparian areas, streams and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values. | Streamside management zones (SMZs ) have been supplemented with RMAs and RCAs (USDA 2004b) as described in the Design Measures section of the EIS.<br>Within SMZs, the constraints defined in Sierra Supplement No. 1 (USDA Forest Service, 1989) apply. This includes no self-propelled ground based equipment, a minimum groundcover of 50%, and shade canopy may not be modified in a way that affects stream temperature.<br>Modifications to these guidelines are possible where site-specific needs exist if the action is reviewed by a hydrologist or fisheries biologist. |
| BMP 1-9 Determining Tractor Loggable Ground: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems. | Limit ground skidding and machine piling with tractors to slopes less than 35%. Endlining can be used to remove logs from steeper slopes. Ground disturbance on areas of shallow soils, notably soils adjacent and abutting to rock outcrops, will be avoided. |
| BMP 1-10 Tractor Skidding Design: By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff water can be controlled in a manner that will minimize erosion and sedimentation. | The sale administrator and purchaser will designate all skid trails prior to ground disturbing activities. If uncertainty arises regarding potential resource impacts of skid trail location, consult with an earth science specialist (i.e., hydrologist, aquatic biologist, or soil scientist). |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 1-12 Log Landing Location: To locate new landings in such a way as to avoid watershed impacts and associated water quality degradation | The following criteria are to be used by the Sale Administrator when evaluating landings:<br>1. The cleared or excavated size of landings will not exceed that needed for safe and efficient skidding and loading operations. Trees considered dangerous will be removed around landings to meet the safety requirements of OSHA.<br>2. Selected landing locations will involve the least amount of excavation and fill possible. Landings must be located outside of SMZs.<br>3. Locate landings near ridges away from headwater swales in areas that will allow skidding without crossing stream channels, violating SMZs, or causing direct deposit of soil and debris to a stream.<br>4. Locate landings where the least number of skid roads will be required, and sidecast can be stabilized without entering drainages or affecting other sensitive areas. Keep the number of skid trails entering a landing to a minimum.<br>5. Position landings such that the skid road approach will be nearly level as feasible, to promote safety and to protect soil from erosion.<br>6. Avoid excessive fills associated with landings constructed on old landslide benches.<br>7. Construct stable landing fills or improve existing landings by using appropriate compaction and drainage specifications.<br>In some cases, using an existing landing located within an RCA or CAR is preferable to constructing a new landing outside of it. These situations will be reviewed on a site-by-site basis by an earth science specialist (aquatics, hydrology, geology, or soils). |
| BMP 1-13 Erosion Prevention and Control Measures during Timber Sale Operations: To ensure that the purchasers' operations will be conducted reasonably to minimize soil erosion. | Timber purchaser responsibilities for erosion control will be set forth in the Timber Sale Contract. Equipment will not be operated when ground conditions are such that excessive damage will result. The kinds and intensity of control work required of the purchaser will be adjusted by the sale administrator to ground and weather conditions with emphasis on controlling overland runoff, erosion, and sedimentation.<br>Erosion control work required by the contract will be kept current. At certain times of the year this means daily, if precipitation is likely or weekly when precipitation is predicted for the weekend. Erosion prevention measures must be applied no later than October 1 and immediately upon completion of activity begun after November 1.<br>If the purchaser fails to perform seasonal erosion control work prior to any seasonal period of precipitation or runoff, the Forest Service may temporarily assume responsibility, complete the work, and use any unencumbered deposits as payment for the work. |

<table>
<tr><th>BMP Name, Objective, and Direction</th><th>Application to the Greys Mountain Project</th></tr>
<tr><td>BMP 1-16 Log Landing Erosion Protection and Control: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.</td><td>Landings will be properly cross-ditched, ripped (if soils are compacted), re-contoured (as necessary), and mulched after use and before the winter precipitation period, whichever comes first. Excess material not needed for erosion control can be piled and burned. Upon completion of the project, consult with the hydrologist or soil scientist to determine the need for additional soil protection measures.</td></tr>
<tr><td>BMP 1-17 Erosion Control of Skid Trails: To protect water quality by minimizing erosion and sedimentation derived from skid trails.</td><td>Erosion control measures will be installed on all skid trails, tractor roads, and temporary roads. Erosion control measures include, but are not limited to, cross ditches (water bars), organic mulch, and ripping.<br><br>Cross ditches will be spaced according to the guidelines below, maintained in a functioning condition, and placed in locations where drainage would naturally occur (i.e., swales). The level of maintenance will be contingent upon existing or predicted weather patterns as determined by the Sale Administer (see BMP 1-13).<br><br>Minimum Cross Drain Spacing
<table>
<tr><td>% Slope</td><td>Maximum Spacing</td></tr>
<tr><td>0 - 15</td><td>125 feet</td></tr>
<tr><td>15 - 35</td><td>45 feet</td></tr>
</table></td></tr>
<tr><td>BMP 1-18 Meadow Protection during Timber Harvesting: To avoid damage to the ground cover, soil, and hydrologic function of meadows.</td><td>Mechanical equipment is not permitted in meadows. Additionally, the SNF has implemented a 100’ protection buffer around meadows that are equipment exclusion zones. Access is not permitted in meadows or the 100’ buffer unless specifically authorized by an aquatic biologist and/or hydrologist.</td></tr>
</table>

