United States
Department of
Agriculture

Forest
Service

February 2013

Draft Environmental Impact Statement

Whisky Ridge Ecological Restoration Project

Bass Lake Ranger District, Sierra National Forest
Madera County, California

Sierra National Forest, Bass Lake Ranger District (Photo taken in 1913)

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 all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for 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, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Whisky Ridge Ecological Restoration Project

Draft Environmental Impact Statement

Madera County, California; Sierra National Forest; Bass Lake Ranger District

Lead Agency:	**USDA Forest Service**
Cooperating Agencies:	**N/A**
Responsible Official:	**Dean A Gould, Forest Supervisor** **1600 Tollhouse Road, Clovis, CA 93611**
For Information Contact:	**Aimee Smith, Range Specialist** **57003 Road 225, North Fork, CA 93643** **(559) 877-2218 ext. 3151**

Abstract: This document examines the environmental effects of a proposal to move towards meeting management goals and objectives for the Whisky Ridge Restoration Project (Whisky Ridge Project) area as set forth in the Sierra National Forest Land and Resource Management Plan (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 promote and maintain ecosystem resilience, sustainability, and health under current, and also changing and uncertain, future environmental conditions (such as those driven by climate change and increasing human use) through the restoration of key ecological processes (e.g., returning fire to the landscape, restoring watershed function), biodiversity, wildlife habitat, and structural heterogeneity and protection of communities in the Wildland Urban Interface/Intermix (WUI) from wildfire. The ecological restoration goals of the Whisky Ridge Project are multi-faceted and includes the following: (1) Restore and maintain watershed function, biodiversity, wildlife habitat, and structural heterogeneity (2) Restore and maintain forest conditions within proposed treatment areas to more closely resemble pre-1900s stand structures which would result in forests that are more resilient and resistant to expected changes in climate and disturbance regimes. (3) Treat the surface (dead and down fuels) and ladder fuels to reduce the risk of spread and intensity of wildfire. (4)Treat conifer stands to improve their resiliency to insect attack, diseases, wildfire, drought conditions, and increased stress due to predicted warmer temperatures and longer periods of depleted soil moisture.

Alternatives considered in detail are: Alternative 1 (No Action), would leave the area in its present condition; Alternative 2 (Proposed Action), would thin coniferstands to reduce stand densities and ladder fuels and promote stand heterogeneity; masticate to reduce stand density, ladder fuels and brush/shrub patches; utilize prescribed and pile burning; construct new and maintain existing fuelbreaks; manually treat and/or prescribed burn noxious weed infestations; prepare and plant failed conifer plantations and understocked areas; restore degraded aquatic features and meadows; reduce fuel loading and ladder fuels in prehistoric and historic cultural resource sites; restore unauthorized off-highway vehicle (OHV) routes 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 livestock distribution; enhance the scenic integrity and scenic stability by locating or treating scenery disturbances; reduce stand densities and improve facilities within developed recreation site boundaries. Alternative 3 (Lower and Limited Mid-Level Canopy Treatment, All Treatments) 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. Alternative 3 also includes construct new and maintain existing fuelbreaks; manually treat and/or prescribed burn noxious weed infestations; prepare and plant failed conifer plantations;and understocked areas; precommercially thin/release plantations; restore degraded aquatic features and meadows; reduce fuel loading and ladder fuels in prehistoric and historic cultural resource sites; restore unauthorized off-highway vehicle (OHV) routes 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 livestock distribution; enhancing the scenic integrity and scenic stability by locating or treating scenery disturbances; reduce stand densities and improve facilities within developed recreation site boundaries

Public Comments:

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This would enable the Forest Service 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 (NEPA) 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).

Send Comments to: Dean Gould, 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.

Date Comments Must Be Received: April 8, 2013

SUMMARY

The Sierra National Forest (SNF), Bass Lake Ranger District (BLRD) proposes to restore and maintain 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 Whisky Ridge Project Area. This project would begin the process of returning treatment areas within the Project Area to forest structures more closely resembling those present prior to the early 1900s. Restoration of forests closer to their pre-1900s structure would result in forests that are more resilient and resistant to expected changes in climate and disturbance regimes (Stephens, 2010). The Whisky Ridge Project would restore the ecological processes and forest heterogeneity through a series of prescribed fire and thinning treatments aimed at reducing stand density, ladder fuels and dead and down fuel loads. Proposed treatments would maintain and improve stand resistance to drought, insects, and disease by reducing inter-tree competition and improving tree vigor. Growth rates of residual trees would increase resulting in larger diameter, taller trees developing over shorter periods of times. 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. 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.

The area affected by the proposal includes 18,285 total project boundary acres primarily within the mid to upper elevations of the Willow Creek watershed, in the Southern Sierra Nevada and is located east of the town of North Fork, California. The Project Area generally lies north of Cascadel Point, north and east of the community of Cascadel Woods, south of Shuteye Peak and west of Whisky Ridge. Vegetation types include ponderosa pine plantations, ponderosa pine, 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 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 railroad and other 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. Prior to the 1900s, forest stands were more open, consisting of a much greater percentage of more fire resistant, shade intolerant pines than the stands of today (North, 2009)(Laudenslayer and Skinner,1995). Owing to these changes, forest stands have become less diverse, more homogenous, more densely stocked, and more susceptible to uncharacteristically severe wildfire and drought. 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 through ecological restoration objectives:

1. Enhance heterogeneity in forest stand structure at both the stand and landscape scale. Maintain or improve growth and vigor of pine, mixed conifer, and fir stands, as well as conifer plantations through density management to increase resiliency by beginning the process of returning treatment areas to conditions more closely resembling those present prior to the early 1900s.
2. Allow for the reintroduction of fire as a process restoration tool.
3. Initiate restoration of key terrestrial wildlife structures and improve wildlife habitat by maintaining and restoring key components that are utilized for shelter, reproduction sites, resting or food sources.
4. Construct new fuelbreaks and maintain existing fuelbreaks.
5. Treat ladder and crown fuels (live and dead) to modify wildland fire spread and fire intensity levels.
6. Use integrated weed management to prevent and control infestations of noxious weeds and invasive non-native plants.
7. Restore production and enhance vitality of culturally gathered plant material through vegetation management activities.
8. Protect the historic values and characteristics of archaeological and historical cultural resources and improve their integrity by reducing fuels within prehistoric and historic cultural resource sites.
9. Improve aquatic habitat and restore degraded meadow (e.g. meadows, streams, and riparian areas).
10. Identify, improve, and maintain National Forest System Roads (NFSR) needed for the project and address NFSR identified for potential decommissioning or reconstruction in the Sierra National Forest Motorized Travel Management Plan (2010) within the Project.
11. Restore to site productivity unauthorized off-highway vehicle (OHV) routes previously identified in the Sierra National Forest Motorized Travel Management Plan (2010).
12. Minimize resource impacts and improve facilities at Whisky Falls Campground.

13. Manage scenery for the highest quality in areas significant to recreation and as seen from key viewing points from which the public views the landscape and are most sensitive to visual change.

Alternative 3 – Lower and Limited Mid-level Canopy Treatments, All Treatment Areas. In Alternative 3, treatment areas and proposed treatments would remain the same as in Alternative 2, except thinning 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 density management treatments (i.e. additional thinning in the mid-level canopy) to address stand density, perpetuation of intolerant tree species and forest health objectives.

Proposed fuels and other restoration treatments including plantation precommercial thinning and release would be undertaken as funding became available.

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 Alternatives

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Air Quality	Effects of ; **Degree of degradation of Air Quality from Smoke** **Tons of Carbon Lost** (Wildfire vs Restoration Treatments)	**Degree of degradation of Air Quality from Smoke -**High degree of long lasting unhealthy to severe degraded air quality from potential uncontrolled wildfire(s). **Tons of Carbon Lost -** Long term loss would occur after wildfire due to carbon stocks being lost.	**Degree of degradation of Air Quality from Smoke -** With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available. **Tons of Carbon Lost -** Net gain of carbon stocks over time due low loss from future wildfire	**Degree of degradation of Air Quality from Smoke -** With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available. **Tons of Carbon Lost -** Net gain of carbon stocks over time due low loss from future wildfire
Aquatic Wildlife TES	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) No effect, no anticipated impacts to species or habitat	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) May affect individuals, but is not likelyto contribute to the Federal listing or in loss of vialbility in the Sierra National Forest	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) May affect individuals, but is not likelyto contribute to the Federal listing or in loss of vialbility in the Sierra National Forest
Aquatic Wildlife Management Indicator Species	Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations) Lacustrine/Riverine: Stream Surface Shading, Flow, and Sediment Wet Meadow: Flow	**Lacustrine/Riverine Habitat** **Wet Meadow Habitat:** No expected direct, indirect or cumulative effects to habitat. Habitat stable at Regional scale	**Lacustrine/Riverine Habitat:** Direct or indirect effects to Stream Surface Shading and Flow not anticipated. **Wet Meadow Habitat:** Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow. Both habitat types stable at Regional scale.	**Lacustrine/Riverine Habitat:** Direct or indirect effects to Stream Surface Shading and Flow not anticipated. **Wet Meadow Habitat:** Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow. Both habitat types stable at Regional scale.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Botany Threatened, endangered, and Sensitive Plant Species *Other Sierra NF TES plant species not listed do not have habitat within the Project Area, therefore would not be effectedby any of the alternatives (see BE/BA).	Determinations for TES Species Determination for Federally listed plant species No effect	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) No direct effects from project activities would occur to the following 4 species of riparian/aquatic habitats, but habitat would not be restored in 11 meadows if this project is not implemented: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* No direct effects would occur to these two species: Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)*	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) Alternative 2 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)* Cumulative effects would not be expected for any of the species shown (see Chapter 3).	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) Alternative 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)* Cumulative effects would not be expected for any of the species shown (see Chapter 3).
Botany NoxiousWeeds	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, contaminated equipment introduces weeds to Project Area), also control of existing infestations would not occur.	Low risk of spread because of project design criteria for prevention of spread as well as the fact that this alternative includes controlling existing weed infestations.	Low risk of spread because of project design criteria for prevention of spread as well as the fact that this alternative includes controlling existing weed infestations.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Cultural Resources	The degree to which historic property values are diminished.	Direct effects to cultural resource sites would occur should an uncharaceristically severe wildfire occur due to untreated fuel accumulations.Indirect effects could occur from artifact looting as a result of increased access to and visibility of sites due to an uncharacteristically severe wildfire. Cultural site context could be affected by post fire runoff and erosion, increased tree mortality, and increased rodent and insect burrowing and continued unauthorized motorized use. Cultural resources could be affected by lack of road maintenance. Cumuluative effects are unlikely under this Alternative.	By following the Stipulations and implementing the Standard Resource Protection Measures outlined in the Regional PA, Attachment B and the Interim Fuels Protocol, and following design measures, the majority of the historic property values of sites would not be diminished as a result of implementing this alternative. Direct effects would occur through breeching an eligible railroad logging system, implementation of WIN projects, road maintenance and reconstruction, OHV design measures and Whisky Falls Campground rehabilitation. Determinations of eligibility for listing on the NRHP and/or MOAs with SHPO would need to be developed and implemented to mitigate these adverse effects. Positive effects to cultural resource sites could occur through returning the project area to pre-suppression conditions. Indirect effects could occur from artifact looting as a result of increased access and visibility of sites due to an uncharacteristically severe wildfire, recreational activities, 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. Cumulative effects would be minimal.	Direct effects would be the same as Alternative 2, with the exception of mechanical thinning within Whisky Falls Campground and cultural resource sites. Indirect effects would be the same as Alternative 2. Cumulative effects would be the same as Alternative 2

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Engineering - 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. This can have the potential to reduce potential erosion problems caused by transportation corridors. Implementation of BMP and erosion control measures would reduce the impacts of such construction.	See Alternative 2.
Fire/Fuels	Effects of fire behavior; Resistance to Control Effects of Fire Effects; Mortality (%) Fire Type Change in Cindition Class Fire Interval (CCFRI) CCFRI 1=No departure	**Resistance to Control** – Moderate to Very High **Mortality** - 71-100% **Fire Type** - Torching **CCFRI** - No acreage change would occur unless a wildfire were to happen	**Resistance to Control –** Very Low to Moderate **Mortality** - 0-69% **Fire Type** -Surface **CCFRI**- 4620 acres would be moved from CCFRI 3 to 1	**Resistance to Control** – Moderate to High **Mortality** - 01-100% **Fire Type**- Torching **CCFRI** - No acreage change would occur unless a wildfire were to happen

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Forest Vegetation Management/Silviculture	Effects of; Stand Density-est. stems per acre. remaining (trees/acre ≥10 inch dbh) Effectiveness - Short Term Effectiveness - Long Term Stand Heterogeneity Estimated Range of Canopy Cover remaining (%) Estimated Range of Tree Diameter remaining ≥ 10 inch dbh	**Stand Density-**est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 92 to 209 trees (not treated last 15 years) Plantations - 120 to 163 trees (not treated last 15 years) Wild Stands - 270 to 390 ft^2 (not treated last 15 years) Plantations = - 160 to 210 ft^2 (not treated last 15 years) **Effectiveness-Short Term-** Growth & vigor will decline—potential for loss due to insects, diseases, drought. Stands/aggregations will not begin process of returning to pre-1900s conditions Percentage of shade intolerant species will decrease. **Effectiveness Long Term -** Growth & vigor will decline more rapidly—potential for loss due to insects, diseases, drought will increase **Stand Heterogeneity** -Heterogeneity will decrease as competition causes shade intolerant trees to drop out of stand. **Estimated Range of Canopy Cover remaining (%)-** Wild Stands - 65 to 89% (not treated last 15 years) Plantations - 65 to 85% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh** Wild Stands = 18 to 27 inches (not treated last 15 years) Plantations = 14 to 18 inches	**Stand Density-**est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 48 to 93 trees (not treated last 15 years) Plantations - 68 to 104 tree (not treated last 15 years) Wild Stands - 180 to 290 ft^2 (not treated last 15 years) Plantations - 120 ft^2 (not treated last 15 years) **Effectiveness-Thort Term -** Growth & vigor will remain same or increase—potential for loss due to insects, diseases, drought will diminish , Stands/aggregations will begin process of returning to pre-1900s conditions. Percentage of shade intolerant species will increase. **Effectiveness Long Term -** Growth & vigor will remain high until next projected reentry in 15 to 20 years.—potential for loss due to insects, diseases, drought will be low **Stand Heterogeneity** Heterogeneity will incease as competition is removed. **Estimated Range of Canopy Cover remaining (%) -** Wild Stands - 55 to 77% (not treated last 15 years) (majority 60%+) Plantations = 55 to 65% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh** Wild Stands = 20 to 29 inches (not treated last 15 years) Plantations = 15 to 18 inches	**Stand Density-**est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 92 to 209 trees (not treated last 15 years) Plantations - 120 to 163 trees (not treated last 15 years) Wild Stands - 270 to 390 ft^2 (not treated last 15 years) Plantations - 160 to 210 ft^2 (not treated last 15 years) **Effectiveness Short Term** - Growth & vigor will decline potential for loss due to insects, diseases, drought. Stands/aggregations will not begin process of returning to pre-1900s conditions. Percentage of shade intolerant species will decrease. **Effectiveness Long Term -** Growth & vigor will decline more rapidly—potential for loss due to insects, diseases, drought will increase **Stand Heterogeneity** Heterogeneity will decrease as competition causes shade intolerant trees to drop out of stand. **Estimated Range of Canopy Cover remaining (%) -** Wild Stands - 65 to 89% (not treated last 15 years) Plantations - 65 to 85% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh-** Wild Stands = 18 to 27 inches (not treated last 15 years) Plantations = 14 to 18 inches

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Geology - Soils	Effects of; Soil Stability Surface Organic Matter: Soil Organic Matter (SOM): Soil Strength: Soil Moisture Regime: Soil Structure & Macro-Porosity	**Soil Stability** -Average soil cover for the project area was at 97% and no erosional features were observed in the project area. **Surface Organic Matter:** 89% of the transects revealed natural forest floor conditions, the remaining 9% was present & intact and 2% was partially missing or patchy. **Soil Organic Matter (SOM):** Mineral soil was present and undisturbed throughout the project area. **Soil Strength:** 3% of the soil transects reveiled minor soil compaction present within the project area. **Soil Moisture Regime:** Conifer encroachment into the meadows would occur unimpeded, resulting in a loss of habitat and retention of groundwater. **Soil Structure & Macro-Porosity**: 3% of the soil transects reveiled minor soil compaction present within the project area.	**Soil Stability** -Design measures would minimize impacts to soil stability. Soil cover would be maintained above 50% in all treatment areas and at or above 90% within 100ft of rock outcrop. **Surface Organic Matter:** Design features would minimize the impacts to the surface organic matter. A reduction would occur but would continue to meet and/or exceed Soil Management Objectives. **Soil Organic Matter (SOM):** Design features would minimize the impacts to soil organic matter (SOM). Slope limitations for mechanical operations on slopes >35% (>50% for mastication operations) and five pieces of large woody debris per acre would be maintained. **Soil Strength:** Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% of a treatment area. **Soil Moisture Regime:** Minimal to no loss of soil productivity and increased soil hydrologic function/water retention. **Soil Structure & Macro-Porosity**: Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% or a treatment area.	**Soil Stability** -Design measures would minimize impacts to soil stability. Soil cover would be maintained above 50% in all treatment areas and at or above 90% within 100ft of rock outcrop. **Surface Organic Matter:** Design features would minimize the impacts to the surface organic matter. A reduction would occur but would continue to meet and/or exceed Soil Management Objectives. **Soil Organic Matter (SOM):** Design features would minimize the impacts to soil organic matter (SOM). Slope limitations for mechanical operations on slopes >35% (>50% for mastication operations) and five pieces of large woody debris per acre would be maintained. **Soil Strength:** Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% of a treatment area. **Soil Moisture Regime:** Minimal to no loss of soil productivity and increased soil hydrologic function/water retention. **Soil Structure & Macro-Porosity**: Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% or a treatment area.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Hydrology – Water Quality	Cumulative Watershed Effects (CWE's) Threshold Levels Reached	With the No Action alternative, no tractor related ground disturbance or prescribed fire would occur, which would eliminate any CWE response from project related activities.	The Proposed Action could potentially elevate the ERA% value of subdrainage 504.1004 to 13.89%. Considering project activities would keep the ERA% below the upper threshold of concern 14%, there is a low to moderate chance of causing a CWE response based on current subdrainage condition.	Cumulative effects for Alternative 3 would be less than those described under the Proposed Action (Alternative 2) and similar to the No Action Alternative, 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. Baseline CWE (ERA %) for subdrainage 504.1004 is high at 13.89%, which resulted from past timber harvest activity. With Alternative 3, no tractor related ground disturbance would occur, which, (given sufficient time), would allow the subdrainage to stabilize and become more resilient to future watershed stressors.
Lands/Special Uses	Effects to Special Uses Permitted in Project Area. Effects to Recrational sites and features within Project Area.	There would be little protection from moderate to high intensity fires to special use and recreational sites/facilities as the accumulation of natural fuels build-up would continue to occur. A wildfire could result in a temporary shutdown of special uses (water lines, fiber optic cables, etc.) and closure of forest roads, trails and campgrounds for health and safety of the public	With implementation of Design Criteria minimal to no negative effects. Ecological restoration activities would reduce the fire risk to special use and recreational sites within and adjacent to the Project Area.	The effects of this alternative would be identical to that of Alternative 2.
Range	Effects to meadow condition and forage production	Meadow condition would move away from desired conditions and forage quality and production would decrease over time.	Meadow condition and forage quality and production would improve from meadow restoration, process and structural restoration treatments.	Meadow condition and forage quality and production would improve but to a lesser extent when compared with Alternative 2.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Recreation; Developed, CUAs, and Motorized Rec, dispersed camping	Effects to Recreation in Project Area	No Effect	With implementation of Design Criteria minimal to No effect	With implementation of Design Criteria minimal to No effect

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Terrestrial Wildlife (T)=Threatened (E)=Endangered (P)=Proposed (C)=Candidate (FSS)=Forest Service Sensitive *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: Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* (T) Bald Eagle *Haliaeetus leucocephalus* (FSS) Wolverine *Gulo gulo*(FSS, C) Willow Flycatcher *Empidonax trailli* (FSS) Sierra Nevada red fox *Vulpes vulpes necator* (FSS) Townsend's big-eared bat *Corynorhinus townsendii* (FSS)	Determinations for TECPS Species No effect. May affect but is not likely to adversely affect. 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. 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. California Spotted Owl *Strix occidentalis occidentalis* (FSS) Great Gray Owl *Strix nebulosa* (FSS) Northern goshawk *Accipiter gentilis* (FSS) Pallid bat *Antrozous pallidus* (FSS) Western red bat *Lasiurus blossevillii* (FSS) American marten *Martes americana* (FSS) 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. California Spotted Owl *Strix occidentalis occidentalis* (FSS) Great Gray Owl *Strix nebulosa* (FSS) Northern goshawk *Accipiter gentilis* (FSS) Pallid bat *Antrozous pallidus* (FSS) Western red bat *Lasiurus blossevillii* (FSS) American marten *Martes americana* (FSS) Pacific fisher *Martes pennanti pacifica* (FSS)

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Terrestrial Wildlife Management Indicator Species *****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: Greater sage-griouse (*Centrocercus urophasianus*) Mule deer (*Odocoileus hemionus)* Yellow warbler (*Dendroica petechia*) Sooty grouse (*Dendragapus obscurus*) Black-backed woodpecker (*Picoides arcticus*)	Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations)	All terrestrial MIS. No direct 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)* Mountain quail *(Oreortyx pictus)* California spotted owl (*Strix occidentalis occidentalis*) American marten (*Martes americana*) Northern flying squirrel (*Glaucomys sabrinus*) Hairy woodpecker (*Picoides villosus*) Although there would be alterations to canopy closure on 260 acres (approximately 3 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)* Mountain quail *(Oreortyx pictus)* California spotted owl (*Strix occidentalis occidentalis*) American marten (*Martes americana*) Northern flying squirrel (*Glaucomys sabrinus*) Hairy woodpecker (*Picoides villosus*) No changes to CWHR type, size, or density are expected with the implementation of Alternative 3. There would be no measurable changes to 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
Visual Resource	Effects to; Scenic Integrity Scenic Stability	**Scenic Integrity:** No direct effects. Potential indirect long-term adverse effects from increased visible disturbances from potentially severe wildfire and insect and disease outbreaks. Compliance in the short-term, but potential indirect long-term adverse effects could reduce the visual quality level to unacceptable modification, a potential two to three level decrease from the Forest Plan Visual Quality Objectives (VQO) of partial retention and modification and no longer in compliance with Forest Plan VQOs. No cumulative effects. **Scenic Stability**: No direct effects, but potential indirect long-term adverse effects due to scenery attributes (i.e., large trees and diverse vegetation) being at risk of being eliminated from a potential sever wildfire and insect and disease outbreaks. Scenic stability is Low. No cumulative effects.	**Scenic Integrity:** Direct short-term effects from ground disturbance and vegetation and fuel treatments. The visible disturbances would result in short-term effects (1-5 years) and reduce the VQOs towards the low-end of partial retention and low-end of modification. Positive indirect long-term effects due to the reduced risk of future sever wildfire and its associated visible disturbances Compliance within 1-5 years after treatment. Partial retention and the high-end of modification VQOs would be met. No cumulative effects. **Scenic Stability:** A positive direct and indirect effect due to increased sustainability of scenery attributes (large trees and diverse vegetation). Scenic stability would increase to High, a two level increase from Low Stability in Alternatives 1 and 3. No cumulative effects.	**Scenic Integrity** Direct short-term effects similar to alternative 2. Potential indirect long-term adverse effects due to fewer trees being removed increasing visible disturbances from potential severe wildfire and insect and disease outbreaks. Compliance within 1-5 years after treatments, but potential indirect long-term adverse effects (similar but less than alternative 1) could change the visual quality level to unacceptable modification, a potential two to three level decrease from the Forest Plan VQOs of partial retention and modification and no longer in compliance with Forest Plan VQOs. No cumulative effects. **Scenic Stability:** Slight positive direct effects as scenery attributes (large trees and diverse vegetation) are slightly enhanced but not as much as in alternative 2. Potential indirect long-term adverse effects due to scenery attributes (large trees and diverse vegetation) at risk of being eliminated from potential sever wildfire and insect and disease outbreaks. Scenic stability would be Low. No cumulative effects.

Table of Contents

Summary ..... **iii**

Chapter 1. Purpose of and Need for Action **1**

Document Structure 1

Background 1

Purpose and Need for Action 6

Proposed Action 7

Decision Framework 9

Forest Plan Direction 9

Public Involvement 10

Issues 10

Other Related Efforts 12

Chapter 2. Alternatives, Including the Proposed Action **13**

Introduction 13

Alternatives Considered in Detail 13

Alternative 1 16

Alternative 2 16

Alternative 3 20

Design Criteria Common to All Alternative 22

Alternatives Considered but Eliminated from Detailed Study 46

Comparison of Alternatives 49

Chapter 3. Affected Environment and Environmental Consequences **62**

Air Quality 67

Aquatic Wildlife and Management Indicator Species 86

Botany: Rare Plants & Noxious Weeds 115

Cultural Resource 133

Economics 150

Engineering/Transportation 158

Fire/Fuels 161

Forest Vegetation/Silviculture 191

Geology/Soils 215

Hydrology/Water Quality 243

Lands/Special Uses 259

Range Management 261

Recreation 276
Terrestrial Wildlife 282
Terrestrial Wildlife Management Indicator Species 308
Visual Resource 329
Short-term Uses and Long-term Productivity 345
Unavoidable Adverse Effects 345
Irreversible and Irretrievable Commitments of Resources 345
Cumulative Effects 346
Other Required Disclosures 346
Chapter 4. Consultation and Coordination 347
Preparers and Contributors 347
Glossary 348
Literature Cited 358
Index 380
Appendices 381
Appendix A – Map Package for Whisky Ridge Project 381
Appendix B – Aquatic and Meadow Restoration 382
Appendix C – National Forest Roads System (NFRS) 385
Appendix D – Road Survey Results 392
Appendix E – OHV Routes 396
Appendix F – Fire & Fuels 397
Appendix G – Best Management Practices for Water Quality Protection Specific to the Whisky Ridge Project 398
Appendix H – Data Tables for Whisky Ridge Project 438
Appendix I – Proposed Treatment Acres 443
Appendix J – Acronyms 449

List of Tables

Table 1. Summary of SMZ by Stream Class 36
Table 2. Riparian Area Management Zones 41
Table 3. Comparison of the Components of the Alternatives 49
Table 4. Comparison of the Effects of the Alternatives 51
Table 5 - Present and Reasonable Foreseeable Actions Addressed for Cumulative Effects by Resource 64
Table 6. Whisky Ridge Project Sensitive Receptors 68
Table 7. Federal de minimus Threshold Levels for Criteria Pollutants Based on Air Basin Attainment Status. 70

Table 8. Class I Airsheds Near the Whisky Ridge Project Area. 72

Table 9. Forestry Practices that Sequester or Preserve Carbon. 72

Table 10. Statewide Emmission Inventory for Natural Sources, Wildfires (tons/day, annual average) 76

Table 11. Modeled Emmissions of a Wildfire Burning Over the Same Amount of Acres as Proposed for RX Burning in Alt 2&3 Within the Whisky Ridge Project Boundary. 76

Table 12. Carbon Flux for Alternative 1 with Wildfire Distrubance. 76

Table 13. Tons of Estimated Pollutants per Individual Project Annual Underburn Program of Work. 77

Table 14. Carbon Flux for Alternative 1 With Wildfire Disturbance. 77

Table 15. Total Emissions From All Prescribed Fire Treatments in Alternative (in total/tons). 79

Table 16. Tons of Emissions for Mechanical Treatments and Road Maintenance-Reconstruction Activities for the Completion of Operations in Alternative 2. 80

Table 17. Emissions Conformity to General Conformity Rule for Criteria Pollutants. 81

Table 18. Carbon Exchange for All Prescribed Burning and Thinning Treatments within Burn Units. 81

Table 19. Comparison Graph of Criteria Emissions for Alternative 1 and 2. 85

Table 20. Comparison Table for Carbon Loss between Alternatives. 85

Table 21. Summary of Subwatershed Conditions. 88

Table 22. Perennial Streams (mi); Resident Trout Occupancy (mi), Riparian Canopy Cover, Mean Summer Water Temperature (period 7/15-9/15), and Maximum Daily Temperature (greatest mean daily between 7/15-9/15). 89

Table 23. Amount of Potential Habitat Within Aquatic Analysis Area for Special Interest Species(using CWHR and GIS). 94

Table 24. Aquatic MIS Habitat. 94

Table 25 Acres of Habitat Cumulatively Affected under Alternative 1. 102

Table 26. Species and Habitat Determinations. 103

Table 27. Species Potential Habitat for Alternative 2. 104

Table 28. Acres of Habitat Cumulatively Affected Under Alternative 2. 110

Table 29. Effects from Whisky Alternatives 2 and 3 on Aquatic/Riparian Threatened, Endangered, Candidate, and Sensitive Species. 111

Table 30. Forest Service Sensitive Plant Species Known or with Potential to Occur Within the Whisky Ridge Project Area, Along With Their Habitat Types. 117

Table 31. Economic Analysis for Alternative 2. 153

Table 32. Whisky Ridge Economic Analysis for Alternative 3. 155

Table 33. Full Time Job Relationship to Project Tasks. 157

Table 34. Condition Class Fire Regime Interval Shown as Percentage of Project Area. 163

Table 35. Wildfire Occurrence for Class A/B Fires from 1970-2008. 164

Table 36. Fire Hstory Within and Surrounding the Project Boundary (within a 3 mile radius). 165

Table 37. Prediction Chart of Spread and Intensity of Forest and Range Fires. 174

Table 38. Rocky Mountain Research Station Fuel Models. 175

Table 39. Indicators for Fuel Models in Timbered Brush/Bhrub Covered Areas. 178

Table 40. Shows the Predicted Results of Fuel Model Conversions Anticipated With This Alternative. 183

Table 41. Comparison of Fire Suppression and Effects Measured by Indicators. 190

Table 42. Whisky Ridge Project Soil Family Subsoil Profiles. 216

Table 43. Whisky Ridge Project Soil Map Units per Preatment Unit. 217

Table 44. Soil Transect Soil Severity Classification. 220

Table 45. Soil Transect Site Observations. 220

Table 46. Conifer Encroachment Data for sSlected Meadows. 221

Table 47. Proposed Conifer Removal Treatments. 222

Table 48. Hydrologic Function Classification for Routes Proposed for Restoration. 223

Table 49. Summary of OHV Routes Selected for Restoration. 225

Table 50. Cross-Drain Intervals Determined by % Slope. 228

Table 51. HFC Rating Guide. 232

Table 52. Stream Mile Summaries for All 8th-Field Subdrainages and Stream Miles Potentially Affected by Project Activities. 244

Table 53. Designated Beneficial Uses for Major Perennial Drainages Downstream of the Project Area. 247

Table 54. Calculated base %ERA and %ERA with the Proposed Action (Alternative 2). 250

Table 55. Summary of Grazing Allotments the Overlap the Project Area. 261

Table 56. Current Permitted Numbers and Season of Use for Castle Peak Allotment. 262

Table 57. Current Permitted Numbers and Season of Use for Castle Peak Allotment. 263

Table 58. Current Permitted Numbers and Season of Use for Haskell Allotment 263

Table 59. Allowable Utilization Levels by Vegetation Community. 267

Table 60. Desired Conditions for Montane Meadows and Riparian Conservation Areas. 268

Table 61. Summary of Meadow Condition Data. 269

Table 62. Summary of Proposed Meadow/Riparian Restoration. 270

Table 63. Special Status Terrestrial Wildlife 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 BEBA 283

Table 64. Alternative 2 Summary of Changes to CWHR Forest Type Within the Boundaries of the Whisky Ridge Project. 288

Table 65. Recent Ecological Restoration Projects on the Sierra National Forest Within Fisher Habitat. 304

Table 66. Selection of MIS for Project-Level Habitat Analysis for the Whisky Ridge Project. 311

Table 67. Summary of Commercial Thinning and Plantation Treatments with Pre- and Post-Treatment CWHR Acres for Whisky Ridge Project Area: Present Compared to Alternative 2. 316

Table 68. Summary of Travelways and Use Areas to be used as Key Viewing Points. 333

Table 69. Summary of Proposed Meadows/Riparian Restoration. 383

Table 70. Proposed Road Construction and Maintenance. 387

Table 71. Hydrologically Connected Drain Points Along Native Surface Level 2 Roads in the Whisky Ridge Project Area. 392

Table 72. Proposed culvert installment and maintenance 395

Table 73. Survey of OHV routes. 396

Table 74. Acres of Post thinning Fuels Treatment. 397

Table 75. Plot Data Summary. 440

Table 76. Proposed Treatment Acres. 443

List of Tab Figures

Figure 1: Associated Bounds and Treatments within Old Forest Linkages 42

Figure 2: Map showing Air Basins and Counties....67

Figure 3. Perennial streams in Project Area aquatic analysis area....87

Figure 4. Habitat distribution across aquatic analysis area in relation to treatment areas....93

Figure 5. Bolander's candle moss in Varer's long meadow, Whisky Ridge Project Area. Photo: Joanna Clines 119

Figure 6. Rawson's flaming trumphet in flower close up. Photo; Chris Winchell 120

Figure 7. Rawson's flaming trumphet flowering in optimal conditions of dappled light. Photo: Chris Winchell.....120

Figure 8. Worldwide range of Rawson's flaming trumpet in relation to the Whisky Project boundary 121

Figure 9. Left: brook pocket moss in waterfall, Right: close-up of plant showing unique flattened appearance of branches....121

Figure 10. Kelloggs lewisia: left: close-up of one plant, right: habitat along Road 7S02I. Photos: Rodney Olsen ..122

Figure 11. Veined water lichen Photo: J. Clines 123

Figure 12. Dead and downed debris and encroaching vegetation on historic railroad grade within the Whisky Ridge Project area 135

Figure 13. Heavy fuels accumulation in prehistoric cultural resource site within the Whisky Ridge Project area ...136

Figure 14. Heavy vegetation encroaching on historic railroad grade within the Whisky Ridge Project area affecting integrity of setting and design....137

Figure 15. Picture taken in 1913 on the Bass Lake Ranger District showing fuel and very open understory conditions. Notice the burn scars on the trees and dwn logs....161

Figure 16. Picture of forest conditions just east of Benedict Meadow at the bottom of Camp 14 Railroad Hoist. Circa late 1920's. Young understory shown has grown into dense stands of shade tolerant conifers that are capable of supporting high severity crown fires....166

Figure 17. Photo showing fuels conditions in fir stands 167

Figure 18. Photo showing fuels conditions in Mixed Conifer stands....167

Figure 19. Photo showing fuel conditions in Pine stands....168

Figure 20. Picture showing Brush areas....168

Figure 21. The diagrams illustrate the relationship between flame length and fireline intensity 172

Figure 22. Yield Tables for Ponderosa Pine from Meyers Bulletin 630 195

Figure 23. Displays stand thinning needs over time as basal increases 196

Figure 24. Example of thinning release....202

Figure 25. Project 8th-Field subdrainages used for analysis. Number indicates subdrainage identifier (NB: subdrainages 504.2101/504.2102/504.2151 and 504.1007/504.1005 have been combined for Cumulative Watershed Effects analysis). 245

Figure 26. SMZ map of the Whisky Ridge Area. Lines represent different stream orders, which are offered a protection buffer based on designated class. Vegetation treatment units have been designed to avoid class I perennial streams where possible....254

Figure 27. Allotment boundaries and meadows with proposed restoration within the Project Area 265

Figure 28. SNF Niche Map – Recreational settings within Whisky Ridge Project Area 330

Figure 29. Left;Views of large pine trees with mosaic patterns of shrubs and grasses in the understory Right;Views of the yellow-orange leaves of the black oak species during the fall season....331

Figure 30. Existing dense conifer stands 331

Figure 31. Left Photo; Views from the Scenic Byway enframed by trees and earth forms. Right Photo; Views from the Scenic Byway to Whisky Ridge Project Area.....333

Figure 32. Visual Quality Objective (VQO) Map 334

Figure 34. Understory becoming very dense with small and intermediate sized trees 335

Figure 35. Left Photo; Desired Conditions: Open, park-like setting with heterogeneity in understory Right Photo, Desired Conditions: Open, park-like setting dominated by large trees.....336

Figure 36. Step-pools built into two narrow headcuts at the toe of Summit Meadow, Sierra National Forest. 435

Figure 37. Log-and Fabric Step-Falls used for headcut mitigation, Johnson Meadow, Sierra National Forest. 436

Figure 38. Photos of a native sod plug.....437

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Document Structure

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

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's Proposed Action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing the Proposed Action and other alternatives. This is organized by (resource area, significant issues, environmental component).

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) Record of Decision (ROD) 1992 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 6).

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. Wildland Urban Interfaces (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 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 project alternatives (see Chapter 2).

Following management goals and direction from the SNFPA ROD (USDA-FS 2004b), treatment areas for the Whisky Ridge Project were developed. These treatment areas were designed to address the need to consider and to improve forest health by restoring and maintaining ecosystem structure, composition and process process to generally resemble those of pre-settlement conditions. Furthermore, treatments were developed and provide for other important objectives based on basic fire and fuels strategies which remained in the SNFPA ROD (USDA-FS 2004b); reducing the risk of wildland fire to WUIs and to effectively modify wildland fire behavior by strategically placing a pattern of area treatments (known in the SNFPA ROD (USDA-FS 2004b) as Strategical Placed Landscape Area Treatment (SPLATs),(see map 6) 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 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) 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, and (2) act as sideboards for local managers as they design projects to meet fuels and vegetation management objectives and respond to site-specific conditions. 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).

In addition to the Forest Land and Resource Management Plan, a recent community-supported and collaborative update to 1995 Bass Lake Ranger District Willow Creek Landscape Analysis would be used as guiding documents for this proposal.

In June of 1995 the Bass Lake RD completed the Willow Creek Landscape Analysis, which outlined ecological units in the watershed and identified common characteristics to key ecological elements including: soil productivity, fire and fuels, vegetation mosaic and wildlife habitat, human influence, heritage resources, transportation system, recreation and water quality. The Whisky Ridge Project lies within the mid to upper elevation of the Willow Creek watershed. In March of 2012, an Addendum to the 1995 Willow Creek Landscape Analysis was prepared as part of a collaborative planning process known as the Willow Creek Planning Collaborative, which involved a broad group of individuals and groups that have a relationship and interest in the community and forest area. The Addendum represents an important record of consensus from this broad stakeholder group on key issues and incorporates their perspectives in regard to community values, desired conditions and suggested management strategies for current and future project planning within the Willow Creek watershed, of which this project is a part. The Addendum outlines community values/beliefs, desired conditions and suggested management strategies for the ecological units that are within the Project

Area in the following topic areas that include: overall forest management (including coniferous forests, oak woodlands, streams, lakes and meadows); fire, biodiversity, management of riparian areas, integration of community economic development considerations in forest restoration planning, Native American sacred places and other historical values, recreation and relationships, communication and collaboration.

In 2011, Forest Service Pacific Southwest Region's (Region 5) set forth, increasing the pace and scale of ecological restoration sufficient to reverse current trends. Ecosystem services and community economic benefits that could be enhanced under this Project include:

- Forest resilience in the face of climate change and changing disturbance processes;
- Fish, wildlife and plant habitat, for both common and rare species;
- Delivery of clean water and an improved flow regime that benefits people, fish and wildlife;
- Rural economic health and green economic activity
- Wood products;
- Maintenance of biodiversity;
- Forage for wildlife and livestock;
- Air quality and;
- Landscapes for health and renewal (e.g. outdoor recreation and scenic beauty).

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 in the area have started and burned from the lower elevations around the North Fork 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 resulting in a buildup of dead and down fuels as well as dense thickets of understory trees which have created multilayered conifer stands. These conditions provide an environment for wildfires to burn at high intensities over large areas, which is not what occurred in these forests historically.

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 are observed on local fires that have occurred in the Sierra National Forest (2001 North Fork Fire; the 2003 Source Point Fire; and the 2008 Cascadel Fire).

Historical records show large wildland fires reached into the southeast, south, southwest, north and northwest areas of the project. There have also been more than 50 fire occurrences within the Project

Area. Topographic features and given suitable burning conditions could easily threaten forest resources within the Project Area.

The Project Area has a long history of past logging activities with the first lumber mill operation built in 1883 on Pechinpah Mountain. From 1883 until 1934 various lumber mills processed timber logged from the area within the project boundary. Ox/donkey teams, railroad, cable and ground-based logging activities over this period removed approximately 5,000 to upwards of 32,000 board feet (ft) of timber per acre. Over 60 percent of this output was in sugar pine and ponderosa pine. Extensive railroad logging conducted within the project area by the Sugar Pine Lumber Company in the late 1920s to early 30s removed an average of 100 million board ft per year. A conservative estimate of 300 million board ft of timber were removed by logging within the project area prior to the mid-1930s and have resulted in most of the forested areas consisting of trees less than 130 years of age. These harvest activities along with subsequent harvesting and fire exclusion/suppression over the past 100 years have resulted in a change in forest structure. Prior to these activities, these forests were comprised of larger diameter pine dominated stands that were less susceptible to drought and fire. Frequent low to moderate intensity fires limited understory vegetation resulting in more open stand conditions. Currently, stands are more even aged, dense, and multilayered, and dominated by second-growth (approximately 85 to 110 year-old) less fire resistant, shade tolerant white fir and incense cedar than 100 years ago. Decades of fire exclusion has resulted in excessive accumulations of down woody material.

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 is 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 1934 has generally consisted of salvage/sanitation, overstory harvests and commercial thinning, with most occurring from 1970 to 1995. Over 900 acres of 10 to 48 year old pine plantations lie within the Project boundaries. These plantations, ranging in size from two to 75 acres, were replanted following regeneration harvesting, salvage logging or fires. The most recent plantations were replanted following the 2001 North Fork Fire. Except for some understocked pockets, these plantations have been reforested and are now established younger-aged conifer plantations consisting of varying tree sizes. 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 Conditions

Changes to the forest structure resulting from past logging activities and the lack of frequent fire have significantly altered ecosystem conditions from those present prior to early 1900s. 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 creating extensive fuel ladders.

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. Conifer stands have become crowded with multiple layers of shade tolerant trees. Stocking levels (stand densities) have reached, or are reaching, density levels where declining growth

and vigor are occurring due to inter-tree competition for sunlight, nutrients and water resulting in the potential for increased rates of mortality. Portions of plantations are suffering from competition from brush and/or conifer overstocking. Shade intolerant (sun-loving) pines and oaks are becoming less vigorous resulting in a further increase in the percentage of shade tolerant fir and cedar remaining in conifer stands. 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 LRMP.

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. Climate models suggest in the future there would be more frequent shifts between ElNino and LaNina events resulting in the climate becoming more extreme with increasing oscillations between wet and drought periods (North 2009). Substantial temperature episodes (fewer frosts, more heatwaves) are also predicted (Dettinger 2004).

Laudenslayer and Skinner (1995) reported finding conditions in the forests of the Sierra Nevada range similar to those present in the Whisky Ridge Project area. They found that fire suppression, climate shift and human disturbance patterns in the last 100 years has resulted in increased tree densities, changes in stand structure and spatial patterns, and buildups of dead, flammable material. They pointed out that many forests are in poor health. Large acreages are densely stocked and outbreaks of insects and other mortality agents are causing extensive amounts of tree mortality especially in white fir and ponderosa pine over short time periods. In their present condition, these overstocked stands would have great difficulty successfully surviving the natural disturbances such as droughts, climate change, insects/disease attacks and/or wildfire that are predicted to occur in future years.

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. Eleven 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.

The meadows proposed for restoration 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 LRMP (USDA, 1991), as amended by the Sierra Nevada Forest Plan Amendment ROD (SNFPA USDA, 2004). The desired meadow condition in accordance with the Forest Plan as amended by the 2004 SNFPA is:

---

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

- 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
- 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 nearly 40 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 and resource availability for many cultural sites within the Project Area. Several prehistoric sites that once had exposed features, access to water resources, and an open viewshed have been encroached by vegetation detracting from the sites' setting and obscuring the view. In some cases the overgrowth has led to a decreased amount of available water. 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 policy of avoiding vegetation management in cultural resource sites, 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.

Manmade features that have created degraded resource conditions are forest roads in poor maintenance condition and unauthorized off-highway vehicle (OHV) routes that are not on the SNF Travel Plan. These unauthorized off-highway vehicle route 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 SNF 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 purpose of this project is to;

Promote and maintain ecosystem resilience, sustainability, and health under current and also changing and uncertain future environmental conditions (such as those driven by climate change and increasing human use) through the restoration of key ecological processes (e.g., returning fire to the landscape, restoring watershed function), biodiversity, wildlife habitat, and structural heterogeneity. The impacts of early 1900s railroad logging and other harvest activities on these federal as well as formerly private lands, combined with the exclusion of fire, have altered forest conditions within the Project Area. Stand species composition has shifted from more fire resistant, shade intolerant pines to less fire resistant, shade tolerant fir and incense cedar. Prior to these activities, these stands were more open comprised of larger diameter pine dominated stands that were less susceptible to drought and fire. Frequent low to moderate intensity fires limited understory vegetation resulting in more open stand conditions. Decades of fire exclusion has resulted in increased fuel ladders and excessive accumulations of down woody material.

Restore and maintain forest conditions within proposed treatment areas to more closely resemble pre-1900s stand structures which would result in forests that are more resilient and resistant to expected changes in climate and disturbance regimes. There is a need to reduce stand densities mainly within the lower and mid-canopy levels of the treated stands to promote increased growth and vigor, stimulate growth of large, insect resistant trees enabling the forest to better withstand predicted fluctuations in temperatures and precipitation, attacks from insects and diseases, and the effects of wildfires. Some of the predicted results would include acceleration of old forest (pre-1900s vegetation characteristics), improvement of stand growth and vigor, more rapid development of larger diameter trees resulting from increased growth rates, retention and perpetuation of a greater percentage of pines and oaks restoring more diverse stands while reducing the risk to wildfire loss.

Treat conifer stands to improve their resiliency to insect attack, diseases, wildfire, drought conditions, and increased stress on vegetation due to predicted warmer temperatures and longer periods of depleted soil moisture. Stocking levels (stand densities) have reached or are reaching density levels where declining growth and vigor is occurring from inter-tree competition thus increasing potential rates of tree mortality. A reduction in the uncharacteristically high percentage of incense cedar and fir needs to occur in order for stands to more closely resemble pre-1900s stand structure. There is a need to improve individual tree growth to accelerate the development of larger diameter, more resilient trees.

Proposed Action

The action proposed by the Forest Service to meet the purpose and need is to;

- Improve terrestrial wildlife habitat on approximately 4,635 acres by implementing coarse woody debris and snag-creating treatments, allowing for several areas of high intensity fire (five to ten acres) through prescribed burning to create pockets of desirable snags and burned habitat for species which utilize burned areas;
- Commercially thin from below 10 – 30 inch diameter at breast height (dbh) mixed conifer, pine, and white fir stands and precommercially thin smaller diameter trees on approximately 2,824 acres;
- Mechanically treat fuels and overstocked vegetation through a combination of precommercially thinning by: hand, spot tractor pile and pile burn; biomass removal; or mastication on approximately 1,881 acres;
- Precommercially thin by masticating approximately 520 acres of conifer stands and brush covered areas;
- Precommercially hand thin, hand pile and pile burn on approximately 200 acres;

- Plant and hand release treated openings within commercial thin , precommercial thin, plantations, and mastication treatment areas on up to 150 acres;
- Treat slash concentrations within commercially thinned stands by a combination of tractor or hand piling and burning or mastication;
- Prescribe underburn utilizing fire only treatments where no mechanical treatment is planned, treatment on up to approximately 2,838 acres;
- Prescribe underburn in areas that are also proposed for mechanical (structural) restoration on approximately 1,776 acres, underburn treatment would occur within treatment areas where the initial treatment would be commercial and/or precommercial thinning;
- Construct 2 and maintain 1 existing fuelbreaks on approximately1,187 acres;
- Improve and restore native plant communities important to local Native American tribes for traditional uses. This would be accomplished within the areas that are planned for prescribed burning and would be completed by using prescribed burning and hand pruning with tools;
- Reduce fuels within prehistoric and historic cultural resource sites by hand thinning and piling, followed with prescribed burning and mechanical treatments on approximately 100 acres;
- Stabilize physically degraded areas within meadows on approximately 16 acres by hand thinning and installation of bioengineered log fabric step-falls;
- Restore degraded meadows by reducing encroaching conifers on approximately 6acres by hand thinning and girdling trees,
- Restore hydrologic function through meadow stabilization by mechanical and hand thinning in Riparian Management Area (RMA) on approximately 72 acres;
- Improve aquatic wildlife habitat utilizing restoration methodology (physical in-stream channel stabilization, restoration of culvert function, and obliteration of a section of system road);
- Minimize riparian impacts and improve livestock distribution by installation of 4 off-site livestock water developments;
- Hand pull and/or prescribed burn noxious weed patches on approximately 5 acres;
- Enhance sensitive plant habitat (Rawson’s flaming trumpet and mosses) on approximately 0.5 acres;
- Decommission and obliterate a section of approximately 0.2 miles of forest system roads and reconstruct approximately 200 feet of existing road to maintain current level of access;
- Perform maintenance on approximately 65 miles of forest system roads;
- Perform reconstruction on approximately 33 miles of forest system roads,
- Construct 5 miles of temporary road;
- Restore site productivity to approximately 10 miles of unauthorized OHV routes through barricade and signage, water bar installation and mechanical treatment;
- Improve facilities at Whisky Falls Campground by installing 9 bear boxes and decommission and replace existing vault toilet at campsites, and

- Remove hazardous trees on approximately 4 acres at Whisky Falls Campground to meet density management and public safety objectives.

Decision Framework

Given the purpose and need, the deciding official would 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 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 Whisky Ridge Project boundary are shown on individual maps for the specific land allocation. These maps are in the Map Package(Appendix A) and include:

Wildland Urban Interface/Intermix (both Defense and Threat Zones). This land allocation encompasses 5,731 acres within the Whisky Ridge 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; 450 acres are designated as Defense Zone[2] 23 acres are designated as urban core, and 5,258 acres are designated as Threat Zone[3]. There are 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 exactly add up due to rounding errors.

California Spotted Owl Protected Activity Centers (PACs) and Home Range Core Areas (HRCA). These land allocation encompass 3263 acres of the Project Area. There are a total of 13,360 acres of high and moderate quality suitable habitat for California spotted owl within the project boundary as defined by California Wildlife Habitat Relationships (CWHR). There are five PACs and eight associated HRCAs either entirely or partially within the project boundaries. The LRMP, as amended sets forth standards and guidelines for this land allocation that address mechanical treatments conducted to meet fuelsmanagement objectives in PACs located in the WUI threat zone 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 nearly 600 acres of suitable nesting habitat within three PAC's that are entirely or partially within the project boundary. There is also 14,902 acres of suitable foraging habitat within the project boundary. The 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 throughout the entire Whisky Ridge Project boundary. The SNFA 2004 ROD (USDA-FS2004b) has set forth standards and guidelines associated with this land allocation that address protection measures for fisher den sitesas well as direction for projects proposed in the Southern Sierra Conservation Fisher Areas (USDA-FS 2004b,

---

[2] Defense Zones designated in the project extend ¼ mile from private property lines.

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

pgs. 61-62). In these standards and guidelines it is left \to wildlife biologist to develop design criterias that protect important habitat structures within fisher habitat. Design criteria for the maintenance and protection of key habitat elements for Pacific Fisher have been developed on current scientific information, issues raised during public scoping and standards and guidelines in the SNFPA 2004 ROD (USDA-FS 2004b) which includesuse of mechanical treatments when 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 Whisky Ridge Project boundary because of the extensive stream network within the project boundary. RCA is a management prescription for riparian areas (typically specified as widths along intermittent and perennial streams) that has goals (from the aquatic management strategy) and Standards and Guides associated with them, which are addressed in the Riparian Conservation Objective consistency analysis. Designation of RCA's is required under the Sierra Forest Plan Amendment (2004), Resource Conservation Objectives, Standard and Guide #91 (page 62).

Public Involvement

A Notice of Intent (NOI) to prepare an Environmental Impact Statement for the Whisky Ridge Project was published in the Federal Register on April 11, 2012. 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 April 13, 2012 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 beginning 2012. On June 13 & 27, 2012 the Forest Service held public field trips 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 published in the Sierra Star (local newspaper) on June 14, 2012. The public field trips were attended by over 60 individuals.

There were eight scoping period 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. Some of these issues led to the development of Alternative 3.

Issues

Comments from the public 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 issues. Significant issues were defined as resource impacts that directly or indirectly are 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 regarding their categorization as non-significant may be found at Bass Lake Ranger District Station in North Fork, California in the project record.

As for significant issues, the Forest Service identified the following issues during scoping:

1. *The Proposed Action to remove trees about 10 inches up to 30 inches in diameter would not reduce the potential for high-intensity and severity fires.*

Alternative 3 responds to this issue because trees over ten inches would not be treated under this alternative. See the Alternative 3 description in Chapter 2 of this document. A summary of the fire/fuels analysis and potential for active crown fire can be found in Chapter 3, Fire/Fuels section of this document.

2. *The prescribed burning elements of the Proposed Action may cause smoke that may adversely affect human health.*

Alternative 1 responds to this issue because no prescribed burning is proposed under this alternative. A summary of the fire/fuels analysis and prescribed burning can be found in Chapter 3, Fire/Fuels section of this document.

3. *The proposed burning may increase CO_2 levels in the atmosphere leading to atmosphere warming.*

Alternative 1 responds to this issue because no mechanical or prescribed burning treatents are proposed under this alternative. A summary of the air quality analysis and CO_2 levels can be found in Chapter 3, Air Quality section of this document.

4. *The Proposed Action would not provide enough high intensity fire for spotted owl foraging.*

Alternative 2 responds to this issue by proposing several pockects of high intensity prescribed burning. See the Alternative 2 description in Chapter 2 of this document. A summary of the terrestrial wildlife analysis and high intensity fire can be found in Chapter 3, Wildlife - Terrestrial section of this document.

5. *The Proposed Action would not provide enough suitable habitat for the sustainability of the black-backed woodpecker population.*

The proposed action was modified from intial scoping to include a more specific proposal. that responds to this issue by proposing to include pockets of high intensity fire to create pockect of conitguous snags. See the Alternative 2 description in Chapter 2 of this document for the detailed proposal. A summary of the terrestrial wildlife analysis and Black-backed Woodpecker habitat can be found in Chapter 3, Wildlife - Terrestrial section of this document.

6. *The Proposed Action may decrease future large snag density potentially resulting in adverse impacts to cavity-nesting wildlife species.*

Alternative 2 responds to this issue because it includes a proposal for several high intensity burn areas to create pockect of desireable snags and burned habitat for species such as the black-back woodpecker. Snag creating treaments such as girdling and/or topping of trees is included in this proposal where inventory data is showing a deficiet of snags in the larger size classes (> than 15 inches dbh trees). See the Alternative 2 description in Chapter 2 of this document. A summary of the terrestrial wildlife analysis and cavity-nesting wildlife can be found in Chapter 3, Wildlife - Terrestrial section of this document.

7. *The Proposed Action may decrease vegetation heterogeneity (montane chaparral, snags and downed logs) which may reduce native biodiversity.*

Alternative 2 responds to this issue because it proposes to promote heterogeneity through structural and process restoration treatments. See the Alternative 2 description in Chapter 2 of this document. A summary of the can be found in Chapter 3, Botany (montane chaparral), Wildlife Terrestrial (snags and downed logs), and Fire/Fuels (high severity fire) section of this document.

8. *The Proposed Action may adversely affect Native American gathering sites.*

Alternative 2 responds to this issue by proposing to restore and enhance culturally gathered plant materials. See the Alternative 2 description in Chapter 2 of this document. Also, a summary of the botany and cultural resource analysis and native plants can be found in Chapter 3, Botany and Cultural Resource section of this document.

9. *Removal of mature trees under the Proposed Action may result in a higher tree mortality rate than would occur without the project, reducing future snag recruitment.*

Alternative 1 responds to this issue as no tree removal would occur. In addition Alternative 3 address this issue as no commercial trees would be harvested. Also, a summary of the silviculture analysis and tree mortality can be found in Chapter 3, Silviculture section of this document.

Other Related Efforts

There are no other related efforts that would affect the Proposed Action or the decision to be made.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered to meet the purpose and need of the Whisky Ridge Project. It describes a no action alternative and two action alternatives in detail as well as those eliminated from detailed study. This section also presents the alternatives in a clear tabular format so that the alternatives and their environmental impacts provide a clear basis for choice among options by the decision maker and display the differences in impact to the public.

Alternatives Considered in Detail

The Forest Service developed the Whisky Ridge Project alternatives, including the No Action, Proposed Action, and a third alternative, in response to issues raised by the public. 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 treated 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 #1 which was that removal of trees about 10 inches up to 30 inches in diameter would not reduce the potential for high-intensity and severity fires as in the Proposed Action.

The Sierra Nevada Adaptive Management Study (SNAMP), which studies Pacific fisher, focuses on an area directly west of the Whisky Ridge Project. As the Whisky Ridge Project falls within the Pacific fisher habitat zone, knowledge gained by the SNAMP project was utilized in the design of the Whisky Ridge Project. Information used in developing the project alternatives includes: current movement patterns and 2008 through 2012 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 design measures from the LRMP 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 is intended to help ensure the sustainability of native wildlife populations 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 (Alternative 2) which includes both;

a. Conventional (hand felling) Harvest and

b. Mechanical Tree Harvest

c. Precommercial Thin (both action alternatives)

d. Mechanical Mastication (both action alternatives)

e. Lop and Scatter (both action alternatives)

"Commercial Thin" consists of two methods of commercial tree removal that are envisioned in alternative 2. Conventional tree harvest is planned within the thinning treatments areas of 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 diameter breast height (dbh) up to approximately 22 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, if including in a contract would be hauled to an electrical generation plant. [4] 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.

Commercial thinning is planned to occur in areas with slopes generally 35 percent or less utilizing ground-based equipment.

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

3."Mechanical mastication" (shredding) of excess trees (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, or it is burned.

4."Lop and Scatter", typically done during the felling phase, 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

Fuel reduction treatments are used to lower the volume of flammable brush and slash across all emphasis areas. Proposed prescribed burning occurs in conjunction with tree removal and without tree removal. Fire suppression capabilities are enhanced by modified fire behavior inside the WUI zones, Stragetically Placed Landscape Area Treatment (SPLATS) and Defense zones which enhances the ability of firefighters to suppress and control wildfires by providing a better measure of safety for the public and fire personnel. Proposed fuels reduction would involve using prescribed fire in specific areas within the Project Area, thinning of some overstocked plantations, emphasis area treatments (DEIS Map 2), and thinning from below.

[4] Biomass removal may require appropriated funds.

Upon completion of the tree removal work and follow-up preparation treatments, Forest Service personnel would apply prescribed fire to treatment areas by using either pile burning or understory burning of pretreated stands to reduce natural down woody fuels and remaining activity-created slash. Proposed underburn areas (RX 300 – 321) are displayed on Map 2. Portions of treatment areas RX303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320 and 321 are designated only for understory burning. A description of the acres of prescribed fire in the Project Area is located in Table 3. 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 only understory burning are planned to have two entries but in the post-harvest burn areas, only one entry is planned within the span (typically 10 years) of this NEPA document. Any further burning in these areas would require further environmental analysis. In the understory burning only area, 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 maintenance understory burning may be desirable 10 – 20 years in the future. Understory burning in untreated natural stands as well as treated stands are proposed for designated areas in both action alternatives. These alternatives were designed so that resultant 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).

1. ‘Thinning from below” refers to the removal of suppressed, intermediate, and some codominant trees to reach a prescribed stocking level to reduce ladder fuels and reduce the competition for resources like sunlight and water. The following techniques would be used:

2. “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. The increased fuel moistures and cooler temperatures used in understory burning (as opposed to broadcast burning) were chosen to to protect desired residual vegetation. Permission to burn is granted by the San Joaquin Valley Air Pollution Control District (SJVAPCD).

3. “Pile Burning” involves burning piles created by hand labor or tractors. Kraft paper may be used to protect an ignition point so piles can be burned in more cold and wet weather conditions. Permission to burn is granted by the SJVAPCD.

4. “Fire lines” involve 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 ridge tops and drainage bottoms with flowing water.

5. “Fuelbreaks” provide areas of fuels-modified along topographic features that would reduce the potential for an uncharacteristically large and severe wildfire and facilitate conditions that result in low-to-moderate severity wildfire. Fuelbreaks also provide suppression personnel a safe and accessible area to engage and contain a wildfire within a desired landscape.

6. “Biomass Removal” involves the removal of landing pile slash and/or the smaller precommercially thinned trees from the Project site (typically to an electrical generation plant).

7. “Mechanical (tractor) Piling” of fuels for burning involves using a tractor equippedwith a brush rake to pileslash concentrations. Except for firelines created around piles, at least 50 percent ground cover is retained during piling. Spot piling of slash concentrations may be needed in proposed underburn areas prior to burning as well as other treatmentareas.

Alternative 1

No Action

This alternative was developed based, in part of, using the "Indicators" for the significant issues #2, 3, and 9 where no tree removal, harvesting, mechanical and prescribed burning treatments are proposed under this alternative. Under the No Action alternative, current management plans would continue to guide management of the Project Area however no actions would be taken to implement those plans at this time or without additional environmental analysis. No restoration treatments would be implemented to accomplish project goals.

Alternative 2

The 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 in an attempt to restructure the forest and restore it to a resilient condition and protect communities from wildfire. The team also worked to minimize adverse impacts to resources in the Project Area that could result from changing weather patterns, drought stress, insect infestation, and wildfire. Design Criterias Common to All Action is incorporated as part of this alternative to address significant issues #4, 5, 6, 7, and 8.

In addition his alternative was developed to meet applicable landscape objectives consistent with the goals and objectives of the LRMP, as amended by SNFPA (USDA-FS, 2004) including:

1) Enhancement of shade intolerant (sun loving) trees through thinning by removing shade tolerant competing trees resulting in more light and less nutrient and moisture competition.,

2) Meeting habitat needs of sensitive species;

3) Reintroduction of fire to mimic historic forest structures and to reduce fuel loading and small diameter (less than 10 inches dbh) tree density to more pre-1900 levels;

4) Beginning to return stand structure and composition to more closely resemble historical conditions prior to railroad and other logging and increasing growth rates of residual trees to promote larger diameter, taller trees more quickly; and

5) Improvement of forest health and ecological resiliency through density management by thinning to promote resilience to changing weather patterns resulting in increased threats from insects, diseases, wildfire, and drought.

One of the resultant adaptive management studies is the Sierra Nevada Adaptive Management Project (SNAMP), which is currently conducting research concentrated on an area of the Bass Lake Ranger District west of the Whisky Ridge Project. Part of SNAMP research is focused on assessing potential impacts of fuels reduction treatments on the Pacific fisher and its habitat. Individual fishers have been trapped, fitted with radio-collars, and intensively monitored throughout the district as part of the SNAMP fisher project. As the Whisky Ridge project falls within suitable fisher habitat, knowledge gained from the SNAMP research has been utilized in the design of the Whisky Ridge project. This data includes: locations of all natal and maternal fisher den sites recorded by SNAMP 2008-2012, fisher home range data for distinct population years, and information on the types of trees used as dens and habitat characteristics surrounding den trees.

Alternative Description

Of the 18,285 total acres within the project boundary, approximately 9,200 acres would have some form(s) of treatment proposed (treatment areas). The remaining 9,085 acres have no treatments proposed due to slopes greater than 35%, standard and guideline limitations on treatment and/or no treatment is needed to meet the purpose and need.

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.

Specific acres of each type of treatment are displayed in the "Proposed Action" Section on page 7 in Chapter 1. A treatment area map (map 1) can be found in the Map Package. Treatments include:

Maintain or improve growth and vigor of pine, mixed conifer, and fir stands, as well as conifer plantations through density management to increase resiliency by beginning the process of returning treatment areas to conditions more closely resembling those present prior to the early 1900s. Enhance heterogeneity in forest stand structure at both the stand and landscape scale. This goal would be accomplished using a combination of precommercial (less than 10 inches dbh) and commercial (10 inches to less than 30 inches dbh) thinning of conifers utilizing mechanized equipment and hand thinning, dozer piling and prescribed burning treatments. Proposed vegetation treatments include commercially thinning from below pine, mixed conifer and fir stands. Understory vegetation would be precommercially thinned where needed.

Precommercially thin by hand or masticate densely stocked conifer aggregations/stands and release from brush competition is also proposed within treatment areas. Thinning would reduce stand densities mainly within the lower and mid-canopy levels of the treated stands Thinning treatments would increase the percentage and perpetuation of shade intolerant pines and oaks by reducing the number of competing incense cedar and fir.

Prescriptions for treatment areas would follow the principles outlined in the PSW-GTR-220 (North, et al. 2009) and PSW-GTR-237 (North, ed., 2012) including the removal of overrepresented shade-tolerant conifers mainly in the lower and mid-level canopy to provide discontinuity in fuels along both the horizontal and vertical fuel profile and increasing forest resilience. Stand densities would be varied based on aggregation of species composition and natural site conditions. Thinning would move stand structures towards the ecological restoration goals of restoring stand structures more consistent with that present prior to the 1900s. Proposed treatment prescriptions are covered in the Chapter 3, Forest Vegetation/Silviculture section.

Treat slash concentrations within commercially and precommercially thinned stands by a combination of tractor or hand piling and burning or mastication.

Allow for the reintroduction of fire as a process restoration tool. This goal would be accomplished by jackpot (spot), understory, broadcast, and/or pile burning to reduce natural and remaining activity-generated fuels. In some treatment areas prescribed fire would be the only restoration tool used to reduce natural fuels and connect other treatments together across steep or broken terrain that would not be treated with other methods. These treatment areas would generally utilize geographic boundaries (e.g. roads, creeks and meadows) and topographic features (e.g. ridges).

Initiate restoration of key terrestrial wildlife structures and improve wildlife habitat by maintaining and restoring key components that are utilized for shelter, reproduction sites, resting or food sources. Snags, coarse woody debris (CWD), oaks, and large diameter trees are some of the essential habitat components in the Sierra Nevada that are used by a wide variety of vertebrates and invertebrates for shelter, hiding cover, denning, nesting, resting areas and food sources. Methods used to restore these habitat components may include precise scattered snag creation by girdling or

topping trees, using prescribed fire—including high intensity fire—to create pockets of contiguous snags, and by felling and leaving trees as downed logs to increase availability of CWD. CWD and snag-creating treatments would be implemented under the direction and design of the wildlife biologist and the silviculturist within the Whisky Ridge project treatment areas.

***CWD**:* Where Common Stand Exam (CSE) inventory data shows that CWD is deficit at a landscape scale, trees 16 inch to 26 inch would be cut and left on the ground to increase tons/acre of CWD to desirable levels of 5-20 tons/acre. Methods to achieve this desired level of CWD may also include recruitment of CWD through prescribed burning treatments that would create some snags, which would eventually contribute to CWD levels.

Oaks: Growth and vigor of oaks would be promoted, where needed, by clearing overtopping conifers.

Snags: Where CSE inventory data shows a deficit of snags in the larger size classes (>15inch dbh), trees 16 inch to 26 inch would be identified for snag-creating treatments such as girdling and/or topping. Ideally, a mix of species of 4 per acres (S&G #11) would be identified for such treatments including ponderosa pine, incense cedar, sugar pine, and white fir. CSE inventory data would be utilized to determine the relative abundance of each tree species and snag-creating treatments would be implemented according to species abundance within the stand.

High Intensity Fire: A total of 22 prescribed burning units are planned for the Whisky Ridge project. Within the boundary of two of these prescribed burn units (as vegetative and topographic conditions allow), a smaller area of 5-10 acres has been identified for high-severity prescribed fire activity. These high intensity burn areas (Map 2 in DEIS Map Package) are located in Unit Rx310 (seven acres), and Unit Rx306 (ten acres). This element was added as part of the Proposed Action as a means of creating pockets of desirable snags and burned habitat for species such as the black-backed woodpecker that utilize recently burned areas for foraging habitat. This treatment would help contribute greater numbers of snags across the landscape level and create a mosaic of multi-seral stage habitats throughout the Willow Creek watershed.

Construct new fuelbreaks and maintain existing fuelbreaks. This goal would be accomplished through thinning, mastication, piling and/or burning.

Treat ladder and crown fuels (live and dead) to modify wildland fire spread and fire intensity levels. This goal would be accomplished by thinning of precommercial and commercial conifers, masticating and/or dozer piling and burning of dead and downed fuels. When needed prescribed fire would be utilized within treatment areas as a tool to reduce natural and activity-generated fuels through pile burning understory and/or broadcastburning. Fuels treatments within the WUI and SPLATS would be accomplished to modify intensity and rate of spread of wildland fires near communities and across the landscape.

Use integrated weed management to prevent and control infestations of noxious weeds and invasive non-native plants. This goal would be accomplished by hand pulling and/or prescribed burning of noxious weed patches: Prior to or during flowering: bull thistle, klamathweed, woolly mullein, and any other high-priority noxious weeds that appear in the Project Area prior to stand and meadow restoration treatments would be treated by non-chemical treatments. This work would continue for at least 5 years, as seeds of these species are present in the soil and the seed bank must be exhausted. Areas infested with noxious weeds where mechanized equipment would be used would be flagged for avoidance to prevent spread of seeds and contaminated soil to clean areas. If burning can be done at the proper time to control noxious weeds, and weeds are present in units planned for burning, weed control would be accomplished through burning in addition to hand-pulling.

Restore production and enhance vitality of culturally gathered plant material through vegetation management activities. This goal would be accomplished through the structural and process

restoration treatments that are included in this proposal (e.g.proposed prescribed burning treatment areas and meadow restoration).

Protect the historic values and characteristics of archaeological and historical cultural resources and improve their integrity by reducing fuels within prehistoric and historic cultural resource sites. This goal would be accomplished by hand thinning and piling, followed with prescribed burning and mechanical treatments. In coordination with the District Archaeologist, this project proposes to treat approximately 100 acres of dead and down fuels and vegetation within cultural resource sites, according to the unit prescriptions.

For prehistoric and historic cultural resources with heavy fuel loading, treatment measures by way of hand thinning brush and understory would utilize chainsaws to thin fuels. Brush would be piled for future burning outside site boundaries in prehistoric sites. Piles could be placed within historic sites, away from features, and only if there are no wooden components. Pile locations would be determined through coordination with the District Archaeologist, and where necessary, hand lines would be constructed around piles to contain fire.

For prehistoric cultural resources with heavy fuel loading, treatment measures by way of low-intensity burning through the cultural resource site may occur. Handlines would be constructed outside site boundaries where necessary to control direction of the fire, and would be done in coordination with the District Archaeologist and fuels personnel. Underburning would only occur in cultural resource sites with a potential for a low intensity fire focused on cleaning out the understory.

For prehistoric and historic cultural resources with heavy fuel loading, thinning of forest stands may occur through mechanical treatment. Should identified tree stands within cultural resources need to be thinned in order to meet forest stand health requirements, those trees that can be reached from outside the boundary of a prehistoric site by a feller-buncher would be cut and removed without disturbing the ground. In coordination with the District Archaeologist, mechanical equipment may enter an historic site to reach trees to be cut in areas with no observed cultural deposits or features.

Improve aquatic habitat and restore degraded meadow (e.g. meadows, streams, and riparian areas). This goal would be accomplished 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. This alterantive was designed 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 includes 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. Refer to Appendix B for detailed proposal.

Identify, improve, and maintain National Forest System Roads (NFSR) needed for the project and address NFSR identified for potential decommissioning or reconstruction in the Sierra National Forest Motorized Travel Management Plan (2010) within the Project. This goal would be accomplished by installing culverts, water barring, obliterating and rerouting short portion of FS roads. Segments of FS road would be reclassificed to Maintenance Level 1. This is proposed to be completed by blockage (by gate or other barrier), seeding with native vegetation and erosion control, Refer to Appendix C for detailed proposal.

Restore to site productivity unauthorized off-highway vehicle (OHV) routes previously identified in the Sierra National Forest Motorized Travel Management Plan (2010). This goal would be accomplished by barricading, sub soiling, water barring, and/or distributing downed logs to decommission routes and/or restore to site productivity (e.g. begin to return to natural conditions). Treatment could include; 1) barricade and sign both ends of the trail to prevent OHV riders from

using the trail; 2) subsoil the track to decompact the soils and allow regeneration of native vegetation; 3) construct adequate water bars to prevent surface erosion; and 4) distribute downed trees that are available in the surrounding forest. Proposed OHV routes to be commissioned are found in Appendix C.

Minimize resource impacts and improve facilities at Whisky Falls Campground. This goal would be accomplished through thinning and hazard tree removal as needed within the campground boundary, installing bear boxes using hand tools and replacing existing vault toilets. Missing or damaged barriers used to restrict vehicle access to prevent resource impacts would be replaced at each of the nine campsites. Bear boxes would be installed at each of the nine campsites using hand tools. Under this proposal, a pad approximately 4 inches to 8 inches in depth by 2 feet wide and 6 feet in length would be dug at each location to level the surface for a permanent concrete pad where the bear boxes would rest. This component of the alternative includes the decommissioning of the current wooden two seat vault toilet and replacement, at the existing toilet location, with a new Sweet Smelling Toilet (SST) housing a two seat vault toilet. Minimal clearance of vegetation would be required to accommodate the new vault toilet foundation which would cover approximately 6 feet x 11 feet square feet. Replace 2,640 linear feet of wooden parking barriers in existing locations to prevent unauthorized vehicle use from degrading campsites and to create designated parking areas. The proposal includes vegetation treatments within the Whisky Falls Campground to meet density management and public safety objectives through thinning and hazard tree removal as needed.

Manage scenery for the highest quality in areas significant to recreation and as seen from key viewing points from which the public views the landscape and are most sensitive to visual change.

This goal would be accomplished through piling, burning and stump cutting in areas that detract from valued scenic areas significant to recreation key viewing points (e.g., burn piles, landings, fuelbreaks, temporary roads, and cut stumps). Also treat areas to minimize ecosystem stressors (e.g., wildland fire, insect outbreaks), and dense vegetative conditions (e.g., excessively dense and even-aged stands) that would detract from the valued scenic character by implementing LRMP Standards and Guidelines (scenic integrity and scenic stability).

Alternative 3

Lower and Limited Mid-level Canopy Treatments, All Treatment Area

How this Alternative was developed

Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only very slightly address stand density and forest health objectives.

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) to fully address stand density and forest resiliency objectives. This alternative was developed based, in part, using the "Indicator" for the significant issue 1 where a higher degree of canopy cover would remain after the treatment and stand densities would remain higher because trees over ten inches would not be treated under this alternative as in the Proposed Action.

Alternative Description

In treatment areas with conifer plantations, fire/fuels objectives would be based on the need to break-up the continuity of crowns created by stands that are considered all one age (even aged). This includes the need to remove some material that would be considered non-commercial sized (i.e. less than 10 inches dbh). In treatment areas where wild stands occur (generally areas outside of plantations), the break-up of crown continuity would not be the main focus but treat fuel ladder to raise the canopy base (the average height of the bottom layer of branches) to fire/fuels objectives. Forest roads that were determined to not meet Forest Service standards would be brought back up to standard through maintenance or reconstruction. 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. Prescribed understory burning only areas would be completed as planned. Proposed fuels and other restoration treatments would be undertakenas funding became available. Fuels treatments would be prioritized by proximity to the WUI and implemented as funding became available.

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

In Alternative 3, the treatments include:

- Improve terrestrial wildlife habitat on approximately 4,635 acres by implementing coarse woody debris and snag-creating treatments, allowing for several areas of high intensity fire (five to ten acres) through prescribed burning to create pockets of desirable snags and burned habitat for species which utilize burned areas;
- Precommercially thin trees up to 10” dbh in mixed conifer, pine, and white fir stands on approximately 5,896 acres. This would be accomplished by hand or mechanical (mastication) methods;
- Plant and hand release treated openings within thinned and mastication treatment areas on up to 530 acres;
- Treat slash concentrations within precommercially thinned stands by a combination of tractor or hand piling and burning or mastication;
- Prescribe underburn utilizing fire only treatments areas on up to approximately 2,840 acres;
- Prescribe underburn within treatment areas on up to approximately 1,780 acres;
- Construct 2 and maintain 1 existing fuelbreaks on approximately1,187 acres;
- Improve and restore native plant communities important to local Native American tribes for traditional uses. This would be accomplished within the areas that are planned for prescribed burning and would 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;
- Stabilize physically degraded areas within meadows on approximately 16 acres;
- Restore degraded meadows by reducing encroaching conifers on approximately 30 acres;
- Restore hydrologic function through meadow stabilization by mechanical and hand thinning in Riparian Management Area (RMA) on approximately 72 acres;

- Improve aquatic wildlife habitat through physical in-stream channel stabilization, restoration of culvert function, road decommissioning and obliteration on section of road system approximately 2 mile area;
- Improve livestock distribution by installation of 4 off-site livestock water developments;
- Hand pull and/or prescribed burn of noxious weed patches on approximately 5 acres;
- Enahnce sensitive plant habitat (Rawson's flaming trumpet and mosses) on approximately 0.5 acres;
- Decommission and obliterate a section of approximately 0.2 miles of forest system roads and recreating access by reconstructing approximately 200 feet using existing forest system roads;
- Perform maintenance on approximately 65 miles of forest system roads;
- Perform reconstruction on approximately 33 miles of forest system roads;
- Construct 5 miles of temporary road;
- Restore site productivity to unauthorized off-highway vehicle (OHV) routes totaling approximately 9 miles;
- Improve facilities at Whisky Falls Campground by installing 9 bear boxes and decommission and replace existing vault toilet at campsites, and
- Remove hazardous trees on approximately 4 acres at Whisky Falls Campground to meet density management and public safety objectives.

Design Criteria Common to All Alternative

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 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.

Air Quality

1. Avoid cumulative impacts to air quality by coordinating prescribed burning activities within the Forest, with burning activities conducted by others (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 (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 (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 (LRMP 1992 S&G # 219).
5. Obtain appropriate permits prior to conducting prescribed burning activities (LRMP 1992 S&G # 220).
6. Incorporate air quality management considerations into fire management (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.

Aquatics Wildlife

In addition to the Forest Service standards and guidelines previously detailed that would be applicable to the Whisky Project. The following design measures would be implented to aquatic/riparian habitat:

1. Streamside Management Zones (USDA - Forest Service 1992 (S&G 33 and 71); USDA Forest Service 2000 (BMP 1-8)) are mapped in the Project Hydrology Report. Class I SMZs are within or adjacent to treatment areas: H-147, H-501, H-502, H-505, M-402, M-403, M-404, RX-302, RX-305, RX-307, RX-308, RX-311, RX-313, RX-314, RX-317, RX-318, RX-319, RX-321, T-112, T-114, T-121, T-122, T-124, T-126, T-130, T-131, T-132, T-137, T-138, T-141, T-142, T-145, T-149, and T-152. Activities within Class I streams are identified under the Old Forest Linkage Prescription under Terrestrial Wildlife (100 foot zone).

   No heavy equipment would enter the Class I SMZ (100 feet).

   Hand treatments of non-merchantable trees could be implemented within the outer 50 feet of the Class I SMZ, although piled material should not be left within 50 feet.

2. Specific to western pond turtle: Class I occupied (USDA - Forest Service 1992 (Forest wide goal and objective 9, S&G 40): Known sites in the aquatic analysis area. Habitat in units M-406, T-100, and T-101 would apply the Old Forage Linkage prescription.

   Project activities occur between June 15th and October 1st.

3. Special Aquatic Features (USDA - Forest Service 2004 (S&G 91): Do not allow heavy mechanical equipment within 100 feet of meadows or other special aquatic features, except for meadows identified for restoration (heavy mechanical equipment limited to 50 feet from meadow edge). Includes treatment areas: H-502, M-400, RX-301, RX-303, RX-305, RX-306, RX-307, RX-308, RX-310, RX-311, RX-312, RX-314, RX-316, RX-317, RX-318, RX-319, T-105, T-107, T-108, T-109, T-112, T-113, T-114, T-122, T-124, T-125, T-126, T-133, T-135, T-136, T-137, T-138, T-139, T-140, T-141, T-142, T-143, T-151, T-152, T-153, and T-157.
4. Applicable to all SMZs:
   - To protect bank stability, do not cut stream bank trees (trees with drip line extending to or over edge of stream bank).
   - Do not cut any tree located within a channel.
   - When lighting piles, start burn from one end only to allow escape route for any species inhabiting piles.
   - No prescribed fire lighting into SMZs, but fire can creep into zone.
5. For water drafting (USDA - Forest Service 2000 (BMP 2-21), use a screened intake device and pumps with low entry velocity 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.
6. The following Best management Practices (BMPs) (USDA – Forest Service 1983; 2002; 2012) requirements are designed to address the watershed management concerns. All applicable water quality BMP's would be implemented. A list of BMP's used within the Whisky project is as follows (See Project Hydrology Report: Stone 2012 for details):

   1.1 Timber Sale Planning Process

   1.2 Timber Harvest Unit Design

   1.3 Surface Erosion Hazard Determination for Timber Harvest Unit Design

   1.4 Use of Sale Area Maps and /or Project Maps for Designating Water Quality Protection Needs

   1.5 Limiting Operating Period of Timber Sale Activities

   1.6 Protection of Unstable Lands

   1.8, 1.19 Streamside Management Zone Designation, Streamcourse and Aquatic Protection

   1.9 Determining Tractor Loggable Ground

   1.10 Tractor Skidding Design

   1.12, 1.16 Log Landing Location, Log Landing Erosion Control

   1.13, 1.17 Erosion Prevention and Control Measures During Timber Sale Operations,

   Erosion Control on Skid Trails, and Fuels Treatments

   1.18 Meadow Protection During Timber Harvesting

   1.20 Erosion Control Structure Maintenance

   2.1 and 2.2 General Guidelines for the Location and Design of Roads and Erosion Control Plan

2.3 Timing of Construction Activities

2.5 Road Slope Stabilization Construction Practices

2.7 Control of Road Drainage

2.8 Constraints Related to Pioneer Road Construction

2.11 Control of Sidecast Material During Construction and Maintenance

2.12 Servicing and Refueling of Equipment

2.13 Control of Construction and Maintenance Activities Adjacent to SMZ's

2.16 Stream Crossings on Temporary Roads

2.17 Bridge and Culvert Installation

2.20 Specifying Riprap Composition

2.21 Water Source Development consistent with Water Quality Protection

2.22 Maintenance of Roads

2.24 Traffic Control During Wet Periods

2.26 Obliteration or Decommissioning of Roads

6.2 and 6.3 Consideration of Water Quality in Formulating Fire Prescriptions and Protection of Water Quality from Prescribed Burning Effects

Botany

Revegetation and Seeding using Native Plants

Any seeding for erosion control or any other purpose would use locally native plant species approved by the Forest Botanist or the Assistant Forest Botanist as outlined in the Region 5 Native Plant Policy (USDA Forest Service, 1994).

Forest Service Sensitive Plants

SNF 1992 LRMP S&G #s 67 and 68, SNFPA 2004 ROD S&G # 125.

1. Flagging for sensitive plant avoidance would be done using white and lime-glo flags tied together.
2. Stretches of stream identified as Essential Habitat for Rawson's flaming trumpet (*Collomia rawsoniana*) (SNF 1992 LRMP, S&G # 33) would have a Riparian Management Area of 150' rather than the usual 100' SMZ where no heavy equipment is permitted (see hydrology design criteria). Essential Habitat includes reaches of Whisky, Gertrude, Owl, Roush, Peckinpah, and Browns creeks (see Botany BA/BE). However, the RMA of 150' may be reduced to 100' by the Forest Botanist in treatment units where there is no flaming trumpet present in the outer 50'.
3. Any Rawson's flaming trumpet populations outside of SMZs, RMAs, or proposed meadow periphery treatments related to flaming trumpet enhancement and meadow restoration would be flagged for avoidance with a 50' buffer unless a different approach is approved by the Forest Botanist.

4. In areas where Rawson's flaming trumpet grows at the meadow periphery and mastication treatments are proposed, flaming trumpet would be flagged for avoidance prior to mastication work and the contractor would be made aware of the areas to be avoided.
5. The Kellogg's lewisia (*Lewisia kelloggii*) populations on the open granitic and/or gravelly areas between plantation units 228 and 236 and south of unit 236 would be flagged for avoidance. The gravel and rock areas would not be driven through for project implementation (except on existing system roads) nor used for parking of vehicles, heavy equipment nor used as log landings.
6. Open, rocky / gravelly habitat in RX burn units 306, 307, and 308 would either be surveyed for Kellogg's lewisia and Yosemite lewisia (*L. disepala*) prior to implementation so that any plants present can be flagged for avoidance, or the absence of plants can be documented. If surveys have not been conducted, areas where vehicles used to conduct the prescribed burning can park and drive would be limited to previously disturbed areas to the extent practical to ensure that habitat for these rare plants is not damaged, and dormant plants are not killed by vehicles or equipment.
7. An equipment buffer of 100 feet would be flagged around the population of the extremely rare brook pocket-moss (*Fissidens aphelotaxifolius*) on Owl Creek upstream of Road 7S08 to prevent any disturbance to the stream habitat or any degradation of the surrounding uplands that might affect the stream.
8. Known Forest Service Sensitive plants in meadows and fens to be restored would be flagged for avoidance (e.g. Bolander's bruchia, *Bruchia bolanderi* in China Meadow), other meadows would be surveyed for Forest Service Sensitive mosses and vascular plants prior to commencement of meadow restoration work and any Sensitive Plants would be flagged (USDA FS 2004, S&G 125). The exception would be in areas where trees are being thinned at meadow peripheries to enhance Rawson's flaming trumpet.
9. Road crossings with streams containing the veined water lichen (*Peltigera gowardii)* occurring within 50 feet of the road would not be used for drafting of water (e.g. Browns, Owl, Whiskey Creeks).
10. The short leafed hulsea (*Hulsea brevifolia*) occurrence at the south edge of Rx Burn unit 309 along Road 7S02 would be flagged for avoidance. Burning during the dormant period for this plant (fall) would be acceptable but ground disturbance by vehicles and heavy equipment must be avoided.

Noxious Weeds

SNFPA 2004 ROD S&G # 38 and 39; USDA Forest Service FSM 2900, Timber Sale Contract Clause B.6.35.

1. All heavy equipment used for implementing the project would be washed before arriving on site to remove soil and seeds of noxious weeds.
2. Noxious weeds within the parts of the project area proposed for treatments and along access roads would be hand-pulled prior to treatments as time and funding allows; but infestations would be flagged for avoidance whether or not they have been hand-pulled first (to ensure that the contaminated soil is not spread by tires if vehicles or equipment park or drive on infested sites). Flagging would be bright orange with the words "noxious weeds" in black.
3. Any erosion control material used for meadow restoration or road reconstruction must be noxious weed free: Either certified weed free or inspected by the Forest Botanist prior to purchase from a local source (e.g. hay and straw

4. Any fill or gravel material used for road reconstruction or armoring of roads must be free of noxious weed seeds. This may require certification by the Forest Botanist or another professional knowledgeable about BMPs regarding weed spread via mineral materials (Cal-IPC, 2012)

Cultural Resources

Cultural resources would be protected through implementation of Standard Protection Measures found in the Regional Programmatic Agreement (PA), the primary protection measure being avoidance for all project activities, including resource design criteria.

The following design criteria are applicable to the Whisky Ridge Ecological Restoration Project:

1. All cultural resource sites within treatment areas and proposed project activities would be delineated prior to implementation.
2. The District Archaeologist would approve landings, borrow sources, and temporary roads prior to Project implementation, as needed.
3. Harvest activities of potential hazard trees within and immediately surrounding the Whisky Falls Campground would avoid historic campground features and be implemented in accordance with Standard Resource Protection Measures found in the Regional PA.
4. All repairs/replacements to campground, recreation (i.e., trails), and special use facilities, if damaged during project implementation (see design features for Recreation, Lands, Special Uses), would need to be approved by the District Archaeologist prior to repair/replacement and may require consultation with the SHPO prior to repair/replacement.
5. The District Archaeologist would be consulted for movement of equipment across and repair of designated trails (see design features for Recreation, Lands, Special Uses), prior to project implementation and subsequent repair, and may require consultation with the SHPO prior to implementation.
6. There may be cultural resource sites within or surrounding Watershed Improvement Needs sites. If they are currently eligible or unevaluated for inclusion on the National Register of Historic Places, they must be treated as eligible. To mitigate the potential adverse effect, a determination of eligibility would be conducted for these sites and any adverse effects mitigated prior to project implementation.
7. Treatment of gathering areas, if identified, would be coordinated with the District Archaeologist prior to treatment implementation.
8. Road maintenance and reconstruction activities on historic railroad grades converted to FS system roads would be reviewed and approved by the District Archaeologist prior to contract preparation and would comply with the following:
    a. Brush disposal piles generated during roadside clearing would not be piled within archaeological sites or within or near features of historical sites;
    b. Equipment would not park or drive on railroad features (e.g., berms, through-cuts) nor turn around outside existing turn-outs on system roads;
    c. No widening of existing road templates;
    d. All blading would remain within existing road prism;
    e. Equipment would not cut into side banks or berms;

f. Through-cut feature would remain intact and would not be cut off at either end. Bladed material would be pushed past the feature and then off the road;

g. No placing lead-off ditches through berms, through-cuts, or other features;

h. When cleaning culverts or drainages, existing headwalls would not be impacted. Drainage structures would be accessed only where there are no existing railroad features;

i. Any existing features that require work would be re-built with in-kind material and design.

Should any adverse effects to the historic railroad system be anticipated, the SNF would follow number 11 below.

9. 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.

10. 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 would 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 would be constructed around piles to contain fire.

11. 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.

12. 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 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.

13. An archaeologist would monitor all fuel reduction activities within and around cultural resource sites during implementation.

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 Forest Plan. 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). This would be accomplished through road reconstruction activities and project road maintenance plans.

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). Field reviews would be scheduled with the Hydrologist, Archeologist and Timber Management Officer.

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.

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; RX 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320 and 321 after structural restoration treatments have been completed. RX 300 and 312, portions areas of RX 301, 304, 306, 311, and 313 underburning would be the initial treatment. Other prescribed fire treatment areas and units needed to treat other resource needs are 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 would 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. 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.
4. 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.

5. Each resource specialty would be involved in review of and finalizing the prescribed burn prescription in the prescribed burn plan to ensure the modeled fire effects would meet their resource objective or would not create conditions that are outside of the guidelines from the SNFPA ROD (USDA-FS 2004b) Standards and Guides.

For the post-harvest slash reduction needs the following criteria would be utilized to reduce and break up continuous concentrations.

1. Following the completion of timber harvest each area would be inspected by field visits to prioritize the need for slash treatments.

Plan for any spot piling needs to be completed after all post-harvest precommercial ladder fuel thinning to minimize extra equipment entries over the landscape.

Forest Vegetation/Silviculture

1. A 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.

To minimize damage to the residual stand, such as loss of canopy and hiding cover and reproduction needed to maintain stand structure and down logs, initial underburning in T stands should only be undertaken during the spring when duff and down log moisture content is high and before actively growing trees become susceptible to excessive damage. Where concentrations of existing and/or created slash are present, spot piling may be needed prior to burning. The Silviculturist and Fuels Representative would coordinate underburning areas prior to undertaking underburning.

To minimize the potential for regeneration of brush species, masticated brushfields would not be burned unless coordination with the Silviculturist has been completed.

To minimize damage to the residual stand and loss of plantation financial investment, underburning would be excluded from the following plantations located within proposed underburn treatment areas unless the Silviculturist determines underburning in a given plantation is acceptable:

- Plantation 236 in Rx309
- Plantation 237 in Rx310
- Plantation 231 in Rx308
- Plantations 224, 225, and 226 in Rx307
- Plantation 223 in Rx306
- Plantation 214 and 216 in Rx304
- Plantations 240, 241, 242 in Rx311
- Plantations 238, 239, 244, 249, 250, 252, and 253 in Rx312
- Plantations 208, 204, 205, 203, 202, and 201 in Rx303
- Plantation 263 in Rx318

To minimize damage to the residual stand during slash piling, tractor size should be limited to a D-5 or smaller size tractor.

Geology/Soils

1. Maintain a 100 foot wide buffer of 90% soil cover below rock outcrops that have the potential to generate runoff into management activity areas and cause erosion. These areas include those mapped out as potential rock outcrop sites and any areas ¼ acre or larger. (FSM 2500 – Watershed and Air Management, Chapter 2550 – Soil Management)
    a. Treatment units with potential rock outcrop greater than 10% of their total area include T100, T101, T105, T107, T108, T112, T113, T118, T119, T123, T125, T127, T134, T138, T139, T140, T143, T146, T148, T149, T150, T152, T153, T156, T157, T158 and T160.
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). “Maintain 90% of the soil porosity over 85% of an activity area (stand) found under natural conditions.” (FSM 2500 – Watershed and Air Management, Chapter 2550 – Soil Management)
3. Subsoil and water bar skid roads and trails in areas where soil compaction exceeds 15% of a treatment area. (FSM 2500 – Watershed and Air Management, Chapter 2550 – Soil Management)

b. 2% of the pre-treatment soil transects showed soil compaction

4. Except for mastication, limit mechanical operations, where sustained slopes exceed 35%, except where supported by on-the-ground interdisciplinary team evaluation. (LRMP S&G 125)

   c. Treatment units with some areas above 35% include T101, T102, T105, T109, T110, T111, T112, T113, T116, T128, T130, T132, T133, T142, T144 and T149.

5. Maintain 50% soil cover over all treatment areas. Where shrub species predominate, attempt crushing prior to piling to create small woody fragments left scattered over the site for soil cover and erosion protection. (LRMP S&G #130)

   d. Pre-treatment average soil cover was at 97%

6. Maintain at least five well-distributed logs per acre as large woody debris (LWD) representing the range of decomposition classes. (SNFPA ROD S&G 10)

   e. Pre-treatment average for the Project Area was 17.10 pieces of LWD per acre

7. Provide for road surface stabilization (gravel) on roads over 5% grade that are located on sensitive soils and are affecting soil productivity and/or water quality. Sensitive soils include; Auberry, Holland and Ultic Haploxeralfs soil families. (SNF- LRMP S&G #129).

   f. Roads located on sensitive soils requiring potential road surface stabilization include 8S27, 8S27B, 8S27C, 8S27D, 8S09 to the junction with 7S07 and 8S09A.

8. Limit tractor piling in those watersheds where CWEs are a concern and use a grapple piler, especially on slopes >25%. (LRMP S&G 120).

   g. Treatment units with a CWE concern in subdrainage 504.1002 include; T112, T113 & T114.

9. Limit mastication treatments to slopes that are 50% or less.

   h. Limit soil displacement and reduce the risk of soil erosion by smoothing or water barring the ruts or trenches, exceeding 6 inches in depth and 25 feet in length on slopes exceeding 35%.

   i. Limit mastication operations to time periods where soils are sufficiently dry to prevent rutting and/or compaction by a single pass of the equipment.

   j. Treatment units with some areas above 35%, include M400, M401, M402, M403, M404 & M406

OHV Route Restoration

Those routes selected for route decommissioning within the Whisky Project Area can have one of the following four design measures/mitigation measures.

1. No action
2. Barricade and sign both ends of the trail to present use.
3. Subsoil the track to de-compact the soil and allow regeneration of native vegetation.
4. Construct adequate water bars to prevent surface erosion.
5. Distribute down trees that are available in surrounding forest on route surface.

Hydrology - Meadows

Design Criteria for Meadow Periphery Buffer Treatments:

1. Mechanical thinning would occur within the 100 foot meadow Riparian Management Area (RMA) around selected meadows adjacent to areas proposed for structural restoration (units). Proposed treatments within the meadow RMA would follow Wildlife-Silvicultural prescriptions, including:
2. Mechanical equipment would be allowed in the outer 50' of the 100' meadow buffer where slope gradients are less than 15%.
3. Mechanical equipment, except for masticators moving over their own slash, would not be allowed to turn in the meadow buffer. Ingress and egress of mechanical equipment, except masticators, would be on the same path within the 100' meadow buffer.
4. Soil disturbance in the RMA that is greater than or equal to 10 feet long and six inches deep in top soil (as opposed to litter or duff) would be immediately rehabilitated by hand restored to replace soil and provide a minimum of 50% ground cover.
    a. Hand thin trees <12" diameter in inner meadow buffer where mechanical equipment cannot reach.
    b. Masticators would be allowed to track and turn in the outer 75' of the 100' buffer if:
    c. Masticators are moving over their own slash
    d. Masticators are working on slopes less than 15%. Slopes exceeding 15% would require review by the district hydrologist, fisheries biologist, or soil scientist.
5. Mechanical thinning would occur where treatment units are proposed, adjacent to the meadow RMA, in the outer 50' and as far as the equipment can reach within the inner 50'of the RMA (see Meadow Implementation Plan). Slash would have a similar treatment in the RMA, as in the adjacent fuel treatment unit, prior to burning. Areas within the meadow RMA where hand thinning is conducted would be hand piled and burn where prescribed fire is proposed.
6. In areas where aspen are located within the meadow RMA, conifers greater than 12 inch diameter located within 50 feet of aspen would be hand thinned using stand treatment Wildlife-Silvcultural prescription, and the boles and limbs would be lopped and scattered and slash would be jack pot burned.

Design Criteria Common to all Meadow Treatments and 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. To ensure ample perching/foraging posts for great gray owls within meadows proposed for restoration, the terrestrial biologist would survey areas where encroaching conifers are intended for removal, prior to project implementation and may require retention of several young trees per meadow acre. Additional conifers with associated shrubs such as azalea and vaccinium growing at the base of the bole may also be flagged for retention to provide nesting habitat for migratory song birds throughout the meadow.
3. No trees greater than 12" dbh would be felled and all conifer removal would be done by hand.
4. Selected cedar and/or fir trees within the project meadows (>12 inch dbh) may be girdled for snag creation if the area is deemed snag deficient.
5. Trees less than 6-feet tall would be cut and left in place; trees greater than 6-feet tall would be bucked and limbed in place and the slash left to dry for a minimum of six weeks and then piled and burned if not used for restoration.