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 1-19 Streamcourse and Aquatic Protection: The objectives of this BMP are:<br>▪ To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values.<br>▪ To provide unobstructed passage of stormflows.<br>▪ To control sediment and other pollutants entering streamcourses.<br>▪ To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities. | a) The location and method of crossings on Class IV and V streams must be agreed to by the sale administrator (SA) prior to construction.<br>b) Stream crossings on Class I – III streams must be approved by the hydrologist and/or aquatic biologist.<br>c) Damage to stream banks and channels will be repaired to the extent practicable.<br>d) All sale-generated debris will be removed from streamcourses, unless otherwise agreed to by the SA, and in an agreed upon manner that will cause the least disturbance.<br>e) Felled trees will not be pulled across perennial or intermittent stream channels without prior approval by the hydrologist and/or aquatic biologist.<br>f) Methods for protecting water quality while utilizing tractor skid trail design in stream course areas where harvest is approved include: (1) end lining, (2) falling to the lead, and (3) utilizing specialized equipment with low ground pressure such as feller buncher harvester.<br>g) Water bars or other erosion control structures will be located so as to disperse concentrated flows and filter out suspended sediments prior to entry into streamcourse.<br>h) Material from temporary road construction and skid trail streamcourse crossings will be removed and streambanks restored to the extent practicable.<br>i) Special slash treatment site preparation activities will be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment.<br>j) Project-related bare soil areas (e.g. skid trails, landings, temporary roads, etc.) will be covered with existing native vegetation mulch, organic debris, or certified weed free straw to at least 50%, well distributed cover, and cross-ditched per BMP 1-17 requirements. |
| BMP 1-20 Erosion Control Structure Maintenance: To ensure that constructed erosion control structures are stabilized and working | During the period of the timber sale contract, the purchaser will provide maintenance of soil erosion control structures contracted by the purchaser until they become stabilized, but not more than one year after their construction. If the purchaser fails to do seasonal maintenance work, the Forest Service may assume the responsibility and charge the purchaser accordingly. The Forest Service sale administrator is responsible for ensuring erosion control maintenance work is completed. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 1-21 Acceptance of Timber Sale Erosion Control Measures before Sale Closure: To ensure the adequacy of required erosion control work on timber sales. | The sale administrator must inspect erosion control measures to ensure their adequacy prior to accepting closure on the unit and/or sale.<br><br>The effectiveness of erosion control measures will be evaluated using BMPEP protocols (see Monitoring Plan) after the sale area has been through one or more wet seasons. This evaluation is to ensure that erosion control treatments are in good repair and functioning as designed before releasing the purchaser from contract responsibility.<br><br>The purchaser is responsible for repairing erosion control treatments that fail to meet criteria in the Timber Sale Contract, as determined by the Sale Administer, for up to one year past closure of the sale. |
| BMP 1-22 Slash Treatment in Sensitive Areas: To maintain or improve water quality by protecting sensitive areas from degradation which would likely result from using mechanized equipment for slash disposal. | All burn piles made with mechanical equipment must be located outside of the SMZ.<br><br>Hand piles will be kept at least 20 feet away from all streams, meadows, springs, seeps, and other sensitive aquatic areas. |
| BMP 2-1 General guidelines for the Location and Design of Roads: To locate and design roads with minimal resource damage. | The following considerations are incorporated into the planning process of road location and design. These measures are preventative, apply to all transportation activities, and indirectly protect water quality:<br>a) Transportation facilities will be developed and operated to best meet the resource management objectives with the least adverse effect on environmental values.<br>b) The location, design, and construction of roads will include the use of the IDT.<br>c) Sensitive areas such as wetlands, inner gorges, and unstable ground will be avoided to the extent practicable.<br>d) Stream crossings will be designed to provide the most cost efficient drainage facility consistent with resource protection, facility needs, and legal obligations. |
| BMP 2-2 Erosion Control Plan: To mitigate and control erosion through effective planning prior to initiation of construction. | Any new construction would be subject to erosion control measures as per an IDT approved plan that may include but not be limited to waterbar installation, sediment fencing, culvert installation and armoring, placement of straw waddles, approved straw cover and/or slash and any other method necessary to mitigate erosion and sediment routing in the project subdrainage(s). |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 2-3 Timing of Construction Activities: To minimize erosion by conducting operations during minimal runoff periods and when soils are dry and less prone to compaction. | Ground-disturbing activities will occur when soils are dry. In some cases soils may never dry sufficiently. Ground-disturbing work that occurs off of existing roads will occur during the dry season and will reduce ground disturbance as much as possible. |
| BMP 2-5 Road Slope Stabilization Construction Practices: To reduce sedimentation by minimizing erosion from road slopes and slope failure along roads. | An adequate soils and geologic investigation will be conducted when finalizing new road construction designs for: correct cut and fill steepness based on the angle of repose for the type of material; methods to handle surface runoff; and necessary compaction standards and surfacing needs. |
| BMP 2-7 Control of Road Drainage: To minimize the erosive effects of water concentrated on roads, to disperse runoff from road surfaces, to lessen sediment yield from roaded areas, and to minimize erosion of the road prism. | Newly constructed or reconstructed roads will be designed to reduce hydrologic connectivity and soil erosion wherever feasible. The sale administrator or other Forest Service representative will ensure that roads are adequately maintained during project implementation to ensure that road drainage features function as designed. |
| BMP 2-9 Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects: To minimize erosion and sedimentation from disturbed ground on incomplete projects. | Erosion control must be completed before the rainy season (usually October). Preventative measures for timely erosion control include:<br>Removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossings.<br>Installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion.<br>Removal of debris, obstructions, and spoil material from channels and floodplains.<br>Planting vegetation, mulching, and/or covering exposed surfaces with jute mates or other protective material. |
| BMP 2-10 Construction of Stable Embankments: To construct embankments with materials and methods which minimize the possibility of failure and subsequent water quality degradation. | Roadways will be designed and constructed as stable and durable earthwork structures with adequate strength to support the treadway, shoulders, subgrade and road traffic loads. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 2-11 Control of Sidecast Material During Construction and Maintenance: To minimize sediment production originating from sidecast material during road construction or maintenance. | Sidecasting is not permitted within SMZs.<br>Waste areas must be located where excess material can be deposited and stabilized. |
| BMP 2-12 Servicing and refueling equipment: To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels. | Storage of hazardous materials (including fuels) and servicing and refueling of equipment will be conducted at pre-designated locations outside of RCAs and CARs. If fueling and/or storage of hazardous materials are needed within RCAs or CARs, those sites must be reviewed and approved by the District Hydrologist or Aquatic Biologist. Additional protection measures, such as containment devices, may be necessary. |
| BMP 2-13 Control of Construction and Maintenance Activities Adjacent to SMZs: To protect water quality by controlling construction and maintenance actions within and adjacent to SMZs so that SMZ functions are not impaired. | Construction and maintenance fills, sidecast, and end-hauled materials will be kept out of SMZs except at designated crossing sites to minimize the effect to the aquatic environment. |
| BMP 2-14 Controlling In-Channel Excavation: To minimize stream channel disturbances and related sediment production. | There will be no in-channel or streambank excavation during any phase of project activities unless authorized by the district hydrologist or aquatic biologist. |
| BMP 2-16 Stream Crossings on Temporary Roads and Skid Trails: | Mechanical equipment crossing of perennial and intermittent (generally class I – III) streams is not permitted unless approved by the district hydrologist or aquatic biologist. Ephemeral streams (stream class IV and V) may be crossed at designated locations as agreed upon by the sale administrator and purchaser. Designate skid trails to avoid stream crossings and SMZs wherever possible. Designated crossings must be as perpendicular to the channel as possible and avoid sensitive soils and riparian vegetation damage. Stream banks must be repaired upon completion of the project. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 2-19 Disposal of Right-of-Way and Roadside Debris: To ensure that organic debris generated during road construction is kept out of streams so that channels and downstream facilities are not obstructed. | If slash generated by road work is disposed of within SMZs, it will be piled and burned or chipped. Material may also be removed from the SMZ for disposal. |
| BMP 2-21 Water Source Development Consistent with Water Quality Protection: To supply water for roads and fire protection while maintaining existing water quality. | Water drafting will not occur in streams when the base discharge is less than 1.5 cfs, and will not draft more than 50% of the ambient discharge over 1.5 cfs. New drafting sites would be approved by the District Hydrologist or Fisheries/Aquatic Biologist and located to minimize sediment and maintain riparian resources, channel condition, meadow integrity, and aquatic species viability and habitat. Approaches will be as near perpendicular to the stream as possible and will be gravel surfaced or otherwise stabilized.<br>If water-drafting is required, pumps with low entry velocity and suction strainers with screens less than 2 mm in size (1/8 in.) will be used. |
| BMP 2-22 Maintenance of Roads: To maintain roads in a manner that provides for water quality protection by minimizing rutting, failures, sidecasting, and blockage of drainage facilities, all of which can cause erosion, sedimentation, and deteriorating watershed conditions. | Roads needed for project activities will be brought to current engineering standards of alignment, drainage, and grade before use, and will be maintained through the life of the project. Roads will be inspected at least annually to determine what work, if any, is needed to keep ditches, culverts, and other drainage facilities functional and the road stable. |
| BMP 2-23 Road Surface Treatment to Prevent Loss of Materials: | Surface stabilization will be considered where grades exceed 12% or road is within riparian conservation areas. |
| BMP 2-24 Traffic Control During Wet Periods: To reduce road surface disturbance and the rutting of roads, and to minimize sediment washing from disturbed road surfaces. | On roads not designated for all weather or winter haul, heavy equipment operations will be limited until the period after the soil has dried in the top 12 inches in the spring. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 2-26 Obliteration or Decommissioning of Roads: To reduce sediment generated from temporary roads, unneeded system and non-system roads by obliterating or decommissioning them at the completion of the intended use. | Temporary roads will be obliterated after serving their intended purpose for this project. This includes: (1) road effectively barricaded; (2) road effectively drained by measures such as re-contouring or outsloping to return surface to near natural hydrologic function; (3) a well distributed mulch or organic cover provides at least 50% cover, or road surface is re-vegetated using local native species; (4) sideslopes are reshaped and stabilized to match the natural contour (as necessary); and (5) stream crossings are removed and natural channel geometry is restored.<br><br>If non-local mulch is used (such as straw), it must be approved by the Forest Service botanist as weed free. |
| BMP 6-1 Fire and Fuel Management Activities: To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity and extent of wildfire. | The project action alternatives are designed to achieve the desired conditions of BMP 6-1. |
| BMP 6-2 Consideration of Water Quality in Formulating Fire Prescriptions: To provide for water quality protection while achieving the management objectives through the use of prescribed fire. | Prescribed burning is planned at the minimum intensity and severity necessary to achieve management objectives, and each Burn Plan will incorporate all relevant design measures from this EIS. |
| BMP 6-3 Protection of Water Quality from Prescribed fire Effects: To maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies. | Fires will be allowed to back into riparian vegetation, but direct lighting within riparian vegetation will not occur.<br><br>All fire lines within RCAs and CARs will be water barred per BMP 1-17 spacing requirements. Fire lines within RCA (i.e., 150 ft., seasonal streams, and 300 ft. perennial streams, springs, and meadows) will be designed and constructed to reduce sediment entry into channels. Fire lines in RCAs will cross perpendicular to streams and follow the natural landscape contour as much as possible. Fire lines within the SMZ will be hand cut. Waterbars will be placed on either side of each stream crossing to prevent or reduce sediment entry into streams. |