6. In all cases, native herbaceous vegetation (e.g., sod) removed during restoration activities would be saved and preserved for later planting.
7. Where appropriate, restoration sites would be planted with native Willows to expedite and enhance the soil stabilization process. Willows would be harvested locally from the same meadow(s) or meadows in the same watershed and at the same elevation range.
8. Water would be dammed and diverted around the restoration areas during construction. This would be done either by pumping the water using a portable fire pump or by gravity draining impounded water using a 10inches flexible corrugated pipe. Diverted water would be put back into the channel at the bottom of the meadow.
9. A watering system would be devised to ensure that newly re-vegetated areas become established as soon as possible.
10. If rock is used in the restoration structures, it would come from local forest stock piles. Currently rock comes from the tunnel talus at Powerhouse 8 off Forest Road 8S03.
11. All heavy equipment (if used) would be washed before and after each project.
12. Refueling of equipment would follow SNFPA-RCO#1-99, which requires that storage of fuel and refueling occur at least 100 feet from any riparian area (spill kit required onsite during implementation).
13. Ingress 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 where the soil is relatively dry, and in all cases, ¾-inch plywood and/or ½-inch polyethylene tread 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.
14. Any ingress routes enlarged and/or created for equipment to access 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.
15. As appropriate, meadow restoration sites would have a livestock exclosure for three to five growing seasons to ensure vegetative recovery and prevent damage to the restoration structures.

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 delibartely killed, destroyed or removed. Riparian vegetation includes but is not limited to the following species:
    - Maples (Acer spp)
    - Alders (Alnus spp)
    - Dogwoods (Cornus spp)
    - Poplars, cottonwoods, aspens (Populus spp)
    - Oaks (Quercus spp)
6. Enough streamside shading would be maintained so as not to adversely affect the existing temperature regimes (confer with the Aquatic and Fisheries Program biologist for more information and guidance for shading requirements).

Stream Crossings:

The greatest potential under all action alternatives 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 E) would further ensure that hydrologic connectivity in streams and special aquatic features not be adversely affected by the Proposed Action or Alternative 3.

Hydrology – Water Quality

Forest policy and regulations to protect water quality and ensure watershed health are detailed by Best Management Practices (BMP's) described in the FSM 2509.22 - Soil and Water Conservation Handbook Chapter 10 - Water Quality Management Handbook, (USDA, 2011), the Riparian Conservation Objective Standards and Guides as set forth in the Sierra Nevada Forest Plan Amendment (USDA, 2004), and the Sierra National Forest Land and Resource Management Plan (USDA, 1991). General project BMPs with their correspondence design measures are listed in Appendix E.

Soil and Water conservation Practices Handbook, Sierra National Forest Supplement No.1, (FSH2509.22) provides standards for the establishment and management of Streamside Management Zones (SMZ's). Included is the incorporation of RMA's and their functional/hierarchical relationship to SMZ's (All stream courses in the Project Area would be protected and assigned SMZ's. 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 1).
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 4th order ephemeral draws. All treatments should be laid out to utilize designated and/or existing crossings.

Table 1. Summary of SMZ 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

Ground disturbance from mechanized equipment in Tractor Units (T) 112, 113, 114 should be minimized due to sensitive watershed conditions. Harvest methodologies should employ a "light-on-the-land" approach such as CTL, feller-buncher, whole tree yarding, and grapple piling.

Lands and Special Uses

A number of the proposed activities may affect areas under special use permit. Special use permits located within the Project Area are identified in the Lands and Recreation Specialist Report. The District Lands Officer would work with permit holders to ensure authorized special use permit sites are clearly identified and visible during Project implementation. The following design criteria would allow the Forest Service to meet commitments specified in special use permits:

1. Prior to project implementation, the District Lands Officer would notify permit holders, in writing, of Forest Service activities planned for implementation near their improvements.
2. The District Lands Officer would ask permit holders to identify on the ground location(s) of their authorized improvements and/or special use permits sites so they are clearly visible during project implementation. As agreed upon with managers responsible for implementation, permit holders may identify their improvements by using a combination of flagging and surveying stakes. Permit holders would be encouraged to print their name and contact phone numbers on the flagging/stakes with indelible ink that is capable of lasting several years.
3. Improvements (roads, utilities, etc.) authorized under special use permit that are damaged by contractors, operators or force account crews during project activities would be repaired by the contractors, operators or force account to pre-project conditions.
4. All improvements under special use permit, such as utility corridors, would be crossed at designated crossings to avoid damage.
5. Sale Administrator would notify the District Lands Officer as soon as possible if apiary sites would be needed for project activities (i.e. landings). Permit holder would be notified in writing, by the District Lands Officer, as soon as possible if an apiary site is needed for project activities. Upon notification, an alternative temporary apiary site may be proposed by the Forest Service to the permit holder, if possible.
6. If an apiary site would be used for project activities, the site would be cleared of project debris and brought back to pre-project condition.

Range

The Rangeland Management Specialist would coordinate with the Contracting Officer and/or Sale Administrator regarding the timing of vegetation management activities (e.g. fuel break and mastication contract work) that would be conducted in proposed treatments areas adjacent to the stockdrive, which starts at FR8S041 to FR8S027 to FR8S027C and includes Route Numbers 23E297 and 23E272 up towards Mormon Hill ending at the junction of Route Number 23E272 and FR7S007F. The stockdrive includes the following proposed treatment areas: T105, T111, T112, 270, 271 and M405). This coordination is necessary to avoid conflicts with the permitted use of this area under term grazing permit. The stockdrive is used to move cattle from the Castle Peak Allotment up to the Haskell Allotment in early July and for gathering in mid-late September.

Recreation

Developed Campgrounds

The Forest Service operates 1 developed campground, Whisky Falls, in the Project Area;

In Whisky Falls campground:

1. To avoid conflicts with Forest visitors, a quarter-mile limited operating period (LOP) on harvest activities would be established around the Developed Campground during peak season months from May 1st through September 30th for the affected areas.
2. Outside the LOP and contingent upon the safety of the public, developed campgrounds would be fully accessible to the public on weekends.
3. Stump cuts would be flush cut to ground and treated with borax.

4. Slash or fuels treatment would be timely and completed to ensure the developed campground is clear of accumulated slash, limbs and cut 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

Several heavily used, popular dispersed recreation sites are included within the Project Area, but would not be limited to any prescribed treatment. All of which are accessible along 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.

Off Highway Vehicles (OHV) designated Concentrated Use Area (CUA)

There are two designated OHV CUAs within the Project Area. They are the Whisky Staging (2.3 acres) and Gertrude E and W Parking (.19 acres).

1. Area boundaries would be delineated on the ground by Recreation OHV staff using orange/black striped flagging and/or brown fiberglass carsonite posts.
2. The designated CUAs would not be used for landings or staging of equipment.
3. Public safety would be the priority.
4. Vegetation treatment near boundaries would maintain desired visual and recreational characteristics; screening foreground to site, with a natural appearing state.

Designated Motorized Trails

1. Some designated motorized trails in the Project Area may be used on an “as needed” basis for timber operations i.e skidding, hauling, or moving equipment. Coordination with Recreation OHV staff prior to timber harvesting activities is necessary. 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. During project activities, access to the designated trails would continue contingent upon the safety of the Forest visitor.
8. A as a result of project activities, any damage to designated trails or associated trail head facilities, such as trail treads, bulletin boards, or barriers would immediately be repaired or replaced to pre-project condition.

Terrestrial Wildlife

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)
- (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 unless they are a direct hazard as defined below in number 4. (SNFPA ROD, pg. 50).
3. Protect all suitable fisher denning habitat with a (LOP) restricting vegetation management activities from March 15 through June 15. 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, comprise fuel break integrity, 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 may be felled within designated fuel breaks where they threaten the integrity of the fuel break, but would adhere to S&G #11 by retaining four of the largest dbh snags per acre. Snags not meeting these criteria would 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 would be retained. These large tree groups would generally 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, would also provide extensive areas of tree group retention as no treatments would 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 would not be available for commercial entry.

7. Conifers with structural decadence, and/or the potential to become future 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 would 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. Black oaks would be retained throughout the Project Area. Within the treatment areas, conifers would be removed that overtop black oaks 10 inches dbh and larger, 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 would be limited by the overall basal area thinning prescription thresholds. Conifer canopy gaps created through this process not only help promote and retain the vigor of black oaks, but also create habitat heterogeneity. A different treatment method would be applied to older, decadent oaks within the treatment units. These older oaks, generally with visible cavities, represent potential fisher and owl denning or nesting sites. Hiding cover such as shrubs, small trees, and down woody material would be retained around these cavitary oaks. These oak retention areas would 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 plantation treatment areas larger than 5 acres by creating 1/10 acre openings associated with young black oaks between 4" and 12" dbh, where present, on an average of 1 for every 5 acres 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. Species diversity would be increased by selecting vigorous conifer species other than

ponderosa and Jeffrey pine for retention during thinning where present. Hardwoods are not planned for removal. (S&G #3; #26).

10. Shrub and understory diversity would be retained throughout the Project Area. Understory vegetation would be maintained in Old Forest Linkages associated with riparian areas (cooler, moister sites—RMAs); 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 are not planned for removal. Post sale treatments would retain pockets of understory growth spread throughout the treatment units so that 15-20% of the total understory growth would be maintained in 1/10 acre pockets within plantation and wild stand treatment units. This would preserve stand diversity while decreasing the threat posed by ladder fuels.
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. Temporary roads and skid trails necessary for project implementation would be 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 2 and Figure 1.

Table 2. 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.

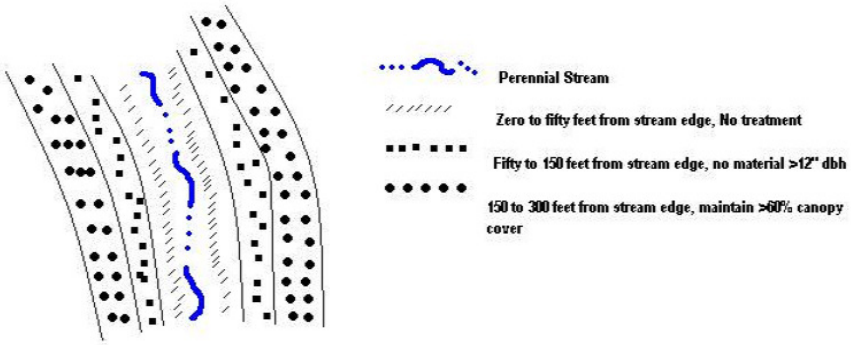


Figure 1: Associated Bounds and Treatments within Old Forest Linkages

Visual Resource

These scenery design features include:

1. Control lines would follow natural contours whenever possible. Underburning operations within view of designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking designated concentrated use areas (CUAs) would be low-intensity to minimize the amount of overstory mortality and tree scorching. Islands of unburned vegetation would be retained in some areas to create mosaic vegetative patterns, increase visual interest and attract wildlife. The edges of the islands would be irregularly shaped, feathered and undulated to create a near-natural appearance.
2. Thin, pile, and burn precommercial thinning slash concentrations within view (up to 150-feet) of FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs prior to underburning to reduce understory fuels and mitigate visual disturbances of the prescribed fire.
3. Upon completion of the underburning treatments, the District Fuels Specialist would consult the Landscape Architect to select remaining dead trees/shrubs to be cut within view (up to 150-feet) from designated motorized trails (only from sensitive viewing points along motorized trails that would be determined in the field by the Landscape Architect), FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs. Efforts would made to cut, pile, and burn these dead trees/shrubs slash concentrations within one year after completion of underburning treatments or as soon as possible.
4. Tree stumps that are within view (up to 150-feet) of FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs would be cut as low to the ground as site conditions (e.g., terrain, rock outcroppings) allow but not to exceed 6-inch heights from the uphill side.
5. Burn piles within view (up to 150-feet) of designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs would burn with more than 90 percent consumption. If 90 percent consumption is not reached (and the remaining fuels still meet the fuels objectives), the remnant slash would be scattered. Efforts would be made to burn these

piles within three years or as soon as possible during low-use recreation season to reduce impacts to forest visitors. Avoid burn piles within Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs, unless approved by the Sales Administrator after consultation with the Landscape Architect.

6. Landings within view (up to 150-feet) of designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs would be restricted to occur within existing openings whenever possible and landing sizes would be minimized. The edges of the landings would be irregularly shaped, feathered and undulated to create a near-natural appearance and mimic the natural openings in the surrounding landscape. Efforts would be made to burn the landing piles within three years or as soon as possible during low-use recreation season to reduce impacts to forest visitors. Avoid landing piles within Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs, unless approved by the Sales Administrator after consultation with the Landscape Architect. Upon completion, landings would be cleaned-up and restored using BMPs such as BMP 1.12 Log Landing Locations and BMP 1.16 Log Landing Erosion Protection and Control.
7. Where possible, in those areas where skid trails and/or fuel break lines are within view from designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs, the skid trails and/or fuel break lines would be covered with slash to minimize visual impacts. The following BMPs associated with skid trails, BMP 1.10 Tractor Skidding Design, BMP 1.17 Erosion Control of Skid Trails would be applied.
8. Within view (up to 150-feet) of designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use areas including Camp 5, and Whisky Staging and Gertrude E and W Parking CUAs, previously constructed temporary roads would be re-opened whenever possible. Temporary roads would be constructed in a manner that closely duplicates the existing contour lines, with a minimum degree of landform alteration limiting the amount of earthwork. Excessive cut and fill slopes for road construction would be avoided. Straight linear road construction, rock outcrops, and/or sensitive areas would be avoided. Upon completion, where the road access is no longer necessary to implement the project, the temporary roads would be restored using BMPs such as BMP 2.2 General Guidelines for the Location and Design of Roads and BMP 2.7 Road Decommissioning. The temporary roads would be closed with naturally-shaped earth mounds, native boulders, or logs to discourage use.

Monitoring Plan

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.

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.

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 would occur during implementation of treatment within cultural resource sites. Monitoring would occur post-implementation to assess potential effects from increased access to and visibility of cultural resources as a result of mechanical treatments, prescribed burning operations, and recreational activities and from potential unauthorized motorized use on linear cultural resource sites. Monitoring would 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.

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.

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. Ten soil transects have been established in the Project Area to determine existing soil conditions. Two 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 decommissioned OHV routes would determine the effectiveness of the decommissioning and closure of these routes. The routes chosen for monitoring would be the most detrimentally impacted routes discovered during conditions assessments. Monitoring would be conducted using the same protocol as the original field assessment, the GYR OHV Monitoring Protocol.

Hydrology/Water Quality

A re-survey of the 2012 Whisky Creek Stream Condition Inventory (SCI) plot (located at UTM NAD83 11N, Easting 0283253, Northing 4127781) should be done five years after project implementation to determine watershed condition. The purpose of the SCI protocol is to collect intensive and repeatable data from stream reaches to document existing stream condition and make reliable comparisons over time within or between stream reaches. SCI is designed to assess effectiveness of management actions on streams in managed watersheds (non-reference streams), as well as to document stream conditions over time in watersheds with little or no past management or that have recovered from historic management effects.

Prior to any meadow stabilization work, a Bank Erosion Hazard Index(BEHI)/Near Bank Shear Stress (NBS) evaluation should be conducted on channel banks and headcuts to quantify the existing erosion rates and sediment volumes entering the watershed. This will allow for a quantitative assessment of sediment reduction in the watershed as a result of the meadow restoration work.

Range

Establishment of an additional monitoring plot at Beehive Meadow (#504M153) including aspen regeneration monitoring is recommended in order to assess meadow ecological status and trend, determine the effectiveness of meadow restoration and detect changes to water (depth to water table), soil (rooting depths) and vegetation (percent of late successional plant species). The long term rangeland condition monitoring plots located in Benedict Meadow (#504M19), Browns Meadow (#504M162) and Lower Browns Meadow (#504M164) would be re-read on a five year interval as part of the *Region 5 Long Term Rangeland Condition and Trend Monitoring Project.*

Terrestrial Wildlife

Post project and during implementation; monitor currently active California spotted owl and Northern goshawk PACs within the project area to assess annual occupancy and breeding status. Monitor for three to five years post implementation to ascertain changes in PAC occupancy status from pre- to post-project.

Visual Resource

Landscape Architect would conduct field reviews and photographs from key viewing points to determine compliance with Forest Plan Visual Quality Objectivies (VQOs), determine if desired conditions are achieved, and identify if any new visual disturbances are present.

The monitory recommendations are based on the There are three types of monitoring specified in the Landscape Aesthetics, A Handbook for Scenery Management. Agriculture Handbook 701: implementation, effectiveness, and validation (USDA-FS, 1995).

Implementation monitoring determines whether the standards and guidelines (e.g., design features, Forest Plan VQOs) were followed. Some agencies call it “compliance” monitoring… or said another way “Did we do what we said we would do” (USDA-FS, 1995).

Effectiveness monitoring determines if application of the management plan is achieved or is headed in the right direction to achieve the desired conditions… in other words did the management practice or activity do what was intended. Did the standards and guides function as intended or were they not effective (USDA-FS, 1995).

Validation monitoring determines if new information exists which alters the validity of the assumptions upon which the plan was based (USDA-FS, 1995).

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA 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 did not meet all aspects of the purpose and need for the project. Therefore, three alternatives were considered but dismissed from detailed consideration for reasons summarized below.

1.An alternative was suggested to use only hand cutting crews and no burning to reduce fuels since the smoke from prescribed fire may put human health at risk and increase global warming.

The public identified prescribed fire as an issue recommending that using hand crews alone to reduce hazardous fuels.This issue was not considered in detail and eliminated because the use of handwork alone would not meet the purpose and need. The purpose and need for this project is to promote ecosystem resilience, sustainability, and health under current and also changing and uncertain future environmental conditions through the restoration of key ecological processes including returning fire to the landscape. The use of handwork alone would not achieve the benefits of prescribed fire (e.g. to provide a flush of soil nutrients to increase the diversity of plants and invertebrates) nor would it be economically feasible.

2.An alternative was suggested that would use only prescribed fire (preferably including mixed-intensity effects to recruit large snags for cavity-nesting species) and no thinning on the acres proposed for mechanical/commercial thinning.

The public identified mechanical/commercial thinning on proposed acres as an issue and suggests that no thinning be done mechanically but instead use only prescribed fire which includes mixed intensity effects to recruit large snags for cavity-nesting species. This alternative was eliminated from detailed study because the use of prescribed fire alone without mechanical thinning would not meet the purpose and need of reducing stand densities and shifting the incense cedar and fir component of the stands to bring the pine composition back to the historic range of variability and improve resiliency to insect attack, disease, wildfire, drought conditions (e.g.potential increased stress on forest vegetation due to predicted warmer temperatures and reduced soil moisture due to climate change).

Present forest conditions in areas proposed for mechanical thinning consist of dense thickets of understory trees with multilayered conifer stands. Utilizing only prescribed fire in these areas with existing fuel loading without first treating through mechanical or hand treatment would not guarantee desired effects to recruit large snags but would burn at levels that may result in severe resource damage, especially to soil layers. Also, ability to control prescribed fire in these areas while protecting public health and safety is unlikely without initial structural restoration treatments. Furthermore, prescribed fire only would not provide an economic benefit that supports the overall restoration actions and objectives of the project (e.g. merchantable volume in timber contract would offset cost of vegetation restoration work).

Current land management direction requires an ecologically healthy level of snags and CWD to be retained within treatment boundaries. Both action alternatives address this concern through analysis and determination of an ecologically based level of snags and coarse woody debris needed to be retained within treatment area boundaries. Alternative 2 includes prescribed fire only treatments 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. Alternative 3 also includes the same prescribed fire only treatment areas. Alternative 3 includes treatment areas with combined

mechanical and prescribed fire and would limit mechanical treatment to trees 10 inches or less dbh which would increase the likelihood of fire created snags. Therefore a prescribed fire only with no mechanical treatment to recruit large snags for cavity-nesting species was eliminated from further detailed studies.

3.An alternative was suggested that would "within the acres of forest proposed for mechanical/commercial thinning, instead of the live trees over 16" dbh being removed, the trees that would otherwise be marked for removal would instead be girdled or killed in some other way in order to actively recruit more large snags for wildlife, or such trees would be felled to provide large downed log structure for small mammals, amphibians, and invertebrates".

The public identified mechanical/commercial thinning on proposed acres as an issue and suggested live trees over 16" dbh being removed, instead be girdled or killed in some other way. This alternative was considered but eliminated because implementation of this alternative would make the Project Area more susceptible to potential impacts from an uncharacteristically severe wildfire (due to heavy fuel loading and density) whichwould not meet the purpose and need to treat conifer stands to improve their resiliency to insect attack, diseases, wildfire, drought conditions, and increased stress on vegetation due to predicted warmer temperatures and longer periods of depleted soil moisture because approximately 30 to 70% of the trees 10" dbh and larger proposed for removal for density management would likely be in the 16" dbh and larger size class. Killing these trees would result in an increase in snags or down logs anywhere from a few per acre in some small stands to over 50 dead trees per acre across the treatment acreage (these estimates are derived from the Greys Mountain project EIS). Where pine trees are killed and either left standing as snags or down logs, the likelihood of insect infestation centers being created is quite high in these mid elevation stands. Substantial increases in additional mortality would then result and be hard to control. Resultant canopy closures would fall below desired for fisher and spotted owls. As recommended in GTR-220 and the LRMP, as revised in 2004, one of the desired outcomes of this project is to increase the percentage of shade intolerant tree species (e.g. pines and oaks). Creating pine bark beetle infestation centers would have the opposite effect of that desired condition in these stands.

Killing trees in other ways would not meet the purpose and need for the project to restore forest conditions within proposed treatment areas to more closely resemble pre-1900s stand structures which would result in forests that are more resilient and resistant to expected changes in climate and disturbance regimes. Using fire to kill enough trees between 16 and 29 inches to accomplish density management to restore areas to closely resemble pre-1900s stand structure would not be feasible. The fire intensity necessary to kill these larger diameter trees would result in the loss of the majority of the smaller diameter trees that are planned to be retained in the understory for stand diversity and structure. Fire is not selective as to which trees would die or survive. The burn prescription needed to accomplish this would be very difficult to obtain without substantial risk of escape. Burning costs would be substantial due to the suppression forces that would be required on site as well as contingency forces needed in the event of an escape. The limited number of days that prescription requirements could be met, suppressions resources were available and authorized air pollution burn days would be available would make execution of this treatment method very difficult over the acreage proposed.

Girdling trees would not meet the purpose and need to maintain or improve growth and vigor of conifer stands, reduce the spread and intensity of wildfires and restore other ecological processes. Killing by girdling and leaving in place large numbers of trees would greatly increase present and future (as snags fall) fuel loadings within the Project Area. The end result would be the opposite of the desired future condition of reducing the potential for spread and intensity of wildfires and would not allow the growth and vigor of conifer stands. Increased snags and down logs would also increase the resistance to control as well as firefighter safety. The Chips Fire is an example of negative, and costly, suppression issues encountered when a fire burned through snags and down logs created by a

previous burn (Storrie Fire). Public visitors and employees working, recreating and using the national forest would be put at additional risk and would open the agency up to possible litigation by knowlingly creating a hazard should an accident or fatality occur if one of these snags fell on a member of the public. Even though most of the snag pockets would be located away from roads and developed recreation sites, this area has moderate to heavy use by the OHV community and hunters who routinely hike and ride on trails and walk through the forest. These individuals would be impacted by the additional hazard created by these snags. This is in contrast to the trail systems in the wilderness areas where visitor use is lower therefore the risk is reduced.

Killing trees by girdling is very costly and often not effective. This process would result in additional costs to taxpayers in contrast to an economic benefit to taxpayers of material being felled and removed under a commercial thinning sale where the purchaser would pay to remove them. Removal through commercial thinning of these trees would provide jobs during the logging operations. Additional jobs would be provided during the processing of these trees at lumber mills and lumber yards along with even more jobs as workers purchased goods and services in their local communities. Processed lumber would be utilized in building construction and help sequester carbon rather than left in the woods to decompose. Girdling or killing trees in other ways in areas proposed for treatment using mechanical treatment does not meet the purpose and need of the project. It therefore was decided to eliminate this alternative from further detailed studies.

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 Alternative 2 (Proposed Action) uses structural and process restoration treatments, the potential for meeting the desired conditions of ecological restoration is much higher than in Alternative 3 which uses limited levels of structural restoration treatments and process restoration treatments.

Table 3. Comparison of the Components of the Alternatives

Proposed Action Treatments	**Unit of Measure**	**Alternative 1** ***No Action***	**Alternativ 2** ***Proposed Action***	**Alternative 3** ***Lower & Mid-Level Canopy,All Treatment Areas***
Tractor - Fuels and vegetation treatments in natural stands and conifer plantations (**harvest/thin, commercial thin and mechanical pile)**	Acres	0	2,824	0
Tractor - Fuels and vegetation treatments in natural stands and conifer plantations (**pre-commercial thin and mechanical pile)**	Acres	0	1,881	4,705
Handwork –Fuels and vegetation treatments	Acres	0	200	200
Mastication - Fuels and vegetation treatments	Acres	0	520	520
Fuel break construction and maintenance (these acres currently overlap with Tractor treatment acres)	Acres	0	1,187	1,187
Reforestation (acreages are included in the acre totals)	Acres	0	150	150
Meadow restoration (conifer encroachment removal)	Acres	0	30	30
Meadow restoration (physical stabilization)	Acres	0	16	16
Meadow restoration (hand and mechanical thinning in RMA	Acres	0	72	72
Meadow Restoration (off-site livestock water development)	Each	0	4	4
Whisky Falls Campground (hazard tree removal and thinning)	Acres	0	4	4
Whisky Falls Campground (bear box installation)	Each	0	9	9
Whisky Falls Campground (vault toilet replacement)	Each	0	1	1
Cultural resource site enhancement	Acres	0	100	100
Noxious weed management	Acres	0	5	5
Sensitive plant habitat enhancement (Rawson's flaming trumpet and mosses)	Acres	0	0.6	0.6

Proposed Action Treatments	**Unit of Measure**	**Alternative 1** ***No Action***	**Alternativ 2** ***Proposed Action***	**Alternative 3** ***Lower & Mid-Level Canopy,All Treatment Areas***
Terrestrial wildlife habitat restoration	Acres	0	4,635	4,635
Aquatic wildlife habitat enhancement	Miles	0	2	2
Road maintenance	Miles	0	65	65
Road reconstruction	Miles	0	33	33
Temporary road construction	Miles	0	5	0
Road decommission and obliterate	Miles	0	0.2	0.2
Restore site productivity to unauthorized off-highway vehicle routes	Miles	0	10	10
Prescribed fire (initial entry)	Acres	0	2,838	2,838
Prescribed fire (after structural restoration treatments have been completed)	Acres	0	1,776	1,776

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. Treatment unit of measures are approximate.

Table 4. Comparison of the Effects of the Alternatives

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Air Quality	Effects of ; **Degree of degradation of Air Quality from Smoke** **Tons of Carbon Lost** (Wildfire vs Restoration Treatments)	**Degree of degradation of Air Quality from Smoke -**High degree of long lasting unhealthy to severe degraded air quality from potential uncontrolled wildfire(s). **Tons of Carbon Lost -** Long term loss would occur after wildfire due to carbon stocks being lost.	**Degree of degradation of Air Quality from Smoke -** With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available. **Tons of Carbon Lost -** Net gain of carbon stocks over time due low loss from future wildfire	**Degree of degradation of Air Quality from Smoke -** With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available. **Tons of Carbon Lost -** Net gain of carbon stocks over time due low loss from future wildfire
Aquatic Wildlife TES	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) No effect, no anticipated impacts to species or habitat	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) May affect individuals, but is not likelyto contribute to the Federal listing or in loss of vialbility in the Sierra National Forest	Foothill yellow legged frog Moutain Yellow Legged Frog (C/FSS) Western Pond Turtle(FSS) Yosemite Toad (C/FSS) May affect individuals, but is not likelyto contribute to the Federal listing or in loss of vialbility in the Sierra National Forest
Aquatic Wildlife Management Indicator Species	Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations) Lacustrine/Riverine: Stream Surface Shading, Flow, and Sediment Wet Meadow: Flow	**Lacustrine/Riverine Habitat** **Wet Meadow Habitat:** No expected direct, indirect or cumulative effects to habitat. Habitat stable at Regional scale	**Lacustrine/Riverine Habitat:** Direct or indirect effects to Stream Surface Shading and Flow not anticipated. **Wet Meadow Habitat:** Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow. Both habitat types stable at Regional scale.	**Lacustrine/Riverine Habitat:** Direct or indirect effects to Stream Surface Shading and Flow not anticipated. **Wet Meadow Habitat:** Project Design Criteria expected to maintain habitat. No direct, indirect, or cumulative effect to Flow. Both habitat types stable at Regional scale.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Botany Threatened, endangered, and Sensitive Plant Species *Other Sierra NF TES plant species not listed do not have habitat within the Project Area, therefore would not be effectedby any of the alternatives (see BE/BA).	Determinations for TES Species Determination for Federally listed plant species No effect	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) No direct effects from project activities would occur to the following 4 species of riparian/aquatic habitats, but habitat would not be restored in 11 meadows if this project is not implemented: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* No direct effects would occur to these two species: Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)*	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) Alternative 2 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)* Cumulative effects would not be expected for any of the species shown (see Chapter 3).	**1 Threatened species** Mariposa pussypaws (*Calyptridium pulchellum*) Alternative 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for: Bolander's candle moss (*Bruchia bolanderi*) Rawson's flaming trumpet (*Collomia rawsoniana*) Brook pocket-moss (*Fissidens aphelotaxifolius*) Veined water lichen *(Peltigera gowardii)* Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* Short-leaved hulsea (*Hulsea brevifolia*) Kellogg's lewisia *Lewisia kellogii* ssp. *kelloggii* *Blandow's bog-moss* (*Helodium blandowii)* Yosemite lewisia (*Lewisia disepala*) (Mono Hot Springs evening primrose (*Camissonia sierrae ssp. alticola*) One-nerved hump moss *(Meesia uliginosa*) Yosemite bog orchid *(Platanthera yosemitensis)* Cumulative effects would not be expected for any of the species shown (see Chapter 3).
Botany NoxiousWeeds	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, contaminated equipment introduces weeds to Project Area), also control of existing infestations would not occur.	Low risk of spread because of project design criteria for prevention of spread as well as the fact that this alternative includes controlling existing weed infestations.	Low risk of spread because of project design criteria for prevention of spread as well as the fact that this alternative includes controlling existing weed infestations.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Cultural Resources	The degree to which historic property values are diminished.	Direct effects to cultural resource sites would occur should an uncharaceristically severe wildfire occur due to untreated fuel accumulations.Indirect effects could occur from artifact looting as a result of increased access to and visibility of sites due to an uncharacteristically severe wildfire. Cultural site context could be affected by post fire runoff and erosion, increased tree mortality, and increased rodent and insect burrowing and continued unauthorized motorized use. Cultural resources could be affected by lack of road maintenance. Cumuluative effects are unlikely under this Alternative.	By following the Stipulations and implementing the Standard Resource Protection Measures outlined in the Regional PA, Attachment B and the Interim Fuels Protocol, and following design measures, the majority of the historic property values of sites would not be diminished as a result of implementing this alternative. Direct effects would occur through breeching an eligible railroad logging system, implementation of WIN projects, road maintenance and reconstruction, OHV design measures and Whisky Falls Campground rehabilitation. Determinations of eligibility for listing on the NRHP and/or MOAs with SHPO would need to be developed and implemented to mitigate these adverse effects. Positive effects to cultural resource sites could occur through returning the project area to pre-suppression conditions. Indirect effects could occur from artifact looting as a result of increased access and visibility of sites due to an uncharacteristically severe wildfire, recreational activities, 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. Cumulative effects would be minimal.	Direct effects would be the same as Alternative 2, with the exception of mechanical thinning within Whisky Falls Campground and cultural resource sites. Indirect effects would be the same as Alternative 2. Cumulative effects would be the same as Alternative 2

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Engineering - 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. This can have the potential to reduce potential erosion problems caused by transportation corridors. Implementation of BMP and erosion control measures would reduce the impacts of such construction.	See Alternative 2.
Fire/Fuels	Effects of fire behavior; Resistance to Control Effects of Fire Effects; Mortality (%) Fire Type Change in Cindition Class Fire Interval (CCFRI) CCFRI 1=No departure	**Resistance to Control** – Moderate to Very High **Mortality** - 71-100% **Fire Type** - Torching **CCFRI** - No acreage change would occur unless a wildfire were to happen	**Resistance to Control –** Very Low to Moderate **Mortality** - 0-69% **Fire Type** -Surface **CCFRI**- 4620 acres would be moved from CCFRI 3 to 1	**Resistance to Control** – Moderate to High **Mortality** - 01-100% **Fire Type**- Torching **CCFRI** - No acreage change would occur unless a wildfire were to happen

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Forest Vegetation Management/Silviculture	Effects of; Stand Density-est. stems per acre. remaining (trees/acre ≥10 inch dbh) Effectiveness - Short Term Effectiveness - Long Term Stand Heterogeneity Estimated Range of Canopy Cover remaining (%) Estimated Range of Tree Diameter remaining ≥ 10 inch dbh	**Stand Density**-est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 92 to 209 trees (not treated last 15 years) Plantations - 120 to 163 trees (not treated last 15 years) Wild Stands - 270 to 390 ft^2 (not treated last 15 years) Plantations = - 160 to 210 ft^2 (not treated last 15 years) **Effectiveness-Short Term-** Growth & vigor will decline—potential for loss due to insects, diseases, drought. Stands/aggregations will not begin process of returning to pre-1900s conditions Percentage of shade intolerant species will decrease. **Effectiveness Long Term -** Growth & vigor will decline more rapidly—potential for loss due to insects, diseases, drought will increase **Stand Heterogeneity** -Heterogeneity will decrease as competition causes shade intolerant trees to drop out of stand. **Estimated Range of Canopy Cover remaining (%)-** Wild Stands - 65 to 89% (not treated last 15 years) Plantations - 65 to 85% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh** Wild Stands = 18 to 27 inches (not treated last 15 years) Plantations = 14 to 18 inches	**Stand Density**-est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 48 to 93 trees (not treated last 15 years) Plantations - 68 to 104 tree (not treated last 15 years) Wild Stands - 180 to 290 ft^2 (not treated last 15 years) Plantations - 120 ft^2 (not treated last 15 years) **Effectiveness-Thort Term -** Growth & vigor will remain same or increase—potential for loss due to insects, diseases, drought will diminish , Stands/aggregations will begin process of returning to pre-1900s conditions. Percentage of shade intolerant species will increase. **Effectiveness Long Term -** Growth & vigor will remain high until next projected reentry in 15 to 20 years.—potential for loss due to insects, diseases, drought will be low **Stand Heterogeneity** Heterogeneity will incease as competition is removed. **Estimated Range of Canopy Cover remaining (%) -** Wild Stands - 55 to 77% (not treated last 15 years) (majority 60%+) Plantations = 55 to 65% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh** Wild Stands = 20 to 29 inches (not treated last 15 years) Plantations = 15 to 18 inches	**Stand Density**-est. basal area per acre remaining (basal area per acre ≥ 10 inch dbh); Wild Stands - 92 to 209 trees (not treated last 15 years) Plantations - 120 to 163 trees (not treated last 15 years) Wild Stands - 270 to 390 ft^2 (not treated last 15 years) Plantations - 160 to 210 ft^2 (not treated last 15 years) **Effectiveness Short Term** - Growth & vigor will decline potential for loss due to insects, diseases, drought. Stands/aggregations will not begin process of returning to pre-1900s conditions. Percentage of shade intolerant species will decrease. **Effectiveness Long Term -** Growth & vigor will decline more rapidly—potential for loss due to insects, diseases, drought will increase **Stand Heterogeneity** Heterogeneity will decrease as competition causes shade intolerant trees to drop out of stand. **Estimated Range of Canopy Cover remaining (%) -** Wild Stands - 65 to 89% (not treated last 15 years) Plantations - 65 to 85% **Estimated Range of Tree Diameter remaining ≥ 10 inch dbh-** Wild Stands = 18 to 27 inches (not treated last 15 years) Plantations = 14 to 18 inches

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Geology - Soils	Effects of; Soil Stability Surface Organic Matter: Soil Organic Matter (SOM): Soil Strength: Soil Moisture Regime: Soil Structure & Macro-Porosity	**Soil Stability** -Average soil cover for the project area was at 97% and no erosional features were observed in the project area. **Surface Organic Matter:** 89% of the transects revealed natural forest floor conditions, the remaining 9% was present & intact and 2% was partially missing or patchy. **Soil Organic Matter (SOM):** Mineral soil was present and undisturbed throughout the project area. **Soil Strength:** 3% of the soil transects reveiled minor soil compaction present within the project area. **Soil Moisture Regime:** Conifer encroachment into the meadows would occur unimpeded, resulting in a loss of habitat and retention of groundwater. **Soil Structure & Macro-Porosity**: 3% of the soil transects reveiled minor soil compaction present within the project area.	**Soil Stability** -Design measures would minimize impacts to soil stability. Soil cover would be maintained above 50% in all treatment areas and at or above 90% within 100ft of rock outcrop. **Surface Organic Matter:** Design features would minimize the impacts to the surface organic matter. A reduction would occur but would continue to meet and/or exceed Soil Management Objectives. **Soil Organic Matter (SOM):** Design features would minimize the impacts to soil organic matter (SOM). Slope limitations for mechanical operations on slopes >35% (>50% for mastication operations) and five pieces of large woody debris per acre would be maintained. **Soil Strength:** Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% of a treatment area. **Soil Moisture Regime:** Minimal to no loss of soil productivity and increased soil hydrologic function/water retention. **Soil Structure & Macro-Porosity**: Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% or a treatment area.	**Soil Stability** -Design measures would minimize impacts to soil stability. Soil cover would be maintained above 50% in all treatment areas and at or above 90% within 100ft of rock outcrop. **Surface Organic Matter:** Design features would minimize the impacts to the surface organic matter. A reduction would occur but would continue to meet and/or exceed Soil Management Objectives. **Soil Organic Matter (SOM):** Design features would minimize the impacts to soil organic matter (SOM). Slope limitations for mechanical operations on slopes >35% (>50% for mastication operations) and five pieces of large woody debris per acre would be maintained. **Soil Strength:** Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% of a treatment area. **Soil Moisture Regime:** Minimal to no loss of soil productivity and increased soil hydrologic function/water retention. **Soil Structure & Macro-Porosity**: Design features would minimize the impacts to soil strength. Mechanical equipment would operate when the soil is sufficiently dry and subsoiling and waterbarring would occur on skid roads and trails when soil compaction exceeds 15% or a treatment area.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Hydrology – Water Quality	Cumulative Watershed Effects (CWE's) Threshold Levels Reached	With the No Action alternative, no tractor related ground disturbance or prescribed fire would occur, which would eliminate any CWE response from project related activities.	The Proposed Action could potentially elevate the ERA% value of subdrainage 504.1004 to 13.89%. Considering project activities would keep the ERA% below the upper threshold of concern 14%, there is a low to moderate chance of causing a CWE response based on current subdrainage condition.	Cumulative effects for Alternative 3 would be less than those described under the Proposed Action (Alternative 2) and similar to the No Action Alternative, 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. Baseline CWE (ERA %) for subdrainage 504.1004 is high at 13.89%, which resulted from past timber harvest activity. With Alternative 3, no tractor related ground disturbance would occur, which, (given sufficient time), would allow the subdrainage to stabilize and become more resilient to future watershed stressors.
Lands/Special Uses	Effects to Special Uses Permitted in Project Area. Effects to Recrational sites and features within Project Area.	There would be little protection from moderate to high intensity fires to special use and recreational sites/facilities as the accumulation of natural fuels build-up would continue to occur. A wildfire could result in a temporary shutdown of special uses (water lines, fiber optic cables, etc.) and closure of forest roads, trails and campgrounds for health and safety of the public	With implementation of Design Criteria minimal to no negative effects. Ecological restoration activities would reduce the fire risk to special use and recreational sites within and adjacent to the Project Area.	The effects of this alternative would be identical to that of Alternative 2.
Range	Effects to meadow condition and forage production	Meadow condition would move away from desired conditions and forage quality and production would decrease over time.	Meadow condition and forage quality and production would improve from meadow restoration, process and structural restoration treatments.	Meadow condition and forage quality and production would improve but to a lesser extent when compared with Alternative 2.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Recreation; Developed, CUAs, and Motorized Rec, dispersed camping	Effects to Recreation in Project Area	No Effect	With implementation of Design Criteria minimal to No effect	With implementation of Design Criteria minimal to No effect

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Terrestrial Wildlife (T)=Threatened (E)=Endangered (P)=Proposed (C)=Candidate (FSS)=Forest Service Sensitive *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: Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* (T) Bald Eagle *Haliaeetus leucocephalus* (FSS) Wolverine *Gulo gulo*(FSS, C) Willow Flycatcher *Empidonax trailli* (FSS) Sierra Nevada red fox *Vulpes vulpes necator* (FSS) Townsend's big-eared bat *Corynorhinus townsendii* (FSS)	Determinations for TECPS Species No effect. May affect but is not likely to adversely affect. 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. 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. California Spotted Owl *Strix occidentalis occidentalis* (FSS) Great Gray Owl *Strix nebulosa* (FSS) Northern goshawk *Accipiter gentilis* (FSS) Pallid bat *Antrozous pallidus* (FSS) Western red bat *Lasiurus blossevillii* (FSS) American marten *Martes americana* (FSS) 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. California Spotted Owl *Strix occidentalis occidentalis* (FSS) Great Gray Owl *Strix nebulosa* (FSS) Northern goshawk *Accipiter gentilis* (FSS) Pallid bat *Antrozous pallidus* (FSS) Western red bat *Lasiurus blossevillii* (FSS) American marten *Martes americana* (FSS) Pacific fisher *Martes pennanti pacifica* (FSS)

Resource Area	Indicator	Alt 1	Alt 2	Alt 3
Terrestrial Wildlife Management Indicator Species *****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: Greater sage-griouse (*Centrocercus urophasianus*) Mule deer (*Odocoileus hemionus)* Yellow warbler (*Dendroica petechia*) Sooty grouse (*Dendragapus obscurus*) Black-backed woodpecker (*Picoides arcticus*)	Habitat conditions or alteration of species CWHR (California Wildlife Habitat Relations)	All terrestrial MIS. No direct 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)* Mountain quail *(Oreortyx pictus)* California spotted owl (*Strix occidentalis occidentalis*) American marten (*Martes americana*) Northern flying squirrel (*Glaucomys sabrinus*) Hairy woodpecker (*Picoides villosus*) Although there would be alterations to canopy closure on 260 acres (approximately 3 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)* Mountain quail *(Oreortyx pictus)* California spotted owl (*Strix occidentalis occidentalis*) American marten (*Martes americana*) Northern flying squirrel (*Glaucomys sabrinus*) Hairy woodpecker (*Picoides villosus*) No changes to CWHR type, size, or density are expected with the implementation of Alternative 3. There would be no measurable changes to 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
Visual Resource	Effects to; Scenic Integrity Scenic Stability	**Scenic Integrity:** No direct effects. Potential indirect long-term adverse effects from increased visible disturbances from potentially severe wildfire and insect and disease outbreaks. Compliance in the short-term, but potential indirect long-term adverse effects could reduce the visual quality level to unacceptable modification, a potential two to three level decrease from the Forest Plan Visual Quality Objectives (VQO) of partial retention and modification and no longer in compliance with Forest Plan VQOs. No cumulative effects. **Scenic Stability**: No direct effects, but potential indirect long-term adverse effects due to scenery attributes (i.e., large trees and diverse vegetation) being at risk of being eliminated from a potential sever wildfire and insect and disease outbreaks. Scenic stability is Low. No cumulative effects.	**Scenic Integrity:** Direct short-term effects from ground disturbance and vegetation and fuel treatments. The visible disturbances would result in short-term effects (1-5 years) and reduce the VQOs towards the low-end of partial retention and low-end of modification. Positive indirect long-term effects due to the reduced risk of future sever wildfire and its associated visible disturbances Compliance within 1-5 years after treatment. Partial retention and the high-end of modification VQOs would be met. No cumulative effects. **Scenic Stability:** A positive direct and indirect effect due to increased sustainability of scenery attributes (large trees and diverse vegetation). Scenic stability would increase to High, a two level increase from Low Stability in Alternatives 1 and 3. No cumulative effects.	**Scenic Integrity** Direct short-term effects similar to alternative 2. Potential indirect long-term adverse effects due to fewer trees being removed increasing visible disturbances from potential severe wildfire and insect and disease outbreaks. Compliance within 1-5 years after treatments, but potential indirect long-term adverse effects (similar but less than alternative 1) could change the visual quality level to unacceptable modification, a potential two to three level decrease from the Forest Plan VQOs of partial retention and modification and no longer in compliance with Forest Plan VQOs. No cumulative effects. **Scenic Stability:** Slight positive direct effects as scenery attributes (large trees and diverse vegetation) are slightly enhanced but not as much as in alternative 2. Potential indirect long-term adverse effects due to scenery attributes (large trees and diverse vegetation) at risk of being eliminated from potential sever wildfire and insect and disease outbreaks. Scenic stability would be Low. No cumulative effects.

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.

Compliance with Forest Service Plan ans Revelant Laws, Regulations, and Policies

The action alternatives (alternatives 2 and 3) are consistent with Forest Plan direction and law, regulation, and policy for each resource, unless otherwise stated in specific resource sections analyses. Project design features incorporate relevant best management practices, conservation measures, standards and guidelines from the Forest Plan, and standards and guidelines referenced to the Sierra Nevada Forest Plan Amendment Record of Decision.

Past, Present and Reasonable Foreseeable Actions

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

In order to understand the 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 would 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 5 - Present and Reasonable Foreseeable Actions Addressed for Cumulative Effects by Resource

Activity Type	Description	Timeline	Unit Of Measure	List of Resource Areas														
				Air Quality	Aquatic Wildlife	Botany-Sensitive Plants	Botany Noxious Weed Spread	Cultural Resource	Forest Vegetation	Fire/Fuels	Engineering	Geology /Soil	Hydrology	Lands/Special uses	Range	Recreation/OHV	Terrestrial Wildlife	Visual Resource
Recreation-Use of Roads and trails; USFS and County, maintained	Includes the network of inventoried road systems within project subwatersheds	Existing and on-going	106 miles	X	X	X	X	X	X	X	X	X	X			X	X	
Recreation-Use of Campground and other USFS Owned Facilities (CUAs; concentrated use areas)	Whisky Falls Campground CUAs; Whisky Staging and Gertrude East and West	Existing and on going	~7 acres		X	X	X	X			X	X	X				X	
Recreation-Trails to be brought into trail system (Travel Management Part 2)	Includes the network of proposed routes to be brought into the motorized vehcile use trail system	Foreseeable future	10 miles			X	X	X			X	X	X				X	
Timber - Past/Current USFS Timber Sales within Whisky Ridge Project subwatersheds	Includes: Green Timber Sales Salvage Harvest Thinning	Existing and ongoing	~7415 acres	X		X	X	X	X	X	X	X	X		X		X	
Timber - Roadside Hazard Tree Removal	Removal of damaged, rotten, dead trees to abate roadside hazard using timber sale	2003-present	17 miles	X		X	X	X	X	X	X	X	X				X	

Activity Type	Description	Timeline	Unit Of Measure	List of Resource Areas														
				Air Quality	Aquatic Wildlife	Botany-Sensitive Plants	Botany Noxious Weed Spread	Cultural Resource	Forest Vegetation	Fire/Fuels	Engineering	Geology /Soil	Hydrology	Lands/Special uses	Range	Recreation/OHV	Terrestrial Wildlife	Visual Resource
	contracts.																	
Fire/Fuels- Fire/Fuels Management Activities	Includes Fuelbreak Construction and Maintenance, Prescribed Burning, ladder fuel removal, mastication	1982-present	~2,500 acres	X	X	X	X	X	X	X	X	X	X	X	X		X	
Private Land - Infrastructure for community of Cascadel	New home construction, power, water, private roads	Ongoing	~480 acres	X			X		X	X	X	X					X	
Private Land- Vegetation Management in communities and other private lands	Timber harvesting, land type conversions Hazard fuels reduction	Ongoing	Individual Community Private Acres	X			X	X	X	X		X					X	
Lands/Special Uses- Special Use Permitted Activities	Apiaries (9sites) Waterlines (2sites) Telephone/Fiber OpticLines (1 site)	Ongoing	A. ~3 acres B. ~1520 feet C.~1.21miles				X	X			X			X			X	
Range – Livestock Grazing	Castle Peak Allotment (March – June) Central Camp Allotment (June – September) Haskell Allotment (June – September)	Ongoing	2664 Animal Unit Months (AUMs) 2018 Head		X	X	X	X			X	X	X		X		X	

Activity Type	Description	Timeline	Unit Of Measure	List of Resource Areas														
				Air Quality	Aquatic Wildlife	Botany-Sensitive Plants	Botany Noxious Weed Spread	Cultural Resource	Forest Vegetation	Fire/Fuels	Engineering	Geology /Soil	Hydrology	Lands/Special uses	Range	Recreation/OHV	Terrestrial Wildlife	Visual Resource
			Months (HMs)															
Range- Range Improvements	Peckinpah Meadow Cow Camp Holding Fields (Bucks, China and Peckinpah Meadows)	Existing and on-going	Various Measures-Mapped Locations		X	X		X		X	X	X	X		X		X	
Hydrology- Crane Valley Dam (Bass Lake) Wetland Mitigation - Meadow Restoration Projects	Stabilization of headcuts, channel banks, and removal of encroaching conifers	Existing and ongoing			X	X	X					X	X		X		X	

Air Quality

The direct, indirect and cumulative effects to Air Quality are summarized from the Air Quality report for the Whisky Ridge Ecological Restoration Project (Stalter, B., 2012)

Affected Environment

The pattern of weather in the Sierra Nevada is influenced by its topography and geographic position relative to the Central Valley, the Coast Range and the Pacific Ocean. Winters are dominated by low pressure in the northern Pacific Ocean while summer weather is influenced by high pressure in the same area. (Sugihara, 2006)

How these patterns affect the project are in the case with winds for dispersing and moving smoke and air pollutants is as follows. During the winter wind patterns are generally driven by frontal passages and diurnal upslope up canyon and downslope down canyon winds. Winds and inversions are not as prevalent due to atmospheric instability being more common during this time. Summer time conditions are driven by more stable air conditions and diurnal slope and canyon winds due to the lack of storm frontal passages. The prevailing winds are from the west/northwest during the daytime hours and reverse to downslope at night. Wind speeds average 2-12 mph and gust to 15 mph at the highest exposed locations on Shuteye Peak. Some of the low lying valleys are prone to short term inversions but are broken up by daily winds.