| BMP Name, Objective, and Direction | Application to the Greys Mountain Project |
|---|---|
| BMP 6-5 Repair or Stabilization of Fire Suppression Related Watershed Damage: To stabilize all areas that have had their erosion potential significantly increased, or their drainage pattern altered by suppression related activities. | In the event of a wildfire, protection of resources would be evaluated under the Burned Area Emergency Response, assessment and treatment Implementation protocol. |
| BMP 6-6 Emergency Rehabilitation of Watersheds Following Wildfires: To minimize as far as practicable: 1.) loss of soil and onsite productivity; 2.) overland flow, channel obstruction and instability; 3.) threats to life and property both on-site and off-site | In the event of a wildfire, protection of resources would be evaluated under the Burned Area Emergency Response, assessment and treatment Implementation protocol. |
| BMP 7-3 Protection of Wetlands: To avoid adverse water quality impacts associated with destruction, disturbance, or modification of wetlands. | Ground disturbing activities will not occur in wetlands or meadows. |
| BMP 7-4 Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Containment and Countermeasure (SPCC) Plan: To prevent contamination of water from accidental spills. | A spill contingency plan and spill prevention and countermeasure plan (SPCC) must be prepared if hazardous materials (including fuels and oils) stored on the Sierra National Forest exceed 1320 gallons, or if a single container exceeds 660 gallons.<br><br>The plan will at a minimum include: the types and amounts of hazardous materials located in the project area, pre-project identified locations for hazardous materials storage and fueling/maintenance activities (must be located outside of RCA and CAR unless prior approval by District Hydrologist or Aquatic Biologist is obtained), methods for containment of hazardous materials and contents of on-site emergency spill kit, and a contingency plan (including contact names with phone numbers) to implement in the event of a spill.<br><br>The SPCC plan must be approved by the Forest Service prior to project implementation. |

## Stream Crossing Design Measures

Traditionally, live stream crossings for skid trails or temporary roads, were constructed by excavating the crossing, placing a culvert in the stream, and filling around the pipe with fill dirt. When the project was complete, the culvert and fill dirt were removed, usually with the bulldozer. This practice caused excessive sediment input into the stream, along with much disturbance of the stream banks. Rehabilitation work consisted of placing waterbars on each bank of the stream along with grass-seed and straw. The grass-seed/straw combo was placed from stream bank to the first waterbar ditch, on each bank, depending on slope gradient.

Cut-to-Length (CTL) machines changed the way operations were conducted in the woods. The harvester/tree processor establishes their route of travel (forwarding trails) through the unit. The harvester cuts trees down, delimbs and produces logs along these trails, all the while leaving the resulting limbs and tree tops (slash) in the trails as a "slash mat" for ground cover. The forwarder follows the harvester, driving over the "slash mat" to pick up the logs and returns to the landing. This procedure works well when abundant material is available in the stands;

The placement and removal of the log fill is accomplished with the harvester, which can grasp the processed logs with its cutting-head, feed wheels and limb knives. This allows the logs to be lifted into and out of position, much like a crane or boom. This not only reduces or eliminates the amount of soil disturbance and stream sediment loading, but the amount of the distubed area is greatly reduced.

For perennial streams, a minimum of an 18" culvert should be used with the slash and small logs (4-8" dbh) to build the crossing. Culvert sizing should be such that a 25 year flood event could pass with no static head development upstream of the culvert. It would be best to consult the district hydrologist and roads engineer for proper watershed analysis and culvert sizing prior to construction.

Inspection of the channel before and after the construction of the crossing will need to be done by the district hydrologist to determine if any restoration is required. Any stream disturbnace will have to be restoraed to pre-disturbace conditions. No fill material (i.e., soil) should be used in the crossing.

During

After

After

Before

## Restoration Methodology: Vertical Instabilities

Vertical instabilities such as headcuts can be arrested in place and inhibited from further headward propagation into a meadow or watershed, which will mitigate further erosion, but do little to restore the water table to its previous elevation. A restoration method known as "plug-and-pond" (which plugs the channel downstream of the headcut and eventually backwaters the headcut) has been employed with great success in some meadows. Plug-and-Pond is effective at preventing erosion and restoring the ground water table in highly incised and degraded meadows; however, this method is only effective in low-gradient meadows (<2%). Most of the meadows in the project area have gradients over 4%, and thus are not suitable candidates for plug-and-pond. As such, design structures such as rock step pools or log-and-fabric step-falls would be the most effective means by which to mitigate further erosion of a headcut.

### *Rock Step-Pool*

Rock step-pools mimic natural channels that have gradients greater than 10% (e.g., Rosgen "A" channels), and are designed to dissipate energy by preventing water from obtaining excess velocity. This design is employed if the height of the drop (i.e., headcut) is greater than the bankfull channel depth (Figure 22).

Materials will include appropriately sized rock (i.e., D84 or greater based on reference reach characteristics of nearby A or B channels), jute fabric, and local native vegetation (sod, native willow, etc.). Traditional use of impervious geotextile material in headcut repair is not recommended because it prevents re-vegetation and stabilization of the rock and also has a tendency to channel overland and base flow behind the facing rock, further eroding the head and sidewalls of the headcut. WIN site condition data collected in the summer of 2009 showed most restoration structures utilizing this type of geotextile material had failed; the WIN sites that had successfully withstood large flood events used large rock, no geotextile fabric, and had completely re-vegetated. In lieu of non-porous geotextile material, coarse jute fabric is recommended where the substrate is non cohesive and easily erodible. This type of jute will hold moisture; allow plants to take root and provide mulch, prevent most fines for washing away, and will eventually biodegrade. In highly cohesive clay-rich soils, no fabric is recommended; proper sizing and placement of rock and re-vegetation will be effective at preventing further erosion.

Rock step pools will require quarry rock to be transported and cached near the restoration site (unless there is sufficient loose rock *in situ*) and hauled to the site via power wheel barrow. This has the potential to cause temporary surface disturbance. Slash (from the vegetation treatments), ply wood, and/or weed cloth will be placed along ingress-egress routes to mitigate these impacts.

**Figure 22. Step-pools built into two narrow headcuts at the toe of Summit Meadow, Sierra National Forest.**

.