The affected environment (geographic area) in this analysis includes areas that would or could experience degradation as a result of the actions proposed. SJVAPCD considered the air basins downwind from the Whisky Ridge Project and is the air basin that direct, indirect and cumulative impact analysis is focused on. Project

The Whisky Ridge Project is within the San Joaquin Valley Air Pollution Control District (SJVAPCD) for Madera County. The district is responsible for implementing and regulating sources that degrade air quality and is 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 Great Basin

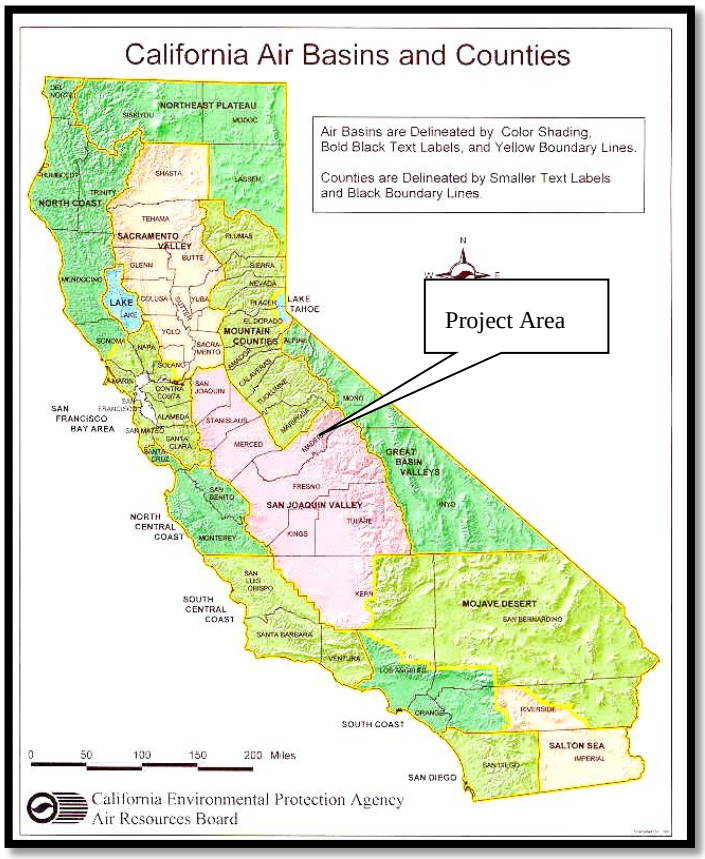


Figure 2: Map showing Air Basins and Counties.

Air District on the eastside of the Sierra Nevada range is considered the air basins downwind from the Whisky Ridge Project and is the air basins that direct, indirect and cumulative impact analysis is focused on.

The Whisky Ridge Project is located within the defense and threat zones of the Wildland Urban Interface (WUI) and situated adjacent to residential areas. Communities surrounding the Whisky Ridge Project include North Fork and Bass Lake to the west, Kinsman Flat and Hogue Ranch/Clearwater area to the east, Cascadel Woods subdivision to the southwest and Central Camp to the north.

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 the SJVAPCD and would be implemented under optimum conditions using best available control measures (listed in Chapter 2 under Air Quality 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 6 below.

Table 6. Whisky Ridge Project Sensitive Receptors.

Sensitive Receptor Type	Location
Towns, Communities, Residential Areas	North Fork, Cascadel Woods, Kinsman Flat, Hogue Ranch Bass Lake, Central Camp, Saginaw Creek Residences.
Recreation Areas	Designated Motorcycle Trails, Redinger Overlook.
Campgrounds	Whisky Falls, Rock Creek, Fish Creek
FS Work Center/Ranger Station	North Fork Ranger Station, Clearwater Station
Roads	4S81 (Scenic Byway)
Class I Federal areas	See Table 3 for Class I areas
Other	Private land 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 national 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 Whisky Ridge Project is to meet the purpose and need for the Whisky Ridge Project while accomplishing the Sierra National Forest Land and Resource Management Plan (LRMP) goal to manage Forest activities so air quality is compatible with federal, state and local laws, including a program that achieves the Clean Air Act (CAA) responsibilities.

Regulatory Frameworks

The LRMP as amended provides the standards and guidelines 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" (LRMP 1992, pg. 4-2). The LRMP has Standards and Guidelines for Air Quality (LRMP 1992, pgs. 4-25) that includes the following:

Avoid cumulative impacts to air quality by coordinating prescribed burning activities within the Forest, with burning activities conducted by others (LRMP 1992 S&G # 216)

Mitigate fugitive dust impacts on air quality by including dust abatement as a requirement for construction activities that have potential to generate dust (LRMP 1992 S&G # 217).

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 (LRMP 1992 S&G # 218).

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 (LRMP 1992 S&G # 219).

Obtain appropriate permits prior to conducting prescribed burning activities (LRMP 1992 S&G # 220).

Incorporate air quality management considerations into fire management (LRMP 1992 S&G # 230).

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 Whisky Ridge 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 2.

- 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 Whisky Ridge Project is within the San Joaquin Valley of Madera County. Currently, the San Joaquin Valley is classified by both the federal and state standards as *Extreme non-attainment* for ground-level ozone and as *serious maintenance status* for PM10. The valley is designated as *in attainment* for all other criteria pollutants. (www.valleyair.org).This air basin is 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 7 shows these *de minimus* level thresholds and are bolded based on air basin status.

Table 7. Federal de minimus Threshold Levels for Criteria Pollutants Based on Air Basin Attainment Status.

Pollutant	Area Type	Tons/Year
8 –Hour Ozone ($NOCs_x$ or VOC)	Extreme nonattainment (SJV Air Basin, Madera county)	10
PM-10	Attainment and Serious maintenance (SJV Air Basin, Madera County)	100
Carbon Monoxide, (SO_2 and NO_2)	Unclassified (Madera County)	100

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 (SO2), NO2, 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 PM10 standards, but the ARB is currently addressing PM10 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 Districts - Local districts 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 San Joaquin Valley Air District 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. The Smoke Management Summary is received through the Prescribed Fire Information Reporting System (PFIRS). 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).

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 8.

Table 8. Class I Airsheds Near the Whisky Ridge Project Area.

Class I Airshed	Proximity to Project Area
Yosemite National Park	Southern Park boundary is located 15 north of Project Area.
Ansel Adams Wilderness Area	Western wilderness boundary approximately 10 miles northeast 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.

Forest Carbon Exchange – Carbon storage (sequestration) occurs in forests and soils primarily through the natural process of photosynthesis. Atmospheric carbon dioxide (CO_2) is taken up through tiny openings in leaves and incorporated as carbon into the woody biomass of trees and vegetation. Roughly half of this biomass is carbon. Some of this carbon makes its way into soils when vegetation, litter and roots decay. Carbon in forests and soils can return to the atmosphere as CO_2 when biomass decays and burns. Forests and soils can therefore act as either a net carbon sink or source. The movement of carbon in and out of trees and soils is part of the Earth's global carbon cycle. Science | Carbon Sequestration in Agriculture and Forestry | Climate Change | U.S. EPA

Table 9. Forestry Practices that Sequester or Preserve Carbon.

Key Forestry Practices	Typical definition and some examples	Effect on greenhouse gases
Afforestation	Tree planting on lands previously not in forestry (e.g., conversion of marginal rangeland to trees).	Increases carbon storage through sequestration.
Reforestation	Tree planting on lands that in the more recent past were in forestry, excluding the planting of trees immediately after harvest (e.g., restoring trees on severely burned lands that would demonstrably not regenerate without intervention).	Increases carbon storage through sequestration.

Forest preservation or avoided deforestation	Protection of forests that are threatened by clearing. or by uncharacteristically severe wildfires	Avoids CO_2 emissions via conservation of existing carbon stocks.
Forest management	Forestry practices (thinnings) that produce wood products to enhance sequestration over time (e.g., lengthening the harvest-regeneration cycle, adopting low-impact logging).	Increases carbon storage by sequestration and may also avoid CO_2 emissions by altering management. Would generate some emissions due to post harvest forest fuels cleanup and prescribed burning.

Bold and italicized forestry practices that are proposed in the Whisky Ridge Project.

In the absence of wildfire, fuel treatments (prescribed fire, mechanical thinning), produces carbon emissions that contribute to global greenhouse gases (Stephens et al. 2009). However, in forests with frequent fire regimes, such as Sierra Nevada mixed-conifer forests, untreated stands result in greater carbon emissions than those treated with prescribed fire (Wiedenmyer and Hurteau 2010). Both modeling and post-wildfire carbon studies support the use of prescribed fire, with or without mechanical thinning, to maximize tree-based carbon storage and minimize carbon emissions in fire-prone forests (Hurteau and North 2009, North and Hurteau 2011). These studies and others (e.g., Stephens et al. 2009) demonstrate that the use of prescribed fire is essential to reducing the long-term carbon emissions in forests of the Sierra Nevada and other frequent-fire ecosystems of the western United States.

Environmental Consequences

Methodology

For each alternative proposed for the Whisky Ridge Project, the 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 $NO_2$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-Whisky Ridge 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 5 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 Whisky Ridge 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).

Emission Calculation Spreadsheet developed by SJVAPCD was used to model smoke emissions to show a comparison between the action and no-action alternatives. Fuels Characteristic Classification System (FCCS) v2.2 was used to model carbon changes between alternatives. Due to lack of a representative fuelbed for post treatment conditions for Alternative 2 and 3 an existing fuelbed was customized. This was done by lowering the fuels and vegetation values that would likely have occurred after thinning and burning treatments proposed in these alternatives.

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

Following is a description of the spatial bounds and discussion of the logic for using these spatial bounds:

Spatial Boundaries

The spatial boundary encompasses the eastern portions of Madera and Fresno counties up to the Sierra Forest boundary along Sierra Crest and down to the San Joaquin Valley within the SJVAPCD Air Basin. This extent was selected because of past and recent project related air quality emissions are being managed at this scale. Because of the uncontained nature of smoke emissions the potential

spread could disperse over to the east side of the Sierra Nevada and into the Great Basin Air district from outside the project area but would not occur with any regularity.

Temporal Boundaries

Following is a description of the temporal bounds used for the cumulative effects analysis: The bounding from 1 day to 1 year. The temporal scale is based on the fact that smoke and project created emissions are not static and will change in duration over time and the measurements to measure these effects have been compiled and displayed as daily and yearly trend graphs. The analysis measures if smoke emissions are reduced with treatments to where there is an ability for low intensity fire (by prescribed fire in the short term) to be re-introduced into a fire dependent ecosystem.

Also considered in this analysis is whether the alternatives and the treatment intensities proposed contribute negatively or positively for greenhouse gas emissions such as carbon dioxide. Since greenhouse gas emissions and climate change issues are global in scale it is beyond the scope of this document to bound this effect. The data presented within this report on carbon exchanges and the associated releases of greenhouse gas emissions is to display the positive and negative effects of forest treatments and wildfires and help with understanding how forest management is tied to the greenhouse gas emission situation currently facing global society.

Alternative 1 – No Action

No actions would be taken to reduce stand densities to improve ecological restoration 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. Greenhouse Gases such as Carbon Dioxide ($CO_{2)}$ would continue to be removed from the atmosphere and the Project Area would continue to perform as a carbon sink unless burned by a wildfire.

Indirect Effects

Indirect effects could occur due to future unplanned ignitions and uncontrolled wildfires within or around the project 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 PM_{10} 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 PM_{10} 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 10.

Table 10. Statewide Emmission Inventory for Natural Sources, Wildfires (tons/day, annual average)

Emissions	Total Organic Gases	Reactive Organic Gases	Carbon Monoxide	Nitrogen Oxides(NO_2)	Sulfur Oxides(SO_2)	PM_{10}
Natural Sources: Wildfire	6,522	3,046	17,474	3,441	302	2,418

Total Organic Gases (TOC) and Reactive Organic Gases (ROC) are similar to Volatile Organic Gases (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 San Joaquin Valley Air Basin 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 11 demonstrates the emissions produced from a wildfire if the acres in the Whisky Ridge Project were affected by an uncontrolled wildfire during typical fire season.

Table 11. Modeled Emmissions of a Wildfire Burning Over the Same Amount of Acres as Proposed for RX Burning in Alt 2&3 Within the Whisky Ridge Project Boundary.

Fuel Type	Total Acres	Fuel Loading (t/a)	Total tons	Tons Particulate Matter (PM_{10})	Tons Particulate Matter ($PM_{2.5}$)	Tons Nitrogen Oxide NO2)	Tons Sulfur Dioxide (SO_2)	Tons Volatile Organic Compounds (VOC)	Tons Carbon Monoxide (CO)
Forest	6,502	79	490,195	6,004.89	5,392.15	857.84	24.51	3553.91	57,107.72

Carbon Exchange for Alternative 2

Table 12. Carbon Flux for Alternative 1 with Wildfire Distrubance.

Modeled Carbon (t/ac)	Carbon flux	Acres	Total Carbon (t/ac)
234	= to or +	16456 (Within Project bdy) *	3,850,704
190	- 190 t/acre (loss due to wildfire)	6502	(1,235,380)
234	Remaining Carbon in biomass surrounding fire	9954	2,329,236
44	Carbon in biomass within fire footprint	6502	286,088
Total Remaining Carbon within Project Boundary		**16,456**	**2,615,324**
Loss of C			**(1,235,380)**

* Project Acres have been reduced by 10% for rock outcrops which cannot produce biomass. Numbers within parentheses are negative values.

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 13 displays the tons of estimated emissions from the BLRD underburns each year. The 102.73 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 13. Tons of Estimated Pollutants per Individual Project Annual Underburn Program of Work.

District Rx Burning Program	Total Acres	Fuel Loading (t/a)	Total tons	Tons Particulate Matter (PM_{10})	Tons Particulate Matter ($PM_{2.5}$)	Tons Nitrogen Oxide NO2)	Tons Sulfur Dioxide (SO_2)	Tons Volatile Organic Compounds (VOC)	Tons Carbon Monoxide (CO)
Forest	350	26	9,100	102.73	87.15	8.05	5.95	89.15	1,088.85

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.

Table 14. Carbon Flux for Alternative 1 With Wildfire Disturbance.

Modeled Carbon (t/ac)	Carbon flux	Acres	Total Carbon (t/ac)
234	= to or +	16456 (Within Project boundary) *	3,850,704
190	- 190 t/acre (loss due to wildfire)	6502	(1,235,380)
234	Remaining Carbon in biomass surrounding fire	9954	2,329,236
44	Carbon in biomass within fire footprint	6502	286,088
Total Remaining Carbon within Project Boundary		16,456	2,615,324
Loss of C			(1,235,380)

* Project Acres have been reduced by 10% for rock outcrops which cannot produce biomass. Numbers within parentheses are negative values.

Summary of Effects

The effects of alternative 1 are forest health would continue to decline due to increasing competition for resources this would increase the fire hazard with more ground surface and aerial fuels and when this forest did burn it would result in higher severity effects and increased greenhouse gas and air quality emissions. The benefit of the no action alternative is carbon stocks in the existing forest would remain and slowly grow until a wildfire or other disturbance provided a method of release for the greenhouse gases in the form of Carbon dioxide CO_2, and Methane back into the atmosphere. The carbon emissions produced from this alternative during a wildfire would be 1,235,497 tons. This large release over a short time span would create detrimental effects over a much larger geographic area. This is because heat , smoke and greenhouse gasses released during large wildfires are driven higher up into the atmospheric layers and become exposed to higher speed transport winds.

Alternative 2 – Proposed Action

Associated emissions from mechanical equipment used in masticating, thinning and hauling operations and emissions produced from burning are shown in table 7. Hazard fuels treatments, including prescribed fire, proposed for this Proposed Action can be found in Chapter 2 – Alternatives Considered in Detail of the Whisky Ridge Environmental Impact Statement

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, it is estimated that approximately 6,502 acres could have prescribed fire used for maintenance treatment of surface fuels. Of these acreages 1,883 acres would be piled and burned and 1,703 acres would utilize underburning units after pile burning has been achieved. There is a total of 2,916 acres that is proposed to utilize prescribed fire as the primary treatment type (RX treatment areas). These areas would require a second prescribed fire entry to achieve desired goals to restore and reintroduce fire into the ecosystem. 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 5 to 10 tons/acre.

Dependent on where and how prescribed fire treatments are being utilized, the fuel loading can range from 3 to 70 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 20-30 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.

The treatment proposals listed in the proposed action for improving wildlife habitat, cultural resources, hydrological resources, botanical, recreation resources, soils and visual scenery resources combined will have a beneficial effect by improving forest fuels conditions to a level that will have reduced smoke emissions in the event of a wildfire and a positive effect on carbon exchange much the same as forest fuels treatments that were analyzed. These proposed treatments on a smaller scale overall and will not have large effect to the landscape overall.

Direct Effects

Smoke Emissions - This alternative proposes to accomplish up 6,502 acres of prescribed fire; both underburning and pile burning combined. If feasible, there could be the option to dispose activity fuels through mastication and/or biomass removal thus reducing the need of pile burning in some areas. When completed, prescribed fire activities proposed under this action would create the following emissions in table 14.

Table 15. Total Emissions From All Prescribed Fire Treatments in Alternative (in total/tons).

Treatment Type	Total Acres	Fuel Loading (t/a)	Total Tons	Tons Particulate Matter (PM_{10})	Tons Particulate Matter ($PM_{2.5}$)	Tons Nitrogen Oxide NOx)	Tons Sulfur Dioxide (SO_2)	Tons Volatile Organic Compounds(VOC)	Tons Carbon Monoxide (CO)
Hand Pile	173	22	3,806	35.98	30.45	3.29	2.25	11.99	377.23
Dozer Pile	1710	40	68,400	512.83	433.49	93.20	44.46	215.46	4954.73
Prescribed Burn / Post Pile Burning	1703	20	34,060	421.49	357.63	31.51	24.69	246.94	4483.15
Prescribed Burn Only	2916	51	148,716	1,020.60	864.59	116.64	69.98	1078.19	10,488.85
2nd Entry	2916	22	64,152	775.66	657.56	37.91	39.37	211.41	8,425.78

Grand Total				**2,766.56**	**2,343.72**	**282.55**	**180.75**	**1,763.99**	**28,729.74**

PM_{10} = Particulate matter <10 microns in size, $PM_{2.5}$ = Particulate matter <2.5 microns in size, NO_2 = Nitrous oxide, SO_2 = Sulfur dioxide, VOCs = Volatile Organic Compounds, CO = Carbon monoxide

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. As displayed in tablw 16.

Table 16. Tons of Emissions for Mechanical Treatments and Road Maintenance-Reconstruction Activities for the Completion of Operations in Alternative 2.

Type of Equipment	Total Number of Hours	PM	Exhaust Hydrocarbons	NO_2	CO	SO_2
Wheeled Tractor	5376	0.18	0.26	1.7	4.96	0.12
Wheeled Loader	1512	0.02	0.04	.32	0.08	0.02
Heavy Duty Diesel Powered Truck	14,808	1.90	1.42	30.84	13.28	3.36
Track Type Tractor	28,000	1.56	1.7	17.64	4.84	1.92
Motor grader	154	0.01	0.01	0.06	0.02	0.01
Total (Entire Project)	**49,850**	**3.67**	**3.43**	**50.56**	**23.18**	**5.43**

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).

Visible dust emissions (VDE [PM_{10}] by general vehicle movement are calculated at 10 lbs per day for 5 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 27 days to haul = 98.01 pounds, which is below *de minimus*. *De minimus* is set at 100 pounds per day for 50 vehicle trips on unpaved roads. Dust abatement is required for roads below 3,000 feet in elevation. The Whisky 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. Criteria Pollutants are those that determined by EPA to have de minimus levels. Total projected treatment emissions where divided over the life of the project document which is 10 years to calculate the annual emission displayed in table 17 below.

Table 17. Emissions Conformity to General Conformity Rule for Criteria Pollutants.

Total Annual Emissions	PM_{10}	$PM_{2.5}$	NO_2
(smoke and equipment)	277.23	234.72	33.31
Annual de minimus levels (Tons)	**100**	**100**	**100**
Percent of Areas Total	**2.77%**	**2.34%**	**0.33%**

Indirect Effects

The communities of Cascadel Woods, North Fork, Bass Lake 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.

Predicted Carbon Exchange for Alternative 2 is displayed in table 18 below.

Table 18. Carbon Exchange for All Prescribed Burning and Thinning Treatments within Burn Units.

Modeled Carbon (t/ac)	Carbon flux = to or +	Acres	Total Carbon (t/ac)
234		16456 (Within Project bdy) *	3,850,704
174	- 174 t/acre (due to thinning and burning treatments)	6502	(1,131,348)
234	Remaining Carbon in biomass surrounding fire	9954	2,329,236
60	Remaining Carbon in biomass within treatment areas	6502	390,120
Total Remaining Carbon within Project Boundary		**16,456**	**2,719,356**
Loss of C			**(1,131,348)**

* Project Acres have been reduced by 10% for rock outcrops which cannot produce biomass. Numbers within parentheses are negative values.

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 Bass Lake Ranger District and in particular prescribed burns within the vicinity of the Whisky Ridge 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.

The carbon emissions produced from this alternative would be 1,131,465 tons which is 9 % less than Alternative 1.

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:

a) The emissions from the action are identified and accounted for in the applicable SIPs attainment or maintenance demonstrations,

b) The emissions are offset,

c) Based on air quality monitoring, the actions do not:

d) Cause or contribute to any new violation of any standard in any area, or

e) Increase the severity or frequency of any existing violations of any standard,

f) The state commits to modify SIP in accordance with the EPA rules, or

g) 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).

h) Title 17 of the California Code of Regulations – Subchapter 2, Smoke management Guidelines for Agriculture and Prescribed Burning

i) 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)

j) Wildland Fires Coordination and Communication Protocol as it applies to the Current Smoke Management Program

k) 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 Sierra National Forest. 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 9% 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_2. 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.

Carbon loss for this alternative is 806,650 tons but due to the reduced amount of fuels the remaining stocks of carbon would be in larger trees and over time the increased growth from these treatments should begin to show a positive gain. The major benefit would be the reduced loss of these carbon stocks from high intensity wildfire.

There will be a reduction in forest carbon because of the proposed treatments in the short term but the remaining stocks of carbon will be in larger and more vigorous trees which over time due to increased growth should begin to show a positive gain. The major benefit will be the reduced loss of these carbon stocks from high intensity wildfire. The benefit of Alternative 2 is a larger portion of carbon stocks within treated areas would remain and continue to grow and sequester carbon following a wildfire or other disturbance. This would produce a lower release of greenhouse gases in the form of carbon dioxide CO_2 and Methane back into the atmosphere.

Alternative 3 – Lower and Limited Mid-Level Canopy Treatments,

All Treatment Areas

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 diameter limit 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 LRMP, Regulatory Frameworks, and Air Quality regulations and Policies.

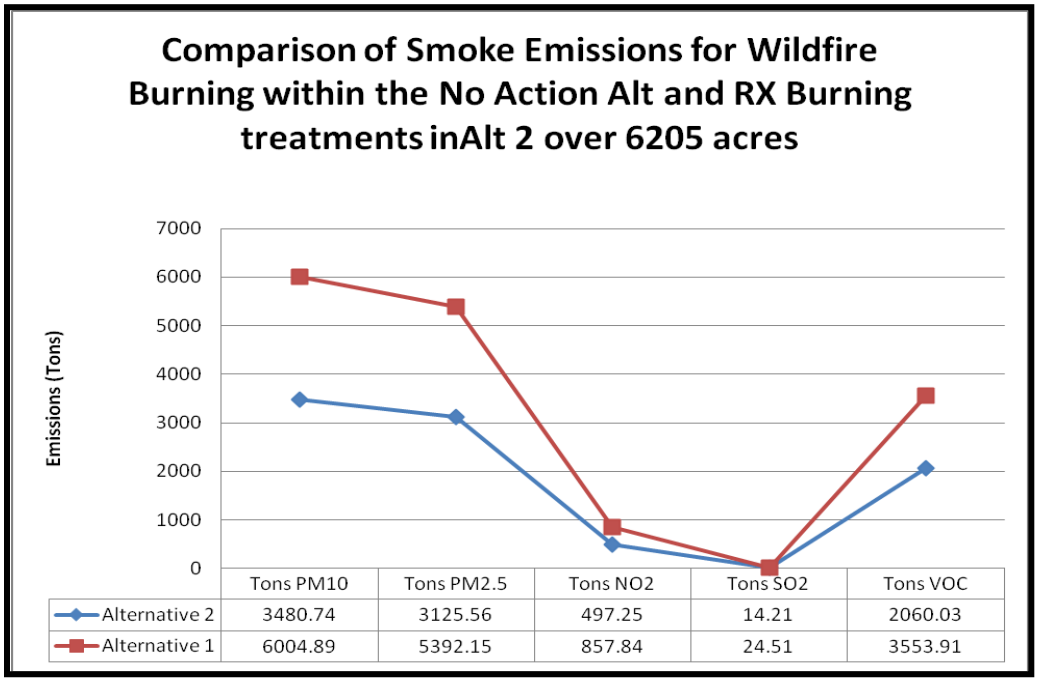
Summary of Effects

The incremental effects of smoke, dust and emissions created by the Proposed Actions in Alternative 2 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 San Joaquin Valley APCD Rule 9110-General Conformity, §51.853 and is expected to conform to the State Implementation Plan for the associated criteria pollutants of NO_2 VOC, PM_{10} and $PM_{2.5}$. This determination would be in compliance with the Sierra National Forest Land and Resource Management Plan's goals as well as meet the Standards and Guidelines written for air quality and visibility.

Carbon accounting is the same as in alternative 2.

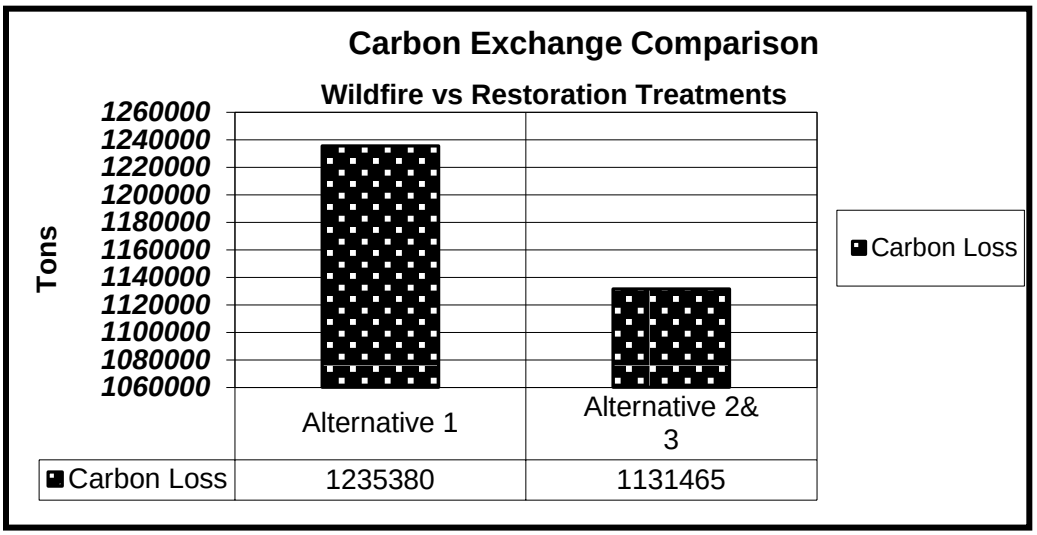
Comparison of Alternatives

Table 19. Comparison Graph of Criteria Emissions for Alternative 1 and 2.



	Tons PM10	Tons PM2.5	Tons NO2	Tons SO2	Tons VOC
Alternative 2	3480.74	3125.56	497.25	14.21	2060.03
Alternative 1	6004.89	5392.15	857.84	24.51	3553.91

Table 20. Comparison Table for Carbon Loss between Alternatives.



	Alternative 1	Alternative 2& 3
Carbon Loss	1235380	1131465

In tables 19 and 20 above both smoke emissions for criteria pollutants and carbon loss were modeled using a wildfire against the prescribed burning treatments that are proposed in the preferred alternative (alt 2). As these illustrate both smoke emissions and carbon show lower values for treated areas than a wildfire burning through the existing forest conditions even with multiple entries of prescribed burning

Aquatic Wildlife and Management Indicator Species ___

The direct, indirect and cumulative effects to the Aquatic Wildlife Management Indicator Species are summarized from the Aquatic Wildlife Management Indicator Species (MIS) report for the Whisky Ridge Project (Strand P., 2012)

Affected Environment

The Whisky Project drains to the San Joaquin River watershed and is comprised of two 5th code Hydrologic Unit Code (HUC5), which are designated Willow Creek (1804000611) and Shaver-Redinger (1804000601). The basin is further divided into HUC 6, 7, and 8s. The Pacific Southwest Region of the U.S. Forest Service (R5) Cumulative Watershed Effects Analysis (CWEA) was conducted at the HUC8 scale, which range from 260 to 2,870 acres in the Project Area. In this analysis, the term 'subwatershed' is used to refer to these HUC8s. Figure 1 indicates stream drainage within the analysis area based on analysis with Geographic Information Systems (GIS). The perennial stream, lakes, and meadows are potentially habitat for amphibians and benthic macroinvertebrates.

The aquatic analysis area used for this assessment consists of the twenty-two 8th code Hydrologic Units (HUC8) that contains the proposed treatment areas. Primary creek drainages within the aquatic analysis area are South Fork Willow, Browns, Whisky, Owl, Gertrude, and Cascadel Creeks. There are approximately 48 miles of perennial streams occurring in the analysis area subwatersheds. Segments of aquatic analysis area streams have been surveyed for stream channel characteristics and stability between 1994 and 2012. Channels and riparian areas were evaluated using various methodologies, including Rosgen channel typing, Pfankuch channel stability ratings, and Stream Condition Inventory. Current aquatic conditions were evaluated considering a combination of channel stability and water temperature. Aquatic/riparian areas represent potential habitat for foothill yellow-legged frog; western pond turtle; mountain yellow-legged frog; Yosemite toad; benthic macroinvertebrates; and Pacific tree-frog. Separate surveys for amphibians and reptiles (herpetofauna) have been completed.

The aquatic analysis area is within the Sacramento-San Joaquin zoogeographic province as described by Moyle (2002). Moyle identifies much of the west slope of the Sierra Nevada mountain range above 5,000 feet in elevation as being historically fishless due to glaciation during the Pleistocene and steep topography. Surveys within the aquatic analysis area have identified that rainbow (*Oncorhynchus mykiss*), eastern brook trout (*Salvelinus fontinalis*), and brown (*Salmo trutta*) trout occur over approximately 25 miles within the Project Area. These species are collectively referred to as resident trout. Resident trout were observed in Browns, Whisky, Gertrude, Cascadel, Fish, and Rock Creeks. Rainbow trout were also reported to occupy the headwaters of Peckinpah Creek at one time (Wheeler and Lee per. comm. 2012), although they have not been observed over the past 20 years. California Department of Fish and Game (CDFG) records indicate that eastern brook trout (1912) were introduced in upper Whisky and (Billie) Browns Creeks, while rainbow trout were planted in Fish Creek from nearby Ross Creek in 1893 (Ellis 1915). The CDFG stocked Whisky Creek annually with between 1,000 and 4,000 catchable rainbow trout between 1950 and 1974. Stocking was discontinued in 1974 due to travel and associated costs (FERC 1985). CDFG records indicate rainbow trout, brown trout and brook trout have been introduced to Rock Creek, and that stocking of rainbow trout continues in the vicinity of Rock Creek Campground.

The fish community represented within the aquatic analysis area is the "rainbow trout" assemblage for the zoogeographic province described by Moyle (2002). Habitats are characterized as having more riffle than pools, with water temperatures seldom exceeding 21º C. Resident trout are considered self-sustaining within the drainage basin, although a put-and-take fishery is maintained by the California Department of Fish and Game (CDFG 2012) within portions of the Project Area. Rock Creek is

popular for angling, while other streams are subject to more limited angling near campgrounds and dispersed campsites.

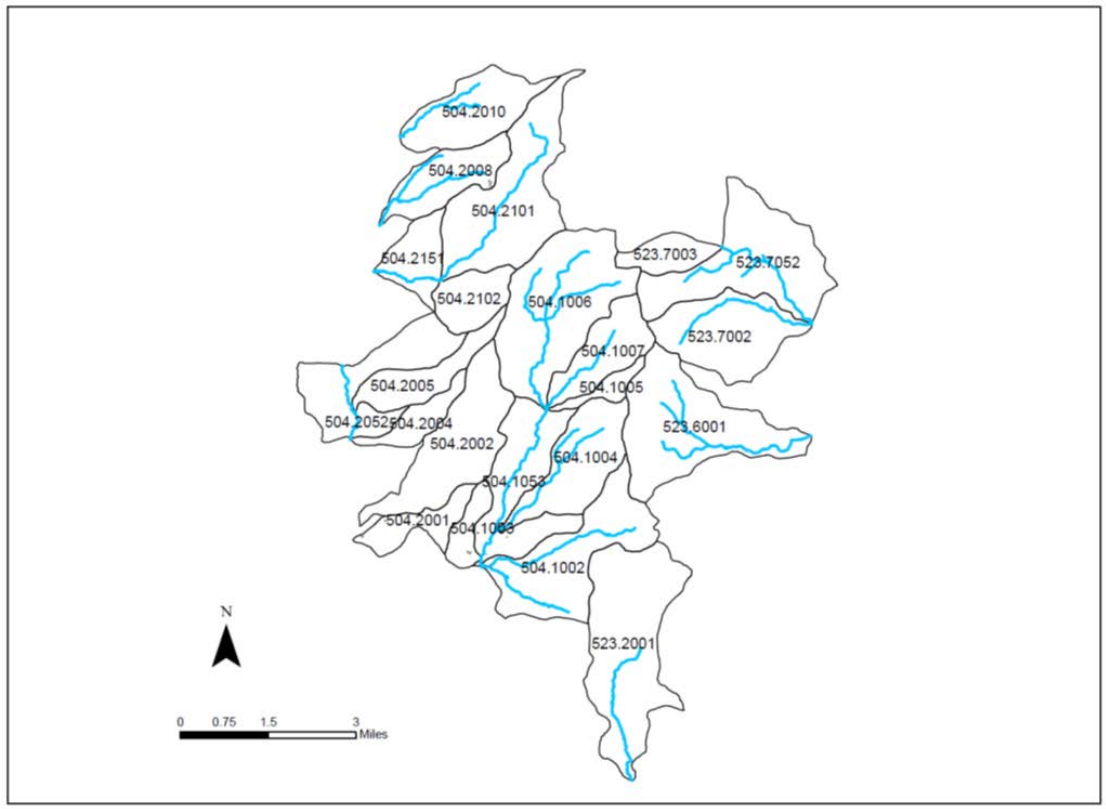


Figure 3. Perennial streams in Project Area aquatic analysis area

Existing Condition

Information contained in this report represents a compilation of approximately 80 kilometers (50 miles) of stream and species survey data. A Stream Condition Inventory (SCI) (USDA – Forest Service 2005) plot was established along a possible response or depositional channels (Montgomery and Buffington 1997) (low gradient, fine substrate) to evaluate current conditions and establish a possible baseline comparison for future monitoring.

Table 21 presents project stream channel survey information (Rosgen channel typing and Pfankuch channel stability ratings). Of stream channels evaluated within the analysis area, approximately 30 miles were channel types considered moderately to highly sensitive to disturbance, as characterized by Rosgen (1996). Of these 30 miles, approximately 10 miles were evaluated as being in Poor condition. The majority of stream reaches evaluated as Poor occur within subwatersheds 504.1002 (3.7 mi); 523.6001 (3.6 mi); 504.1004 (1.7 mi); and 504.2101 (1.2 mi). Some of these streams channels had been affected by the rain-on-snow event of 1997 when observed in 1998, and were evaluated as stable during the 2012 review (Stone).

The Project Hydrology Report (Stone 2012) notes that there “are several areas (subwatersheds 504.1002 and 504.1004) within the proposed project boundary that are unstable and sensitive to disturbance. 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 (2001) 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 504.1002 has an unstable main stem channel, which would be sensitive to any excess sediment delivery and/or runoff. As such, ground disturbance from mechanized equipment should be minimized in this subdrainage and harvest methodology should use a "light-on-the-land" approach."

Table 21. Summary of Subwatershed Conditions.

HUC8 Subws.	Acres	Channel Sensitivity (2012 review)*	2012 Pfankuch stability (Rosgen modified)*	Rosgen Channel Typing (mi)	Rosgen Sensitivity (mi)			Poor Stability (mi) (1998 Review)
					Low (mi)	Moderate (mi)	High (mi)	
504.1002	2095	Extreme	Poor	5.5	0.7	2.4	2.4	3.7
504.1003	376	-	-	0.0	0.0	0.0	0.0	0.0
504.1004	1441	Low	Fair	5.7	0.7	1.8	3.2	1.7
504.1005	257	-	-	1.8	0.6	0.2	0.9	0.2
504.1006	2728	Low	Good	5.3	2.1	1.1	2.2	0.3
504.1007	1011	Very low	Good	3.7	2.7	0.3	0.8	0.0
504.1053	1648	Moderate	Good	2.7	1.6	0.2	0.9	0.0
504.2001	598	-	-	0.0	0.0	0.0	0.0	0.0
504.2002	1888	Low	Fair	2.9	1.6	0.2	1.1	0.0
504.2004	486	Moderate	Fair	0.0	0.0	0.0	0.0	0.0
504.2005	832	-	-	0.0	0.0	0.0	0.0	0.0
504.2008	1014	-	-	0.0	0.0	0.0	0.0	0.0
504.2010	1342	-	-	2.8	2.0	0.3	0.5	0.2
504.2052	1593	Moderate	Good	0.0	0.0	0.0	0.0	0.0
504.2101	2482	Low	Good	3.0	1.0	1.3	0.6	1.2
504.2102	715	Very high	Good	0.0	0.0	0.0	0.0	0.0
504.2151	711	-	-	3.0	2.7	0.3	0.0	0.0
523.2001	2868	Very low	Fair	0.0	0.0	0.0	0.0	0.0
523.6001	2520	-	-	11.3	3.4	3.7	4.2	2.6
523.7002	1707	-	-	0.0	0.0	0.0	0.0	0.0
523.7001	517	-	-	0.0	0.0	0.0	0.0	0.0
523.7052	2423	-	-	3.4	2.2	0.4	0.8	0.3
				51.2	21.3	12.3	17.5	10.3

*From project hydrologist review (Stone 2012).

Table 22 displays miles of perennial streams, miles occuppied by resident trout, 2010 mean summer (7/15-9/15) water temperature, and maximum daily mean water temperature from the larger perennial streams. Streams in the project analysis area met the Desired Condition 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 22. Perennial Streams (mi); Resident Trout Occupancy (mi), Riparian Canopy Cover, Mean Summer Water Temperature (period 7/15-9/15), and Maximum Daily Temperature (greatest mean daily between 7/15-9/15).

HUC8	Acres	Drainage	Perennial (mi)	Resident Trout (mi)	Riparian Canopy Cover (%)	Mean summer water temp (C°)	Max water temp (C°)
504.1002	2095	Cascadel Creek	4.8	0.5	79	-	-
504.1003	376	Unnamed trib to Whisky Creek	0.0	0.0	-	-	-
504.1004	1441	Gertrude Creek	3.6	2.9	70	10.3	12.1
504.1005	257	Rousch Creek	0.0	0.0	66	-	-
504.1006	2728	Whisky Creek, Upper	6.3	3.6	54	11.9	16.5
504.1007	1011	Owl Creek	1.9	1.7	60	-	-
504.1053	1648	Whisky Creek, Lower	3.3	3.2	67	-	-
504.2001	598	Unnamed trib to Peckinpah Creek	0.0	0.0	-	-	-
504.2002	1888	Peckinpah Creek	0.0	0.0	-	-	-
504.2004	486	Unnamed trib to SF Willow Creek	0.0	0.0	-	-	-
504.2005	832	Unnamed trib to SF Willow Creek	0.0	0.0	-	-	-
504.2008	1014	Unnamed trib to Sand Creek	3.5	0.6	-	-	-
504.2010	1342	Timber Creek	2.5	1.0	55	-	-
504.2052	1593	SF Willow Creek	1.5	1.4	-	-	-
504.2101	2482	Browns Creek, Upper	3.8	2.3	71	11.4	14.8
504.2102	715	Unnamed trib to Browns Creek	0.0	0.0	-	-	-
504.2151	711	Browns Creek, Lower	1.2	1.2	75	-	-
523.2001	2868	Saginaw Creek, Upper	2.7	0.0	-	-	-
523.6001	2520	Fish Creek, Upper	5.0	3.6	75	11.3	13.8
523.7002	1707	Slide Creek	2.8	0.9	-	-	-
523.7003	517	Unnamed trib to Rock Creek	0.0	0.0	-	-	-
523.7052	2423	Rock Creek, Middle	4.2	2.4	34	13.0	18.1

Species Accounts and Habitat

The following provides information on aquatic/riparian candidate and U.S. Forest Service (USFS) sensitive species that are either known to occur or have potential habitat within the aquatic analysis area, and the system used to quantify and evaluate potential habitat and suitability. Species habitat within the analysis area is displayed in Table 3. Figure 3 portrays potential habitat in relation to Proposed Action treatment areas.

Foothill yellow-legged frog (FYLF)

***Distribution**:* Historically, foothill yellow-legged frogs 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 Willow, 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, Willow riffles (≤ 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 long 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 foothill yellow-legged frog as a sensitive species in 1998.

Occurrence in the Analysis Area: The Museum of Vertebrate Zoology ((MVZ); Berkeley, California) does not include FYLF specimens from the analysis area. The California Natural Diversity Database (CNNDB) indicates a FYLF located along South Fork of Willow Creek (near analysis area boundary) during the early 1970's. USFS surveys within potential habitat have not detected FYLF within the analysis area.

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. These areas have trees greater than six inches in diameter and canopy closures greater than 10%. The essential elements for the species are indicated to be algae, invertebrates, lithic (rocky substrate), and water. Within the analysis area there are approximately 18 miles of potential habitat under 5000 feet elevation, providing approximate habitat acreage of 660 acres for this species.

Western pond turtle (WPT)

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 Willow 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 Endangered Species Act (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 1994 and 2012. WPT have been detected along 3 miles of stream within the aquatic analysis area.

Potential Habitat: This turtle is often restricted to areas near the banks or in quiet backwaters where the current is relatively slow and basking sites and refugia are available (CDFG 2008). Movements of WPT of over 1 mile have been reported when local aquatic habitat conditions change (e.g. drought) or movements to nesting or overwintering sites. However, most stay within 325 feet of the stream channel mainly moving during breeding and egg-laying (CDFG *ibid*). Water and Slow Water are identified as essential elements of habitat. Within the analysis area there are approximately 18 miles of potentially suitable stream habitat below 5000 feet in elevation. There approximately 1,470 acres of potential habitat within the analysis area using CWHR criteria.

Mountain yellow-legged frog (MYLF)

Distribution: The Sierra Nevada yellow-legged frog occurs at high elevation (4,500-12,000 ft.) only in the Sierra Nevada Mountains of California (CDFG 2008). 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 USFS sensitive species list and the USFWS continue to refer to the species as mountain yellow-legged frog (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 waterbodies) 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 would 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 (also known as Sierra Nevada yellow-legged frog). There are no records of the species within either the CNDDB or the MVZ databases for the analysis area, and the species was not detected during USFS surveys within the analysis area.

Potential Habitat: MYLF typically live along the edge of watercourses and rely heavily on an aquatic environment for foraging, shelter, breeding and protection from predators. There is approximately 29 miles of stream habitat below 5000 feet in elevation. An estimated acreage of suitable habitat is derived from the total miles of stream with a 165-foot habitat on each bank (CDFG 2008) with a 165-foot dispersal area for an approximate total of 1,155 acres of potential suitable habitat for this species

Yosemite toad (YT*)*

Distribution: The original range of the Yosemite toad (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 Willow pools and small, slow moving, Willow 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 m² (2.1 ac), while Liang (2010) estimated mean home range of 27,430 m² (6.8 ac), and noted female home range was more than 1-1/2 times larger than males. Yosemite toad seek cover during non-breeding seasons (approximately August to March) in abandoned rodent burrows or by moving into adjacent forested areas (CDFG 2008).

Yosemite toads 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 Yosemite toad 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 2012. No breeding meadows or individual Yosemite toad were identified within the aquatic analysis area during surveys. The nearest known occupied site is approximately 5 miles from the closest potential breeding meadow within the aquatic analysis area. The CNDDB identifies a record of the species at Chilkoot Lake (approximately 4.5 miles from the aquatic analysis area) from 1946, but several surveys of the site in the last 10 years have not detected current occupancy at that site.

Potential Habitat: This species occurs above 6,000 feet in elevation in meadows, lake edges, and some stream habitats only in the central Sierra Nevada Mountains. YT also require terrestrial habitat. Metamorphs appear to overwinter their first year in the terrestrial meadow habitat adjacent to their rearing site and move to more distant terrestrial habitat during mid-summer of their second year (Kagarise Sherman and Morton 1993; USDI-USFWS 2002). Suitable breeding habitat for this analysis was considered all meadows above 6000 feet elevation. There are approximately 80 acres of meadow habitat above 6000 feet elevation within the aquatic analysis area. The CWHR model evaluates YT habitat as 900-meters surrounding meadows above 6000 feet elevation (approx. 7445 acres).

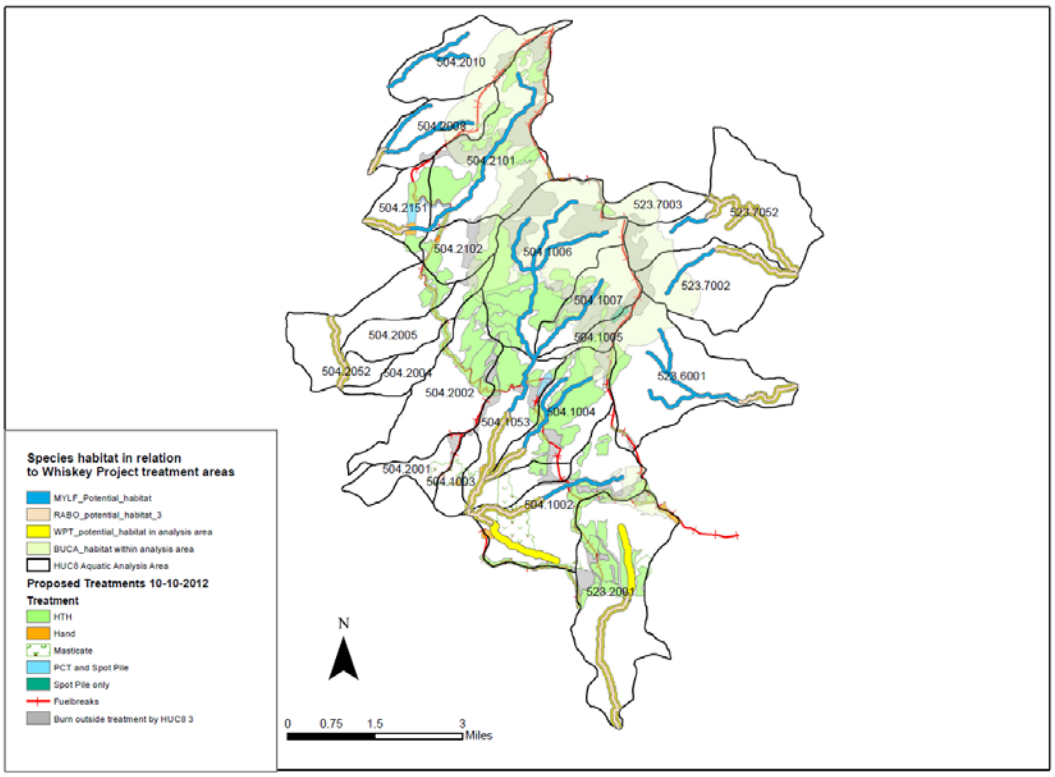


Figure 4. Habitat distribution across aquatic analysis area in relation to treatment areas

Table 23 summarizes the amount of potential habitat for the special interest herpetofauna, along with a CWHR quantification of amount characterized as medium or better.

Table 23. Amount of Potential Habitat Within Aquatic Analysis Area for Special Interest Species(using CWHR and GIS).

Species	*Potential Habitat (ac)*	*CWHR Medium/Good (ac)*
Foothill yellow-legged frog	660	100
Western pond turtle	1470	170
Sierra Nevada yellow-legged frog	1155	80
Yosemite toad	7445	5980

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 2012a). 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 48 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 approximately 98 acres of CWHR wet meadow habitat within the aquatic analysis area. Table 24 summarizes the potential aquatic MIS habitat.

Table 24. Aquatic MIS Habitat.

Species	Potential Habitat (ac)
Riverine/Lacustrine	39
CWHR Wet Meadow	98

Desired Condition

Specific desired conditions (DC) for the Whisky Project Areaare identified under the Willow Creek Landscape Analysis (USDA - Forest Service 1995). It is Forest Service policy to analyze impacts to TE species to ensure management activities are not be likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Species habitat conservation is linked to standards and guidelines developed under the Forest Land and Resource Management Plan (LRMP) for the Sierra National Forest (USDA – Forest Service 1992). The Forest Service (FS) develops and implements management practices to ensure that rare plants and animals do not become threatened or endangered and ensure their continued viability on National Forests. It is FS policy to analyze impacts to sensitive species to ensure management activities do not create a significant trend toward Federal listing or loss of viability. The LRMP provides direction for threatened, endangered, and Forest Service Sensitive (FSS) species, along with standards and guidelines to be implemented for the protection of aquatic biota and their habitat. The LRMP was amended in 2001 and 2004 by the Sierra Nevada Forest Plan Amendment (SNFPA), which provided a revision in LRMP standards and guidelines, and included an Aquatic Management Strategy for habitat conservation. Habitat conservation is provided through a combination of streamside management zones and riparian conservation areas.

Desired conditions related to aquatic/riparian habitat are identified as water temperature; canopy cover, grounds cover in SMZs and RMAs, channel stability, trampling/chiseling of banks, width/depth ratio, sedimentation of riffles, pool/riffle ratio, and turbidity. The DC for the Whisky Project are:

Water Temperature: < 70° F (20°C).

Canopy Cover: same as existing

Ground cover in SMZs and RCAs: > 50% (USDA – Forest Service 1992).

Channel stability: Good or better

Trampling/Chiseling of banks: <20% (USDA – Forest Service 1992).

Width/Depth ratio: 20:1 or less.

Sedimentation in riffles: <25%.

Pool/riffle ratio: 1:1.

Turbidity: meet Clean Water Act Objectives.

Environmental Consequences

This section analyzes the effects (environmental consequences) from the Whisky Project 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.

Complete descriptions of project alternatives are available in Chapter 2 of the DEIS for the Whisky Project. The combined treatments proposed for the action alternatives would reduce fire ladder conditions by removing understory and intermediate trees (thinning); piling slash for burning; burning slash piles; masticating and/and or precommercially thin stands; reducing fuel loading through controlled burning; and removing conifers encroaching on meadows. It would also stabilize stream channels in meadows; thin cultural sites; provide vegetative clearing along cattle stock-drive; establish off-site water sources away from meadow channels; restore portions of user-defined OHV routes with compacted soil; install bear boxes and movement a campground toilet; implement culvert work to restore function; and reconstruct and maintain roads. 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 Whisky 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 benthic macroinvertebrates 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 Whisky 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).

Methodology

As identified under Current Conditions, segments of aquatic analysis area streams have been surveyed for stream channel characteristics and stability between 1989 and 2011. Channels and riparian areas were evaluated using various methodologies, including Rosgen channel typing, Pfankuch channel stability ratings, and Stream Condition Inventory. Aquatic conditions were evaluated considering a combination of channel stability, and water temperature. Separate surveys for herpetofauna have been completed.

Rosgen Channel Typing: Channel types (Rosgen 1996) were determined based on channel attributes such as width/depth ratio; gradient; sinuosity; and substrate, along with sediment and transport characteristics. Between 1994 and 1998, approximately 50 miles of stream channel were evaluated within the aquatic analysis area. Stream reaches with low sensitivity are bedrock/boulder (Rosgen channel types A1-2, B1-3, C1-2, F1-2, and G1-2). These channel types are considered inherently stable and are not significantly influenced by land management activities. However, sediment build-up can occur in these channels if upstream stream channels degrade. Effects to aquatic habitat focuses on those Rosgen channel types considered as sensitive, degraded, or unstable (sensitivity of moderate and high). Results of this inventory are displayed in Table 1.

Pfankuch channel stability ratings: The Pfankuch channel stability rating (USDA – Forest Service 1975) was developed to evaluate stream channel condition and stability from within the floodplain

and stream channel. This method utilizes observation of attributes from the upper banks, lower banks, and channel bottom. Channels are categorized into three ratings of Poor, Fair, or Good. Channel types were evaluated in terms of sensitivity to disturbance as presented by Rosgen (1996), which varies by channel gradient and size of substrate. The Modifications proposed by Rosgen evaluate each channel type separately in terms of vegetative bank cover, stream bank cutting, channel bottom deposition, channel bottom scour and deposition, and percent stable material. Under Rosgen's (*ibid*) modified approach, channels are evaluated considering sensitivity to disturbance, recognizing channel characteristics rather than evaluating all channels against a common metric. Results of this inventory are displayed in Table 1.

Stream Condition Inventory: A Stream Condition Inventory (SCI) (USDA – Forest Service 2005) plot was established within the analysis area. SCI consists of stream features or attributes that are useful in classifying channels, evaluating the condition of stream morphology and aquatic habitat and making inferences about water quality. Data on particle distribution and channel geometry information, large woody debris, bank configuration, stream shade, channel stability, and water temperature was collected.

Species Surveys: Between 1993 and 2012 portions of the streams, meadows, and ponds within the allotments were surveyed by the U.S. Forest Service (USFS) for herpetofauna. USFS surveys utilized a Visual Encounter Survey (VES) as described in Fellers and Freel (1995), which has been successful on the Sierra National Forest for detection of foothill yellow-legged frog; mountain yellow-legged frog; Yosemite toad; and western pond turtle, along with numerous common herpetofauna. Species records from the California Natural Diversity Database (CNDDB) and the Museum of Vertebrate of Zoology (MVZ) were also queried for the aquatic/riparian threatened, endangered, and sensitive species collected within the analysis area.

Water Temperatures: During 2010, summer water temperatures were collected from five sites within the aquatic analysis area from stream segments ranging from 4900 – 5600 feet elevation. Water year (10/1 – 9/30) 2010 was an "Above Normal" water year based on criteria established by the State Department of Water Resources.

Cumulative Watershed Effects: A Cumulative Watershed Effects (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). 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%). Thus, if the %ERA exceeds the Lower TOC%, then an interdisciplinary (soils, hydrology, and aquatic biology) field evaluation is triggered to determine if a CWE response is occurring. The upper limit for the TOC% is 14%. If a subwatershed's total %ERA (with the Proposed Action and reasonably foreseeable future actions) is equal to or greater than 14%, the probability of a cumulative water effect increases.

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

Spatial and Temporal Context for Effects Analysis

The aquatic analysis area consists of 22 HUC8 subwatersheds that contain the proposed Whisky 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.

Connected 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 the Draft Environmental Impact Statement (DEIS) for the Whisky Project.

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 Project 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 Whisky Project to reduce fire ladder conditions (thinning); pile slash for burning; burn slash piles; plant understocked areas; thin cultural resource sites; masticate and/and or precommercially thin stands; plant trees; reduce fuel loading through controlled burning; remove conifers encroaching meadows; stabilize stream channels within meadows; remove noxious weeds; restore user-defined OHV routes; or reconstruct and maintain roads. No Whisky associated treatments would be implemented as displayed in Table 5, with projected acres of potentially affected herpetofauna and aquatic MIS habitat displayed.

Direct Effects

There would be no anticipated direct effects to special interest herpetofauna or MIS habitat as a result of the implementation of Alternative 1.

Indirect Effects

There would be no anticipated indirect effects to special interest herpetofauna as a result of the implementation of Alternative 1. 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.

Riparian Canopy Cover: Alternative 1 would maintain current levels of stream shading.

Water temperature: Water temperature data collected from the Project Areain 2010 indicates it currently meets the Desired Condition (< 21º C). Alternative 1 would maintain current water temperatures.

Flow: No changes in flow would be anticipated under Alternative 1.

Cumulative Effects

Past, present, and reasonably foreseeable actions within the Project Areas are displayed in Chapter 3 of the DEIS for the Whisky Project. Known activities occurring spatially and temporally within the analysis area are recreational use (both developed and undeveloped), roads; cattle grazing, and fires. Also, it is anticipated that aquatic habitat would be altered over longer time frames by climate change.

Recreation: There are approximately 31 miles of inventoried Off-Highway Vehicle (OHV) routes within the aquatic analysis area, some that cross habitat for Forest Service sensitive 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. Approved routes require improvements to protect resources. This analysis considers the 18 miles of approved routes within the analysis area, under the Record of Decision for the Travel Management Plan (USDA – Forest Service 2010). Approximately 1 mile of approved routes traverses potential habitat for all four species. Approximately 13 miles of inventoried routes would be expected to continue to have effects within the short-term (10-year period).

Within the project analysis area there are 3 developed campgrounds, and several overflow camping areas. These facilities total approximately 23 acres. Some of the campgrounds and overflow areas are located adjacent to water, thus are within habitat for amphibians (approximately 13 acres WPT and 7 acres FYLF 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). Handling may harm animals or in some instances handlers. 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. Ravens are noted as natural predators for a variety of herpetofauna (Kagrise-Sherman and Morton 1993; Jennings and Hayes 1994; Ashton et al. 1997; Maxell and Hokit 1999; and Boatman 2002). 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. Boatman (2002) identifies that increased forage opportunities for raven may be associated with road mortality and landfills. Rainbow trout are stocked by the California Department of Fish and Game near campgrounds nears Rock and Fish Creeks. 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: There are no additional on-going or recently completed vegetation or fuels projects that might effects species or habitat.

Roads: The existing National Forest Transportation System (approximately 156 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 60 miles of habitat, representing 8 acres of foothill yellow-legged frog; 13 acres of western pond turtle; 12 acres of mountain yellow-legged frog; and 88 acres of Yosemite toad 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-dependent species and they may even be particularly vulnerable to it (Trombulak and Frissell *ibid*). Literature suggests that highest road-kill rates are near wetlands and that amphibians represent the largest percent of species.

Cattle grazing: The aquatic analysis area includes portions of the Haskell and Central Camp allotments. There are approximately 1,080 acres of Primary Use Areas within the analysis area, which represents available forage. Primary Use Areas were defined as meadows (approx. 130 acres) buffered by 250 feet. The grazed meadows represent potential habitat for Sierra Nevada yellow-legged frog (90 ac.); and Yosemite toad (715 acres). A stock-drive to move cattle between lower elevation allotments to higher elevation areas traverses approximately 1.1 miles through the Project Area, but the stock drive does not pass through potential habitat for any of the candidate of sensitive species. 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 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 2012) 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 Whisky 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 (2010), 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 Browns, Rock, Fish, and Whisky Creek drainages in the Project Areaare 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 Willow pools during the springs, which provide breeding habitat for Yosemite toad. A similar effect to Willow lakes would reduce the suitability of habitat for mountain yellow-legged frog, 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 (2002) identified that “Fire suppression, and changes in fire frequency and hydrology, has probably contributed to the decline of Yosemite toads 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 Yosemite toad habitat.”

The Whisky Project is being proposed to reduce or modify the intensity and spread of wildland fires across the landscape and near communities, in this case Whisky. 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.

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 2003 (year of Vegetation Typing), there have been four fires that burned within or partially within the analysis area covering approximately 390 acres. There fires affected approximately 50 acres of habitat (11 acres foothill yellow-legged frog; 28 acres western pond turtle; and 12 acres mountain yellow-legged frog). The fires burned at lower severity through the riparian areas representing habitat.

CWE Analysis: The CWE analysis in the Whisky Hydrology Report (Stone 2012) notes that all of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). HUC8 subwatersheds 504.1002; 504.1005/504.1007; 504.2008; 523.6001; and 523.7002 currently exceed the lower TOC%. None of the subwatersheds currently exceed the upper TOC% (14%). Essentially the only watershed considered a candidate for CWE response is subdrainage

504.1004. Subdrainage 504.1004 is 1,442 acres and is drained by Gertrude Creek, which is tributary to Whisky Creek. Channel observations and S-Star measurements (amount of fines in pools) suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. The project hydrology report indicates that under 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.

Sediment: Roads and trails identified as causing resource damage would not be addressed in terms of decommissioning, obliteration, or reconstruction. As such, these roads and trails would continue to erode and degrade, which could have long-term adverse effects to watershed function and water quality (Project Hydrology Report).

Summary of Effects

Table 25 summarizes overlap of potential habitat by other Actions. Habitat may also be altered by climate change.

Table 25 Acres of Habitat Cumulatively Affected under Alternative 1.

Species	Potential habitat (ac)	Grazing Meadows (ac)	Rec/OHV Effected (ac)	Fire (ac)	Road (ac)	Whisky (ac)	Cum. Effect (ac)	% Habitat Affected
Foothill yellow-legged frog	661	0	7	11	8	0	26	4%
Western pond turtle	1471	0	13	28	22	0	63	4%
Mountain yellow-legged frog	1155	88	0	12	12	0	112	10%
Yosemite toad	7443	714	9	0	88	0	811	11%
Lacustrine/riverine*	38.5	2	0	0.25	0.2	0	2.45	6%
Wet meadow	98	98	0	0	0	0	98	100%

As noted under occurrences in the species accounts, there are no known sites occupied by foothill yellow-legged frog, mountain yellow-legged frog or Yosemite toad in the analysis area. Western pond turtle occurs at several sites within the analysis area and there would be no effects on this species under the No Action Alternative. No changes to current riparian canopy cover, water temperature, flow, or sediment would be anticipated. Sites that are currently contributing excess sediment would continue.

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

Alternative 1 would be consistent with Forest Service direction for threatened, endangered, and sensitive species. It would additionally be consistent with Forest Service direction for MIS.

Table 26 displays findings consistent with Forest Service Manual 2670 regarding threatened, endangered, candidate, and sensitive species. The table also displays findings regarding habitat for

aquatic MIS as identified under the National Forest Management Act (36 CFR 219) , and that effects of the project on MIS are to be assessed during the preparation of NEPA documents prior to project implementation to determine if project modifications are necessary to reduce potential negative effects (FSM 2534.1).

Table 26. Species and Habitat Determinations.

Species	Determination	Rational for the Determinations
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
Riverine/Lacustrine MIS	Amount of habitat remains stable	No anticipated changes to riparian canopy cover, water temperature, flow, or sediment.
Wet Meadow MIS	Amount of habitat remains stable	No anticipated changes to wet meadows.

Alternative 2 – Proposed Action

Alternative 2 represent the Proposed Action. The combined treatments proposed involve tree thinning (both commercial and precommercial approx. 5900 ac.); prescribed fire (approx. 4620 ac. prescribed burning (2780 acres beyond areas to be thinned) and post-thin burning); mastication of brush and submerchantable trees (approx. 530 ac.); high intensity fire (20 acres); handpiling and burning (approx. 130 ac); removal of noxious weeds (approx.5 acres); enhancement of sensitive plant habitat (1 ac); road reconstruction (approx. 33 mi.), and maintenance (approx. 65 mi.), along with temporary roads (approx. 5.0 mi.); decommissioning approximately 0.2 miles of Forest System Road 8S26D; replacement of two culverts on Forest System roads 7S068 and 7S07F to reduce sediment; and restoring soil productivity on user-define vehicle trails (approx. 10 mi). Additionally, conifers encroaching at selected meadows (30 ac.) would be removed, four off-site water developments for cattle, and restoration actions (approx. 16 ac.) would be implemented to improve channel stability within meadows 503M15; 504M28; 504M29; 504M37; 504M59; 504M60; 504M153; 504M167; and 504M312. All these activities individually and together would have risks and both short-term and long-term effects on aquatic species, even with the project design measures and BMPs in place.

Table 7 summarizes gross acres from proposed activities. Effects from wildfire would be similar to those discussed under Alternative 1. Hand thinning, including felling of encroaching conifers in meadows; hand removal of noxious weeds; reforesting understocked areas (planting); vegetation removal at historic and prehistoric resource sites; vegetation clearing along grazing stock drives; installation of bear boxes or moving a campground toilet would not be anticipated to effect water surface shade, flow or sediment.

Foothill yellow-legged frog: There are approximately 660 acres of potential foothill yellow-legged frog habitat within the aquatic analysis area. Alternative 2 would affect approximately 17 acres (table 27) of potential habitat. Most of the effected acres would be subject to mastication (10 acres) and hand-treatments within SMZs (6 acres). FYLF was not detected during surveys in the analysis area and the Project Areais not within dispersal distance of any known population.

Western pond turtle: There are approximately 1,470 acres of potential western pond turtle habitat within the aquatic analysis area. Alternative 2 would affect approximately 116 acres (table 7) of potential habitat. Most of the effected acres would be subject to mastication (57 acres), commercial thinning (32 acres), and hand-treatments within SMZs (24 acres). WPT were detected along three streams within the analysis area overlapping portions of four treatment areas (T-101; T-102; T-103; and RX-319).

Mountain yellow-legged frog: There are approximately 1,155 acres of mountain yellow-legged frog potential habitat within the aquatic analysis area. Alternative 2 would affect approximately 93 acres (table 7) of potential habitat. Most of the effected acres would be subject to thinning (44 acres); prescribed fire (40 acres); meadow stabilization structures (6 acres); and hand-treatments within SMZs (3 acres). MYLF was not detected during surveys in the analysis area and the Project Areais not within dispersal distance of any known population.

Yosemite toad: There are approximately 7,443 acres of potential Yosemite toad habitat within the aquatic analysis area. Alternative 2 would affect approximately 3,334 acres (table 27) of potential habitat. Most of the effected acres would be subject to prescribed fire (approximately 2040 acres); commercial thinning/and or burning (1,215 acres); spot pile and burning (28 acres); meadow stabilization/meadow encroachment treatments (17 acres); and hand-treatments within SMZs (13 acres). YT was not detected during surveys in the analysis area and the Project Areais not within dispersal distance of any known population.

Table 27. Species Potential Habitat for Alternative 2.

Species	Hand Thin	Tractor Thin	Masticate	PCT and Spot Pile	RX burn	Spot Pile only	Meadow Stabiliz. & encroach.	*Treated Acres	Potential Habitat
Foothill yellow-legged frog	6	0	10	0	1	0	0	17	661
Western pond turtle	24	32	57	0	3	0		116	1471
Mountain yellow-legged frog	3	44	0	0	40	0	6	93	1155
Yosemite toad	13	1216	0	23	2037	28	17	3334	7443
Riverine/Lacustrine	0	0	0	0	0	0	0	0	39
CWHR Wet Meadow	0	0	0	0	0	0	0	0	98

*Acreages approximations generated by GIS. Acres represent gross area ActivitiesNet treatment acres would less considered implementation of Controlled Areas; portions on treatment units lacking access or not requiring treatment. PCT=Precommercial thin.

Direct Effects

There is overlap between timing of proposed activities, resulting in potential effects on foothill yellow-legged frog, western pond turtle, mountain yellow-legged frog and Yosemite toad. Potential direct effects could occur from crushing of individual animals by tractor thinning, mastication, or from burning of animals. Project design measures would be expected to protect breeding and rearing sites from direct effects, thus subadult and adult lifestages would be potentially affected. Hand thinning, including falling of encroaching conifers in meadow; hand removal of noxious weeds; vegetative clearing at prehistoric and historic cultural resource sites; channel stabilization in

meadows; placement or bear boxes and moving a toilet site in a campground, and vegetative clearing along cattle stock-drives would not be anticipated to result in direct effects. User defined OHV routes not approved as part of the Forest Travel Management Plan (USDA- Forest Service 2010) and do occur within potential habitat for special interest herpetofauna, but no direct effects would be anticipated by 10 miles of trail restoration (barricading, covering with brush, or ripping to reduce compaction).

Proposed tractor thinning (T units), tractor piling, mastication (M units), and hand-treatments (H units) overlaps species habitat in units T112-114; T120-132; T137-142; T145; T147; T149-158; M402-404; H501, H503; H505; H507; and H508. The potential for direct effects from crushing on herpetofauna 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 or movements to overwintering sites. 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. Western pond turtle may move beyond the areas associated with limited treatments in SMZs (CWHR movements 325 feet from water). Adult Yosemite toad 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 or within Yosemite toad foraging habitat for units RX302; RX304-315; RX317-319; and RX321. Underburning potentially affects mountain yellow-legged frog, foothill yellow-legged frog, western pond turtle, and Yosemite toad. 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 estivating 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. The proposed high intensity burn would be located based on topography and vegetative conditions, avoid areas where western pond turtle are known to occur and would not be within potential habitat for any aquatic/riparian TES species.

Direct effects to foothill yellow-legged frog, mountain yellow-legged frog, and Yosemite toad 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 not being within dispersal distance of project treatment areas. The nearest known occupied sites for any of these species is more than 8,000 meters from the nearest proposed treatment unit. Western pond turtle were detected in the analysis area. Foraging sites would be partially protected by project design measures. The turtle is generally associated with water, which is buffered by streamside management zones that would be anticipated to protect the turtle from direct effects.

However, turtle movements during the period of operation may be beyond the SMZs (CWHR movements 225 feet beyond SMZ). No project activities would take place until after June 15 in

treatment units adjacent to occupied habitat (units T101-103 and RX319) to protect turtle movement from overwintering sites or avoid disturbance during egg deposition by females. Individual turtles may be subject to direct effects.

Thinning, tractor piling, underburning, mastication, and roads can affect meadows and wetlands directly by encroachment, and indirectly by altering surface and subsurface flow paths. Alteration of the hydrologic flow paths can indirectly affect meadow and wetland function. The effects can include erosion and / or lowering of the water table. BMP 1-8 (Streamside Management Zones) would be applied along the wet meadow perimeter where treatments are proposed. The SMZs would be Class I (100 feet). The inner 50 feet of the SMZ could include hand treatments on precommercial conifers that would not be anticipated to affect wet meadow habitat. Beyond the 98 acres of wet meadow, approximately 72 acres are proposed for thinning within the100- foot SMZ, with limited heavy equipment permitted within 50-feet of the meadow edge.

Indirect Effects

Thinning to reduce ladder fuels would occur over approximately 5,900 acres under this alternative. Underburning (including sites both thinned and unthinned) could occur over up to 4,620 acres, hand thinning on 130 acres, and mastication on 530 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. Thinnings are proposed within the 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 (16 acres) to restore hydrologic function in meadows 504M28, 504M41, 504M59, 504M60, 504M153, and 504M312 may result in short-term increases in sediment through stream bank exposure during treatment. Hand felling of encroaching conifers at some of these meadows may improve habitat for Yosemite toad, which was identified as being impacted by encroaching conifers resulting from alteration of the fire regime (USDI-USFWS (2002). None of the meadows proposed for restoration were determined to be occupied by special interest herpetofauna. It is expected that meadow treatment sites would recover within several years and overall site stability would increase, while sediment contribution would decline from current condition and improve aquatic/riparian habitat.

Riparian Canopy Cover: Proposed management actions have the potential to directly and indirectly 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 lifestages 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 treatment 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 riparian canopy cover would be anticipated from the Proposed Action. Riparian canopy cover would remain at approximately 70% across the analysis area, which would maintain the desired condition.

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. However, in addition to direct solar radiation, Beschta et al. (1987) addresses possible affects from angular solar radiation and describes how canopy cover can be evaluated as angular canopy density. 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 angular solar radiation.

As measured during the summer of 2010, daily mean water temperatures in the analysis area were less than 21° C (desired condition). The mean summer (7/15 – 9/15) and maximum daily mean water temperatures during the 2010 monitoring period were presented in Table 2. Mean water temperatures met the Desired Condition (< 21º C). It is anticipated that the majority of the trees would be retained and the inner 50-foot No-Treatment zone would intercept angular 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. Water temperatures would be anticipated to meet the desired condition.

Flow: Of the remaining elements that may indirectly 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 under the Whisky 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 that affect riverine habitat. 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 would 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 to contribute 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 Whisky, 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. The USDI-USFWS identifies conifer encroachment as resulting in a decline to Yosemite toad habitat (2002). 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 whether flow would increase over the long term.

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 (Stone 2012) notes that any changes in flow resulting from thinning would be unlikely to persist beyond 10 years.

Stream channel stabilization to restore hydrologic function in meadows 504M28; 504M41; 504M59; 504M60; 504M153; and 504M312 may result in short-term increases in sediment through stream bank exposure during treatment. It is expected that sites would recover within several years and overall site stability would increase and sediment contribution would decline from current condition. Over the long term these projects should maintain the water table and reduce downstream erosion. Removal of encroaching conifers may also reduce transpiration and allow more water to be retained at the meadow. Any increases in soil moisture would be expected to be utilized by the remaining vegetation, so it would not likely be available for stream flow. No changes to direct or indirect effects on meadow hydrology are anticipated as a result of implementing Alternative 2.

Cumulative Effects

Cumulative Watershed Effects: 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, hand piling, and planting, are assumed to have no effect on hydrology or water quality.

The only subdrainage that has a moderate adjective rating for CWE response is 504.1004, which is drained by Gertrude Creek and tributary to Whisky Creek. Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition (Stone 2012).

Sediment: The CWE analysis in the Whisky Hydrology report indicates that all of the subdrainages are considered sensitive to moderately sensitive to disturbance (i.e., 4 - 5% Lower TOC %). The project hydrology report (Stone 2012) identifies that the existing road system is currently in poor condition and in need of maintenance. In their current state of disrepair, the roads in the Project Areaare increasing hydrologic connectivity, contributing to increased sediment input and causing overall watershed degradation. 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 maintenance (65 miles) and reconstruction (33 miles) would reduce hydrologic connectivity and reduce sediment from existing sources. Reconstruction of culverts on roads 7S068 and 7S076 would also reduce two current sources of sediment. Meadow restoration (16 acres) to restore hydrologic function in meadows 504M28, 504M41, 504M59, 504M60, 504M153, and 504M312 and establishment of four off-site livestock water developments may result in short-term increases in sediment through stream bank exposure during implementation. None of the meadows proposed for restoration or off-site livestock development were determined to be occupied by special interest herpetofauna. It is expected that meadow treatment sites would recover within several years and overall site stability would increase, while sediment contribution would decline from current condition and improve aquatic/riparian habitat. Restoration of 10 miles of user-defined OHV trail may further reduce sediment contribution.

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 2012), 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).

Summary of Effects

Table 28 summarizes overlap of potential habitat by other Actions and Whisky. Habitat may also be altered by climate change and alteration of the fire return interval. Effects from actions not part of the Whisky Project were previously disclosed under Alternative 1 and effects would be similar to those discussed under the No Action Alternative.

Table 28. Acres of Habitat Cumulatively Affected Under Alternative 2.

Species	Potential habitat (ac)	Rec/OHV Effected (ac)	Roads(ac)	Grazing Primary use (ac)	Fire (ac)	Whisky Project (ac)	Cum. Effect (ac)	% Habitat Affected
Foothill yellow-legged frog	661	7	8	0	11	17	43	7%
Western pond turtle	1471	13	22	0	28	116	179	12%
Mountain yellow-legged frog	1155	0	12	88	12	93	205	18%
Yosemite toad	7443	9	88	714	0	3334	4145	56%
Riverine/ Lacustrine	39	0	0.2	2	0.3	0	2.5	6%
CWHR wet meadow	98	0	0	98	0	0	98	100%

It is not anticipated that the Whisky Project (Alternative 2), in addition to other activities in the Project Areasubwatersheds, would contribute to cumulative effects to habitat for foothill yellow-legged frog, western pond turtle, or mountain yellow-legged frog. Movements by the frogs and turtle tend to follow stream channels. The Old Forest Linkage corridors along perennial streams would be anticipated to maintain connectivity of habitat. Over half of the potential habitat for Yosemite toad could be treated under the Proposed Action. The primary effect to Yosemite toad would be alteration to foraging habitat due reductions in stand density and possibly overhead canopy cover. These types of changes would not alter CWHR habitat quality, which would be maintained at medium quality (Project Aquatic BA/BE: Strand 2012).

Riverine/Lacustrine: Changes in flow and shade would not be expected under any alternative proposed under the Whisky Project. Road maintenance and reconstruction may reduce current levels of road-generated sediment under Alternatives 2 and 3. While approximately 6.5 miles of BMI habitat are adjacent to a treatment unit, overall habitat would be expected to be maintained through project design measures. Existing trend in the habitat or aquatic macroinvertebrates across the Sierra Nevada bioregion would not be expected to be altered under any project alternative.

CWHR wet meadow: Since 2002, the Pacific tree frog has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA - Forest Service 2006; 2010; Brown 2008). These data indicate that Pacific tree frog continues to be present at these sample sites, and that the distribution of Pacific tree frog populations in the Sierra Nevada is stable, and neither Alternative 2 nor 3 would affect that trend.

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

Table 29 displays findings consistent with Forest Service Manual 2670 regarding threatened, endangered, candidate, and sensitive species. The table also displays findings regarding habitat for aquatic MIS as identified under the National Forest Management Act (36 CFR 219) , and that effects of the project on MIS are to be assessed during the preparation of NEPA documents prior to project

implementation to determine if project modifications are necessary to reduce potential negative effects (FSM 2534.1). Alternative 2 would be consistent with Forest Service direction for threatened, endangered, and sensitive species. It would additionally be consistent with Forest Service direction for MIS.

Table 29. Effects from Whisky Alternatives 2 and 3 on Aquatic/Riparian Threatened, Endangered, Candidate, and Sensitive Species.

Species	Determination	Rational for the Determinations for Alternatives 2 and 3
Foothill yellow-legged frog	May affect individuals, but is not likely to lead to federal listing or loss of viability for the foothill yellow-legged frog in the Sierra National Forest.	Not detected within the aquatic analysis area during surveys Nearest known occupied site is 5 miles from any treatment area, which is beyond dispersal range of species. Available habitat is primarily (85%) Unsuitable or Poor based on CWHR. Proposed treatments occur over approximately 3% of potential habitat, and 7% cumulatively with other projects. 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 western pond turtle in Sierra National Forest.	Detected within the aquatic analysis area during surveys Occupied habitat overlaps three tractor thinning and one prescribed fire treatment units. Limited operating period after June 15th would reduce potential direct effects to turtles moving from overwintering sites or disturbance to females during egg deposition. Available habitat is primarily (88%) Unsuitable or Poor based on CWHR. Proposed treatments occur over approximately 8% of potential habitat, and 12% cumulatively with other projects. Proposed treatments are not anticipated to reduce quality of CWHR habitat. Possible direct effects to individuals in effected treatment units.
Mountain 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 yellow-legged frog in the Sierra National Forest.	Not detected within the aquatic analysis area during surveys Nearest known occupied site is 5 miles from any treatment area, which is beyond dispersal range of species.. Available habitat is primarily (94%) Unsuitable or Poor based on CWHR. Proposed treatments occur over approximately 8% of potential habitat, and 18% 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 Yosemite toad in the Sierra National Forest.	Species was not detected during Forest-wide surveys between 2002-2004, or during 2012 project surveys. No meadows are occupied within aquatic analysis area subwatersheds Nearest occupied meadows (> 5 miles) from any proposed treatment unit and beyond CWHR dispersal distance of species (0.6 mi). Proposed treatments occur over approximately 45% of potential habitat, and 56% cumulatively with other projects. Proposed treatments not anticipated to reduce quality of CWHR habitat (81%) would be maintained at medium or better.

Riverine/ Lacustrine	Stable	Application of project design measures, Forest Service standards and guidelines, and best management practices would be anticipated to maintain or improve current conditions. No anticipated changes to riparian canopy cover, water temperature, flow, or sediment.
CWHR wet meadow	Stable	Application of project design measures, Forest Service standards and guidelines, and best management practices would be anticipated to maintain or improve current conditions. No anticipated changes to wet meadows.

Monitoring Recommendations

See Hydrology Report.

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

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. 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. 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, and all thinning would be pre-commercial.

Table 7 from Alternative 2 would also represent overlap of treatments and species habitat for Alternative 3.

Direct Effects

As previously noted in Alternative 2, there is overlap between timing of proposed activities and potential effects on foothill yellow-legged frog, western pond turtle, mountain yellow-legged frog and Yosemite toad. Potential direct effects could occur from crushing of individual animals by tractor thinning, or mastication, or from burning of animals. Project design measures would be expected to protect breeding and rearing sites from direct effects, thus subadult and adult lifestages would be potentially affected. Hand thinnig, including falling of encroaching conifers in meadow; hand removal of noxious weeds; vegetative clearing at prehistoric and historic cultural resource sites; channel stabilization in meadows; placement or bear boxes and moving a toilet site in a campground, and vegetative clearing along cattle stock-drives would not be anticipated to result in direct effects.

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. The proposed area of high intensity burn would avoid areas known to be occupied by western pond turtle.

Similar to Alternative 2, direct effects from Alternative 3 to foothill yellow-legged frog, mountain yellow-legged frog, and Yosemite toad 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. Breeding and rearing sites for frogs and toads would be generally protected by project design measures. These species are closely associated with water, which is buffered by streamside management zones that would be anticipated to protect the frog from

direct effects. Western pond turtle were detected within the aquatic analysis area, adjacent to several treatment units (T101-103 and RX319). Western pond turtle may move beyond SMZs during the period when project activities are implemented. Individual turtles may be subject to direct effects within these three units.

Indirect Effects

Thinning to reduce ladder fuels, mastication, and underburning would occur on over the same acreage analyzed under Alternative 2. Table 27 in Alternative 2 identifies that treatment areas represent approximately 17 acres of foothill yellow-legged frog, 116 acres of western pond turtle, 93 acres of mountain yellow-legged frog; and 3,334 acres of Yosemite toad habitat. Alternative 3 has a risk of compacting soil (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 2012); streamside management zones; and project design criteria are expected to reduce the potential for sedimentation and protect aquatic habitat (Stone 2012).

As noted under Alternative 2, 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 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.

Riparian canopy cover: Similar to Alternative 2, there would be no alteration to current riparian canopy cover anticipated.

Water temperature: Similar to Alternative 2, there would be no anticipated alterations to riparian canopy cover, thus there would be no effects on water temperature expected from Alternative 3. The desired condition (< 21° C) would be anticipated across the analysis area.

Flow: Similar to Alternative 2, the Project Hydrology Report (Stone 2012) notes that any changes in flow resulting from thinning resulting from Alternative 2 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 Whisky DEIS. For the Whisky aquatic analysis area, other known activities are vegetation projects, cattle grazing, roads, and recreational use (campgrounds and OHV trails). Acres of habitat potentially affected would be similar to Table 9 under Alternative 2.

CWEA: Cumulative effects would be less than those described under the Proposed Action (Alternative 2) and similar to the No Action Alternative, 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 (Project Hydrology Report).

Sediment: Similar to Alternative 2.

Summary of Effects

Similar to Alternative 2, in addition to other activities in the Project Areasubwatersheds, Alternative 3 would not be anticipated to contribute to cumulative effects to habitat for foothill yellow-legged frog, western pond turtle, or mountain yellow-legged frog. Movements by frogs and turtles tend to follow stream channels. The Old Forest Linkage corridors along perennial streams would be anticipated to maintain connectivity of habitat. Over half of the potential habitat for Yosemite toad could be treated under Alternative 3. The primary effect to Yosemite toad would be alteration of foraging habitat due reductions in stand density and possibly overhead canopy cover. Since Alternative 3 does not remove trees within the mid-level canopy, both stand density and overhead canopy cover would likely be greater than Alternative 2. However, these types of changes would not alter CWHR habitat quality between the two alternatives, which would be maintained at medium quality.

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

Table 27 in Alternative 2 displays determination of effects on aquatic/riparian threatened, endangered, candidate, and sensitive herpetofauna based on known information on species, habitat available, literature review, and anticipated effects that would also be application to Alternative 3. Aquatic MIS (riverine/lacustrine and CWHR wet meadow) would remain stable as noted under Alternative 2. Alternative 3 would be consistent with Forest Service direction for threatened, endangered, and sensitive species. It would additionally be consistent with Forest Service direction for MIS.

Botany: Rare Plants & Noxious Weeds

The direct, indirect and cumulative effects to Botany below are summarized from the Whisky Ridge Ecological Restoration Project Botany Report (Clines J., 2013).

Introduction

This section provides a brief description of the vegetation types found in the project area in order to set the stage for describing the existing condition and analyzing the effects of the alternatives on:

1. Threatened, Endangered, and Forest Service Sensitive plants and the habitats they require to persist, and
2. Invasive non-native plants and noxious weeds (risk of introduction and spread).

The Biological Assessment/Biological Evaluation (BA/BE) is a separate combined report (Clines, 2013a), available upon request, that analyzes the proposed Whisky Ridge Projectin sufficient detail to determine the potential effects on Threatened, Endangered, and Sensitive (TES) plant species. Specifically, the BA documents potential effects on species proposed for federal listing or already listed as threatened or endangered species and critical habitat, if relevant. The result is a determination whether or not formal consultation or conference is required with the United States Department of Interior, Fish and Wildlife Service, pursuant to the Endangered Species Act. The BE analyzes effects on Forest Service Sensitive plant species in order to determine whether the Proposed Action and alternatives would result in a trend toward any Sensitive species becoming Federally listed. This BA/BE was prepared in compliance with standards and direction established in Forest Service Manual 2670.3 and 2672.42 and conforms with legal requirements set forth under Section 7 of the Endangered Species Act (19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14 (c).

The Noxious Weed Risk Assessment (Clines, 2013b) is a separate report, also available upon request. The Sierra Nevada Forest Plan Amendment ROD (USDA 2004) contains standards and guidelines aimed at reducing the introduction and spread of noxious weeds in Sierra Nevada National Forests. One of these standards requires a noxious weed risk assessment for all NEPA analyses involving ground-disturbing activities. The purpose of the risk assessment is to identify vectors for weed spread and changes in habitat that might favor the introduction of new weed species into a proposed Project Area, or might further spread weeds that already exist within the project boundaries, and to identify appropriate prevention measures that can be incorporated into the Proposed Action to eliminate or minimize weed spread.

Affected Environment

Existing Condition

General description of the vegetation with an emphasis on rare plant habitat: The Whisky Ridge Project Area lies on the west slope of the central/southern Sierra Nevada, and ranges in elevation from 3676 to 9733 feet 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 northern half of the Project Area has extensive areas of rock outcrops, which though often termed "barren" sites on maps, 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 or high fuel loads 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 Whisky Ridge Ecological Restoration Project area sets the stage for analyzing effects of the alternatives on Forest Service Sensitive Plants by examining project effects on their habitat, as well as analyzing the effects of the alternatives on native plant diversity in a general way, including how the project will affect the state of noxious weeds in this part of the Forest.

Chapparral: 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 mariposa manzanita, greenleaf manzanita (*Arctostaphylos patula*), mountain whitethorn (*Ceanothus cordulatus*), deerbrush (*Ceanothus integerrimus)*, littleleaf ceanothus (*C. parvifolius*), bitter cherry (*Prunus emarginata*) and Sierra gooseberry (*Ribes roezlii*). Chinquapin (*Chrysolopis sempervirens)* is found in the uppermost reaches of the Project Area.

The chaparral, especially in the foothill zone, is characterized by a rich native herbaceous flora. Some herbaceous chaparral species are present most years, varying in vigor and floral output with annual weather patterns. Others are found only after fire: there is a suite of chaparral annuals that germinates in response to cues such as heat, smoke, or the chemical makeup of rainwater that passes through burned shrubs (Keeley and Keeley, 1987). This unique and temporally sporadic component of the chaparral ecosystem is important to maintain the long term native biological diversity of the chaparral and to keep it as resilient as possible from invasive non-native plant invasions.

Montane chaparral either exists on sites where soils are too thin or rocky to support forests, exists as a seral stage after disturbance such as burning, timber harvest, or fuels reduction. Often called "brush fields," areas dominated by montane chaparral that were previously forested can be characterized by a heterogeneous mix of shrub species or they can be quite homogeneous – often dominated by impenetrable stands of mountain whitethorn and greenleaf manzanita.

Forested Areas: The lower coniferous forest areas are typically 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 (greenleaf manzanita, chinquapin, mountain whitethorn, bitter cherry). 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 of dense forest canopy devoid of with scarce herbaceous or woody plants in the understory.

Riparian Vegetation 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 about 11 meadows within the Project Area. 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 very 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. Please see the Hydrology Report (Stone 2012a) for a detailed description of the meadows found in the Project Area and their condition.

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 these articles and other scientific literature, along with 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),) (UC Berkeley, 2013) there is no reason to suspect that the species known or suspected to be present in the Whisky Ridge ERP area were significantly more common in the past.

Region 5 is in the final stages of revising the 2006 Regional Forester's Sensitive Plant list, this project consideredthe revised species list that will be finalized in 2013 and thus does not include some species being removed such as *Epilobium howellii* and *Meesia triquetra* which do occur in the project area but have been determined by botanical experts in Region 5 to be more common and to face fewer threats than previously thought. The forms documenting the rationale for removing these species from the Regional Forester's Sensitive Plant list are in the project record for this EIS. These species will remain on the Sierra National Forest Watch list and will continue to be managed with caution during project planning and implementation.

Table 30 shows the Forest Service Sensitive Plants that are known to occur or that may occur within the Whisky Ridge ERP 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 30. Forest Service Sensitive Plant Species Known or with Potential to Occur Within the Whisky Ridge Project Area, Along With Their Habitat Types.

SPECIES	OCCURRENCE IN WHISKY RIDGE ECOLOGICAL PROJECT AREA	HABITAT
Bruchia bolanderi BOLANDER'S CANDLE MOSS	Occurs in Varer Long Meadow and China Meadow, likely more.	RIPARIAN/MEADOW. Vertical banks of streams and horizontal soil on logs, 5000-7500 feet.
Camissonia sierrae ssp. *Alticola* 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 RAWSON'S FLAMING TRUMPET	Occurs along most perennial streams and around some meadows in the project area.	RIPARIAN/MEADOW. Streamsides and meadow edges, 2500 – 7000 feet.
Fissidens aphelotaxifolius BROOK POCKET -MOSS	Occurs along Owl Creek – this is the only occurrence in the Sierra NF and one of only two in the State.	RIPARIAN/MEADOW. Rocky substrate in streams, < 6300 feet.
Helodium blandowii *BLANDOW'S BOG-MOSS*	None known to occur but fen habitat is present in several meadows and the Sierra NF falls within the range of this species	RIPARIAN/MEADOW. Wet meadows, fens, and seeps in coniferous forests, 6500 – 9500 feet.
Hulsea brevifolia SHORT-LEAFED HULSEA	One occurrence along Road 7S02 in RX burn unit 309.	FORESTED. Granitic or volcanic soils in openings and under canopy in mixed conifer and red fir forest, 5000 – 9000 feet.
Lewisia disepala YOSEMITE LEWISIA	None known to occur but suitable rocky habitat present.	ROCKY/GRAVELLY. Granitic sand and gravel in ponderosa pine, mixed conifer, and upper montane coniferous forest, 4000 – 7500 feet.
Lewisia kellogii ssp. *kelloggii* KELLOGG'S LEWISIA	Two occurrences on large rock outcrop south of RX burn unit 309, on either side of spur road 7S02"I"	ROCKY/GRAVELY. Open, gravelly flats in mixed conifer and subalpine forest, 6000 – 11,000 feet.
Meesia uliginosa 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.
Peltigera gowardii (formerly *P. hydrothyria* VEINED WATER LICHEN	6 occurrences within the project area, many are large and robust.	RIPARIAN/MEADOW (AQUATIC) Cold, clear, unpolluted streams in conifer forests, 4000 – 8000 feet.
Plantanthera yosemitensis YOSEMITE BOG ORCHID	No occurrences known in project area, but suitable habitat is present.	RIPARIAN/MEADOW. Saturated areas and fens in montane meadows surrounded by coniferous forest, 7000-7300 feet.

More information about the Forest Service Sensitive Plants known to occur within the Project Area is found below (please see the Biological Evaluation/Biological Assessment for Plants for more details about other species listed in the table):

***Bruchia bolanderi* – Bolander's bruchia:** Bolander's bruchia is a tiny summer-growing ephemeral moss of high montane and subalpine meadows. The distinctive, long-stalked sporophyte capsules emerge in late summer or early fall, when these plants are most easily distinguished from other tiny ephemeral mosses (Norris & Shevock, 2004).

Bolander's bruchia was previously thought to be endemic to California and Oregon (Rushing 1986, Christy and Wagner 1996), is now also known from Nevada and Utah (UC Berkeley Bryophyte Database, 2013). California populations are known from Eldorado, Fresno, Tulare, Madera, Mariposa, Modoc, Nevada, Placer, Tuolumne, Tehama and Plumas counties (UC Berkeley Bryophyte Database, 2013; CNPS 2013). The Sierra NF has 8 occurrences, two of which occur within the Whisky Ridge ERP.

Bolander's bruchia colonizes organic or mineral (often bare) soil along stream banks, in and around meadows and springs, specifically along small streamlets through montane meadows and at the edges of fens (Malcolm, Shevock, and Norris, 2009). Sites range in elevation from 3800 to 8200 feet (UC Berkeley Bryophyte Database, 2013).

The species is opportunistic, taking advantage of disturbed sites where there is minimal competition from other vegetation (Christy and Wagner 1996), though its tolerance of disturbance would logically be limited to events that do not obliterate the occurrence. This species does not seem to compete well with other plants, therefore some disturbance is necessary to maintain open habitat (Harpel 2008). It is possible that regular light disturbance maintains habitat for this early seral species.

The ephemeral nature of this species and its occurrence in disturbed sites allow some flexibility in management (Christy and Wagner 1996). Fuels reduction projects that enter riparian zones, direct trampling by livestock and recreational activity have been identified as potential threats. Any activities that permanently remove plants or populations and their habitat would be clearly detrimental: e.g. well-meaning meadow restoration projects whereby erosion gullies and head cuts are reshaped (sometimes using heavy equipment), reconstruction or removal of roads through meadows, etc. This can be averted by ensuring that such projects are surveyed thoroughly before implementation and mitigation or avoidance is then built into the project (as for the Whisky Ridge Project).

Figure 5. Bolander's candle moss in Varer's long meadow, Whisky Ridge Project Area. Photo: Joanna Clines

***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) (Figure 6). 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 CNDDB), 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 of these 12 major drainages 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 (Wilson, Clines, and Hipkins, 1999).

Figure 6. Rawson's flaming trumphet in flower close up. Photo; Chris Winchell

Populations are found in moist sites both in ponderosa pine forest and in mixed conifer forest. Flaming trumpet is dependent on the cool, moist conditions found along streams, preferably in good hydrologic condition. Research and field observations have shown that there is a balance of light and shade at which flaming trumpet flowers optimally (Liskey, 1993; J. Clines, field observations 1988-2012). 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 (Taylor et al. 1987; Hevron, 1989; Liskey, 1993; Wilson, Clines, and Hipkins, 1999).

Figure 7. Rawson's flaming trumphet flowering in optimal conditions of dappled light. Photo: Chris Winchell

Within the Whisky Ridge ERP, Rawson's flaming trumpet occurs extensively, please see Figure 8. Populations are dense along Browns Creek, Gertrude Creek, Whisky Creek, Owl Creek, Roush Creek, and around China Meadow, Peckinpah Meadow, and Benedict Meadow.

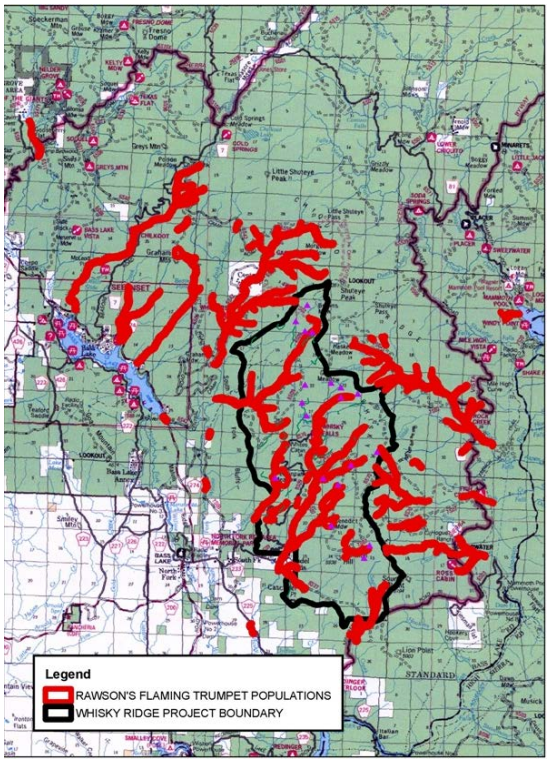


Figure 8. Worldwide range of Rawson's flaming trumpet in relation to the Whisky Project boundary

***Fissidens aphelotaxifolius* – brook pocket moss:** The brook pocket moss is an extremely rare moss, known from only two locations in California, one on the Sierra National Forest (Figure 8) and one on the Klamath NF in Siskiyou County. The Sierra National Forest location was reconfirmed during a field visit by the Forest Botanist and bryophyte experts Jim Shevock and Eve Laeger of the California Academy of Sciences on October 15, 2012. The site had not been monitored for 12 years, since its discovery in 2000. Plants were found to be in good condition, occupying between 0.75 and 1.0 square meter on the lower side of a rocky overhang that would normally form a waterfall, but in October 2012, there was hardly any water in the creek, making it easier to locate the moss and determine its extent. The brook pocket moss occurs along Owl Creek just north of Road 7S08, between Tractor units T128 and T129

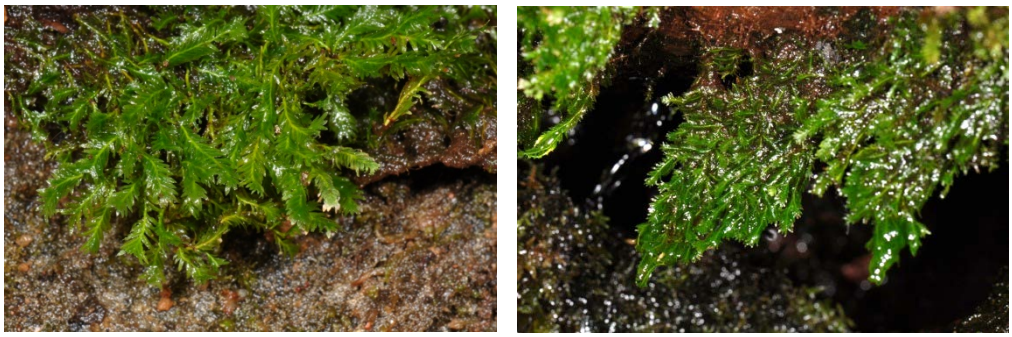


Figure 9. Left: brook pocket moss in waterfall, Right: close-up of plant showing unique flattened appearance of branches

***Hulsea brevifolia* – short-leaved hulsea:** The short-leaved hulsea is a locally endemic perennial herb found in montane forests of the central and southern Sierra Nevada (Baldwin, 2012). Plants are 3 to 6 dm 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 mm in diameter (Baldwin, 2012). 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.