### *Log-and-Fabric Step-Falls*

If accessibility to a restoration site has the potential for significant ground disturbance (i.e., requires closed roads to be re-opened, or results in excessive length of rock haul routes through meadows, etc.), then materials *in situ* can be used. Since part of each restoration design will include the removal of encroaching conifers like lodgepole pine, small logs (4” - 10” dbh) will be readily available. These can be used to build a log-and-fabric step falls for headcut restoration. These structures have been found to be effective in wet meadow environments where the wood is submerged and abundant vegetation has become established to hold the lip of the headwall (Figure 23). Materials will include logs cut to four to eight foot lengths (4” to 10” dbh), jute fabric, stakes, 2” fencing staples, smooth fencing wire, and native sod clumps.

**Figure 23. . Log-and Fabric Step-Falls used for headcut mitigation, Johnson Meadow, Sierra National Forest.**

### *Rock Arch Dam, Filter Dam, and Weir Grade-Control Structures*

For knick points or grade control along a channel reach, a rock arch structure can provide a step-falls scour pool function, and when installed in series, can be used to check velocity and dissipate energy along straightened stream reaches. A filter dam is used to raise the bed of a gully by trapping suspended load, and some wash load in the interstices of the larger rock. Like rock arc and filter dams, weirs provide grade control and can be constructed of a variety of materials.

### *Sod Plugs*

Water typically moves through meadows as sheet flow, swale flow, or channelized flow in stable E channels. Changes in peak flow from increased hydrologic connectivity in the watershed can concentrate flow in meadows, causing the incision of swales, existing natural channels, and cow trails. Returning (incised) channelized flow back into overland flow will promote localized ground water mounding and the overall elevation of the water table in the meadow. This can be achieved by filling in small (<2'x2') incised channels with native fill, sod, weed-free rice straw, sod, native logs and slash, or a combination of all these. If these channels no longer act as conduits through the meadow, then during peak flow events, water will move over the surface of the meadow as opposed to being channeled through the meadow, greatly increasing the residence time of the water within the meadow system.

## Restoration Methodology: Lateral Instabilities

### *Vanes, Cross-Vanes and J-Hooks*

In order to stabilize denuded unstable channel banks, it is often necessary to reduce the near bank shear stress to allow for vegetative recovery, in addition to other bank stabilization efforts. This is especially true for the outside of meander bends where shear

stress is highest. There are many in-stream structures that provide bank protection, and the designs specified here use both rock and *in situ* wood material. Many of these restoration structures are also used in the induced meandering method of channel restoration (described below). Vanes act as deflectors and can divert high velocity flow away from a cutbank or the outside of a meander bend. The vane functions by moving the zone of maximum velocity outward from the bank, protecting the adjacent bank and creating a point bar, but producing erosion on the opposite bank. Vanes can be constructed from a variety of materials, with post-vane design being the most adaptable to applications in a forest or near a meadow. Cross-Vanes decrease near bank shear stress and concentrate flow into the thalweg. Cross-Vanes are multifunctional in that they provide grade control, reduce bank erosion, create a stable width-to-depth ratio, maintain sediment transport capacity, and sediment competence. Like Cross-Vanes, J-Hooks serve the same purpose, but are typically employed for only one channel bank, usually on the outside of a meander bend.

### *Induced Meandering (Baffles, Vanes, and Weirs)*

Deeply Incised and straightened channels may be too degraded to cost-effectively employ grade control or bank stabilization. Many of these channels are in the early stages of evolution from a G-type to an F-type channel, where the belt width becomes sufficient to allow meanders, point bars and flood plains to begin formation for the given gradient. It is often useful to give the this natural channel evolution a gentle “push” in the right direction by inducing meanders to develop. The restoration design involves placing a series of in-stream structures (weirs, vanes and baffles) to control and divert flow to increase or decrease lateral erosion at critical points in the channel. The objective is to widen the channel (belt width) to facilitate the development of meanders and eventually alter that meander geometry appropriate for the reach. This will also help develop flood plains and point bars, each of which is essential for the proper functioning of the channel. This method is not suited for high bed load streams and/or streams that do not have the competence to efficiently move the sediment derived from the channel banks.