There are about 50 occurrences of short-leafed hulsea documented on the Sierra National Forest, and others on adjacent forests and in Yosemite National Park totalling about 65 occurrences. The elevational range is 5000 to 9000 feet, and the species occurs from Tuolumne County south to Tulare County. Habitat for short-leaved hulsea is gravelly or sandy exposed areas as well as densely canopied 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 (Joanna Clines, field observations), and many populations consist of thousands of individuals.

There is one occurrence of short-leafed hulsea known in the Whisky Ridge project area, at 6500' on both sides of Road 7S02 at the southern edge of RX Burn unit 309. This occurrence was discovered by Forest Service seasonal employee Chris Winchell in 2008 and was noted to consist of approximately 150 plants and to be in good condition with few threats.

***Lewisia kelloggii* ssp. *kelloggi* – Kellogg's lewisia:** Kellogg's lewisia is known from approximately 25 locations from Humboldt County southward to Madera County. In Madera County there are 6 occurrences in the vicinity of Shuteye Peak; the two most recently discovered in 2010 are within the Whisky Ridge ERP just to the south of Shuteye Peak; these 2 occurrences were observed to be in good condition. Across the range of the species, some populations are composed of several hundreds of plants, some are smaller.

These semi-succulent perennial herbs grow on rock outcrops and gravel as shown in Figure 10. Plants emerge and bloom by June or July and once they have set seed, they wither and become invisible although they are still alive but dormant. Habitat is typically open, gravelly or sandy flats or rock outcrops within upper mixed conifer forest and subalpine forest. Occurrences vary from well-protected in Yosemite National Park to vulnerable in Eldorado, Tahoe and Sierra NFs where OHV and other recreation impacts are ongoing.

Figure 10. Kelloggs lewisia: left: close-up of one plant, right: habitat along Road 7S02I. Photos: Rodney Olsen

Two occurrences of Kelloggs's lewisia occur within the Whisky Ridge ERP along spur road 7S02I, near plantations 228 and 236, and near Tractor unit 160. The upper occurrence is closer to Road 7S02 and is next to Rx Burn Unit 309. Undiscovered plants may exist within Rx Burn Unit 306.

Veined water lichen – *Peltigera gowardii gowardii* (formerly *Peltigera hydrothyria*)Veined water lichen is found in cold unpolluted streams in conifer forests along the western slope of the Sierra Nevada. The California occurrences are disjunct from other U.S. populations. This distinctive species was thought to be in decline throughout its historic range but more and more vigorous populations are being found in the Sierra NF over the last 15 years. Sierran populations currently appear stable, but the extent of local extirpations in California is not known (Shevock, 1998). This aquatic lichen is a foliose species with a delicate "leafy" thallus (Figure 11) It is a black "lettuce"-like lichen growing on rocks and on stream bottoms. Clumps range in size from a few centimeters to over a decimeter Reproductive structures have been observed, and asexual reproduction is possible, but how the lichen actually colonizes new habitats is unknown (Peterson, 2010).

Threats are activities that change the water chemistry, alteration of the stream channel, excessive alteration of riparian vegetation thereby increasing water temperature; or drastically increasing flows that scour the gravels and rocks on which the lichen is attached. This species primarily occurs in streams with clear, unpolluted, water. Peak flows are probably not of the intensity that would lead to scouring. The streams have a rich aquatic bryophyte flora (Shevock, 1998). Increased sedimentation, nutrients, or a rise in temperature would significantly impact occurrences (Davis, 1999).

The Whisky Ridge project area contains abundant suitable habitat for the veined water lichen, and large, vigorous occurrences exist in the project area. Occurrences are known along Browns Creek at Road 8S09 with RX burn units 307 and 308 on either side; Owl Creek between Road 8S70 and 8S70E (south of RX burn unit 313), 2 on Owl Creek and a nearby tributary along 7S94 (no units), and one in a plantation on Owl Creek along road 7S68. In addition, there is an occurrence in Whisky Creek at Whisky Falls (north of Tractor Unit 142). Additional stretches of perennially flowing water within the project area may contain additional veined water lichen populations.

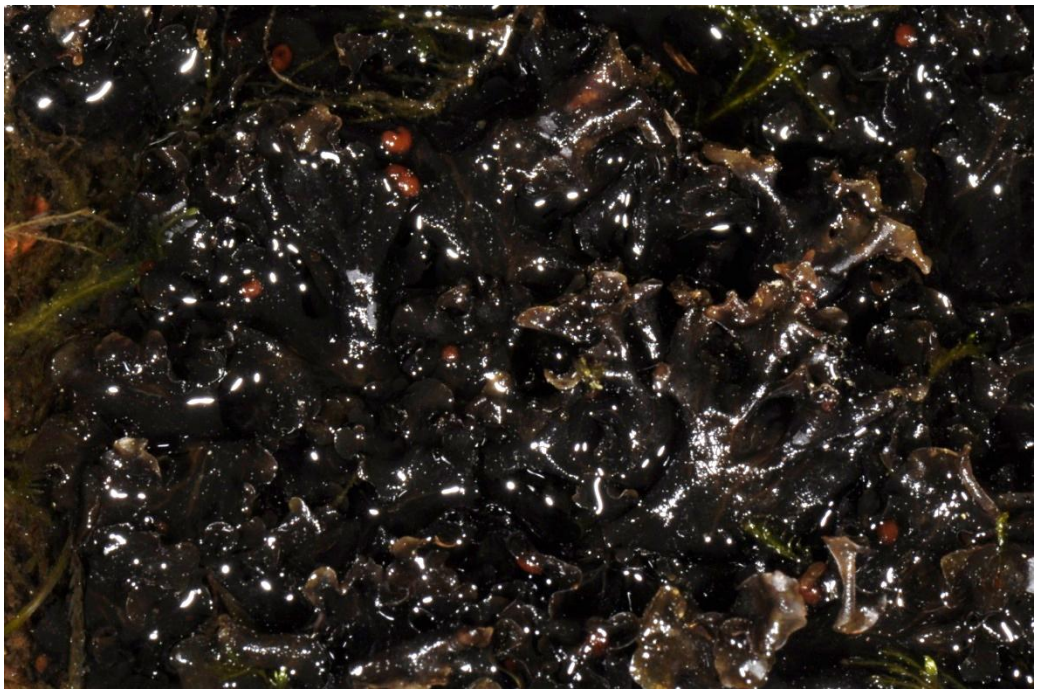


Figure 11. Veined water lichen Photo: J. Clines

Noxious weeds and invasive non-native plants: Invasive non-native plants (invasive weeds) are species which, if allowed to spread, cause ecological and economic damage, an example is yellow starthistle (*Centaurea solstitialis*) which is damaging rangelands and natural areas on over 12 million acres of California. Invasive weeds may be officially listed as "noxious" at the federal or state level, or may be rated by the California Invasive Plant Council (Cal-IPC, 2006) assigns ratings of high, moderate, or limited ecological impact statewide based on ecosystem impacts, potential for invasiveness, and ecological distribution. Weeds on the California Noxious Weed list with ratings of "A" or "B" have always been of highest priority for state and county weed managers (CDFA, 2010). Until 2011, new infestations of State A and B rated weeds were 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. State budget cuts have resulted in the CDFA eliminating their noxious weed program, leaving the Forest Service, and counties with reduced budgets to take up the slack.

Surveys conducted during 2012 for this project and in previous years for other projects (e.g. for the Haskell Allotment Environmental Assessment) revealed that the primary invasive weed species in the Project Area is bull thistle (*Cirsium vulgare*). This weed is mostly in meadows but can also flourish in disturbed areas along roads, trails, OHV routes, and camping areas. Overall, the Whisky Ridge ERP area is not badly infested with invasive weeds. Species rated as "C" on the California State Noxious Weed species are currently known from this area: In addition to bull thistle, klamathweed (*Hypericum perforatum*), common mullein (*Verbascum thapsus*), and cheatgrass (*Bromus tectorum*) are found at light levels especially in the lower elevation areas of the Project Area. The primary weeds known to occur within the Project Area are described below:

Bull thistle (*Cirsium vulgare*) - CIVU. There are infestations of bull thistle within the project boundary and along access roads to the Project Area. Bull thistle tends to be especially prevalent in meadows, and is present in several of the meadows proposed for restoration: Although not as highly invasive as other noxious thistles found outside of the Project Area (e.g. Italian thistle), bull thistle competes with and displaces native species and decreases forage values in meadows and uplands at elevations up to and above 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 significantly 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, 2013).

Klamathweed or common St. Johnswort (*Hypericum perforatum*) – HYPE. Infestations of klamathweed are found scattered within and just outside of the lower elevations of the project area, this weed is not prevalent in the Project area although it is spreading rapidly along roads leading to the Project (e.g. near Cascadel Woods). 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).

Desired Condition

For diversity of native vegetation in general: For montane and foothill chaparral, the desired condition is to maintain patches of chaparral on the landscape with the historical range of variability and to maintain heterogeneity (age class variation, native species diversity) within areas occupied by these vegetation types.

For foothill chaparral this is primarily defined as;

- Ensuring that fire return intervals are similar to those that occurred prior to European contact (avoiding drastically reducing the number of years between fires to the detriment of the native vegetation as described above);
- Managing the vegetation using properly timed prescribed fire and mechanical methods to maintain the native herbaceous and especially the fire-following flora in the soil seed bank (by ensuring the fire return interval is not too short and that invasive non-native species do not prevail

For montane chaparral, the desired condition is to maintain this vegetation type on the landscape where it is the Potential Natural Vegetation (PNV) and to manage forests to retain sufficient seeds in the understory so species that make up montane chaparral are present after disturbance as a seral stage In other words, ensure that invasive weeds are kept at a minimum or eliminated, and reduce the chance for uncharacteristically severe wildfire over huge areas so that species of native shrubs typical of montane chaparral are available in the soil seed bank to respond to disturbance such as fire, timber harvest, fuels reduction, and mastication by germinating and providing ground cover and wildlife habitat while forests grow back.

For Forest Service Sensitive Plants the desired condition is to maintain sensitive plant populations currently existing within the Whisky Ridge ERP area at their current population numbers and to maintain their habitat suitable for long term viability. The desired condition is also to maintain suitable habitat for Forest Service Sensitive plants that may exist undiscovered in the project area. The desired condition derives from the following management direction:

- Forest Service Manual 2672 provides standards for biological evaluations and provides a list of all Regional Forester designated sensitive wildlife and plant species occurring on National Forest System lands. Current policy as shown in the Forest Service 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.
- Sierra National Forest Land and Resource Management Plan (USDA 1992). 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 Forest Service actions. Under Forest Plan Management Standards and Guidelines in the 1992 LRMP, the forest is to a) develop sensitive plant species management guides to identify population goals and compatible management activities that will 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 will 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 1992).

- Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004). Standard and Guideline 125 for Sensitive Plant Surveys (corrected errata for page 66): Conduct field surveys for TEPS plant species early enough in the project planning process that the project can be designed to conserve or enhance TEPS plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.11). If additional field surveys are to be conducted as part of project implementation, survey results must be documented in the project file.

For invasive non-native 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. The Forest Service Manual (FSM 2900) outlines the laws and regulations guiding the Forest Service's noxious weed management.

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. A literature review of effects of the proposed treatments on the native plant diversity within the vegetation types proposed for treatment was conducted and combined with the Forest Botanist's 25 years of experience observing the recovery of Sierra National Forest vegetation after similar treatments (Joanna Clines, field observations).

Surveys for the project were conducted in 2012 and in previous years for other projects; rare plant information obtained as a result of these surveys is maintained in a Forest Service GIS database and survey forms are turned in to the California Natural Diversity Database as per a formal data sharing agreement between the US Forest Service and the California Department of Fish and Wildlife. (CNDDB, 2013). Data on Sensitive Plant locations was also obtained from the Rarefind database (CNDDB, 2013) and UC Berkeley on-line bryophyte database (UC Berkeley, 2013) The noxious weed data is mapped in Forest Service the GIS library so that control efforts can begin prior to and/or during project implementation.

Because there are 11 species of Forest Service Sensitive Plants that may occur in the project area or along access roads where they may be affected, but as only six are known to occur, this analysis is focused on effects to **habitats** for all of these species as shown in Table 30: Riparian, Rocky/Gravelly, and Forested. This way effects to all species, known and potentially occurring are covered in the analysis. Specific evaluation of potential effects to species known to occur in the project area is included under the habitat type for that species.

Spatial and Temporal Context for Effects Analysis

The spatial context for the botany analysis is the project area with a buffer of about one mile for vegetation diversity and Forest Service Sensitive plants as several species fall on the project boundary. For noxious weeds, the roads leading to and from the project area, especially those that would be used to transport logs and equipment used to implement the project, are considered, and a 3 mile buffer is used to consider noxious weeds along roads that surround the project area.

For direct and indirect effects the timeframe is one to five years, based on the fact that monitoring of project effects on plant community diversity, rare plant populations, and invasive weed infestations 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.

Incomplete and Unavailable Information

There are areas within the project area that were not surveyed for sensitive plants as the area was too large to allow 100% survey of all areas where activities will occur. However, the species that occur or might occur in the Whisky Project area generally prefer specific habitat types. Project Design Criteria were written to minimize the potential for damage to any possible undiscovered populations that might exist. Noxious weeds show up continually, thus even if the area had been covered 100%, new weed infestations may show up over the 3-5 years that will be required to complete all of the components of the Action Alternatives.

Alternative 1 – No Action

Native plant diversity, especially of chaparral, would not be increased under the No Action alternative (see discussion under Alternative 2). It is expected that under Alternative 1, the number of populations of Forest Service Sensitive species of forested habitats would remain the same and the number of plants per occurrence would remain constant or decrease in the event of a large, uncharacteristically severe wildfire. For species of species rocky/gravelly habitats, there would be no effect. For species of riparian and aquatic habitats there is a greater chance that populations of rare plants in the degraded meadows proposed for restoration under Alternatives 2 and 3 would decrease in number as meadow hydrology continues to deteriorate. The number of noxious weed infestations would increase if the weed control actions proposed in Alternatives 2 and 3 are not implemented.

Direct Effects

Native plant diversity would possibly be lower over the long term under the No Action Alternative but there would be no direct effects as this element is abstract and cannot be characterized by the concept of direct effects. No direct effects would occur to Forest Service sensitive plants or their habitats if the no-action alternative is chosen because project activities would not take place. No direct effects regarding the spread of noxious weeds would occur.

Indirect Effects

Native herbaceous and woody species richness (one way of assessing diversity) is likely to increase in areas being treated to reduce fuels, and this would not occur under Alternative 1. However the accompanying risk of non-native weed spread would not occur either.

Forest Service Sensitive Plants

Species of Forested Habitats: Indirect and cumulative effects have the potential to occur to Forest Service Sensitive plants living in forested conditions under the no-action alternative partially from the ongoing and increasing potential for uncharacteristically severe wildfire. If occurring over large enough acreage, and at high enough intensity, uncharacteristically severe wildfire has the potential to cause significant disturbance to soil, ground cover and canopy cover, placing species like the short-leafed hulsea at risk. Through the introduction of weeds during emergency suppression actions and the fact the weeds are able to get the upper hand over natives after very hot, large fires, extreme fires can also allow the opportunity for the spread of invasive weeds, which can affect Forest Service sensitive species and native vegetation diversity in general through competition for resources.

The invasive weeds in the project area would continue to spread without the manual control proposed in the action alternatives. There is evidence that leaving forests with high fuel buildups alone may be less risky, at least in the short term, due to risk of weed spread associated with disturbance and opening of the canopy during fuels treatments (Keeley, 2006), but this project has been designed to minimize the risk of weed introduction and spread.

Species of Riparian an Meadow Habitats: In addition, riparian and meadow habitat in the degraded meadows proposed for restoration would continue to deteriorate without implementation of the meadow restoration actions described in Chapter 2, thus suitable habitat for the rare plant species listed in Table 30 that occur in these types of habitats would likely be reduced in quantity and quality over time as their habitat diminished in quality and quanitity. For Rawson's flaming trumpet, meadow edge restoration work around China Meadow would not take place, and the lack of flowering that appears to be correlated with 100% canopy cover in flaming trumpet populations could result in less sexual reproduction and less resilience to environmental change over time at this location.

Species of Rocky/Gravelly Habitat: No indirect effects to Sensitive species of these habitats would be expected under the No Action alternative.

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

Alternative 1 is in compliance with the Forest Plan, FSM 2670, FSM2080, and other Regulations, Policies, and Plans relevant for Forest Service Sensitive Plants and Noxious Weeds, although goals stated in these plans and policies would not be reached as quickly.

Summary of Effects

Under Alternative 1, there would be no direct effects to Sensitive Plants, but indirect effects would be possible as measured by the following indicators: numbers of populations and numbers of plants per population for plants of **riparian and aquatic habitats** may diminish over time in the degraded meadows that are proposed for restoration under Alternatives 2 and 3, as they would not be restored and may continue to lose hydrologic and biological integrity. Plants of **forested habitats** may lose populations or numbers of plants per population should uncharacteristically severe wildfire occur where these plants grow. Plants of **rocky and gravelly habitats** would have no direct, indirect, or cumulative effects due to the Project as it would not take place. The lack of certainty about indirect effects for native plant diversity, Sensitive Plants, and Noxious Weeds under the No Action Alternative does not allow conclusions that cumulative effects would occur.

Alternative 2 – Proposed Action

Direct Effects

Native plant diversity: Montane chaparral may be temporarily reduced in acreage in certain areas of the project, but maintaining a mosaic of chaparral with openings occupied by herbaceous natives along with forest stands of various ages is desirable and likely replicates pre-European conditions more than the current condition.. There is research indicating that the silvicultural and burning treatments proposed in Alternative 2 result in increased vascular plant diversity post-treatment (Battles et al, 2000; Collins et al., 2007) and this has been the observation of the Forest Botanist, provided that non-native invasive weeds are not given a chance to dominate. The project is designed

to minimize this probability although there is a risk that weeds will prevail without management intervention (Keeley, 2006).

Species of Forested Habitat: Sensitive Plants can be directly killed by heavy equipment used for timber harvest, mastication, or prescribed burning driving on them, especially while they are leafed out, flowering, or in the process of seed formation. Prescribed burning, especially if conducted outside of the season these plants evolved to tolerate or benefit from fire, could directly kill or impair individual plants. The only Sensitive species known to occur in the Whisky Ridge ERP is the short-leafed hulsea, and the one known occurrence would be protected by flagging to ensure avoidance during project implementation.

Species of Riparian and Meadow Habitat: Nearly every major stream has patches of Rawson's flaming trumpet. Ground disturbing activities that could harm flaming trumpet populations would be prohibited (see Hydrology and Botany Project Design Measures). The hand-thinning around China Meadow intended to open up the canopy for flaming trumpet would have no direct effects. For the other seven species of these habitats that might occur in the project area, project design measures for botany, hydrology and aquatics would prevent direct effects. The Whisky Ridge ERP has been carefully designed to avoid or minimize harmful effects to these species and habitats.

Species of Rocky/Gravelly Habitat: Plants growing in theserocky or sandy areas could be harmed when driving on them changes the course of water flow by creating ruts and berms. The project has been designed to minimize these types of impacts.

Indirect Effects

Native plant diversity: There is research indicating that the silvicultural and burning treatments proposed in Alternative 2 result in increased vascular plant diversity post-treatment (Battles et al, 2000; Collins et al., 2007) and this has been the observation of the Forest Botanist, provided that non-native invasive weeds are not given a chance to dominate. The project is designed to minimize this probability although there is a risk that weeds will prevail without management intervention (Keeley, 2006).

Species of Forested Habitat: If additional occurrences of the short-leafed hulsea do occur in the project area, there is some chance they would benefit from having dense canopy opened up. The Sierra NF botanists have observed vigorous recovery of this plant after disturbance such as burning and clearing along roadsides.

Species of Riparian and Meadow Habitat: The Whisky Ridge ERP has been carefully designed to avoid or minimize harmful effects to these habitats. For Rawson's flaming trumpet, some opening of the canopy nearby may be beneficial, and ground disturbing activities that could harm flaming trumpet populations would be prohibited (see Hydrology and Botany Project Design Measures). The hand-thinning around China Meadow intended to open up the canopy for flaming trumpet is expected to increase flowering and seed production, a beneficial indirect effect. For the other seven species of these habitats that might occur in the project area, project design measures for hydrology and aquatics would prevent indirect effects. The meadow restoration work would improve habitat conditions for any of these species should they occur nearby.

Species of Rocky/Gravelly Habitat: Plants growing in rocky or sandy areas could be harmed when driving on them changes the course of water flow by creating ruts and berms. The project has been designed to minimize these types of impacts as a result of project activities.

Noxiuos 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 5. For Kellogg's 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 Whisky Ridge ERP 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 most 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 Whisky Ridge EPR would not add to these slight impacts because there are SMZs along the streams inhabited 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 population in the project area was 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 5 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 has been designed to minimize the likelihood of weed introduction due to project activities, 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. Rawson's flaming trumpet around China Meadow would have an opportunity to increase sexual reproduction and this treatment could be a model for future habitat enhancement actions for this species.

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

Alternative 2 is in compliance with the Forest Plan, FSM 2670, FSM 2080, and other regulations, policies, and plans relevant for Forest Service Sensitive plants and noxious weeds because selective botanical field surveys were conducted, the project is designed to improve habitat for the Forest Service sensitive Rawson's flaming trumpet and several species of meadows; and the project has been designed to protect other species of Sensitive 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 2013a). No consultation with US Fish and Wildlife Service is necessary.

Summary of Effects

It is expected that after implementation of Alternative 2, the number of populations of Sensitive Plant species 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. The condition of the native vegetation and of the amounts of montane chaparral and the mosaic of age classes of native plant communities within the project area would be more ecologically in keeping with the pre-European conditions under which these plant communities evolved.

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

Direct Effects

The effects are the same as for Alternative 2.

Indirect Effects

The effects are the same as for Alternative 2.

Cumulative Effects

The 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, FSM 2080, and other regulations, policies, and plans relevant for Forest Service Sensitive plants and noxious weeds because selective botanical field surveys were conducted, the project is designed to improve habitat for the Forest

Service sensitive Rawson's flaming trumpet and several species of meadows; and the project has been designed to protect other species of Sensitive 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 2013a). No consultation with US Fish and Wildlife Service is necessary.

Summary of Effects

It is expected that after implementation of Alternative 3, the number of populations of Sensitive Plant species 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. The condition of the native vegetation and of the amounts of montane chaparral and the mosaic of age classes of native plant communities within the project area would be more ecologically in keeping with the pre-European conditions under which these plant communities evolved.

Cultural Resource

The direct, indirect and cumulative effects to Cultural Resources below are summarized from the Whisky Ridge Ecological Restoration Project Cultural Resources Report (Potter E., 2013).

Affected Environment

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.

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, but where the interests of native people are considered to achieve a mutually beneficial outcome during project implementation. The location of these sites is kept administratively confidential. The SNF would 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.

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. 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 and on earlier historic resources. The results of 37 years of cultural resource surveys and investigations have identified approximately 136 archaeological and historical properties including numerous miles of linear segments of historic logging history within the 18,285 acres of the Whisky Ridge Project. Site types include prehistoric habitation and processing locales and historic sawmills, roads, cow camps, water conveyance systems, mining sites, homesteading, Forest Service administration, and railroad logging. Though approximately 85% (15,530 acres) of the project area has been previously surveyed for cultural resources, the majority (74%) of the survey is not considered adequate to current standards. Approximately 15% (2,755 acres) of the project area has never received survey for cultural resources. Of the 136 known sites, 3 have been evaluated as Not Eligible for the NRHP, 1 as Eligible for the NRHP, and the remaining cultural resources are unevaluated.

For nearly 40 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, increased brush load 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 n.d.; Deal 2002; Gassaway 2011; Shultz 2004; Winthrop 2004). Additionally, the increase in fuels through this practice and historic fire suppression methods (see Fire/Fuels Affected Environment, Whisky Ridge Ecological Restoration Project DEIS) has altered the original setting for most cultural resource sites including an increase in the density of fuel ladders and a high degree of canopy closure.

Projectile point typology indicates prehistoric occupation from ca. 4000 B.C. to post 1250 A.D. in the Whisky Ridge Project area. Within the Whisky Ridge Project area prehistoric site occupation took advantage of the more exposed granitic openings which are not conducive to heavy vegetation

accumulation in the form of fuel ladders. While the overstory on these granitic exposures is relatively thin, the brush understory has grown within the cracks and crevices and those locations that have a substantial soil deposit. This has altered the original setting and resource availability for many cultural sites within the Whisky Ridge Project area. Several prehistoric sites that once had exposed features, access to water resources, and an open viewshed, have been encroached by vegetation detracting from the sites' setting and obscuring the view. In some cases the overgrowth has led to a decreased amount of available water.

These conditions detract from integrity of setting for both prehistoric and historic cultural resources by obscuring site features and the viewshed. Outside the granitic exposures, the current setting throughout the Whisky Ridge Project area is a combination of dense brush and saplings, creating a fuel ladder and a heavy accumulation of dead and down debris on a thick duff layer, creating a heavy ground cover susceptible to wildfire (see Figures 11 and 12). 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 site (Shultz 2004).

Figure 12. Dead and downed debris and encroaching vegetation on historic railroad grade within the Whisky Ridge Project area

Figure 13. Heavy fuels accumulation in prehistoric cultural resource site within the Whisky Ridge Project area

Numerous studies have been conducted on fire effects to cultural resources (see Deal n.d., Deal 2002, Gassaway 2011, Gassaway 2011a, Shultz 2004, Steffen 2002, and Winthrop 2004). 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 is to irreparable damage. 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 6 cm in depth 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). Chemical sourcing (identification of source material through chemical analysis) of lithic artifacts may also be affected by exposure and duration of heat (Deal n.d.).

Effects from the fire itself are direct effects 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 Whisky Ridge Project area, there is a combination of ground, surface and crown fuels. Many cultural sites have become overgrown with vegetation creating fuel ladders. Ninety-four percent of the Whisky Ridge 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.

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 (see Figure 14) 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 site's design. Where these features are obscured by underbrush or dense tree stands, a site's design is masked. Within the Whisky Ridge 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.

Figure 14. Heavy vegetation encroaching on historic railroad grade within the Whisky Ridge Project area affecting integrity of setting and design

The spatial distribution of features is also a key element in a site's design. Where these features are obscured by underbrush, dead and downed fuel accumulation, or dense tree stands, a site's design is masked. Within the Whisky Ridge 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.

The conversion of historic railroad grade to Forest Service system roads has also affected the design, setting, workmanship, materials, feeling, and association of cultural resources. For example, there are prehistoric sites that are now bisected by FS system roads that have displaced artifacts and continue to damage features. The historic railroad grades have often been considerably widened and features damaged or destroyed through previous road maintenance and reconstruction activities. OHV use within the project area has also damaged or destroyed artifacts and features and altered the design, setting, workmanship, feeling, and association of prehistoric and historic cultural resources by utilizing or crossing historic linear resources and historic and archaeological resources.

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; 36 CFR Part 800 (Protection of Historic Properties); and the objectives outlined in Section 3.5.18 *Cultural Resources* in the SNF Forest Land and Resource Management Plan (USDA Forest Service 1991: 3-68 – 3-69), including complete inventory of the project area, evaluation of all cultural resources within the project area, determination of project effects on significant cultural resources, mitigation of adverse effects to significant cultural resources, monitoring of cultural resources avoided by project activities, and assisting local Native American communities in the continuation and enhancement of their cultural traditions. Maintaining and preserving the integrity values (location, design, setting, feeling, workmanship, materials, association) of cultural resources and those aspects of cultural resources that contribute to National Register eligibility is mandated by the NHPA. In addition, enhancement of those values that contribute to National Register eligibility is sought.

To meet the above desired condition, cultural resources within the Whisky Ridge Project area alternatives should be identified, evaluated for eligibility to the NRHP, mitigated should an adverse effect be determined, avoided, and/or managed for maintenance, improvement, and preservation of integrity values. This project seeks to restore the cultural resource landscapes for a limited number of cultural resource sites closer to the time at which they were occupied. To accomplish this, proposed treatments would be utilized within cultural resource 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. This project also seeks to enhance cultural gathering areas through thinning and prescribed burning. Thinning and prescribed burning has proven effective on another cultural gathering area on the Bass Lake Ranger District and has resulted in an increase of culturally available materials. A sample of cultural resources avoided by project activities would be monitored post-project implementation.

Environmental Consequences

Methodology

Existing information from Archaeological Reconnaissance Reports, Cultural Resource Site records, Survey Coverage and Site Atlases, historic documents and archives, current and historic maps,

topographic maps, Government Land Office maps and (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 6 cultural resource sites were field visited to asses their current condition. The information gathered was used to address existing condition within the Whisky Ridge Project Area. Analysis of the alternatives is based on assessing the degree to which cultural resource values would be diminished by implementing the various alternatives and preserving and enhancing those characteristics and values that make a cultural resource site eligible for the NRHP.

Incomplete and Unavailable Information

Portions of the Whisky Ridge Project area were surveyed for cultural resources between 1976 and 2002. However, the majority of the Whisky Ridge Project area has not been surveyed to current standards. Approximately 1/4 of the previous survey is considered adequate and approximately 15% of the entire project area has never received cultural resource survey. 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 is likely. Due to time limitations and budget constraints, the SNF would consult with the California State Historic Preservation Officer (SHPO) per the *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) on a non-intensive survey strategy focusing on survey intensity based upon site probability and areas archival research reveals is likely to contain historic resources. Archaeological survey would be contracted out and conducted during the 2013 and 2014 field seasons.

Many known sites within the Whisky Ridge Project area have not been visited for over 20 years. In this time, site conditions have likely changed. When sites are revisited, those that need to be would be updated to current recording standards. Furthermore, the SNF cultural resource GIS layers are incomplete. If needed, known cultural resource sites would be updated, the locations recorded using Global Positioning System (GPS) technology, and delineated in the field. Newly discovered cultural resource sites would be recorded, tracked with GPS, and delineated in the field.

Once field work is completed, cultural resource compliance for this project would be documented in an Archaeological Reconnaissance Report (ARR). This report, which would describe the location and composition of the cultural resource sites within the project boundary, would be kept administratively confidential under the provisions of the Archaeological Resource Protection Act of 1979, 36 CFR 296 and 36 CFR 800.11(c) *Confidentiality*.

To evaluate candidate sites for proposed treatments, known sites within treatment units would be visited to assess the density of fuels and the current setting. Proposed treatment within these sites would comply with Stipulations and Standard Resource Protection Measures (SRPMs) of the Regional PA and the *Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects* (Interim Fuels Protocol). Selection of treated sites would be based on preserving and enhancing those characteristics and values that make a cultural resource site eligible for the NRHP.

Overview of Issues Addressed

An undertaking can have no effect, no adverse effect, or an adverse effect on a cultural resource. An adverse effect to a cultural resource can occur when an undertaking directly or indirectly causes alterations in its character or use. An adverse effect on a cultural resource occurs when an

undertaking alters its important characteristics and is measured by the degree to which it diminishes its location, design, setting, materials, workmanship, feeling or association (Integrity Measures) (36 CFR 800.5(a)(1)). These integrity measures can also be used to characterize the nature of any potential effects, whether they are direct, indirect or cumulative effects; and their severity. The degree to which cultural resource values are diminished would be used to measure the direct, indirect and cumulative effects of the proposed undertaking.

Issue Indicators

When assessing direct, indirect, and cumulative effects, assessments are based on cultural resources possessing at least one of the following NRHP values (36 CFR 60.4(a – d)) and possessing integrity, unless specific information already exists:

- Prehistoric archaeological sites: Criteria A, C and D
- Historic archaeological sites: Criteria A, B and D
- Historic structures: Criteria A, B, and C
- Traditional Cultural Properties: Criterion A

When the nature and scope of a proposed undertaking is such that its effects can be reasonably predicted and appropriate measures can be undertaken to ensure that the values of cultural resources are not affected in any way, then those cultural resources may be managed in a manner that ensures their values are preserved. However, preserving these values from certain project types (i.e., fuels reduction, timber, prescribed fire, etc.) has led to undesirable fuel loading conditions within cultural resource sites that now have the potential to pose a threat to NRHP values or integrity and have obscured the design, setting, and feeling of many cultural resources. This analysis would assess whether prior protection has resulted in beneficial or detrimental conditions and would make recommendations based on the assessment for a selected number of cultural resource sites. When protection and preservation of cultural resource values is in conflict with proposed project actions, the cultural resources would be assessed for their potential to be adversely affected by proposed project activities.

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. Some cultural resources extend beyond the Whisky Ridge Project area boundary. Therefore, the Area of Potential Effect (APE) includes the totality of the cultural resource and the degree to which project activities would affect the whole resource would be considered. 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 20-year intervals.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A list of past, present, and reasonably foreseeable actions considered under this effects analysis is provided in Chapter 3 of the Draft Environmental Impact Statement (DEIS) for the Whisky Ridge Project.

Alternative 1 – No Action

Direct Effects

The lack of vegetation management within and around cultural resource sites would continue directly to affect the integrity of a cultural resource site by altering its setting, design, materials, and feeling. Current erosion and unauthorized motorized trails would continue to adversely affect cultural resource sites resulting in artifact and feature displacement and washouts along linear cultural resources.

Indirect Effects

Indirect effects under this alternative could happen should an uncharacteristically severe wildfire occur resulting from untreated fuel accumulations within and around cultural resource sites. Under this alternative, fuel loading would continue to increase. The lack of fuels reduction management could result in higher intensity wildfires, thereby potentially adversely affecting approximately 136 archaeological and historical cultural resources and miles of historic linear resources within the project boundary, especially those with wooden components. Should a wildfire occur within the project area, suppression tactics may also adversely affect cultural resource sites through loss of contextual data. Thermal alteration (>800° C) (Steffen 2002; see also Gassaway 2011a) alters the morphological composition of artifacts, thereby potentially negatively affecting the data potential within cultural resources (see also Deal n.d.). High temperatures generated from a severe wildfire can also affect the ability to chemically source lithic material, thereby affecting archaeological study of prehistoric trade patterns (Deal n.d.).

Should a wildfire occur, indirect effects could also 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 negative effects to morphological features.

Cumulative Effects

Cumulative effects to 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 and future actions would comply with law, regulation, and policy, cumulative effects are unlikely.

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

As no undertaking would occur under 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 of cultural resources remain the responsibility of the SNF regardless of whether or not an undertaking occurs.

Summary of Effects

This alternative has the potential for effects on approximately136 cultural resources and miles of linear historic resources since no land management activities would occur. Effects could result from falure 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, suppression effects, and continued unauthorized motorized use and would continue to adversely affect integrity of setting for cultural resource sites as the fuel loading would continue to increase. As no action would occur under this alternative and future actions would follow law, regulation, and policy, cumulative effects are unlikely.

Alternative 2 – Proposed Action

Direct Effects

Due to incomplete survey and site information, it is not possible to assess and analyze all potential effects the Whisky Ridge Project would have on cultural resources. However, it is possible to address types of effects from proposed project activities to currently undiscover cultural resources as most sites types are represented within the Whisky Ridge Project. There are a total of approximately 136 known cultural resource sites and miles of historic linear resources throughout the Whisky Ridge Project that have the potential to be affected by implementing this alternative. Analysis of potential effects from project activities to the known sites would act as a reasonable proxy for examination. Cultural resource sites may be affected by prescribed burning, tractor thinning, mastication, planting, road maintenance, off-site water development, culvert replacements, conifer removal in meadows, decommissioning unauthorized motor vehicle routes, campground rehabilitation and WIN projects. The majority of the cultural resource sites and features in the Whisky Ridge Project would be protected through the application of SRPMs of the Regional PA and Interim Fuels Protocol or design criteria and thus would have no direct effects. Where SRPMs are not an effective measure or where it is anticipated project activities would affect cultural resources, the SNF would take into account the effects of the project activities on the cultural resources and would mitigate any adverse effects. These effects are discussed below.

Timber/Silviculture

Several of the cultural resource sites are linear historic railroad and logging systems that have the potential to be adversely affected by project activities. These systems include railroad grades, spur grades, hoists and tramway remains. These systems retain intact earthworks and features such as through-cuts, cut and fill construction, retaining walls, wooden debris, and trash dumps. The SPLC

was recently determined eligible for the NRHP, meaning it retains the values and characteristics that make it historically significant and qualify it for listing on the NRHP. It is anticipated there would be direct negative effects to the SPLC railroad grade system due to restricted access to tractor and mechanical units that require crossing (breeching) the linear segments for access. These breeches have the potential to alter the NRHP defining characteristics and values of the railroad system that contribute to its eligibility and may result in adverse effects. An MOA with SHPO for the linear components of the SPLC would be developed and executed prior to project implementation to mitigate any adverse effects.

Fire/Fuels

As noted in Fire History of the Fire/Fuels section of the Whisky Ridge Ecological Restoration Project DEIS, it has been determined that under certain burning conditions a fire could severely affect the ecosystem within the Whisky Ridge 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. Smoldering fires can burn extensively for lengthy periods. This has also been shown to affect chemical sourcing of lithic materials (Deal n.d.). Therefore, prescribed burning through archaeological sites would be carefully controlled and monitored during implementation. In addition, SRPMs) of the Interim Fuels Protocol would be implemented to protect sites during prescribed fire implementation. These actions would have a beneficial effect on cultural resources and enhance their character defining attributes.

Identified cultural gathering areas are managed as cultural resource sites. As with all cultural resource sites on public lands, the SNF must ensure confidentiality of location. Left unmanaged or avoided from project impacts, these gathering areas often are choked with brush and downed fuels limiting the potential harvest. SRPMs are not an effective tool to manage these areas and would result in increasing density of the understory and an unfavorable quality of materials or food items. There is a concern that the proposed action would adversely affect cultural gathering areas. If cultural gathering areas are identified, Alternative 2 and design criterion 7 for Cultural Resources address this concern. If gathering areas are identified to the SNF, the SNF would coordinate with the tenders of these areas prior to and during project implementation to insure they are properly managed. If cultural gathering areas are not identified, this alternative does have the potential to adversely affect these areas as the proposed treatment for a given area may negatively impact the cultural materials. Another gathering area actively managed on the SNF has benefitted from hand thinning, brush piling, and underburn treatments and has resulted in a significant increase of culturally gathered plants available for collection that were previously smothered by thick forest litter and duff. Proposed project activities, including Cultural Resources design criterion 7, hand thinning, piling, and underburning, would enhance these traditional gathering areas and would benefit the resource through active management.

Cultural Resources

Cultural resource policy of avoiding sites from project activities over the last 40 years mimics the No Action alternative. While areas surrounding sites have received treatment, minimal to no action has been allowed within site boundaries. The proposed action to treat within cultural resource sites through low-intensity burning or through hand and mechanical treatments would have a beneficial

effect to resources approximating pre-suppression site setting, design and feeling, thereby enhancing those characteristics and values that contribute to NRHP eligibility. Monitoring during implementation would insure there are no adverse effects to cultural resource sites.

Hydrology

One WIN proposal has the potential to adversely affect a cultural resource site, as the project could potentially displace or obliterate artifacts and/or features of the cultural resource site through soil disturbance. The cultural resource site is currently unevaluated and must be treated as eligible. To mitigate the potential adverse effect, either application of SRPMs or a NRHP determination of eligibility would be conducted for this site and any adverse effects mitigated prior to project implementation.

There would be an effect to the railroad grade from the closure and rehabilitation of Forest Road 7S08. The grade is currently eroding in a drainage due to failure of the original crossing feature and OHV traffic and would continue to erode washing away the existing grade on either side of the drainage. Rehabilitating the drainage through bank stabilization would positively affect the grade as the drainage sidewalls would be re-vegetated and would protect further degradation of the grade. While the proposed blockage of this road segment by gate or other barrier may affect the setting and design of the grade by introducing a modern design element, the effect would be minimal and not detract from the feeling of the larger network system. Moreover, this would eliminate OHV traffic on this portion of the grade allowing the drainage to heal and re-vegetate, thereby arresting the decay of the grade.

Engineering

This alternative further has the potential to adversely affect several prehistoric and historic cultural resource sites through road maintenance and reconstruction activities. Many historic railroad grades, wagon roads, and Forest Service system roads bisect prehistoric and historic cultural resources. Similarly, many historic railroads and wagon roads were converted to Forest Service 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. Many roads within the Whisky Ridge Project would require heavy maintenance or reconstruction. This may include brushing, blading, construction of drainage dips, and replacing plugged or non-functioning culverts. In Alternative 2, where determined effective, prehistoric archaeological resources would be protected from road activities by padding or avoidance in accordance with SRPMs of the Regional PA. Where FS system roads overlay historic linear resources, continued use of Forest Service system roads is consistent with stipulations of the Regional PA. Brushing typically does not affect, and may even enhance setting, of prehistoric cultural resource sites and historic linear resources. Should a FS system road that overlays a historic linear resource within the project area require maintenance or reconstruction that would alter the characteristics of the historic linear resource, that segment of the linear resource would be evaluated for its contribution to the NRHP eligible SPLC prior to reconstruction. Where SRPMs and design criteria cannot eliminate effects to cultural resources, prior to project implementation, unevaluated cultural resources would be evaluated for eligibility to the NRHP, effects assessed, and mitigated should the effects be determined to be adverse. Adverse effects would require an MOA be developed with SHPO for each site.

OHV

There are locations where Designated Motorized Trails overlap cultural resource sites. Design measures addressed in Designated Motorized Trails under Recreation (Design Criteria 7(i.e., gouging and berms from equipment across trails) may have an adverse effect to cultural resources. These cultural resource sites would be protected through the application of avoidance measures (SRPMs of the Regional PA). There may be effects to cultural resources due to proposed decommissioning of unauthorized OHV routes (e.g., water bar installation, mechanical treatment, installation of barricade and signs). The type of decommissioning could have an adverse effect where a route proposed for decommissioning travels through or utilizes a cultural resource site. Coordinating with the District Archaeologist and selecting the type of decommissioning in response to the cultural resource site type should minimize any potential effects. Where this is not possible or effective, prior to project implementation, these cultural resources would be evaluated for eligibility to the NRHP, effects assessed, and mitigated should the effects be determined to be adverse.

Recreation

Based upon available information, the Whisky Falls Campground in the project area was established by 1958. Therefore, it qualifies as a cultural resource. Should this campground still retain historic features, there is the potential for harvest operations to adversely affect the resource. Harvest activities, including thinning to improve stand health, would avoid historic campground features in accordance with SRPMs of the Regional PA and 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. The Whisky Falls Campground rehabilitation has the potential to adversely affect the historic Whisky Falls Campground by changing the historic design, materials, workmanship, and composition of the campground. Prior to project activities, the campground would be evaluated for NRHP eligibility, effects assessed, and mitigation measures implemented, if necessary.

Indirect Effect

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, prescribed burning operations and recreational activities such as dispersed camping and unauthorized motorized off-trail activity through increased access to and visibility of cultural resources, increasing the likelihood of adverse effects from artifact looting and vandalism. Follow-up patrols and monitoring should minimize this potential effect.

Positive indirect effects to cultural resources from tractor thinning, mastication, and underburning could occur as a result of returning the project area to pre-suppression conditions, thereby enhancing the setting of the surrounding landscape and decreasing the likelihood of an uncharacteristically severe wildfire.

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

Cumulative Effects

Cumulative Effects occur through past, present, and reasonably foreseeable actions in the project area. Past actions in the project area include historic sawmill and logging activities, cattle grazing, mining, homesteading, Forest Service administration, and recreational use. For cultural resource sites, the effects are addressed in the potential for the action to adversely alter those characteristics and values that qualify a cultural resource site for NRHP eligibility. Therefore, the APE is the whole of the cultural resource site. For example, the SPLC was an historic railroad logging system that operated within and around the Whisky Ridge Project area. A logging spur was part of the more complex network of railroad camps, grades, and activity areas that made up the SPLC system. The potential for an adverse effect on a railroad spur may then affect the cumulative whole of the railroad logging network. It is anticipated there would be effects to the National Register eligible SPLC railroad system from breeches required to access units during the Whisky Ridge Project. Cumulatively, these breeches (and any future breeches) could impact the integrity of the whole system and result in an adverse effect. An MOA with SHPO for the linear components of the SPLC would be developed and executed prior to project implementation to mitigate any adverse effects.

Cumulative effects could also occur in the form of looting and vandalism through increased cultural resource visibility after project implementation. This would 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 SRPMs of the Regional PA and monitoring of site condition on a regular basis. As current anticipated effects from Alternative 2 to cultural resources would be mitigated through development and execution of an MOA, and future actions would follow law, regulation and policy, it is anticipated cumulative effects from this action alternative would be minimal.

Identified cultural gathering areas are managed as cultural resource sites. As with all cultural resource sites on public lands, locations are confidential. Left unmanaged or avoided from project impacts, these gathering areas often are choked with brush and downed fuels limiting the potential harvest. SRPMs are not an effective tool to manage these areas and would result in increasing density of the understory and an unfavorable quality of materials or food items. There is a concern that the proposed action would adversely affect cultural gathering areas. If cultural gathering areas are identified, Alternative 2 and design criteria 7 for Cultural Resources address this concern. If cultural gathering areas are not identified, this alternative does have the potential to adversely affect these areas as the proposed treatment for a given area may negatively impact the cultural materials. Another gathering area actively managed on Forest has benefitted from hand thinning, brush piling, and underburn treatments and has resulted in a significant increase of culturally gathered plants available for collection that were previously smothered by thick forest litter and duff. Proposed project activities, including Cultural Resources design criteria 7, hand thinning, piling, and underburning, would enhance these traditional gathering areas and would benefit the resource through active management.

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

Regulatory Framework

The Forest Service 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) implement 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: the 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 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 SRPMs 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 Sierra National Forest Land and Resource Management Plan (USDA Forest Service 1991), the SNF has identified three objectives to integrate cultural resource management with other multiple use management (USDA Forest Service 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 (USDA Forest Service 1991: 4.3.18) through a set of Standards and Guidelines (USDA Forest Service 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).

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, 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 April 13, 2012 to members and groups in the Native American community in accordance with NEPA policy. These groups have also been involved in the Willow Creek Collaborative effort and many have attended the public field trips held on June 13, 2012 and June 27, 2012. In addition, a consultation letter in compliance with Section 106 of the NHPA would be sent to Native American community members and groups. Consultation has consisted of meetings, letters, and presentations, and is documented in the project record. At the time of publishing, the SNF has received one concern from the tribal community regarding cultural gathering areas. This concern is addressed in the Direct Effects section for Cultural Resources under Alternative 2.

Summary of Effects

By following the Stipulations and implementing the SRPMs outlined in the Regional PA and the Interim Fuels Protocol and following cultural resource design criteria, the majority of cultural resource sites would not be affected as a result of implementing this alternative. Alternative 2 has the potential to adversely affect the NRHP eligible SPLC railroad system. Through development and implementation of an MOA with SHPO, this effect would be mitigated. This alternative also has the potential to adversely affect cultural resource sites through implementation of proposed WIN projects, road maintenance and reconstruction activities, OHV design measures, and rehabilitation of the Whisky Falls Campground. Potential effects to sites from these proposed actions would require NRHP determinations of eligibility and may require development of MOAs to mitigate adverse effects. Once mitigated, it is not anticipated there would be direct effects to cultural resource sites from this alternative. Potential indirect effects to cultural resource sites under Alternative 2 are minimal and would be mitigated through post-implementation monitoring. As current anticipated effects from Alternative 2 to cultural resources would be mitigated through development and execution of an MOA, and future actions would follow law, regulation and policy, it is anticipated cumulative effects from this action alternative would be minimal.

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

Design Features and Mitigation Measures

Design features and mitigation measures would be the same as Alternative 2 with the exception that there would not be harvesting trees within Whisky Falls Campground and thinning fuel loading through mechanical treatment within cultural resource sites under the Interim Fuels Protocol. These two design criteria would be eliminated from Alternative 3.

Direct Effects

Direct effects would be the same as Alternative 2 with the exception of harvesting trees within Whisky Falls Campground and thinning through mechanical treatment within cultural resource sites. Not harvesting within the campground and cultural resource sites would allow the potential for

increased fuel loading and alteration of design and setting characteristics, potentially resulting in a diminished value of the resource to qualify for listing on the NRHP. Breeching historic railroad grades would not be needed for timber logging, but would still be needed for mastication treatments. Therefore, it is anticipated there would still be a direct negative effect on the SPLC and development and implementation of an MOA with SHPO would still be required.

Indirect Effects

Indirect effects would be the same as Alternative 2 because the proposed activities have the potential to diminish those values and characteristics, such as design and setting that contribute to a site's eligibility for listing on the NRHP. Positive indirect effects to cultural resources from mastication and underburning could occur as a result of returning the project area to pre-suppression conditions, thereby enhancing the setting of the surrounding landscape and decreasing the likelihood of an uncharacteristically severe wildfire.

Cumulative Effects

Cumulative effects would be the same as Alternative 2.

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

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

Economics

The economics effects are summarized from the Economics report for the Whisky Ridge Ecological Restoration Project (Napier K., 2012).

The Whisky Ridge Project Area was selected for treatment based on the need to restore key ecological processes, biodiversity, wildlife habitat, and structural heterogeneity in the Willow Creek watershed. The location of the project in this watershed has made it a priority that incorporates desired conditions and values as expressed by the Willow Creek Collaborative in the Addendum to the Willow Creek Landscape Analysis. The Addendum combines the perspectives of many different stakeholders and serves as a guide to project development, including perspectives on economic development and feasibility of forest restoration activities.

Restoration activities include the use of commercial and precommercial thinning, mastication, and prescribed fire to reduce stand density, reduce the build-up of hazardous fuels, maintain growth and vigor of stands, and alter forest structure using principles in GTR-220 and GTR-237 as a guide. Treatments are needed to prevent similar situations that occurred in the last decade in Arizona, New Mexico, Colorado 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 high-severity wildfires. Proposed fuel reduction and density management treatments would: (1) generate sawtimber volume, (2) help stimulate the economy through the utilization of forest products, (3) maintain jobs in the local timber and vegetation management industries, and (4) provide funding for current and future restoration projects including, but not limited to: meadow restoration, fuel reduction, recreation sites and trails, wildlife habitat, and range improvements.

Currently (2012) the Sierra NF is providing sawtimber 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 infrastructure is voiced as a concern by some segments of the public.

Biomass is another forest product which may stimulate the local economy. A feasibility analysis was prepared by a consulting firm for the Yosemite-Sequoia Resource Conservation and Development Council for a small-scale (1 mega-watt) biomass plant to be built in North Fork. The study found that woody biomass resulting from forest restoration projects (as well as private land in the area) is available in volumes sustainable to operate a biomass plant within a 30-mile radius, much of that under USFS management. It is estimated that 8,500 bone dry tons (BDT) may be available from USFS lands. Haul costs for byproduct material from timber harvests were estimated to range from $45 to $65 per BDT. (TSS Consultants, 2012).

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 would

be lost. The success of ecological restoration projects would be minimized if no mills are located within a reasonable haul distance.

Stakeholders from the Willow Creek Planning Collaborative provided their perspectives on the use of forest products and the associated economic value in Section IV, "Integration of Community Economic Development Considerations in Forest Restoration Planning," as written below in the final addendum:

3. Restoration projects are expected to create economic resources (such as by removing trees), but would not be designed to maximize economic resources. Trees would not be cut just for their economic value, but because it's the right thing to do for the forest. It is expected that there would be value in what is removed for forest health and that the Forest Service would use this value to pay for the work that needs to be done.

The district finds that at the present, the cost of the proposed treatment is higher than the value of the sawtimber and would require appropriated funds to fulfill the objectives. The Region 5 Transaction Evidence Appraisal (TEA) is the method in which the value of timber and the costs of associated activities are calculated. This economic analysis would give the public an approximate comparison of costs between alternatives. An economic analysis is required to comply with NEPA guidelines and is helpful in selecting an alternative by showing comparative costs and\or revenues between alternatives. Alternative selection would be based on the alternative that best accomplishes the purpose and need of the project.

The economic analysis for the Whisky Ridge Ecological 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 activities. 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.

Tables 31 and 32 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 $2,304,336. Alternative 3 would require $1,223,187 more in appropriated funds than Alternative 2 to complete work. The employment benefits for Alternative 2 would be approximately $6,719,984 more than Alternative 3. The economic costs for Alternative 3 are higher overall to implement and it would not treat the 3,173 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. In Alternative 2, biomass operations would cost approximately $1,058,244, with a value of $1,831. Biomass removal under Alternative 3 would cost about $355,011 less due to the fact that less material (i.e. tops and branches from commercial thinning operations) would be removed and transported.

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). Fire risk would be reduced in units proposed for commercial thinning (3,173 acres) and those treatment areas where hand thinning/tractor pile/burn pile, mastication, and under burn take place under Alternative 3 (1,815 acres). The fire reduction benefit could be as much as $3,120,294 in either action alternative.

This analysis compares the project value based on product value, implementation cost, and employment benefits for the action alternatives. 5,896 acres of tractor ground was analyzed in this document for Alternative 2. The economic analysis is based on the estimated gross commercial thin acres (3,173) expected to be flagged on the ground for timber harvesting. Alternative 3 does not include acreage for commercial thinning since the maximum diameter of trees to be removed is 10 inches. 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.

Table 31. Economic Analysis for Alternative 2.

Value - Sawtimber[1]					
Total Gross Acres = 3173	% by Species Volume	Volume/Species		Advertised Rates	Total Value
PP 10 inch - 29.9 inch sawtimber	8%	1,851 ccf	x	$138.02 /ccf	$255,434
		964 mbf		$264.86 /mbf	
SP 10 inch - 29.9 inch sawtimber	11%	2,728 ccf	x	$139.13 /ccf	$379,477
		1421.3 mbf		$266.99 /mbf	
WF 10 inch - 29.9 inch sawtimber	43%	10,563 ccf	x	$179.78 /ccf	$1,899,101
		5,505 mbf		$345.00 /mbf	
IC 10 inch - 29.9 inch sawtimber	38%	9,397 ccf	x	$258.81 /ccf	$2,432,164
		4,897 mbf		$496.66 /mbf	
LP 10 inch - 29.9 inch sawtimber	~1%	31.99 ccf	x	$135.49 /ccf	$4,334
		16.67 mbf		$260.01 /mbf	
Biomass		7324.9 ccf	x	$0.25 /ccf	$1,831
Total Value, Sawtimber		**24571 ccf**	**(12,803 mbf)**		**$4,970,510**
Total Value, Biomass		**7324 ccf**	**x .25/ccf**		**$1,831**
Total Value, Sale		**(Sawtimber + Biomass)**			**$4,972,341**

Conversion Factor for ccf to mbf; 0.5211 Conversion Factor derived from USFS Region 5 Transaction Evidence Appraisal, using average conversion factors from past timber sale cruise data.

Stump to Mill Cost					
Stump to truck Cost	24571	ccf	@	$65.90 /ccf	**$1,619,229**
Other Cost	24571	ccf	@	$28.76 /ccf	**$706,662**
Road Reconstruction Cost	24571	ccf	@	$12.89 /ccf	**$316,720**
Road Maintenance Cost	24571	ccf	@	$2.91 /ccf	**$71,502**
Temp Road Cost	24571	ccf	@	$0.34 /ccf	**$8,354**
Haul Cost	24571	ccf	@	$89.89 /ccf	**$2,208,687**
Sawtimber Scale	3071	trips	@	$1.60 /trip	**$4,914**

Biomass	7324	ccf	@	$69.26 /ccf		**$507,308.00**
	(23806	tons	@	$21.31 ton)		
Advertise Rate Sawtimber	24571	ccf	@	$22.13 /ccf		**($543,756)**
Total Other Cost						**$4,899,619**
Net Value						**$72,722**
Forest Service Agency Responsibility					**Full-time jobs[3]**	
Mastication	530	acres	x	$545 /acre	1	**$288,850**
Hand/T Units Thin	157	acres	x	$170 /acre	4	**$26,690**
Hand Units Pile	157	acres	x	$900 /acre	4	**$141,300**
Hand Units Burn Piles	157	acres	x	$75 /acre	2	**$11,775**
Tractor Pile	635	acres	x	$280 /acre	1	**$177,800**
Underburn T units	1703	acres	x	$150 /acre	1	**$255,450**
Underburn Rx units	2916	acres	x	$300 /acre	1	**$874,800**
Burn Tractor Piles	635	acres	x	$75 /acre	2	**$47,625**
					16	jobs
Total Non Harvest Cost						**$1,824,290**
Total Project Value						**($1,751,568)**
Fire Reduction Benefits[2]				$606 /acre	5149 acres	**$3,120,294**
Harvest Employment[3] 169						jobs
Total Full Time Jobs						**185**
Total Employee-Related Income						**$7,399,984**

Table 32. Whisky Ridge Economic Analysis for Alternative 3.

Value - Sawtimber[1]						
Total Acres = 1815	% by Species Volume	Volume/Species		Advertised Rates		Total Value
PP 10 inch - 29.9 inch sawtimber	0%	0 ccf	x	/ccf		$0
		0 mbf				
SP 10 inch - 29.9 inch sawtimber	0%	0 ccf	x	/ccf		$0
		0 mbf				
WF 10 inch - 29.9 inch sawtimber	0%	0 ccf	x	/ccf		$0
		0 mbf				
IC 10 inch - 29.9 inch sawtimber	0%	0 ccf	x	/ccf		$0
		0 mbf				
LP 10 inch - 29.9 inch sawtimber	0%	0 ccf	x	/ccf		$0
		0 mbf				
Biomass		4867.0 ccf	x	$0.25 /ccf		$1,217
Total Value		**0**	**ccf**			**$0**

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	4867 ccf 15818 tons	@ @	$82.48 /ccf $25.37 ton		**$401,413.00**
Advertised Rate Sawtimber	0 ccf	@	/ccf		**$0**
Total Other Cost					**$401,413**
Net Value					**($401,413)**

Forest Service Agency Responsibility				**Full-time Jobs[3]**	
Mastication	530 acres	x	$545 /acre	1	**$288,850**
Hand/T Units Thin	157 acres	x	$170 /acre	4	**$26,690**
Hand Units Pile	157 acres	x	$900 /acre	4	**$141,300**
Hand Units Burn Piles	157 acres	x	$75 /acre	2	**$11,775**
Tractor Pile	635 acres	x	$280 /acre	1	**$177,800**
Underburn T units	1703 acres	x	$150 /acre	1	**$255,450**
Underburn Rx units	2916 acres	x	$300 /acre	2	**$874,800**
Burn Tractor Piles	635 acres	x	$75 /acre	2	**$47,625**
				17	jobs
Total Non Harvest Cost					**$1,824,290**
Total Project Value					**($2,225,703)**
Fire Reduction Benefits[2]			$606 /acre	5149 acres	$3,120,294
Harvest Employment[3]					jobs
Total Full Time Jobs					**17**
Total Employee-Related Income					**$680,000**

[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 the Pacific Northwest, each million board feet harvested supports 13 jobs. The number of jobs created fluctuates with different studies, some ranging from as few as 9 to as many as 28. The Leppke and Mason report from November 2005 reports direct forest industry employment. Estimates depend on type of harvest and degree of manufacturing in a given area. Jobs are also created in forestry operations, logging, hauling, processing, or renewable energy. Indirect jobs are also created through local expenditures by workers, support services within community, or government services. (Lippke, Bruce; Mason, Larry. Nov. 2005. Implications of Working Forest Impacts on Jobs and Local Economies Discussion Paper). The restoration and fuel work would support additional direct and indirect employment.

The employment benefit of implementing product removal and fuel reduction treatments is an important aspect in project economics. Whenever a project is implemented that puts people to work and provides a product to the free market, societal benefits are 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 13.2 jobs are supported both directly and indirectly (Lippke & Mason, 2005). This ratio can range from 9 jobs to 28 jobs depending on location and the type of products removed (Lippke & Mason, 2005). In addition to product removal, other vegetation treatments in the Project Area help support the local economy. Table 33 displays the anticipated number of full time jobs supported by vegetation treatments other than product removal.

Table 33. Full Time Job Relationship to Project Tasks.

Task	Workers	# of Production	Acres of Treament	Direct full time jobs	Indirect Full time jobs	Total Full time Jobs
Mastication	2	4 ac./day	530	1.0	1.5	2
Hand/T Units Thin	1	1 ac./day	157	0.6	0.9	1
Hand Units Pile	**2**	**2** ac./day	157	0.6	0.9	1
Hand Units Burn Piles	**7**	**5** ac./day	157	0.9	1.2	2
Tractor Pile	**2**	**5** ac./day	635	1.0	1.4	2
Underburn T Units	10	30 ac./day	1703	2.2	3.1	5
Underburn Rx units	10	30 ac./day	2916	3.8	5.3	9
Burn Tractor Piles	7	15 ac./day	635	1.2	1.6	3

Engineering/Transportation

The direct, indirect and cumulative effects to Transportation are summarized from the Engineering/Transportation report for the Whisky Ridge Ecological Restoration Project (Hosford A., 2012).

Affected Environment

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.

Existing Condition

The existing transportation system for the Whisky Ridge Ecological Restoration Project consists of approximately 98 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 minor amounts of new temporary road construction is needed.

There are 84.5 miles of NFS native and aggregate surfaced roads and approximately 13.5 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 meet acceptable standards established in the Forest Service Handbook 7709.58.

Desired Condition

The highest priority for District road management would continue to be safety for the traveling public and employees and improvement and restoration of roads with resource or access needs. The Whisky Project is proposing to perform road maintenance and/or road reconstruction activities on all or portions of roads listed in Appendix C.These roads would require a final field review prior to project activities to determine complete road reconstruction and/or road maintenance needs.

The logging systems plan has identified approximately 5 miles of temporary road construction for unit access. These roads would be closed upon completion of use.

There are multiple recorded archeological and historical sites within the Whisky Ridge Ecological Restoration 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. Planned road reconstruction and road maintenance activities for the Whisky Ridge Ecological

Restoration Project would be reviewed by the District Archeologist to develop mitigation requirements for archeological /road site conflicts prior to work activities.

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. Road decommissioning would not take place.

Alternative 2 – Proposed Action

Indirect Effects

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.

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

Indirect Effects

In Alternative 3, treatment areas would remain the same as in Alternative 2. Indirect effects would remain the same as in Alternative 2.

Regulatory Framework

All road maintenance, reconstruction and new construction would follow the Sierra National Forest Land Management Plan Standards and Guidelines. Best Management Practices (BMP) developed for road maintenance activities would be incorporated into the design of this proposed project.

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. National Forest System 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.

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.

Fire/Fuels

The direct, indirect and cumulative effects to Fire/Fuels are summarized from the Fire/Fuels Specialist Report for the Whisky Ridge Ecological Restoration Project (Stalter, B., 2012)

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 (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 large high-intensity wildfires, including crown fire (Scott and Reinhardt 2001).

Figure 15. Picture taken in 1913 on the Bass Lake Ranger District showing fuel and very open understory conditions. Notice the burn scars on the trees and dwn logs

Fire Regime

A generalized description of the role fire plays in a forest is termed a fire regime and is typically articulated in terms of frequency, severity, and intensity of fire (Agee 1993).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 and survival. 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 Nevada Ecosystem Project (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 have shown that most areas, both historically and recently, have burned at low- to moderate-severity , with occasional small (100-2000 m^2) high severity patches that create canopy gaps and subsequent patches of similar-aged tree groups (Scholl and Taylor 2010; Thode et al. 2011). Tree regeneration in gaps is facilitated by the 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 large-scale high-severity fire effects in our forest. Thus, application of high-severity prescribed fire beyond the occasional torching of small groups of trees would create novel conditions compared to fire effects over the last four hundred years (Scholl and Taylor 2010).

Numerous peer-reviewed scientific documents have noted striking changes in structural and functional components of the Sierra Nevada ecosystems since 1860, largely due to alterations in the pre-Euro-American settlement fire regime (Caprio and Graber 2000). The Whisky Ridge Project is characterized as Sierra ponderosa pine and mixed conifer; historically this forest ecology zone displayed a low-intensity and frequent fire regime. 100 % of the project area is in Group I and has a fire frequency of 0-35 yrs with fire being of a low to mixed severity type.

A measure of the extent to which contemporary fires are burning at frequencies similar to the frequencies that occurred prior to Euro/American settlement with the mean Fire Return Interval as the basis for comparison is the Condition Class Fire Return Interval (CCFRI). Presently for the Whisky Ridge Project 94% of the area is high departure with insufficient fire on the landscape. This measure is listed in table 34.

Table 34. Condition Class Fire Regime Interval Shown as Percentage of Project Area.

Existing Conditions within the Whisky Project	
Condition Class Fire Return Interval	**% of Area Affected**
Unburnable Areas	2.17%
High Departure/Excess Fire	0.16%
Moderate Departure/Excess Fire	0.30%
Low to No Departure	0.75%
Moderate Departure/Insufficient Fire	1.14%
High Departure/Insufficient Fire	**95.48%**
Grand Total	100.00%

Fire History

Fire history in the last 100 yrs has been one of a change from naturally ignited lightning and human set fires that openly burned over the landscape and kept ground, surface and aerial fuels and vegetation within levels that were within the historical range of variability (HRV) for these systems. As fire suppression came into full capability in the 1930's with the large influx of manpower and equipment all fires were systematically suppressed with the cumulative fuels and vegetation increased by magnitudes never before experienced to the present condition.

Fires that burn in the upper elevation of the project area are mostly ignited by lightning and average 1- 5 ignitions per year depending on the summer monsoon moisture pattern. The lower elevation fire ignitions are mostly human caused and most are caught at initial attack with the exception being the larger sized fires in the recent past that occurred during suppression resource drawdown or were started by marijuana cultivators and became established in inaccessible terrain.

Table 35 illustrates the wildfire starts for smaller class A&B[5] sized fires. This data is from 1970 to 2008. There have been over 368 fire starts in this 42 year time span.

[1] Fire size is classified by 5 levels beginning with A size fires = 0-.25 ac's, B size = .25-10 ac's, C size = 10-100 ac's, D size = 100-300 ac's and E size = over 300 ac's.

Table 35. Wildfire Occurrence for Class A/B Fires from 1970-2008.

Class A/B Wildfire Occurrence 1970-2008					
Number of Fires	**Decade**				
Fire Year	**1970**	**1980**	**1990**	**2000**	**Grand Total**
1970	16				16
1971	7				7
1972	18				18
1973	12				12
1974	10				10
1975	12				12
1976	17				17
1977	10				10
1978	7				7
1979	4				4
1980		16			16
1981		10			10
1982		7			7
1983		8			8
1984		11			11
1985		11			11
1986		9			9
1987		20			20
1988		14			14
1989		15			15
1990			20		20
1991			8		8
1992			9		9
1993			10		10
1994			6		6
1995			5		5
1996			4		4
1997			4		4
1998			11		11
1999			4		4
2000				7	7
2001				3	3
2002				6	6
2003				4	4
2004				8	8
2005				7	7
2006				3	3
2007				12	12
2008				3	3
Grand Total	113	121	81	53	368

Historic wildfire cartographic data beginning in 1910 show that between 1911 and 2008 there have been 40 fires greater than 10 acres (Class C) within 3 miles of Whisky Ridge Project area. These

fires were mostly human caused and ranged in size from 23 to 25,016 acres. Most of these wildfires started and burned from the lower elevations around the North Fork and Bass Lake area up into the project area with the normal prevailing west and northwest wind direction. The risk of fire ignitions and wildfire burning into this landscape would remain the highest along these developed areas.

Table 36 show the Fire History Records ((Class C fires >10 Acres) within and outside of the Whisky Ridge Project area. Map 1 of the map package of this document shows the approximate perimeters of these fires and their proximity to the community of Whisky Ridge Project and the project area.

Table 36. Fire Hstory Within and Surrounding the Project Boundary (within a 3 mile radius).

Wildfire History Acres for Class C and above
1910-2008

Fire Years	**Decade 1900-1919**	**1920-1929**	**1930-1939**	**1940-1949**	**1950-1959**	**1960-1969**	**1980-1989**	**2000-2008**	**Grand Total**
1911	11398								11398
1916	7575								7575
1917	1989								1989
1919	1127								1127
1920		703							703
1921		145							145
1922		25016							25016
1923		415							415
1924		6259							6259
1925		40							40
1926		424							424
1928		224							224
1931			641						641
1933			2416						2416
1940				132					132
1944				157					157
1957					66				66
1958					42				42
1959					165				165
1964						106			106
1980							254		254
1984							27		27
1985							764		764
1987							27		27
2001								4130	4130
2002								402	402
2004								384	384
2005								23	23
2007								99	99
2008								277	277
Grand Total	22089	33226	3057	289	273	106	1072	5315	65427

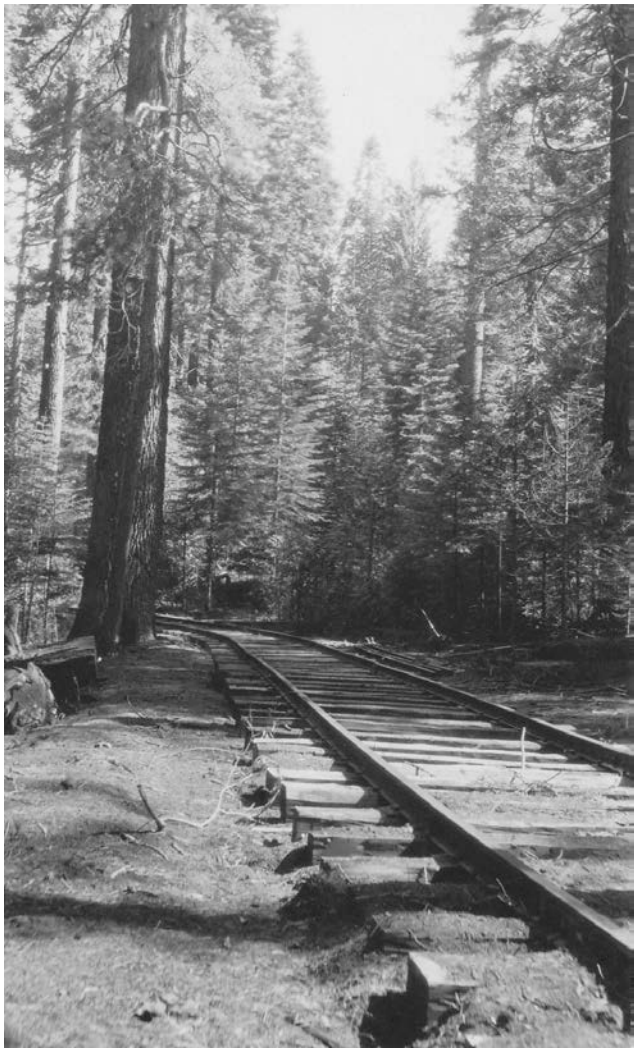


Figure 16. Picture of forest conditions just east of Benedict Meadow at the bottom of Camp 14 Railroad Hoist. Circa late 1920's. Young understory shown has grown into dense stands of shade tolerant conifers that are capable of supporting high severity crown fires

Logging History

Timber harvesting started in the area in the 1890's around the Peckinpah Meadow area. From 1922 to 1931 the Sugar Pine Lumber Company harvested timber 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 1931 has generally consisted of salvage/sanitation, regeneration harvests and commercial thinning, with most occurring from 1970 to 2009. 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 Figure 3

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 white fir/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 portions of fire impacted areas where they are severely overstocked. 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. Logging slash fuels were treated with machine pile and burning and lop/scatter methods.

Along the southern boundary and in scattered locations within the project there are existing ponderosa/jeffery pine conifer plantations that were established from past regeneration harvests. These plantations have become overstocked and are in need of thinning both commercially and precommercially to reduce tree density and canopy fuels.

Since the early 1970's there have been commercial thinnings completed fewer than seven timber sales (Browns Thinning 1971, Benedict Thinning 1977, Owl 1993, South Fork 1995, Foster 1996, Pine Grove 1997, and Gertrude 2002. Logging slash was reduced or modified by pile and burn and/or by lop/scattering and left onsite. The high priority piling areas were those with the heaviest slash concentrations or if the areas were located in existing fuel breaks. Piling was completed by dozers with some limited hand piling done on steeper inaccessible terrain.

Fire Behavior in current Fuel Loading

Ground and surface fuels within the Whisky Ridge Project Area vary throughout the project and have 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 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) 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.

Figure 17. Photo showing fuels conditions in fir stands

Mixed Conifer Stands - Fuel Model TL3 is described as the lighter amount of ground and surface fuels associated with it and is used to describe the stands with higher numbers of true fir conifers in the higher elevations of the Whisky Ridge Project 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 15 to 70 tons per acre.

Figure 18. Photo showing fuels conditions in Mixed Conifer stands

Mixed Conifer and Ponderosa Pine Stands - Fuel model TL8 describes where there are areas where there is a moderate fuel load small saplings and suppressed trees have begun to fill in the understory of larger trees. Ponderosa and Sugar Pine make up a larger portion of the tree species composition. The surface fuels are of smaller size, mostly less than 3” in size. Estimated surface fuel loadings average is between 10 and 50 tons per acre.

Fuel Models 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 or have a shrub component (Bear Clover) as a carrier for fire spread. 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 Whisky Ridge 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. The areas along the lower elevations in the Pinegrove Mine area are represented by these fuel models

Figure 19. Photo showing fuel conditions in Pine stands

One component that is very apparent during fuel loading measurements on the nearby Greys Mountain Project was the consistent duff loading. This is a key fuels element that past fires kept at low levels, so fires would not burn through the surface fuels and smolder in this layer for long durations like today's fires do. The average fuel loading in this duff layer is on average 20 to 60 ton per acre. Even a low to moderate intensity burning fire causes higher burn severity levels to vegetation and soils because of the long term exposure to high heat levels from this dense compacted fuel layer.

Figure 20. Picture showing Brush areas

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. Estimated surface fuel loadings average is between 5 and 25 tons per acre.

Crown Fuels

The crown fuels in the Whisky Ridge 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).

The canopy fuels in the Whisky Ridge 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.

Approximately 12% of project area` has been previously thinned since the early 1990's. Within these areas a more open and spaced crown fuel arrangement exists. These treated areas would reduce the potential of a surface fire from easily transitioning into the upper crowns of the larger leave trees. Crown fire initiation is low in these areas. Project area design utilized these areas to tie together treatment areas and provide larger more continuous SPLAT's to break up fire intensity and spread.

WUI

The Whisky Ridge Project is located within the defense and threat zones of the WUI and situated adjacent to residential areas around the project boundary, 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 Sierra Fisher Conservation Area apply in known home range outside the WUI.

Communities surrounding the Whisky Ridge Project include North Fork and Bass Lake to the west, Kinsman Flat and Hogue Ranch/Clearwater area to the east, Cascadel Woods subdivision to the southwest and Central Camp to the north. With the continuity of the fuels within the Whisky Ridge 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 Whisky Ridge Project.

Desired Condition

The SNFPA ROD, 2004 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 condition class 2 or 3 to condition class 1. The land allocations and their specific desired conditions used for this project include:

Wildland Urban Intermix: (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 structures. (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)

- 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.
- 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 flight) of the Whisky Ridge 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 in 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) fuel loading data collected during past timber sales (South Fork 1995' and Foster 1999') and during the nearby Greys Mountain Project 2011 were utilized to estimate fuel loadings within the project area. This method was used because the project area is composed of the same forest types as the Greys Mountain Project with similar existing fuel loadings.

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 Whisky Ridge 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. Canopy Bulk Density describes the density of available canopy fuel in a forest timber stand. It is defined as the mass of available canopy fuel per canopy volume unit. Canopy Base height describes the average height from the ground to a forest stand's canopy bottom. Specifically, it is the lowest height in a stand at which there is a sufficient amount of forest canopy fuel to propagate fire vertically into the canopy. Tree lists 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 all trees measured at diameter breast height (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; USDA Forest Service, 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 90th percentile weather conditions for the project area. Ninetieth percentile 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).

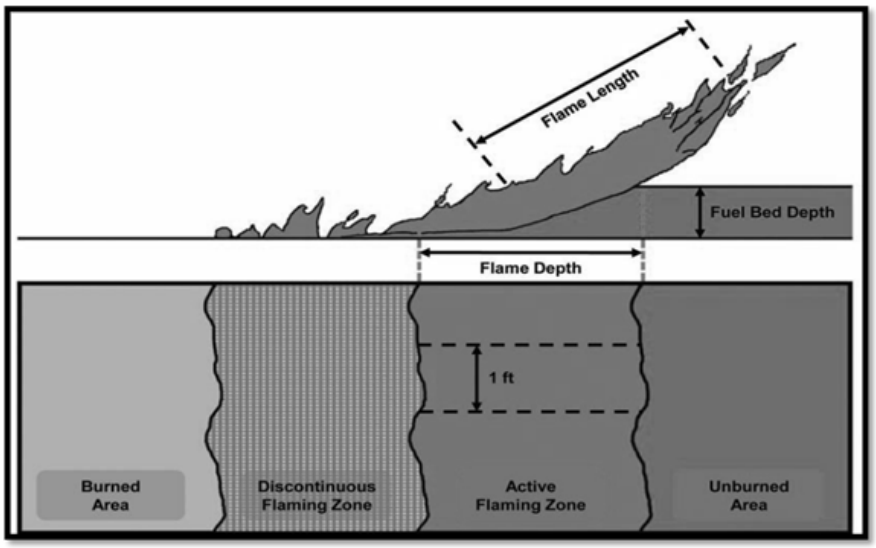


Figure 21. The diagrams illustrate the relationship between flame length and fireline intensity

Figure 21 shows a side view of a wind-driven fire and illustrates flame length is measured from midway in the active flaming zone to the average tip of the flames. The overhead view illustrates that fireline intensity is the heat energy release per unit time from a foot (or meter) wide section of the fuel bed extending from the front to the rear of the active flaming zone.

Fire Family Plus (a program used for analyzing historic weather and fire danger rating records) was used to determine what 90th percentile weather conditions are from representative Remote Automated Weather Station (RAWS) historic weather records see table 7 below. Twenty years of recorded weather data (1991-2011) from the North Fork 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.

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 is; Fuel Models: See fire behavior Table 39 for fuel models. Crown fuels and environmental inputs: See Table 40.

1-hour Fuel Moisture (%):	3
10-Hour Fuel Moisture (%):	4
100-Hour Fuel Moisture (%):	6
Live Woody Fuel Moisture (%):	60
Foliar Moisture (%):	80
Air Temperature (%):	97
20 foot Windspeed (mph):	12
Wind Reduction Factor:	2 0.3
Canopy Bulk Density (lb/ft3):	0.0119 and 0.0874
Canopy Base Height (feet):	10 Existing condition for timber
	20 for Alternative 2 and 15 feet for Alternative 3
	2 for Brush existing condition
	10 for Alternatives 2 and 3
Slope (%):	20

Indicators

Analysis Indicators Measured - The Sierra Nevada Forest Plan Amendment Record of Decision (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\Resistance to Control
- Average Flame Length
- Average Fireline Intensity

- Average Mortality in Ponderosa Pine, Sugar Pine, White Fir and Incense Cedar conifers (range of average size existing 10” dbh; for post treatment 20” 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. The tables below displays trigger points for these actions.

Table 37. Prediction Chart of Spread and Intensity of Forest and Range Fires.

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. 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. Hand line cannot be relied on to hold fire. 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. 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. Control efforts at the head of the fire are ineffective.

To measure the degree of change between existing and resultant conditions between alternatives, table 37 (Scott and Burgan, 2005) and an adjective class guide table 38 was used as a guide (Scott and Burgan, 2005) to quantify the spread rates, flame length, fireline intensity and resistance of control. These guides rates the rates of spread, and flame lengths 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 38. Rocky Mountain Research Station Fuel Models.

ROS (Ch/h)	FL (Ft)	Adjective Class
0-2	0-1	Very Low
2-5	1-4	Low
5-20	4-8	Moderate
20-50	8-12	High
50-150	12-25	Very High
>150	>25	Extreme

Spatial and Temporal Context for Effects Analysis

Following is a description of the spatial bounds and discussion of the logic for using these spatial bounds:

Spatial boundaries

The spatial boundary encompasses the Browns, Whisky, Owl, Gertrude drainages and the upper portion of the Saginaw Creek drainage. The cumulative effects spatial boundary is the entire Whisky Ridge project boundary with South Fork of Willow Creek on the west, San Joaquin River on the East, Shuteye Ridge on the North and Castle Peak on the South. This extent was selected because of past and recent fire history being very prevalent in the lower elevations and burning up into the project boundary). Fire danger that exists in the Whisky Ridge 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 within the Whisky Ridge Project area is of limited scope in reducing hazardous fuel conditions.

Temporal boundaries

Following is a description of the temporal bounds used for the cumulative effects analysis: The bounding includes the effects from historic vegetation management projects, prescribed burning and wildfires, dating back to the 1980's and out to management directed effectiveness of completed fuels treatments which is 15 to 20 yrs into the future. The temporal scale is based on if the effects of treatments of the alternatives designed meet the purpose and need of the project. The analysis measures if fuel loadings are reduced to where wildfire effects are moderated and where there is an ability for low intensity fire (by prescribed fire in the short term) to be re-introduced into a fire dependent ecosystem. Also considered in this analysis is whether the alternatives and the treatment intensities proposed allow for forest resiliency while providing for the forest structure diversity needed for wildlife habitat.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Listed are other present and reasonably foreseeable future actions occurring in the vicinity that may be considered for potential cumulative effects with the proposed Whisky Ridge Project depending on the effects to a particular resource.

Use of Roads and Trails: USFS and County maintained

Transportation system providing ingress and egress to the project area and also the trails within the project boundary are included**.** .

☑ **May have cumulative effects with the proposal**

☐ Will not have cumulative effects with the proposal

Explain: The transportations system of both roads and trails within and surrounding the project will be impacted by fuels and vegetation treatments of the proposed action. There could also be impacts by fire suppression activities should a wildfire occur in the future.

Current and Future Timber Sales: (Green Timber Sales, Roadside Hazard Trees and Salvage)

☑ **May have cumulative effects with the proposal**

☐ Will not have cumulative effects with the proposal

Explain: Currently there are no active timber sales within the project area but future activities will include commercial thinning and roadside hazard tree timber harvest as treatments to move the existing vegetation towards the desired conditions

Fire and Fuels Management Activities: Fuelbreak Construction and Maintanence, Prescribed Burning, Ladder Fuel Reduction and Mastication

☑ **May have cumulative effects with the proposal**

☐ Will not have cumulative effects with the proposal

Explain: There is currently 2 existing fuelbreaks (Whisky and Ponderosa) within the project area. There are 2 fuelbreaks planned for new construction. These fuelbreaks are designed to tie together with existing fuelbreaks and to serve as anchors for landscape scale prescribed burning projects in the future and provide anchor points for suppression actions in the event of a wildfire. Other fuels reduction, removal or redistribution activities that may occur within the project boundary in the future would be mechanical mastication, hand cutting of ladder fuels and piling of slash and down fuels by hand or with dozer. These treatments would help move vegetations and forest fuels towards the desired condition.

Private Property: Infastructure and Home Construction and Vegetation Management Activities

☑ **May have cumulative effects with the proposal**

☐ Will not have cumulative effects with the proposal

Explain: Activities such as new home construction and infrastructure maintenance could occur in the future with the effect being and increased risk of human caused wildfire ignition that could burn into

the project area. Vegetation management activities that have occurred and are planned for the future would be hazard reduction thinning of forest fuels surrounding private landowner homes. The slash is typically disposed of by chipping or burning. These activities are very localized and usually occur over small acreages usually less than 1 acre.

Alternative 1 – No Action

Direct Effects

There are no treatments to reduce the potential high to extreme fire behavior conditions that would result under the No-Action Alternative and therefore, no direct effects.

Indirect Effects

In choosing the No Action alternative the Sierra National Forest managers would be accepting the risk and effects of possible uncharacteristically severe wildfire to the watersheds, the WUI communities, and the associated wildlife habitat land allocations for species such as Pacific Fisher, Northern Goshawk and Spotted Owl among other sensitive species. There would be very limited to no potential for the utilization of prescribed fire as a form of restoration treatment or to 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. 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. There would some some benefits to fire dependent vegetation and specific wildlife species such as the Black Backed Woodpecker during the years immediately following the fire as growing environment, food sources and habitat would be plentiful in the short term.

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 10 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 represent 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. Table 39 shows the indicators for current existing conditions and those associated with the conversions in Fuel Models under Alternative 1.

FL - Average Flame Length
FLI - Average Fireline Intensity
Resistance to Control - Resistance to Control Average
ROS - Average Rate of Spread
Crown - Crown Fire Potential
Mortality - Mortality in Conifer Species

Table 39. Indicators for Fuel Models in Timbered Brush/Bhrub Covered Areas.

Fuel Model	FL (feet)	ROS (ch/hr)	FLI (Btu/ft/s)	Crown (transition and fire type)	Resistance to Control (low, mod., high)	Probability of Mortality (%) PP/SP/IC/WF [6]
Sierra Mixed Conifer						
Existing Conditions– FM 10	6.0	9.9	279	Yes; Torching	Mod/High	71/96/81/74
Future Conditions – TU5	8.4	10.5	581	Yes; Torching	Mod/High	80/100/95/99
Further Future - Conditions -SB2	6.5	14.9	330	Yes; Torching	Mod/High	79/99/81/95
Brush/Shrub Areas						
Existing Conditions– SH2	5.3	8.1	217	Yes/Torching	Mod/High	49/77/8/37
Future Conditions – SH5	15.9	67.3	2326	Yes/Torching	Very High	80/100/95/99

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 these brush fields 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.

Table 39 above displays 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 Whisky Ridge 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. (B. Stalter 2012)

As surface fuels continue to accumulate naturally, with no additional management actions, suppression efforts will 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

[6] PP- Ponderosa Pine, SP- Sugar Pine, IC- Incense Cedar, WF- White Fir

effective due to closed continuous canopy. If fire were to start in or burn into the Whisky Ridge 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.

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).

Although crown fires would have 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 will 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)

Cumulative Effects

In choosing the No Action alternative the Sierra National Forest managers would be accepting the risk and effects of possible severe wildfire to the watersheds, the WUI communities, and the associated wildlife habitat land allocations for species such as Pacific Fisher, Northern Goshawk and Spotted Owl. 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.

Fire Suppression

Past, present and reasonably foreseeable actions for the Whisky Ridge Project Area, along with fire management policy of full suppression at the smallest size (97 percent of all fires would be controlled at 10 acres or less from SNF LRMP, (1991) have contributed to the current existing condition for the Whisky Ridge Project Area and are used to depict the existing condition and the resultant fire behavior within the project area.

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 Whisky Ridge 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 and horizontal 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 39) show that conditions are present in the Whisky Ridge Project area to produce the potential for crown fire. This could be in the form of torching single trees, and groups of trees and short crown runs dependent on weather, fuels and topography of where the fire were to occur.

Crown fires remove much or 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) and old forest characteristics for habitat, this successional “set-back” could pose negative consequences. This condition would benefit some wildlife species such as the black backed woodpecker and other avian and insect species that would flourish in the short term as food and favorable habitat increased. Any increase in snag habitat that would occur would be limited to less than 10 yrs due to the local weather phenomena in this area which are very high east to north east gradient winds in the fall and spring months. These winds called “Mono” winds are a yearly occurrence and blow between 30 and 60 mph across Shuteye Ridge and Whisky Ridge and down towards North Fork. This is the only area on the Sierra National Forest that experiences these winds on a consistent basis. What this means for snag habitat is most snags that are created naturally by insects and fires (North Fork, Cascadel and Source) are blown down within 4-8 yrs later by these winds. Areas that are sheltered are usually spared this effect but the normal westerly winds from winter storms blow strong enough over this exposed landscape that these are blown as well. The tree

species that are the longest standing are the older large diameter Sugar Pine Ponderosa and Incense Cedar snags which due to their rot resistance and high amount of heart wood composition (High pitch composition) hold up well over time. Within the fires mentioned above these species are the ones still standing after multiple very heavy winter storms and wind events. White Fir has the lowest likelihood to remain standing after these events. Fir is at high levels in the composition of the tree species within the project area, so these would likely create downed logs (Burt Stalter, 2012).

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

The predicted rate of spread, flame length, and fireline intensity would increase due to fuel accumulation if left untreated (refer to table 10. 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 over the next 20 years. Aerial fire suppression could not support ground forces due to the inability of retardants to reach ground fuels because of closed canopy cover. Fire effects from a wildfire burning through these untreated stands would be detrimental to ecosystem structures such as water quality, soil and vegetation. There would some benefits to fire dependent vegetation and specific wildlife species such as the Black Backed Woodpecker during the years immediately following the fire as growing environment, food sources and habitat would be plentiful in the short term.

Alternative 2 – Proposed Action

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 silviculturally prescribed basal

area and stocking level. Through the treatments in Alternative 2, the recommendations in Table 4 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, existing fuel model would be converted to another fuel model, typically a fuel model with lower surface fuel loadings and reduced fire behavior. In stands represented by Fuel Model FM 10, there would be conversion 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 TL5 may occur until post activity treatments were completed, and then a conversion to a Fuel Model TL8 or TL 1 would result. In stands represented by Fuel Model TU5 and SB2, would be converted 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, and then a conversion to a Fuel Model TL8 would result.

In areas currently represented by Fuel Model SH2, mastication would be used to convert it to a Fuel Model SB1 and/or SB2 (moderate to heavy dead and down activity fuel). 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.

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 will also be decreased through the thinning of lower and mid-level canopies. It is estimated that, on average the canopy bulk density will be reduced from 0.0119 lb/ft3 to 0.00874 lb/ft3 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 will be used to remove excess material.

In areas where brush species or small conifers are the dominant vegetation cover, masticators will be used to in effect change the vertical continuity of the fuel. Reduction in tree density is the most significant change to forest structure post-mastication, particularly where dense stands of saplings or small trees are being thinned. Mastication equipment is effective at removing nearly all small trees and reductions in total density can be more than 60%. (Harrod, R., et al 2009). 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.

Changes to fire behavior characteristics are commensurate with observed changes to fuels and forest structure. Pre-treatment stand conditions are often susceptible to passive or active crown wildfire. Mastication of small diameter stands can reduce canopy closure and raise canopy base height thereby making it more difficult for fire reach tree crowns or be sustained within the crowns. Burning

following mastication will further reduce future wildfire characteristics, at least for the short-term(Harrod, R., et al 2009).

In areas where there are lower amounts of ladder fuels and/or smaller areas, mastication and/or hand cutting will 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 that used for removal of excess commercial-sized material, it is anticipated there may be a short-term increase in surface fuel loading. Additional post harvest treatments may be needed to reduce surface fuel loadings that are in excess of 20 tons/acre (SNFPA ROD, 2001). Post activity treatments would include dozer and/or hand piling and burning and/or broadcast/jackpot burning to manage these fuel loads.

Fire Behavior / Fire Effects

Table 40. Shows the Predicted Results of Fuel Model Conversions Anticipated With This Alternative.

Fuel Model	FL (Feet)	ROS (Ch/hr)	FLI (Btu/ft/s)	Crown (Transition and fire type)	Resistance to Control (Low/Med/ High)	Probability of Mortality (%) PP/SP/IC/WF
Sierra Mixed Conifer-Ponderosa Pine (moderate fuel loading w/some brush)						
Existing Conditions- FM 10	6.0	9.9	279	Yes; Torching	Mod/High	71/96/81/74
Short Term Conversion- TL5	2.6	6.1	47	No/Surface	Low/Mod	0/0/0/0
Short Term Conversion- SB2	7.6	21.0	467	No/Surface	Moderate	42/69/06/32
Desired Condition - TL1	0.7	1.2	3	No/Surface	Very Low/Low	0/0/0/0
Desired Condition - TL8	4.2	8.2	117	No/Surface	Low/Mod	06/12/01/05
Sierra Mixed Conifer-Ponderosa Pine (moderate-heavy fuel loading)						
Existing Conditions- TU5	8.4	10.5	581	Yes; Torching	Mod/High	80/100/95/99
Short Term Conversion- SB2	7.6	21.0	467	No/Surface	Moderate	42/69/06/32
Short Term Conversion- TU5	9.5	13.9	764	Yes/Crowning	Mod/High	79/99/86/97
Desired Condition - TL8	4.2	8.2	136	No/Surface	Low/Mod	06/12/01/05
Sierra Mixed Conifer-Ponderosa Pine (heavy fuel loading)						
Existing Conditions- SB2	6.5	14.9	330	Yes; Torching	Mod/High	79/99/81/95
Short Term Conversion- SB2	7.6	21.0	467	No/Surface	Moderate	42/69/06/32
Desired Condition - TL8	4.2	8.2	126	No/Surface	Low/Mod	06/12/01/05

Fuel Model	FL (Feet)	ROS (Ch/hr)	FLI (Btu/ft/s)	Crown (Transition and fire type)	Resistance to Control (Low/Med/ High)	Probability of Mortality (%) PP/SP/IC/WF
Brush/Shrub (includes some mixed conifer stands with brush understory)						
Existing Conditions– SH2	5.3	8.1	217	Yes/Torching	Mod/High	49/77/8/37
Future Condition - SB1	3.9	8.6	107	No/Surface	Low/Mod	06/11/01/04
Desired Condition - TU1	2.3	4.3	36	No/Surface	Low	0/0/0/0
Future Condition - SB2	7.6	21.0	467	No/Surface	Low/Mod	42/69/06/32

Table 40 above 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 mixed conifer stands. Because of the variability in the three facets needed to predict fire behavior; fuel, weather and topography within the Whisky Ridge 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.

Indirect Effects

Fire Suppression

Alternative 2 in effect reduces ladder fuels which in turn increases canopy base height. Canopy density (in the form of canopy bulk density) is decreased through the thinning of the mid-level canopy, but 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. As shown in Table 7, 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 will not open canopies to the extent needed to realize these concerns. It is estimated that in most areas, canopies will remain at 60 percent cover 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 will 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. If management strategy for unplanned ignitions is modified by future Sierra National Forest Land Resource Management Plan revisions than future unplanned ignitions may be utilized to manage fuels

loads within the project area in the future. The proposed treatments will provide fuels and vegetation conditions that will greatly assist fire managers in using this method as viable management option.

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 Old Forest Linkages with limited treatments will have lower potential for loss since there will 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 and are needed in addition to or in lieu of fire in many areas to move conditions away from dense forests to more open forests dominated by large trees. (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 Whisky Ridge Project area (based on sampled plot data). These species also tend to have increased susceptibility to wildfire as well and 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 but not eliminated.

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 will be treated first and then will 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. The main effect of low-intensity fire is its reduction of natural and activity

(management created) fuels, litter, shrub cover, and small trees providing a flush of soil nutrients, and increase in the diversity of plants and invertebrates. By reducing canopy cover, fire also increases habitat and microclimate heterogeneity at site, stand and landscape levels. (North, M., et.al. 2009)

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 frequency and extent in recent decades because of the combined effects of increasing forest fuels from fire exclusion and 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 (Westerling et al. 2006). Though there are variations in predictions and models, one point of consensus is that most agree the climate will become warmer and more extreme, suggesting oscillations between wet and drought conditions will 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 will 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). Alternative 2 uses the first two strategies (resistance and resilience) and attempts to build, through its purpose and need, the adaptive capacity of forest ecosystems to climate changes and uncharacteristic fire behavior that occurs under extreme weather and ignition conditions (North, 2009; Stephens et al. 2010).

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+"). These effects would continue to occur throughout the untreated areas within the project area.

Cumulative Effects

Error! Reference source not found. Past, present, and reasonably foreseeable activites displayed in chapter 3, table 5 may effect the increase of potential wildfire behavior and associated effects on resources (wildlife habitat, soil, aquatic habitat). Not all projects affect fire behavior and fuels but will have an overall effect of improving the resiliency of the forest to severe wildfire.

Condition Class Fire Return Interval

Under Alternative 2 the Condition Class Fire Return Interval would be changed from high departure-insufficient fire to low to no departure on over 25% (4620 ac's) of the project area and would begin to condition the forest stands within the burn areas for further managed prescribed burns.

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 SPLAT's which reduces the hazard 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. Treatments included in this alternative are: thinning from below in conifer stands, either by pre-commercially, commercially, and/or mastication of vegetation (conifers) to reduce lower and mid- level canopy stand densities; mastication of brush and shrub patches; prescribed burning, both understory and piles; manual reduction and/or prescribed burning of noxious weed infestations; and prepare and plant failed conifer plantations. After prescribed burning treatments have been completed a change of Condition Class Fire Return Interval of over 25% of the project area acres would be accomplished.

Alternative 3 – Lower and Mid Level Canopy Treatment, 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 and objectives.

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

(2004) standards and guidelines associated with the Goshawk would be implemented with this alternative.

This Alternative and was developed in response to a significant issue determined from public scoping. This issue stated the *"proposed action to remove trees from 10 to 30 inches in diameter would not reduce the potential for intensity and severity fires"*.

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 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 would make it difficult for fire retardant and/or water dropping from air tankers and helicopers 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 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. Future options to use unplanned ignitions for ecosystem restoration and management may be limited. This would be due to the higher tree densities in the mid and upper canopies and species composition that would still have shade tolerant species as the dominant layers which would suffer higher levels of mortality by fire. This would also occur following prescribed burning entries but not to the levels of a wildfire event.