# Appendix C---Soils and Geology

Greys Mountain Project Meadows

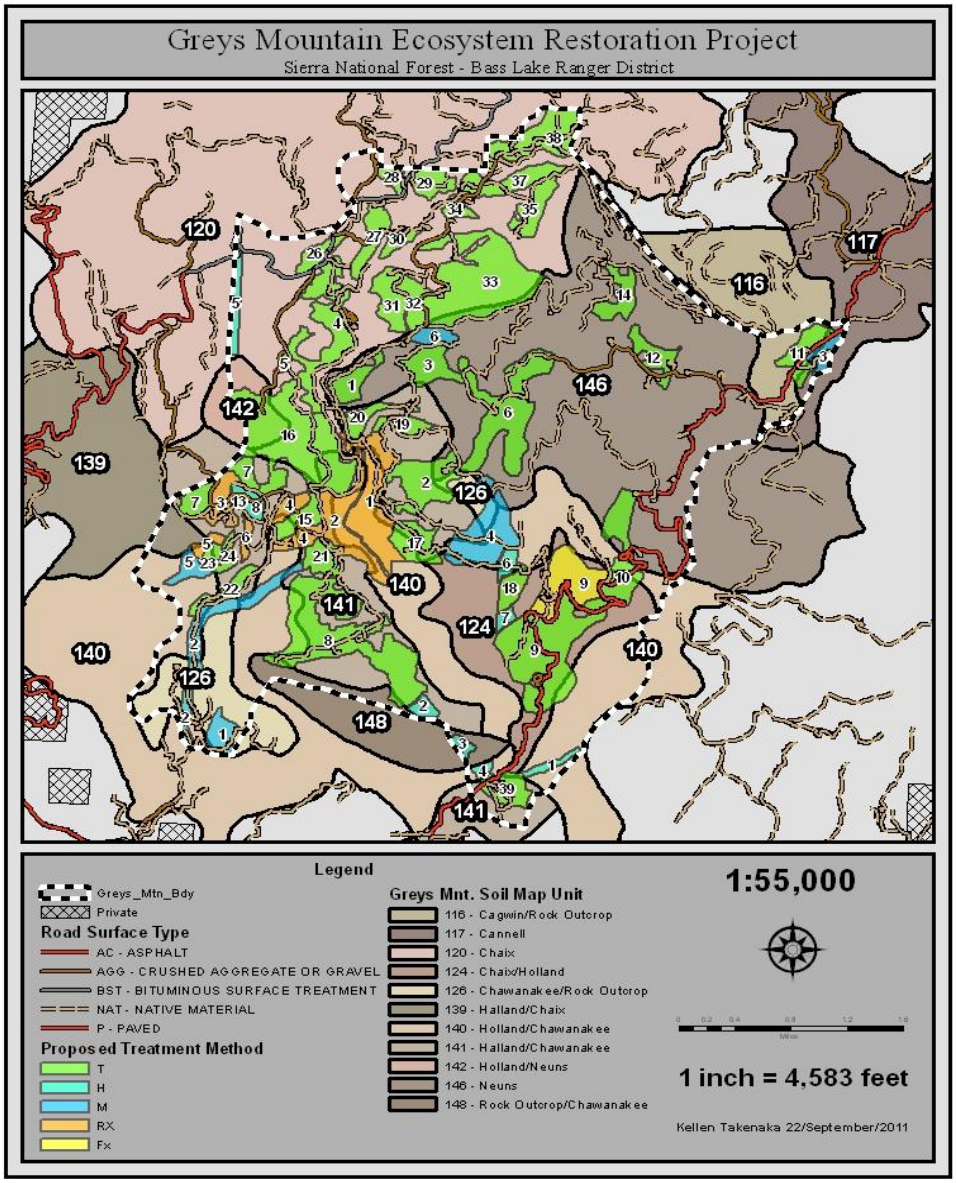



**Figure 24. Greys Mountain Project selected meadows for conifer encroachment**

# Greys Mountain Project Soil Transects

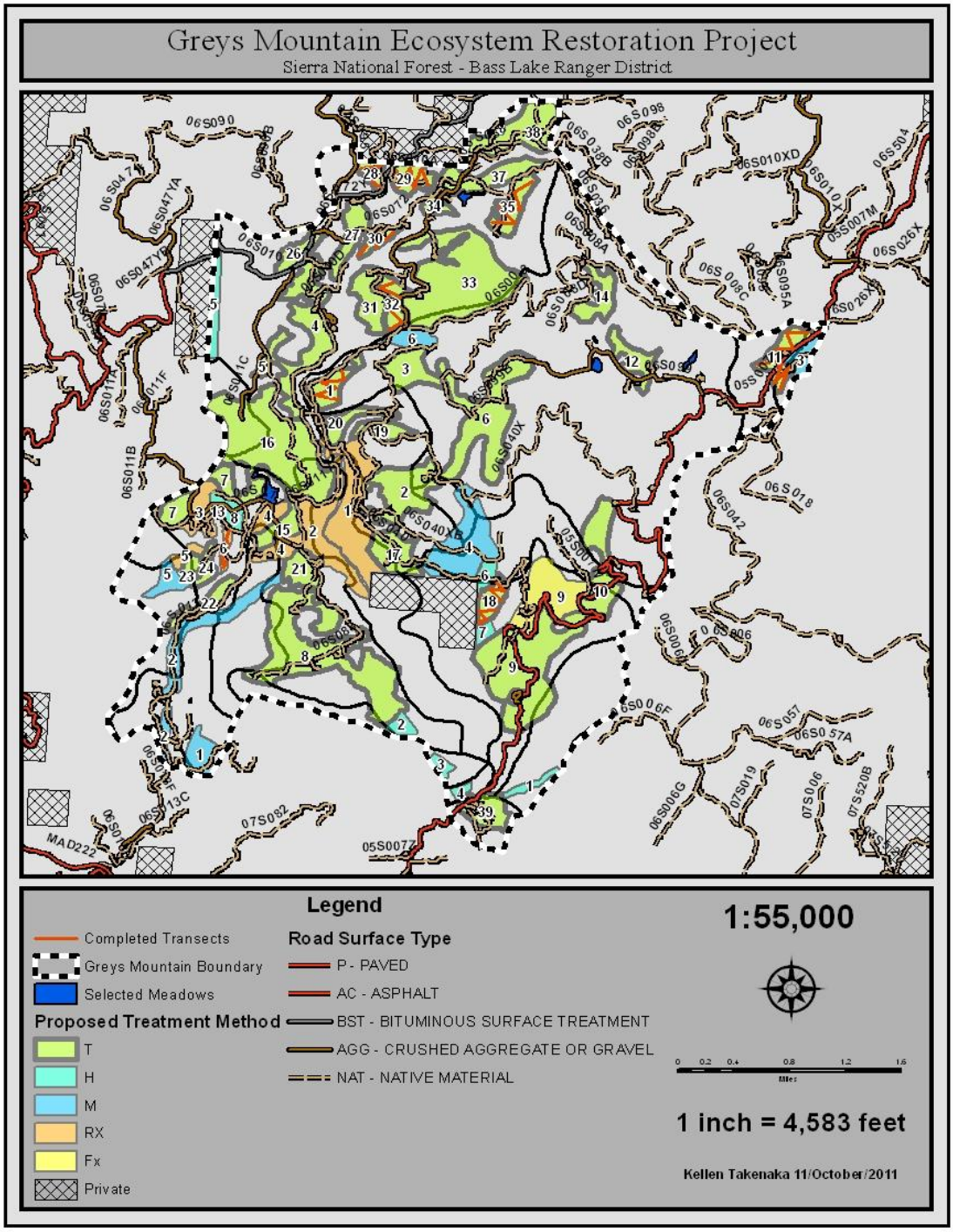



**Figure 25. Greys Mountain Project soil transects**

## Meadow Encroachment Classification

| | |
|---|---|
| Level 0 | Unable to determine. Approximate extent of encroachment unable to be determined using aerial photography due to poor image quality, lack of reliable reference points, or missing photo(s). |
| Level 1 | Increasing area. An increase in meadow or meadow ecotone area has occurred. |
| Level 2 | 0%. No encroachment as indicated by no visible evidence of new growth in the meadow or meadow ecotone area. In addition, there is no discernible decrease in tree height from an established tree line outside the meadow to shorter new growth within the meadow or meadow ecotone. |
| Level 3 | Minimal encroachment (1-5%). Tree encroachment only occupies 1-5% of the non-encroached 1940/1944 meadow or meadow ecotone area. New growth is denoted by trees visible in the meadow or meadow ecotone that formerly did not exist. This encroachment may be accompanied by a discernible change in tree height from a taller, established tree line outside the meadow transitioning to shorter new growth in the meadow or meadow ecotone. |
| Level 4 | Moderate encroachment (6-15%). The visually estimated area of tree encroachment is 6-15% of the non-encroached 1940/1944 meadow or meadow ecotone area. New growth is denoted by trees visible in locations once barren of conifer vegetation. This encroachment may be accompanied by a discernible change in tree height from a taller, established tree line outside the meadow transitioning to shorter new growth in the meadow or meadow ecotone. |
| Level 5 | Extensive encroachment (16-35%). The visually estimated area of tree encroachment is 16-35% of the non-encroached 1940/1944 meadow or meadow ecotone area. This encroachment may be accompanied by a discernible change in tree height from a taller, established tree line outside the meadow transitioning to shorter new growth in the meadow or meadow ecotone. |
| Level 6 | Severe encroachment (36-60%). The visually estimated area of tree encroachment is 36-60% of the non-encroached 1940/1944 meadow or meadow ecotone area. This encroachment may be accompanied by a discernible change in tree height from a taller, established tree line outside the meadow transitioning to shorter new growth in the meadow or meadow ecotone. |
| Level 7 | Extreme encroachment (61-100%). The visually estimated area of tree encroachment is 61-100% of the non-encroached 1940/1944 meadow or meadow ecotone area. This encroachment may be accompanied by a discernible change in tree height from a taller, established tree line outside the meadow transitioning to shorter new growth in |

## Soil Transect & Meadow Summaries

**Table 58. Soil disturbance class by percent present for each soil transect completed**

| Soil Transect | Soil Disturbance Class | | | |
|---|---|---|---|---|
| | Class 0 | Class 1 | Class 2 | Class 3 |
| GM T1 | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T11A | 97.00% | 3.00% | 0.00% | 0.00% |
| GM T11B | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T12 | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T18 | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T28 | 97.00% | 3.00% | 0.00% | 0.00% |
| GM T29 | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T30 | 93.00% | 3.00% | 3.00% | 0.00% |
| GM T32 | 100.00% | 0.00% | 0.00% | 0.00% |
| GM T35 | 97.00% | 3.00% | 0.00% | 0.00% |
| GM Rx6 | 100.00% | 0.00% | 0.00% | 0.00% |

**Table 59. Forest floor summary**

| Forest Floor Summary | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GM T1 | | GM T11A | | GM T11B | | GM T12 | | GM T18 | | GM T28 | |
| Mean: | 4.4 | Mean: | 3.97 | Mean: | 4.13 | Mean: | 5.07 | Mean: | 7.3 | Mean: | 4.8 |
| Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 3.70 | 5.10 | 3.11 | 4.82 | 3.19 | 5.08 | 4.17 | 5.97 | 6.37 | 8.23 | 3.95 | 5.65 |
| GM T29 | | GM T30 | | GM T32 | | GM T35 | | GM Rx6 | | Mean: | 4.80 |
| Mean: | 3.7 | Mean: | 3.97 | Mean: | 5.23 | Mean: | 5.8 | Mean: | 4.47 | | |
| Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | | |
| 3.22 | 4.18 | 3.42 | 4.52 | 4.45 | 6.02 | 4.80 | 6.80 | 3.71 | 5.22 | | |

**Table 60. Forest slope summary**

| Forest Slope Summary | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GM T1 | | GM T11A | | GM T11B | | GM T12 | | GM T18 | | GM T28 | |
| Mean: | 17.1 | Mean: | 26.57 | Mean: | 12.2 | Mean: | | Mean: | 22.97 | Mean: | 16.27 |
| Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 15.19 | 19.01 | 23.80 | 29.34 | 10.83 | 13.57 | | | 21.08 | 24.85 | 14.08 | 18.46 |
| GM T29 | | GM T30 | | GM T32 | | GM T35 | | GM Rx6 | | Mean: | 16.65 |
| Mean: | 12.43 | Mean: | 7.83 | Mean: | 14.97 | Mean: | 18.9 | Mean: | 17.3 | | |

| Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | |
|---|---|---|---|---|---|---|---|---|---|---|
| 10.94 | 13.92 | 6.49 | 9.17 | 11.72 | 18.21 | 17.49 | 20.31 | 15.66 | 18.94 | |

**Table 61. Large woody debris (LWD) summary**

| Large Woody Debris (LWD) | | |
|---|---|---|
| Soil Transect | Points/Transect | Points/Acre |
| GM T1 | 9 | 22.5 |
| GM T11A | 16 | 40 |
| ~~GM T11B~~ | ~~N/A~~ | ~~N/A~~ |
| GM T12 | 13 | 32.5 |
| GM T18 | 28 | 70 |
| GM T28 | 11 | 27.5 |
| GM T29 | 9 | 22.5 |
| GM T30 | 8 | 20 |
| GM T32 | 9 | 22.5 |
| GM T35 | 17 | 42.5 |
| GM Rx6 | 13 | 32.5 |
| Average LWD Points/Acre | | 33.25 |

**Table 62. Summary of meadow encroachment for the selected meadows in the Greys Mountain Project area**

| Meadow Encroachment | | | | | |
|---|---|---|---|---|---|
| Meadow | Area in 1944 (Acres) | Area in 2008 (Acres) | Change in Area (Acres) | Percent Change in Area | Class |
| 504M132 | 1.55 | 1.10 | 0.45 | 28.96% | 5 |
| 504M293 | 6.32 | 4.3 | 2.02 | 31.95% | 5 |
| 504M211 | 4.98 | 3.64 | 1.34 | 26.87% | 5 |
| 504M212 | 1.16 | 0.46 | 0.70 | 60.19% | 6 |
| 503M7 | 11.84 | 8.09 | 3.75 | 31.69% | 5 |
| 504M233 | 2.57 | 2.89 | -0.32 | -12.57% | 1 |

## Soil Transect Visual Indicators Confidence Intervals

**Table 63. Soil transect data for T units 1, 11, 12, 18 and 28**

| Confidence Interval: 80 & ME: 10 | GM T1 | | GM T11A | | GM T11B | | GM T12 | | GM T18 | | GM T28 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Confidence Interval | | Confidence Interval | | Confidence Interval | | Confidence Interval | | Confidence Interval | | Confidence Interval | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| Forest floor Impacted? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Live Plant? | 13.43% | 33.23% | 0.83% | 12.51% | 7.94% | 25.39% | 10.64% | 29.36% | 0.83% | 12.51% | 5.38% | 21.29% |
| Invasive Plant? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Fine Woody? <7 cm | 59.27% | 80.73% | 22.30% | 44.37% | 41.66% | 65.01% | 38.30% | 61.70% | 38.30% | 61.70% | 45.07% | 68.27% |
| Coarse Woody? >7cm | 0.83% | 12.51% | 0.83% | 12.51% | 0.83% | 12.51% | 0.00% | 7.53% | 0.83% | 12.51% | 0.00% | 0.00% |
| Bare Soil? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rock? | 0.00% | 0.00% | 0.00% | 7.53% | 0.00% | 0.00% | 22.30% | 44.37% | 0.00% | 0.00% | 0.00% | 0.00% |
| Topsoil displacement? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Erosion?, comment! | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? <5cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? 5-10cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? >10cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning light | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning moderate | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning severe | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Compaction? 0-10 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Compaction? 10-30 cm | 0.00% | 0.00% | 0.00% | 7.53% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Compaction? >30cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure 0-10 cm | 0.00% | 0.00% | 0.00% | 7.53% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure 10-30 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure >30 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

**Table 64. Soil transect data for T units 29, 30, 32, 35, and 36**

| Confidence Interval: 80 & ME: 10 | GM T29 | | GM T30 | | GM T32 | | GM T35 | | GM Rx6 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Confidence Interval | | Confidence Interval | | Confidence Interval | | Confidence Interval | | Confidence Interval | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| Forest floor Impacted? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Live Plant? | 7.94% | 25.39% | 25.39% | 47.95% | 45.07% | 68.27% | 5.38% | 21.29% | 22.30% | 44.37% |
| Invasive Plant? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 7.53% |
| Fine Woody? <7 cm | 45.07% | 68.27% | 16.32% | 37.02% | 25.39% | 47.95% | 45.07% | 68.27% | 10.64% | 29.36% |
| Coarse Woody? >7cm | 0.00% | 7.53% | 0.00% | 7.53% | 0.00% | 0.00% | 0.83% | 12.51% | 0.00% | 0.00% |
| Bare Soil? | 0.00% | 0.00% | 2.98% | 17.02% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rock? | 0.83% | 12.51% | 0.00% | 7.53% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Topsoil displacement? | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Erosion?, comment! | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? <5cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? 5-10cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Rutting? >10cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning light | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning moderate | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Burning severe | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Compaction? 0-10 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Compaction? 10-30 cm | 0.00% | 7.53% | 0.00% | 7.53% | 0.00% | 0.00% | 0.00% | 7.53% | 0.00% | 0.00% |
| Compaction? >30cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure 0-10 cm | 0.00% | 7.53% | 0.00% | 7.53% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure 10-30 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Platy/Massive/Puddled structure >30 cm | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

# Appendix D – Data Tables for Greys Mountain Project

Greys Mt. Plot Data Summary Table
Existing and Proposed Action Conditions

The Greys Mt. plot data summary table displays plot data collected within the proposed treatment areas displayed on the Greys Mt. EIS map. Variable plots were taken using a 30 Basal Area Factor prism for trees 10 inches dbh and larger. Only trees 10 inches dbh and larger were included in these tables. Plots were placed evenly across proposed treatment areas. Since these plots covered all the area within most treatment polygons and due to the wide variability of vegetation present, plots representing non treatment aggregations are present as a part of this sample. These non treatment plots would tend to lower the overall average existing basal area in these stands. The data presented here is an average of all the plots within a treatment area. Plot conditions varied widely from a basal area low of 90 ft2 to 520 ft2 per acre. Fixed plot data recorded variations in trees 2 inches dbh and larger per acre ranging from 15 trees to hundreds per acre. In some plots no small trees were captured in the sample while in others hundreds per acre were. Several plots represent "groupings of conifers with increased BA retention (20-30" dbh)" similar to those retained in the Cedar Valley, Sugar Pine, and Fish Camp project areas. The column labeled "No. Plots" displays the number of plots within each grouping.

Between 1881 and 1892 a mill in the Soquel area operated by the Madera Flume and Trading Company harvested timber within the project area. The majority of the Greys Mt. project area was heavily railroad logged between 1926 and 1927. Logs were processed at the mill at Sugar Pine. The 1944 aerial photos provide a graphic display of the extent of that activity. Scattered older trees were left following logging. The vast majority of conifers present today were seedlings and saplings present in the understory that survived the logging entry. Several plantations within the project area were planted in the late 1960s at the tail end of a concerted effort to reforest understocked areas. A number of additional conifer plantations were created between the 1980s and early 1990s. Approximately 1450 acres of plantations are present within the project area. Stands proposed for treatment average 90 to 110 years of age. Overall average site quality sampled is a Dunning 1.

Plot data indicates that stands proposed for thinning consist mostly of pine and mixed conifer cover. Stands heavy to white fir are found in only a few small areas. Since these stands originated from advance reproduction present in the understory during the railroad logging era, they are heavy to shade tolerant, more fire prone, species of incense cedar and white fir.

The mean diameter shown for these plots was taken from data runs utilizing the plot data collected. The leave mean diameter was taken from the projected leave basal area and projected number of leave trees per acre 10 inches dbh and larger. (Generally, mean leave diameters will be somewhat lower when leave trees less than 10 inches dbh are included in the calculation. It is very doubtful that any unit will have an 8 inch or larger increase in average diameter following treatment.) Since this data is a representative sample of aggregations found in the stands, it is not intended to imply that any particular unit averages a particular diameter, basal area or crown

closure. As can be seen from the data sampled, the average diameter following treatment will be larger than before due to the removal of many small trees per acre across treatment units.

The plot data and summaries shown provide insight into the variability of the vegetation present within the proposed treatment areas. During collection of the plot data, trees that might be selected for removal under the proposed thinning prescription for that species composition were noted. From that data, potential leave and cut basal area, leave and cut tree sizes and numbers and existing and post harvest crown closures were determined. On a number of plots, for various reasons, leave basal area exceeds targets for that species composition.

**Legend for Greys Mt. Plot Data Summary Tables**

**Location:**

Number corresponds to the Treatment Area Number on Project Map where the majority of these aggregations are present. (Each treatment area has more than one aggregation. Stocking levels, crown closures, and diameters within treatment areas vary by the aggregation present.)

(MC) represents an area that is considered a Mixed Conifer dominated stand

(PP) pine dominated stands

(WF) represents an area that is considered a White Fir dominated stand

**Species Composition:**

| | |
|---|---|
| PP | Ponderosa Pine |
| SP | Sugar Pine |
| WF | White Fir |
| IC | Incense Cedar |
| OK | Oak |

**Crown Closure:**

Given in percent.

CWHR relationship for crown closure designation

| | |
|---|---|
| P | 25-39% |
| M | 40-59% |
| D | 60% + |

Desired Basal Area for comparison is:

Pine dominated wild Stands = 150-180 ft2/acre

Mixed Conifer (MC) dominated Stands = 210 ft2/acre

White Fir (WF) dominated Stands = 240 ft2/acre

For Alternative 3 a surogate of 10 inches dbh was used to display the changes that would occur based on only removing ladder fuels in wild stands.

Since trees to be removed in wild stands would be either intermediate or suppressed, overall crown closures following treatment will not significantly change. Since no trees 10 inches and larger would be removed under this alternative, density management would not take place. Post treatment basal areas and trees per acre would remain essentially the same as before treatment.

## Table 65. Conifer Plot Data Tables

| Location | Species Composition | | | | | Age | Site | Trees 10" & larger | | | | | | | Basal Area 10" & larger | | | | | | Crown Closure | | Mean | Leave Mean Dia | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PP | SP | IC | WF | OK | | | Total | Cut 10-15 | Cut 16-19 | Cut 20-25 | Cut 26-29 | Lv 20-29 | Tot Lv | Total | Cut 10-19 | Cut 20-25 | Cut 26-29 | Lv 20-29 | Tot Lv | Before | After | Dia | Dia | Plots |
| 1 | 6 | 6 | 33 | 55 | 0 | 80 | 1 | 81 | 14 | 9 | 12 | 4 | 36 | 42 | 266 | 30 | 30 | 17 | 180 | 189 | 61(D) | 50(M) | 24.5 | 28.7 | 7 |
| 2 | 25 | 8 | 35 | 17 | 15 | 108 | 3 | 93 | 9 | 0 | 1 | 1 | 33 | 82 | 200 | 7 | 4 | 4 | 119 | 185 | 79(D) | 78(D) | 15.6 | 20.3 | 8 |
| 3 | 24 | 42 | 11 | 23 | 0 | 84 | 3 | 92 | 2 | 0 | 0 | 0 | 30 | 90 | 211 | 3 | 0 | 0 | 146 | 208 | 74(D) | 73(D) | 15.9 | 20.6 | 9 |
| 4 | 16 | 15 | 33 | 34 | 2 | 81 | 1 | 68 | 17 | 12 | 6 | 0 | 30 | 33 | 217 | 37 | 19 | 0 | 157 | 161 | 71(D) | 64(D) | 20.8 | 29.9 | 8 |
| 5 | 3 | 12 | 26 | 53 | 6 | 81 | 2 | 52 | 0 | 3 | 7 | 1 | 27 | 41 | 170 | 5 | 20 | 5 | 120 | 140 | 56(M) | 51(M) | 22.9 | 25.0 | 6 |
| 6 | | | | | | 79 | | | | | | | | | | | | | | | | | | | |
| 7 | 47 | 6 | 22 | 15 | 10 | 89 | 2 | 55 | 0 | 2 | 4 | 2 | 33 | 47 | 188 | 4 | 11 | 7 | 142 | 165 | 62(D) | 59(D) | 23.8 | 25.4 | 8 |
| 8 | 38 | 16 | 20 | 17 | 9 | 82 | 3 | 105 | 20 | 3 | 1 | 0 | 26 | 81 | 192 | 22 | 3 | 0 | 99 | 167 | 74(D) | 70(D) | 15.8 | 19.4 | 18 |
| 9 | 14 | 7 | 33 | 41 | 5 | 93 | 2 | 124 | 32 | 8 | 8 | 2 | 38 | 74 | 278 | 43 | 20 | 8 | 160 | 207 | 79(D) | 71(D) | 17.3 | 22.7 | 18 |
| 10 | 22 | 10 | 20 | 43 | 5 | 77 | 2 | 82 | 4 | 0 | 1 | 0 | 20 | 77 | 150 | 4 | 4 | 0 | 75 | 142 | 70(D) | 69(D) | 17.1 | 20.2 | 8 |
| 11 | 0 | 0 | 0 | 100 | 0 | 68 | 2 | 77 | 0 | 0 | 0 | 0 | 37 | 77 | 225 | 0 | 0 | 0 | 175 | 225 | 68(D) | 68(D) | 19.5 | 19.5 | 8 |
| 12 | 0 | 25 | 0 | 75 | 0 | 83 | 3 | 86 | 3 | 4 | 4 | 0 | 23 | 74 | 199 | 11 | 11 | 0 | 123 | 176 | 57(M) | 52(M) | 18 | 20.9 | 6 |
| 13 | 0 | 8 | 83 | 9 | 0 | 65 | | | | | | | | | | | | | | | | | | | |
| 14 | 0 | 5 | 0 | 95 | 0 | 91 | 2 | 138 | 33 | 12 | 3 | 1 | 30 | 89 | 260 | 50 | 10 | 3 | 140 | 197 | 77(D) | 69(D) | 16.8 | 20.1 | 9 |
| 15 | 13 | 15 | 25 | 32 | 15 | 94 | 3 | 60 | 9 | 2 | 1 | 0 | 31 | 48 | 199 | 11 | 4 | 0 | 162 | 184 | 67(D) | 65(D) | 20.4 | 26.5 | 8 |
| 16 | 22 | 13 | 36 | 25 | 4 | 101 | 1 | 120 | 25 | 13 | 9 | 1 | 44 | 72 | 294 | 46 | 22 | 6 | 184 | 220 | 77(D) | 67(D) | 19.2 | 23.7 | 19 |
| 17 | 30 | 10 | 30 | 26 | 4 | 94 | 3 | 75 | 11 | 4 | 1 | 0 | 26 | 58 | 190 | 20 | 3 | 0 | 124 | 167 | 72(D) | 69(D) | 20.3 | 23.0 | 8 |
| 18 | 30 | 5 | 31 | 24 | 10 | 80 | 2 | 79 | 4 | 6 | 4 | 0 | 32 | 64 | 205 | 15 | 10 | 0 | 140 | 180 | 77(D) | 73(D) | 19.5 | 22.7 | 6 |
| 19 | 2 | 22 | 40 | 12 | 24 | 76 | 3 | 104 | 12 | 3 | 4 | 1 | 29 | 84 | 250 | 15 | 10 | 5 | 150 | 220 | 88(D) | 86(D) | 17.8 | 21.9 | 6 |
| 20 | 0 | 5 | 41 | 45 | 9 | 68 | 1 | 75 | 11 | 2 | 0 | 1 | 34 | 61 | 207 | 15 | 0 | 5 | 160 | 197 | 70(D) | 67(D) | 19.2 | 20.2 | 6 |

| Location | Species Composition | | | | | Age | Site | Trees 10" & larger | | | | | | | Basal Area 10" & larger | | | | | | Crown Closure | | Mean | Leave Mean Dia | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 31 | 17 | 15 | 32 | 5 | 85 | 1 | 79 | 17 | 5 | 2 | 1 | 33 | 54 | 197 | 22 | 4 | 4 | 146 | 167 | 67(D) | 62(D) | 18.2 | 23.8 | 7 |
| 22 | 53 | 6 | 25 | 14 | 2 | 86 | 1 | 77 | 4 | 9 | 16 | 1 | 44 | 47 | 255 | 20 | 40 | 5 | 185 | 190 | 72(D) | 62(D) | 24 | 27.2 | 6 |
| 23 | 13 | 13 | 37 | 13 | 24 | 121 | 1 | 72 | 17 | 6 | 0 | 0 | 32 | 49 | 190 | 25 | 0 | 0 | 140 | 165 | 69(D) | 65(D) | 21.5 | 24.6 | 6 |
| 24 | 66 | 5 | 5 | 5 | 19 | 156 | 2 | 47 | 0 | 5 | 4 | 2 | 36 | 36 | 210 | 10 | 10 | 10 | 180 | 180 | 73(D) | 68(D) | 26.7 | 30.2 | 3 |
| 26 | 4 | 0 | 29 | 67 | 0 | 79 | 1 | 155 | 54 | 0 | 34 | 0 | 40 | 67 | 360 | 45 | 90 | 0 | 190 | 225 | 75(D) | 61(D) | 16.9 | 24.8 | 2 |
| 27 | 11 | 5 | 17 | 66 | 0 | 88 | 1 | 125 | 46 | 13 | 23 | 4 | 39 | 39 | 383 | 68 | 64 | 18 | 233 | 233 | 72(D) | 60(D) | 22 | 33.1 | 8 |

Note: The data displayed above represents an average of the vegetation present within a particular treatment area. Due to variability of the vegetation present, varying aggregations are also present within treatment areas. Refer to the description and legend pages for more detailed explanations. (Data not run for units 6 and 13).

(A number of aggregations combine to form a stand.)

| Location | Species Composition | | | | | Age | Site | Trees 10" & larger | | | | | | | Basal Area 10" & larger | | | | | | Crown Closure | | Mean | Leave Mean | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PP | SP | IC | WF | OK | | | Total | Cut 10-15 | Cut 16-19 | Cut 20-25 | Cut 26-29 | Lv 20-29 | Tot Lv | Total | Cut 10-19 | Cut 20-25 | Cut 26-29 | Lv 20-29 | Tot Lv | Before | After | Dia | Dia | Plots |
| 28 | 0 | 6 | 47 | 47 | 0 | 98 | 1 | 111 | 43 | 5 | 19 | 2 | 43 | 43 | 380 | 50 | 60 | 10 | 260 | 260 | 75(D) | 61(D) | 23 | 33.2 | 3 |
| 29 | 1 | 1 | 47 | 51 | 0 | 91 | 1 | 119 | 24 | 13 | 13 | 2 | 42 | 67 | 313 | 43 | 34 | 9 | 193 | 227 | 70(D) | 60(D) | 20.2 | 24.9 | 7 |
| 30 | 5 | 2 | 33 | 58 | 2 | 97 | 1 | 122 | 34 | 21 | 2 | 4 | 35 | 61 | 285 | 70 | 5 | 15 | 165 | 195 | 73(D) | 61(D) | 18.7 | 24.2 | 6 |
| 31 & 32 | 0 | 38 | 11 | 51 | 0 | 90 | 1 | 89 | 14 | 18 | 7 | 4 | 31 | 46 | 314 | 44 | 18 | 16 | 219 | 235 | 76(D) | 67(D) | 22.4 | 30.6 | 13 |
| 33 | 3 | 14 | 32 | 50 | 1 | 92 | 1 | 105 | 25 | 9 | 8 | 3 | 35 | 60 | 273 | 33 | 20 | 12 | 176 | 208 | 70(D) | 61(D) | 20.6 | 25.2 | 18 |
| 34 | 12 | 9 | 47 | 29 | 3 | 92 | 1 | 105 | 21 | 27 | 17 | 2 | 38 | 38 | 340 | 70 | 50 | 10 | 210 | 210 | 71(D) | 60(D) | 23.6 | 31.8 | 3 |
| 35 | 2 | 36 | 24 | 38 | 0 | 109 | 1 | 117 | 29 | 24 | 8 | 5 | 33 | 51 | 334 | 64 | 22 | 21 | 206 | 225 | 75(D) | 64(D) | 20.2 | 28.4 | 8 |
| 37 | 1 | 4 | 37 | 58 | 0 | 100 | 1 | 76 | 6 | 5 | 4 | 0 | 42 | 61 | 240 | 15 | 15 | 0 | 180 | 210 | 69(D) | 53(M) | 21.1 | 25.1 | 8 |
| 38 | 2 | 26 | 31 | 41 | 0 | 82 | 1 | 134 | 42 | 20 | 23 | 7 | 42 | 42 | 401 | 75 | 60 | 30 | 236 | 236 | 75(D) | 62(D) | 21.6 | 32.1 | 9 |
| 39 | 56 | 6 | 34 | 4 | 0 | 82 | 2 | 89 | 0 | 3 | 0 | 0 | 32 | 76 | 196 | 5 | 0 | 0 | 125 | 191 | 68(D) | 67(D) | 18 | 21.4 | 6 |

# Appendix E -- Acronyms

- BLRD = Bass Lake Ranger District, Sierra National Forest
- CA = California
- Calif = California
- CAR = Critical Aquatic Refuge
- CO = County
- CWHR = California Department of Fish and Game's California Wildlife Habitat Relationships program
- Elev = Elevation
- HSRD = High Sierra Ranger District, Sierra National Forest
- HUC = Hydrologic Unit Code (watershed delineations)
- Mi = Mile
- NF = National Forest
- SJ = San Joaquin
- SJR = San Joaquin River
- Tribs = Tributaries
- USDI = US Department of Interior, Fish and Wildlife Service