As stated in Alternative 2 the positive benefits of increased mortality with this alternative is more snag habitat would be created for black backed woodpecker and other avian species and future down log recruitment would increase over time as snags fell to the ground due to decay and environmental conditions.

Cumulative Effects

Under Alternative 3, there would be no significant change in cumulative effects from those listed under Alternative 2.

Summary of Effects

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 improve forest health.

Comparison of Alternatives

Fuel models displayed are based on averaged worst case scenarios after post treatment. Table 40 shows that treatments in the proposed alternative and alternative 3 are effective in reducing potential flame length, rate of spread, fireline intensity, and resistance to control. Alternative 3 shows there is a greater potential and risk for condition crowning due to closer crown density.

Table 41. Comparison of Fire Suppression and Effects Measured by Indicators.

Indicators	Alternative 1–No Action		Alternative 2 –Proposed Action			Alternative 3 –Fire and Fuels Only		
	Mixed Conifer FM 10	**Brush / Shrub SH5**	**MixedConifer TL1**	**Ponderosa Pine TL8**	**Mastication SB2**	**MixedConifer TU5**	**Ponderosa Pine TL8**	**Mastication SB2**
Fire Suppression								
Flame Length (feet)	6.0	15.9	0.7	4.2	7.6	9.5	4.2	7.6
Rate Of Spread (ch/hr)	9.9	68	1.2	8.2	21	10.5	8.2	21
Fire Line Intensity(Btu/ft/s)	279	2,326	3	117	467	581	117	467
Resistance to Control (low, mod., high)	Mod/High	Very High	Very Low	Low/Moderate	Moderate	Mod/High	Low/Moderate	Moderate
Fire Effects								
Crown transition and fire type	Yes/Torch	Yes/Torch	No/Surface	No/Surface	No/Surface	Yes/Torch	No/Surface	No/Surface
Mortality (%) PP/ SP/ IC/ WF	 71 96 81 74	 80 100 95 99	 0 0 0 0	 06 12 01 05	 42 69 06 32	 80 100 95 99	 06 12 01 05	 42 69 06 32
Change in Condition Class Fire Return Interval (Acreages change)								
CCFRI 1=No Departure	No acres would be changed		4620 acres would moved from CCFRI 3 to 1			4620 acres would be moved from CCFRI 3 to 1		

Forest Vegetation/Silviculture

The direct, indirect and cumulative effects to Forest Vegetation are summarized from the Forest Vegetation /Silviculture report for the Whisky Ridge Ecological Restoration Project (Smith D., 2013)

Affected Evironment

The Whisky Ridge Project Area has a history of past heavy logging activities. Since the late 1800s numerous small sawmills have dotted the landscape within the project boundaries. In the late 1920s, the Sugar Pine Lumber Company moved operations south from Central Camp into the Whisky Ridge area. During this time period, much of the lands within the Project Area were owned by the lumber company. In 1928, the 9 Line (Brown's Creek) hoist was constructed to provide access into the area above the South Fork Bluffs. Around 1930, the Camp 14 hoist was completed providing access into the area near Benedict Meadow. Heavy railroad logging took place throughout the majority of the Project Area until the Sugar Pine Lumber Company declared bankruptcy, a victim of the depression, in the early 1930s. Logs were transported to the main sawmill in Pinedale. Over its 9 years of operation, the company averaged an annual cut of 100 million board feet a year. More than 60 percent of this output was in sugar pine and ponderosa pine. 500 employees worked as either lumberjacks or support staff for the woods operations. Until the mid-1980s, more than 2000 acres of the original private lands remained privately held by lumber companies.

During the railroad logging era, 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 young, even aged, 90 to 110 year old 6 to 24 inch diameter breast high (dbh) white fir, incense cedar, sugar pine, and ponderosa/Jeffrey pine. Scattered larger diameter (predominant) trees left during the railroad logging days can be found through portions of these stands.

Since the demise of the Sugar Pine Lumber Company, a number of timber harvest operations have taken place on both public and former private lands within the Project Area. These operations have involved a number of different harvest treatments. Past entries have included sanitation, salvage, hazard tree removal, thinning, and regeneration treatments. Over the past 20 years, approximately 2,300 acres have been commercially thinned.

Existing Condition

Over 900 acres of pine plantations, ranging in size from an acre or two to 75 acres, have been established within the Project Area since the mid-1960s, the most recent following the 2001 North Fork Fire. 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)], the oldest of these are in need of commercial thinning while many of the younger plantations are in need of release or precommercial thinning.

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 that prior to the 1900s were once dominated by more fire resistant, shade intolerant, ponderosa and sugar pine have become predominately stocked with less fire and drought resistant fir and incense cedar. The majority of the stocking 10 inches in diameter and larger within the Project Area is comprised of white fir (around 39 %); incense cedar (around 27%) is the next most prevalent species followed by ponderosa pine (16%) then sugar pine (13%). Black oak comprises around 5 %. Incense cedar and white fir comprise almost all of the precommercial size trees within wild stands. 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 ft^2 per acre in more open areas to oak pockets to densely stocked pockets of 350-400 ft^2 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, the result of early logging or fires, 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.

Climatic Shifts

Ferrell (1996) stated in the drought portion of his report on the effects of insects and pathogens on forests that tree ring and lake level studies have established that compared to the previous two centuries weather during the 20th Century was relatively moist without the decades-long droughts that occurred earlier. The period 1937-1986 was the third wettest half century in the last 1,000 or more years (Stein, 1996) (Graumlich, 1991). Laudenslayer and Skinner (1995) further confirmed that "much of the 20th Century was very moist and relatively warm." 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). North (2009) states that "climate would become more extreme, suggesting oscillations between wet and drought conditions would be more common." He goes on to express that "drought stress would make current, high-density, Sierra forests more susceptible to pest and pathogen mortality, particularly from bark beetles (Ferrell 1996, Fettig, et al. 2007, Maloney, et al 2008, Smith et al. 2005)".

The wetter than normal 20th Century (SNFPA, 2004) 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 weather 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).

Laudenslayer and Skinner (1995) reported that fire suppression, climate shift and human disturbance patterns in the last 100 years has resulted in increased tree densities, changes in stand structure and spatial patterns, and buildups of dead, flammable material. Their report also stated that "although, outbreaks of insects occurred prior to European settlement, they were relatively brief and spatially confined." "These same insects now are affecting entire landscapes nearly continuously." They point out that many forests are in poor health. Large acreages are densely stocked and outbreaks of insects and other mortality agents are causing extensive amounts of tree mortality especially in white fir and ponderosa pine over short time periods.

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 the 20th 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% less water is anticipated to arrive in reservoirs between April and July. Soil moistures would dry out earlier and by summer would 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). Van Mantgem (2007) attributes the observed mortality to regional warming rather than a response to crowded understory. 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 LRMP as amended by the SNFPA, 2004 ROD, addressed the desired condition, management intent and management objectives for individual land allocations. Located predominately at mid elevations, 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 goal and with short-term strategy of reducing the adverse effect of wildfire and reducing stand susceptibility to insects/pathogens, competition and drought-related tree

mortality through density management. A higher percentage of more fire resistant, shade intolerant tree species (pines and oaks) would be present in the stand. Stand densities would not only be maintained at levels that would be more resilient to predicted changes in weather patterns but also improve perpetuation of healthy intolerant tree species. Residual tree diameter and height growth would be increased enabling them to acquire old forest characteristics (larger size) more rapidly. Stands would more closely resemble those present prior to the heavy railroad logging era.

Species composition within aggregations along with normal stocking level (yield) tables and projected growth to reach 80 % of normal basal area per acre stocking in 15 to 20 years were used to determine desired stocking levels for the Whisky Ridge Project. In addition, Stand Density Index (SDI) was used in determining desired stocking in pine stands to account for the impact of Dendroctonus bark beetles in pine.

Commercial thinning needs to be undertaken in aggregations/stands within these approximately 90-110 year old, even aged, young growth stands and 28 to 48 year old pine plantations in order to reach the desired conditions. Thinning would 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.

Density Management Measures

Basal Area Stocking Levels

Normal Yield Tables, generally described in Basal Area per acre, display the maximum basal area a site can support for a given species, site quality and age (Oliver, et al, 1996). 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). For a short period of time, basal areas in excess of “normal” can be maintained in some areas. These “normal” stocking levels were calculated during the abnormally wet 20th Century (SNFPA, 2004) and are likely too dense to be maintained during the predicted longer, hotter, more moisture stressed summer seasons that are predicted to occur as described in the Climate Shifts section. 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. (Kilgore, 1979)(Parsons, 1979)(Bouldin, 1999)(Fitzgerald, 2005)(Taylor, 2006)(North, 2009)

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.

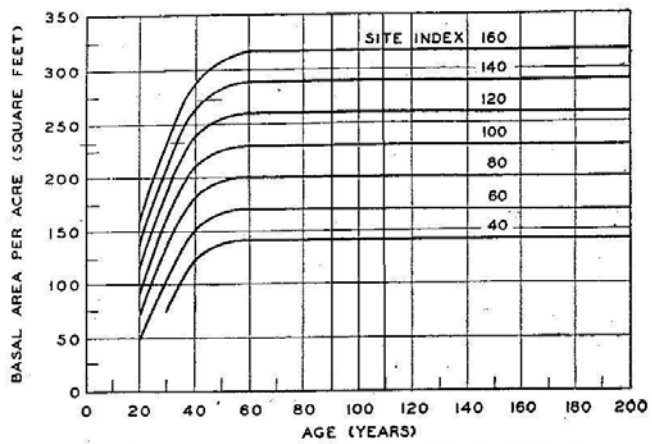


FIGURE 4.—Basal area per acre of trees 0.6 inch and more in breast-height diameter.

TABLE 4.—*Basal area per acre*[1] *of trees 0.6 inch and more in diameter*

Age (years)	Basal area per acre, by site index—												
	40	50	60	70	80	90	100	110	120	130	140	150	160
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
20	------	32	46	58	70	82	93	104	115	126	137	148	159
30	74	90	106	122	138	152	165	177	189	201	213	225	237
40	123	137	151	165	180	195	210	224	238	252	264	276	287
50	138	153	167	182	196	211	226	240	255	269	283	296	308
60	141	155	169	184	198	213	228	243	258	273	288	303	317
70	141	155	169	184	198	213	228	243	258	273	288	303	318
80	141	155	169	184	198	213	228	243	258	273	288	303	318
90	141	155	169	184	198	213	228	243	258	273	288	303	318
100	141	155	169	184	198	213	228	243	258	273	288	303	318
110	141	155	169	184	198	213	228	243	258	273	------	------	------
120	141	155	169	184	198	213	228	243	258	273	------	------	------
130	141	155	169	184	198	213	228	243	258	273	------	------	------
140	141	155	169	184	198	213	228	243	258	273	------	------	------
150	141	155	169	184	198	213	228	243	258	273	------	------	------
160	141	155	169	184	198	213	228	243	258	273	------	------	------
170	141	155	169	184	198	213	228	243	258	273	------	------	------
180	141	155	169	184	198	213	228	243	258	273	------	------	------
190	141	155	169	184	198	213	228	243	258	273	------	------	------
200	141	155	169	184	198	213	228	243	258	273	------	------	------

[1] To nearest whole number.

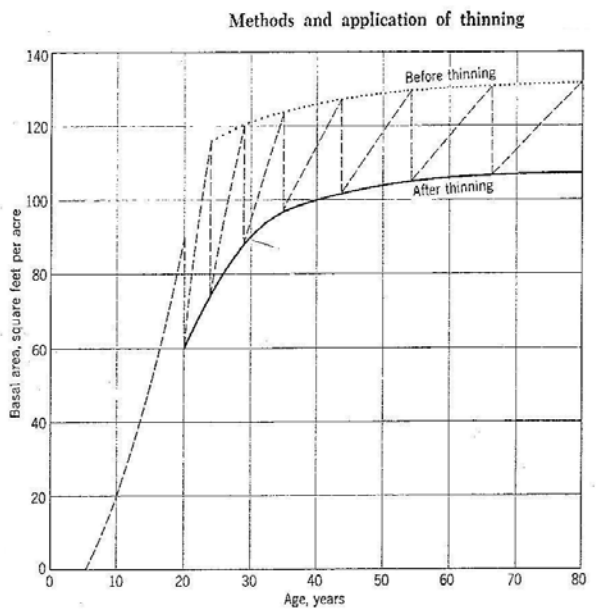
Figure 22. Yield Tables for Ponderosa Pine from Meyers Bulletin 630

Figure 22, from Meyer's Ponderosa Pine Yield Table, Bulletin 630, provides an example of one of the yield tables used for this analysis. Meyer's Figure 4 displays basal area per acre curves for different sites and ages. Meyer's Table 4 displays the same information in tabular form. Note that except for the very highest growing site (160 - uncommonly high site quality), maximum basal area per acre is reached by age 60 on a fully occupied site. Total basal area does not increase beyond this point as the stand ages as additional basal area growth is offset by basal area loss due to mortality.

As stands approach 80 to 90 % of full stocking, basal area 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 % 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.



A hypothetical example showing how basal area should vary during a series of thinnings. The solid line (———) indicates the lower guiding limit of basal area reserved after thinning. The dashed line (- - - -) shows the fluctuations in actual basal area. The dotted line (. . . . . .) represents an approximation of the level to which basal area should be allowed to increase before thinnings are repeated. The interval of time elapsing between thinnings lengthens with age because the rate of growth in basal area declines as the trees grow larger. The arbitrary assumption is made that, in this case, the basal area left after each thinning should increase gradually from the middle of the rotation onward.

Figure 23. Displays stand thinning needs over time as basal increases

Figure 23(Smith 1962, 1986) displays a series of thinning entries over time. The upper line in the case of this Project represents 80% of normal. The lower line is the target leave basal area. The dashed line represents growth after thinning followed by the next thinning entry. Note the expected increase in basal area growth as residual trees capture the increase in available nutrients and soil moistures.

The desired condition for stocking levels and the measure used for comparison of alternatives is:

- Average basal area in pine, mixed conifer, white fir, and ponderosa pine plantation aggregations
- Average potential basal area growth
- Basal area following thinning—ponderosa pine—150 ft^2 per acre (50% normal- Meyers 630)
- Basal area following thinning—PP plantations—120 ft^2 per acre (45% normal - O&P PSW 133

- Basal area following thinning—mixed conifer—210 ft^2 per acre (60% normal - Dunning & Reineke 354)
- Basal area following thinning—white fir—240 ft^2 per acre (60% normal Schumacher 407)

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 (1995,2009) 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 a 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 % 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, 1975) (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. The Cochran, 1999, report states that the "upper management zone for this high site, SDI 240, should lower the probability of serious mortality from mountain pine beetle and perhaps western pine beetles." Long (2005, 2012) suggests that to avoid substantial self-thinning, an appropriate upper SDI limit would be SDI 250. Long (2005) further states that density management regimes should never be designed to exceed a SDI 250. Based on these studies, in order to ensure prompt response to thinning, maintain crown ratios above 40 % and minimize mortality, these 90-110 year old pine stands should be maintained between SDI 230-SDI 270 (approximately 150 ft^2-180 ft^2 per acre).

As stated previously, Long (2005) suggests that a SDI 150 is the lower limit of full site occupancy for ponderosa pine. He further states that densities in the range of a SDI 150 to SDI 175 are appropriate for capturing "near maximum" stand growth. 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), the desired condition following treatment for these young, 28 to 48 year old, ponderosa pine plantations within the Project Area should be a SDI 200 (approximately 120 ft^2/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)
- SDI—PP plantations SDI 200 (approximately 120 ft^2/acre)

Environmental Consequences

Methodology

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 % (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.

Indicators

For this project, the following indicators were used to determine the effects on forest health:

- 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), 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;
- The short (immediate) and long-term (length of effectiveness of treatment) associated with different prescriptions;
- Stand heterogeneity, and;
- 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.

Alternative 1 – No Action

Direct Effects

The No Action alternative meets the LRMP as amended by SNFPA, 2004 requirement that a no action alternative be included in the analysis. 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 Whisky Ridge project, the Whisky Ridge project boundary would be used to display indirect/cumulative for all alternatives. Wide swings in weather conditions as has been experienced over the past thirty years and is predicted to continue to occur would place increased stress on these untreated stands. As described in the Climate Shifts section, during droughts, increased mortality usually occurs first at the lower and middle elevations on both western and eastern slopes of the Sierra range and spreads to the upper elevations only if the drought is protracted. This Project is located predominately in mid elevations. 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, increased temperatures and longer periods of moisture depleted soils. Excessive stand/aggregation densities in ponderosa pine stands would result in the likelihood of heavy mortality. Drought and insect induced mortality would escalate. Intolerant tree species (pine and oaks) would become increasingly susceptible to being shaded out. 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, the most recent occurring in 2001 and 2008. Many have 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 would 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.

Cumulative Effects

The Whisky Ridge project boundary and conifer vegetation actions in Cascadel Woods will be used to analyze cumulative effects for all alternatives because treatments on forest vegetation effect the area that is being treated (e.g. reducing competing vegetation provides additional nutrients, available moisture, light, etc. to the nearby vegetation).

Over the past 20 years approximately 2,300 acres have been treated within the Whisky Ridge Project Area. Some stands treated 15 to 20 years ago that have reached or exceeded the 80 % stocking target basal area would not be thinned under Alternative 1 of the Whisky Ridge Project. Spot piling of existing slash concentrations or underburning would not be done in some of the more recent treatment areas.

Under all three alternatives, conifer vegetation actions undertaken within Cascadel Woods 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

Alternative 2 was created to meet the Purpose and Need for the Whisky Ridge Project. The Purpose and Need for the Whisky Ridge Project was drawn from direction from the LRMP as amended by SNFPA, 2004. All treatments proposed under Alternative 2 take into consideration LRMP direction and applicable Standards and Guides and are in compliance with SNFPA, 2004. 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 some codominants) canopy stand densities and release trees; 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 managementin the Project Area.

Direct Effects

Commercial thinning in these stands/aggregations would reduce competition and provide room for crown expansion by removing the more poorly growing trees, excess trees, and fuel ladders from these stands before completion results in much additional reduction in growth or competition, insect, disease, drought or fire related mortality increases. Thinning would begin to return stand composition of the second growth stands and plantations to that which would better resemble stands present prior to railroad logging and fire exclusion. Reduced competition would help perpetuate shade intolerant species and enable residual trees to increase diameter and height growth rates enabling them to more quickly acquire old forest characteristics (larger size) as envisioned in the SNFPA, 2004 ROD. Refer to the Whisky Ridge Plot Data Summary Table, in Appendix H, for average plot data information by treatment area. The Whisky Ridge Project Estimated Treatment Area Table, in Appendix I, discloses estimated treatments by treatment area for the Proposed Action.

An issue (Issue 9) was raised that removal of mature trees may result in a higher tree mortality rate than would have occurred without the project leading to reduced future snag recruitment. The Whisky Ridge EIS discloses that stands/aggregations are presently too dense and need thinning to maintain or improve growth and vigor and move them towards the goals envisioned in the SNFPA, 2004 ROD. As stated in the EIS, the stands being treated are young growth, 90 to 110 years old. The proposal is thinning from below as directed by the SNFPA, 2004 ROD. The larger trees would remain in the stand. Predominant trees (the oldest) would remain. The proposal would result in a greater percentage of shade intolerant species being perpetuated and retained in the stand than at present. Only 15 % of the Project Area is proposed for commercial thinning leaving 85 % of the Project Area with the same number of larger trees as present today. Thinning would remove the felled material from the site thus reducing future fuel loadings. Snag recruitment is discussed elsewhere in the document.

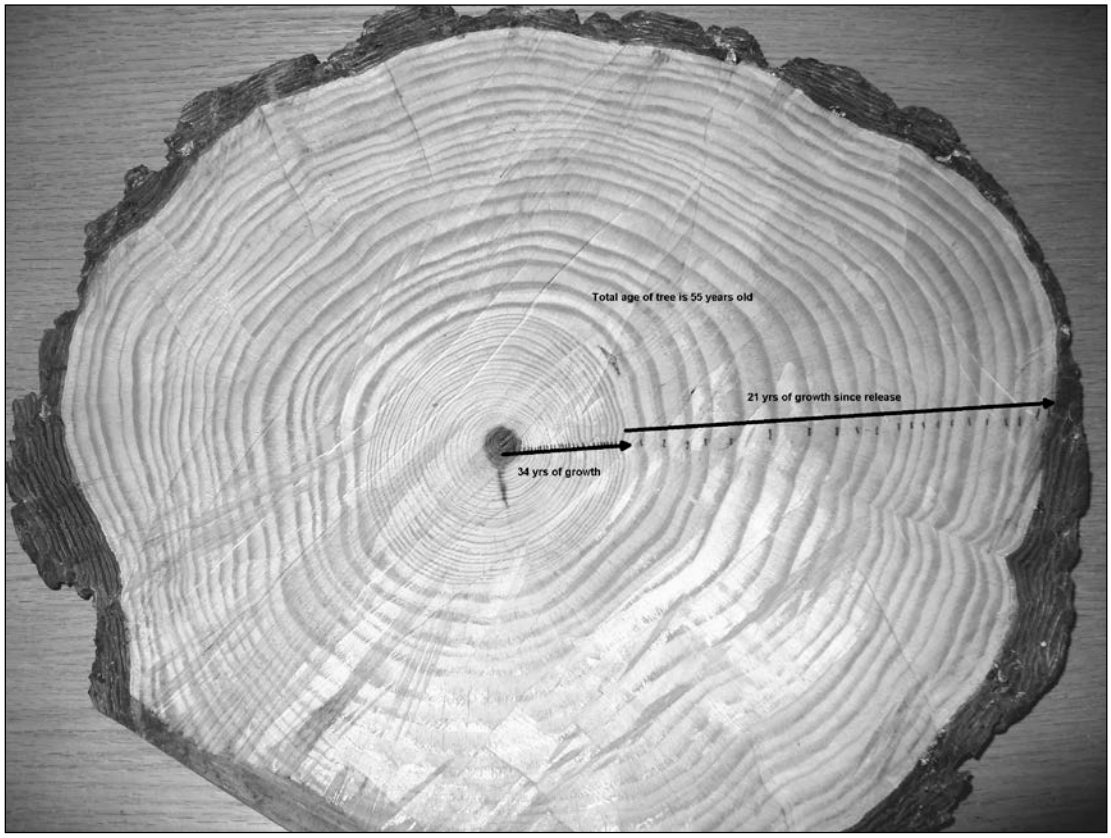


Figure 24. Example of thinning release

This ponderosa pine was released from competition at 34 years of age. The diameter inside the bark at 34 years was 3.9 inches. The diameter inside the bark 21 years later was 14.6 inches. Total diameter at 55 years of age outside bark was 16.5 inches. Average diameter growth for the first 34 years was 1/10 of an inch per year. Average diameter growth for the last 21 inches was 1/2 inch per year. It took 34 years to reach 3.9 inches in diameter without release. In the 21 years following release the tree grew another 10.6 inches in diameter. Removing sufficient competing vegetation as described in the FEIS would free up moisture and nutrients for the residual trees to utilize. Thinning as described in the FEIS that creates room for crown expansion would allow retention of 40% or greater crown ratios. These more vigorous residual trees would be better able to utilize the increased nutrients and soil moistures made available by the reduction of competition resulting in increased growth as seen in figure 24.

Numerous research papers have documented the positive effects of thinning. Figure 3 offers an example of the positive effects of thinning on growth. Studies have shown that active management through thinning is critical to maintaining healthy trees that are less susceptible to mountain pine beetle attack. A Feeney (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 (Fettig, 2007). 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. In his report, Fettig, 2007, stated that 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 ft2 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 basal area/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 % of normal basal area stocking 15 to 20 years following harvesting. Maintaining a stocking level that remains at 80 % 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 weather fluctuations, increasing temperatures and longer summer dry spells which are predicted to become 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 ROD 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 would generally reduce stocking to leave basal areas of around 150 to180 ft2 per acre depending on age, site, and existing crown condition (50-60 % of normal--SDI 230-270). This entry would still result in the retention of basal areas substantially above the SDI recommendations for thinning. (150 ft2 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, and older trees and in HRCAs.) (Normal stocking for ponderosa pine for this site and age is 270 to 290 ft2 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.

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 % of normal. Leave basal areas, depending on site index and age, would be around 210 ft2 per acre (Mixed Conifer) and 240 ft2 (White Fir). (Normal basal area stocking for 90 to 110 year old mixed conifer stands on similar sites ranges from 330 to 360 ft2 per acre. Normal for white fir ranges from 420 to 445 ft2 per acre). Canopy covers that meet or exceed those directed under the SNFPA, 2004 ROD would be retained following treatment.

The portions of the 28 to 48 year old pine plantations planned for thinning would be thinned to basal areas of around 120 ft2 to 140 ft2 per acre (SDI 200 to SDI 220) depending on existing crown condition and adjacent openings. As previously discussed, densities in the range of a SDI 150 to SDI 175 are appropriate for capturing “near maximum” stand growth. Thinning would permit these thinned portions of the pine plantations to continue vigorous growth for a period of 10 or more years at a rate that can generally withstand insect attack and the stresses of drought. As these plantations approach the planned next thinning entry in15 to 20 years, these stands would have exceeded Long’s (2005, 2012) recommended upper limit of SDI 250. They would become increasingly more at risk of loss due to insect attack or stress due to competition or drought conditions.

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. Figure 3 provides an example of the increased diameter (basal area) growth that can be expected as the result of thinning.

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 SNFPA, 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. Shade 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).

To obtain maximum growth and reduce fuel ladders, trees less than 10 inches dbh not needed for stocking or cover for wildlife would be removed with this entry within the treatment areas not designated as mastication or prescribed fire only as funding becomes available. These follow-up treatments to remove precommercial size trees and brush would further reduce stress on the remaining stand. 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 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.

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. Thinning to the proposed leave 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 (Emmingham, 1983)(Oliver, 1996). 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). 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 20th Century and better able to withstand changing conditions (North 2009).

Stand heterogeneity is limited in a number of locations within the Project Area. Even aged stands heavily dominated by second growth white fir and incense cedar cover 30 to 40 acre and larger stands within the Project Area. Small openings around black oaks, small rock outcrops offer some diversity. Many black oaks and pines are being overtopped by white fir and cedar. As previously disclosed, commercial thinning will reduce the competition from competing conifers adjacent to these oaks and pines helping to develop more heterogeneity. Openings, generally larger than ½ acre in size, resulting from past mortality, brush removal or other events would be planted with rust resistant sugar pine and either ponderosa pine, Jeffrey pine, white fir or red fir depending upon elevation. Planted areas would be released by hand generally to a five foot radius around each tree to reduce competition from brush. In addition, up to 30 small openings may be expanded to create openings ¼ to ½ acre in size by removing intermediate (poor form) trees, less than 24 inches dbh, along the opening edge. Rust resistant sugar pine would be planted into larger openings. The hand and mastication thinning and release of natural stands/aggregations of conifers and plantation trees generally less than 10 inches dbh that would be undertaken within treatment units as part of this proposal, 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 two to three untreated larger oaks per acre. An estimated 10-15% of the acreage in treatment units actually designated for commercial thinning would not be commercially thinned due to the non-treatment aggregations described previously. In addition, shrub and understory diversity would be retained throughout the Project Area during follow-up treatments through the retention of 15-20 % of the total understory growth in approximately 1/10th to ¼ acre pockets within wild stand treatment units. These non-treated aggregations combined with enlarged small openings, other planted openings, precommercially thinned pockets, and understory retention pockets will enhance stand heterogeneity within treatment areas. Meadow restoration projects, as proposed, would enhance the heterogeneity within the Project Area. An issue (Issue 7) was raised by the public that stand heterogeneity may be decreased as a result of the implementation of this alternative. The proposed treatments in combination with the 85 % of the Project Area that would not be commercially thinned would actually increase stand heterogeneity.

A shaded fuelbreak runs from near the 9 Line hoist in section 20 along the South Fork Bluffs to Whisky Ridge. This fuelbreak was instrumental in stopping both the North Fork Fire (2001) and the Cascadel Fire (2008). Another existing shaded fuelbreak runs from Cascadel to Cascadel Point then easterly to Road 4S81. Light thinning is proposed to maintain these fuelbreaks. A new shaded fuelbreak is proposed to be established running along Whisky Ridge towards Shuteye Peak. Commercial thinning is only proposed as a part of this new construction in treatment areas T123, T158, T155, and T153. Another new shaded fuelbreak is proposed to run from Mormon Hill south to Road 8S27 in Section 25. The majority of this proposed fuelbreak is situated within 48 year old ponderosa pine plantations. The commercial thinning prescription within these stands would be similar to the pine plantation treatment prescription. No trees 30 inches dbh or larger would be removed with this entry. The thinning proposed for the maintenance or construction of segments of

these fuelbreaks is designed to result in an effective fuelbreak until the next planned entry in 15 to 20 years while also providing a high level of canopy cover for wildlife habitat.

Mastication precommercial thinning/release/fuels reduction treatments are proposed for seven treatment areas. The majority of these treatment areas are planned to provide a fire protection buffer around the Cascadel Woods subdivision. Although the mastication acreages (M400-M406) appear to be fairly large, the actual treated areas would be limited due to the large number of draws within each proposed treatment area. Pockets of reproduction 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. Plantation 264 lies within M404. This plantation will be precommercially thinned and released. Plantation 272 lies within M405. This small plantation is planned to be commercially thinned and is included in the commercial thinning acreage. Office records indicate that a small plantation may also be present within M406. The vegetation within the remainder of the mastication treatment areas should consist of brush, oaks and young conifers. Small approximately 1/10th acre pockets of brush/reproduction would be left untreated over 10 to 15 % of the treated area. 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 occur through germination of manzanita seed not resprouting. 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. Since the majority of the mastication treatment proposed would be for the added fire protection around Cascadel Woods and brush reestablishment is not desirable, areas that have been masticated should not be underburned.

Hand thinning followed by hand piling and pile burning is proposed in 12 treatment areas (H500-511). In addition, treatments planned for the southwest portion of T125 and all of T126 are confined to hand work with follow-up underburning. Hand treatments in these areas are designed to connect fuels treatments with other planned treatments. Thinning within these H stands would be confined to trees 10 inches dbh and smaller. 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 1st or after October 30th. 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. Thinning in these areas would connect fuels reduction treatments, improve the growth and vigor of the treated aggregations and increase the percentage of shade intolerant species.

Whisky Falls Campground is located within the proposed Project Area. Hazard tree removal along with some light thinning is proposed in the campground. Treatments within Whisky Falls Campground would remove hazards to the public as well as maintain or improve the vigor of the trees remaining within the campground. A lighter thinning would be undertaken within the campground than in other treatment areas. This lighter thinning would reduce competition but retain a higher level of canopy cover and screening retention than treatments outside of the campground boundaries. 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.

The reintroduction of fire into fire excluded stands presents a challenge. To meet the challenge of reintroduction of fire while minimizing damage to the residual stand, the Silviculturist and Fuels Officer would coordinate areas to be underburned prior to undertaking underburning. 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). For this reason, initial post-harvest underburn

entries within thinned areas are planned to take place in the springtime only. In areas where the initial proposed treatment is underburning only and substantial numbers of desirable leave trees are present, the initial entry should be conducted in the springtime. 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.

A number of 40 to 48 year old ponderosa pine plantations are located within Rx319. Portions of this proposed underburn area were previously underburned. A late fall follow-up underburn in this previously underburned area once sufficient rains have occurred to thoroughly wet the duff beneath the residual trees should reduce ground fuels to desired levels while minimizing damage to the residual stand. Due to the fairly accessible nature of Rx319, desired results should be attainable over the remainder of the proposed underburn area utilizing a winter underburn once the duff beneath the canopy of the residual stand has become thoroughly wet. A small portion of Rx320 was recently planted after a wildfire at that location. Underburning within this planted area should be avoided.

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.

Even though spot piling of slash concentrations is planned as a post-harvest treatment in thinning areas, accumulated duff and slash would remain around residual trees. To minimize damage to the residual stand, spring burning would be planned to 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 would be planned to 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.

Expected mortality of residual trees resulting from underburning would be greater in stands underburned in the fall than those underburned in the spring. 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 underburn only areas. 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 would be obtained.

Two small (5 to 10 acre) areas would be burned with a hot prescription to create snags. These small high intensity burns will not have an appreciable effect on the vegetative cover within the Project Area.

Of the 18,285 acres within the Whisky Ridge Project Area, 9,188 acres were analyzed for potential treatments. Through further analysis, this acreage was reduced to approximately 8,263 acres of potential treatment. Approximately 5,425 acres would receive vegetation (thinning and mastication) treatments under this alternative. Of the 5,425 acres approximately 2,824 acres would be commercially thinned (approximately 15 % of the Project Area). Treatments in the remaining 2,601 acres would consist of: precommercial thinning on 1,881 acres by hand felling and tractor piling or mastication, precommercial thinning and hand piling on approximately 200 acres, and precommercial thin/release/reduce fuels on another approximately 520 acres by mastication. Light underburning would be implemented on approximately 1,776 acres of the proposed commercially and/or precommercially thinned areas. An additional estimated 2,838 acres would be treated through prescribed burning only. The remaining 10,022 would not receive any treatment. Upon implementation of the thinning and mastication planned for the 5,425 acres under this alternative, stand vigor would be improved making these stands more resilient to the effects of insect attack, drought conditions and predicted future weather variances. Within the 2,838 acres of prescribed burn only areas, dead and down fuels as well as some ladder fuels would be reduced.

The remainder of the Project Area (10,022 acres) is not proposed for treatments. Conditions and CWHR classifications would remain the same as presently found. Within HRCAs and OFLs the aim as stated in the SNFPA, 2004 is to retain 60 % or greater canopy cover, where available. (The intent of the project is to retain canopy cover of 60 % or greater in CWHR 4 and 5 size classes where it presently exists.) Retention of this level of canopy cover would continue to provide sufficient shading to restrict invasion of brush species into the understory. 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 % or greater canopy cover, where available.

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 ft2 or more for mixed conifer and 210 ft2 or more for pine and in many instances may reach 300 to 400 ft2 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. These more densely stocked areas of larger trees, along with the 85 % of the Project Area where commercial thinning would not be implemented would provide areas for future snag recruitment, a concern raised and recorded as Issue 6.

Alternative 2 would perform maintenance on approximately 65 miles and reconstruction on approximately 33 miles of forest system roads. Planned road work would have a positive effect on the Project Area. Access for implementation of the planned treatments and the public would be improved. Restoration of unauthorized OHV routes by installing barricades, signs and water bars would reduce the potential for OHVs causing soil compaction and erosion within the Project Area. Subsoiling of portions of OHV routes would be done in consultation with the Silviculturist to ensure minimal damage to the residual stand. Installation of bear boxes in Whisky Falls Campground would not have an adverse effect on campground vegetation. Installation of a new toilet in Whisky Falls Campground would be done in consultation with the Silviculturist to ensure minimal damage to the residual stand.

Indirect Effects

Retention of these higher basal areas to provide more dense 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 ft2/ac) leaves them at a level where SDI 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, 2009, stated that a SDI 365 (approximately 240 ft2/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 Negron and Popp 2004 report found that plots infested by mountain pine beetle had significantly higher total basal area, ponderosa pine basal area, stem density and SDI (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 OFLs 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 effect 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. Long term effects would be to maintain or increase growth and vigor of treated stands, accelerate development of old forest characteristics in wild stands and plantations. 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 for these completed projects was expected to be 50 to 60% or greater. Field and aerial photo reviews by the District Silviculturist following harvest has shown

canopy cover to have 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 (Amman 1989; Bartos and Amman 1989; Schmid et al. 1992, 1995) 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 (Amman 1973, 1989) or cause turbulences that disrupt pheromone plumes used for recruiting conifer species during initial phases of host tree colonization (Thistle et al. 2004, 2005) (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% 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% 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.

The indirect effects for the approximately 10,022 acres of the Project Area where no treatments are proposed would be the same as Alternative 1, No Action. The 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.

Cumulative Effects

The Whisky Ridge Project boundary and conifer vegetation actions in Cascadel Woods will be used to analyze cumulative effects for all alternatives because treatments on forest vegetation effect the area that is being treated (e.g. reducing competing vegetation provides additional nutrients, available moisture, light, etc. to the nearby vegetation).

Over the past 20 years approximately 2,300 acres have been treated within the Whisky Ridge Project Area. Some stands, treated 15 to 20 years ago, have reached or exceeded the 80 % stocking target basal area and are proposed for a second commercial thinning entry with the Whisky Ridge Project. More recently thinned areas have not yet reached the 80 % basal area stocking level and would not be treated at this time. Spot piling of existing slash concentrations or underburning would be the only treatment done in some of the more recent treatment areas.

Under all three alternatives, conifer vegetation actions undertaken within Cascadel Woods 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 3 – Lower and Limited Mid-Level Canopy Treatment, all Treatments

Alternative 3 was created to explore the effects of adopting an alternative that only used vegetation treatments to meet a fire/fuels issue (Issue 1). As proposed, this alternative would not meet the density management, promotion of shade intolerant trees, returning treatment area conditions to more closely resemble early 1900s, stand heterogeneity, and fuelbreak construction aspects of the Purpose and Need for the Whisky Ridge Project. Treatments that are proposed under Alternative 3, however, are in compliance with the LRMP, SNFPA, 2004. 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

Very little density management would be accomplished with this alternative in wild stands. Fuel ladder removal would occur on a portion of the 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.

Since trees 10 inches dbh and larger would not be treated, only very limited density management would be accomplished within plantation aggregations planned for commercial thinning under Alternative 2. Plantations in need of commercial thinning to manage density would not be thinned. Precommercial release and thinning treatments would be accomplished in plantations, where needed, provided funding became available. If funding became available, openings, generally larger than ½ acre in size, resulting from past mortality, brush removal or other events would be planted with rust resistant sugar pine and either ponderosa pine, Jeffrey pine, white fir or red fir depending upon elevation. Planted areas would be released by hand generally to a five foot radius around each trees to reduce competition from brush.

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 size 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.

Two small (5 to 10 acre) areas would be burned with a hot prescription to create snags. These small high intensity burns will not have an appreciable effect on the vegetative cover within the Project

Area. Meadow restoration projects, as proposed, would enhance the heterogeneity within the Project Area. Road maintenance and reconstruction would only occur under the normal road maintenance schedule. Much of the road work that would be accomplished under Alternative 2, Proposed Action, would not be completed under Alternative 3. Restoration of unauthorized OHV routes by installing barricades, signs and water bars would reduce the potential for OHVs causing soil compaction and erosion within the Project Area. Subsoiling of portions of OHV routes would be done in consultation with the Silviculturist to ensure minimal damage to the residual stand. Installation of bear boxes in Whisky Falls Campground would not have an adverse effect on campground vegetation. Installation of a new toilet in Whisky Falls Campground would be done in consultation with the Silviculturist to ensure minimal damage to the residual stand.

Indirect Effects

Shade intolerant pine and oaks would become less vigorous and continue to drop out of the stands. Stand heterogeneity would decline as shade intolerant species declined. Individual tree growth rates would decline. Post treatment stocking levels would be too dense to withstand the stresses of drought and weather variances. Stand densities would continue to increase, tree vigor would decrease, making them increasingly more vulnerable to insect, disease or drought induced mortality. Since the density of trees 10 inches dbh and larger would not be reduced and growth rates would decline, the LRMP, SNFPA, 2004 desired condition of returning forest structure and function to more closely resemble early 1900s (presettlement) conditions would not be met.

Since stand densities would continue to increase, wide swings in weather conditions as has been experienced over the past thirty years and predicted to continue 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 as competition continued to increase. Once successfully attacked by bark beetles, they would serve as dispersal points for additional mortality occurring in the adjoining stand, potentially resulting in larger portions of these pine plantations and surrounding stands suffering insect attack and subsequent morality. 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.

Cumulative Effects

The Whisky Ridge Project boundary and conifer vegetation actions in Cascadel Woods will be used to analyze cumulative effects for all alternatives because treatments on forest vegetation effect the area that is being treated (e.g. reducing competing vegetation provides additional nutrients, available moisture, light, etc. to the nearby vegetation).

Over the past 20 years approximately 2,300 acres have been treated within the Whisky Ridge Project Area. Some stands treated 15 to 20 years ago that have reached or exceeded the 80 % stocking target basal area would not be thinned under Alternative 3 of the Whisky Ridge Project. Spot piling of existing slash concentrations or underburning would be the only treatment done in some of the more recent treatment areas.

Under all three alternatives, conifer vegetation actions undertaken within Cascadel Woods 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.

Geology/Soils

The direct, indirect and cumulative effects to Geology/Soils below are summarized from the Whisky Project Geology/Soils Report (Gallegos A., Takenaka K. 2012).

Affected Environment

Existing Condition

Soils

Soils in the proposed Project Area vary in their sensitivity to management from soil map unit to soil map unit. Soils with higher clay contents in combination with increased soil moisture have the highest potential for reduced soil porosity, soil compaction can occur down to 12" deep. Younger soils with reduced soil profile depths, commonly containing a Willow A horizon, are susceptible to the removal of the overlying thin A horizon. Soil disturbance is considered by any activity that results in detrimental soil compaction or loss of organic matter beyond the thresholds identified in the soil quality standards, soil disturbance can also be termed as ground disturbing activities.

Concerns for soils in the Project Area include:

1. There is a concern that areas proposed for ground based harvest contain soils that are highly susceptible to a reduction of soil porosity caused by the compaction from heavy equipment operating when soils are to moist or wet.
2. There is a concern that prescribed fire and tractor piling would reduce soil cover and cause an increase in accelerate erosion that could result in a loss of soil productivity.
3. There is a concern that ground based harvest systems on slopes that are too steep or are on Willow soils would displace surface soil horizons that could result in accelerated erosion and/or reduce soil productivity.
4. There is a concern that mastication on steeper slopes, during increased levels of soil moisture could lead to a reduction in soil porosity, increased depth of incision into the subsurface soil profile and have increased amounts of accelerated erosion possibly occurring.

Within the Project Area six soil families can be identified; Cagwin, Chaix, Chawanakee, Holland, Lithic Xeropsamments and Sirretta. See Table 42 for the soil family, soil taxonomy, soil temperature regime, soil texture per soil horizon, hydrologic group and drainage class. These six soil families in addition with bed rock combine to form twenty individual soil map units. See Table 2 for the soil map unit, soil map unit name, maximum erosion hazard (MEH), sensitivity, proposed treatment type and treatment number for the corresponding soil map unit. See Table 43 for soil map unit, soil map unit name, MEH, sensitivity, treatment area and treatment numbers. MEH rates the potential of land use activities to cause accelerated erosion rates to exceed that of natural soil formation; low, moderate, high and very high EHR can be given. The sensitivity rating of each soil is determined by its susceptibility to a loss in soil productivity by ground disturbing activities. Soil sensitivity is determined by the thickness of the A horizon, depth to the underlying bedrock and the MEH rating. A low, moderate or high sensitivity rating can be given.

Table 42. Whisky Ridge Project Soil Family Subsoil Profiles.

Whisky Ridge Ecological Restoration Project - Soil Family Profiles					
Soil Family	**Taxonomy**	**Temp. Regime**	**Texture**	**Hyd. Group.**	**Drainage Class**
Cagwin	Dystric Xeropsamments	Frigid	A: 0 to 5 inches, loamy coarse sand	A	Somewhat Excessively Drained
			C1: 5 to 17 inches, gravelly loamy coarse sand		
			C2: 17 to 32 inches, gravelly loamy coarse sand		
			C3r: 32 inches, highly weathered granitic rock		
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		
			Cr: 36 inches, highly weathered granodiorite		
Lithic Xeropsamments	Lithic Xeropsamments	Frigid	A1: 0 to 4 inches, gravelly loamy coarse sand	D	Excessively Drained
			A2: 4 to 9 inches, gravelly loamy coarse sand		
			C: 9 to 11 inches, gravelly loamy coarse sand		
			R: 11 inches, unweathered granodiorite		
Chawanakee	Dystric Xerochrepts	Mesic	A: 0 to 4 inches, coarse sandy loam	C	Somewhat Excessively Drained
			Bw: 4 to 19 inches, coarse sandy loam		
			Cr: 19 inches, highly weathered granodiorite		
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		
Sirretta	Dystric Xerorthents	Frigid	A1: 0 to 1 inches, gravelly coarse sandy loam	A	Somewhat Excessively & Excessively Drained
			A2: 1 to 7 inches, gravelly coarse sandy loam		
			A3: 7 to 30 inches, very cobbly loamy coarse sand		
			C1: 30 to 45 inches, very gravelly coarse sand		
			C2: 45 to 60 inches, very gravelly loamy coarse sand		

Table 43. Whisky Ridge Project Soil Map Units per Preatment Unit.

Whisky Ridge Ecological Restoration Project - Treatment Soils					
Soil Map Unit	Map Unit Name	MEH	Sensitivity	Area	Treatment Number(s)
111	Cagwin Family, 25 to 60 percent slopes	Moderate / High	Moderate / High	T	152
				Rx	309
113	Cagwin Family-Lithic Xeropsamments-rock outcrop complex , 15 to 45 percent slopes	Moderate / High	Moderate / High	T	123, 127, 128, 129, 150, 151, 152, 153, 155, 156, 157, 158, 159, 160
				Rx	307, 308, 309, 310, 311, 312, 315
				H	508, 511
114	Cagwin Family-Lithic Xeropsamments-rock outcrop complex , 45 to 65 percent slopes	High / Very High	High	T	142, 154, 155
				Rx	304, 306, 308
				H	507
118	Chaix Family, 5 to 35 percent slopes	Moderate / High	Moderate	T	144, 145, 146, 147, 148
				H	505, 506
119	Chaix Family, 35 to 65 percent slopes	High / Very High	Moderate / High	T	144, 145, 154
				Rx	304
120	Chaix Family, deep, 5 to 45 percent slopes	Moderate / High	Low / Moderate	T	112, 114, 115, 117, 118, 119, 122, 124, 128, 129, 131, 132, 134, 135, 136, 137, 138, 139, 140, 141, 142
				Rx	303, 304, 313, 314, 315, 316, 317, 318
121	Chaix Family-chaix family, deep complex, 15 to 50 percent slopes	High	Low / Moderate	T	121, 122, 123, 124, 125, 126, 129, 130, 131, 140, 141, 142
				Rx	301, 304, 305, 306, 311, 313, 314, 315, 321
122	Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 3 5 percent slopes	High	Moderate / High	T	111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 124, 125, 126, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144
				Rx	301, 302, 303, 304, 305, 314, 316, 317, 318, 321
				H	503, 504
123	Chaix-Chawanakee Families-Rock Outcrop complex, 35 to 65 percent slopes	High / Very High	Moderate / High	T	143, 148, 149, 150, 154
				Rx	307, 308
				H	504
125	Chaix-Holland families complex, 35 to 65 percent slopes	High / Very High	Moderate / High	Rx	300
				M	400, 401, 402
				H	500, 501
126	Chawanakee Family-Rock Outcrop complex, 35 to 65 percent slopes	High / Very High	High	T	144, 146, 148
				H	505

136	Holland Family, 5 to 35 percent slopes	Moderate / High	Low	M	400, 401, 402, 403, 404
				H	500, 501
137	Holland Family, 35 to 65 percent slopes	High / Very High	Moderate	T	105
				M	403, 404, 405
				H	502
138	Holland-Chaix families complex, 5 to 35 percent slopes	Moderate / High	Low / Moderate	T	100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110
				Rx	319, 320
				M	405, 406
139	Holland-Chaix families complex, 35 to 65 percent slopes	High / Very High	Moderate / High	T	105
				Rx	300, 301, 320
				H	501, 502
140	Holland-Chawanakee families complex, 35 to 65 percent slopes	High / Very High	Moderate / High	T	101, 108, 110, 111, 112, 113, 116, 120, 133, 134, 135
				Rx	301, 303, 316, 317, 318, 319
				M	403, 404, 406
				H	501, 503
144	Lithic Xeropsamments-Rock Outcrop association, 5 to 40 percent slopes	Moderate / High	High	H	507, 508
				Rx	305, 306, 311
148	Rock Outcrop-Chawanakee Family association, 35 to 65 percent slopes	High / Very High	High	T	146, 147, 148, 150, 160
				Rx	307
				H	509
153	Rock Outcrop-Lithic Xeropsamments complex, 45 to 85 percent slopes	Very High	High	T	152
				Rx	309, 310
				H	510, 511
160	Sirretta Family-Rock Outcrop complex, 45 to 65 percent slopes	High	High	N/A	N/A

T: Thinning Unit, Rx: Prescribed Burn Unit, M: Mastication Unit, H: Hand Unit

Soils within the Project Area have primarily formed from granitic material; parent materials include Quartz Monzonite of Shuteye Peak, Granodiorite of Shuteye Peak, Granodiorite of Whisky Ridge, Granite of Shuteye Peak (Huber, 1968; Lockwood & Bateman, 1976). The soils can be categorized as being one of three soil types; Entisols, Inceptisols or Alfisols. Entisols are the youngest of the 12 soil orders and are commonly found with only a single A horizon over a C horizon. Due to its young age not enough time has occurred to allow the formation of a mineral B horizon. A less mature soil has few horizons within its profile, commonly only an A horizon and as a result any displacement within the A horizon can result in decreased soil productivity in theses soils.

Inceptisols however are slightly older and have had enough time to allow for the formation of a mineral B horizon in their subsurface profile. Greater number of soil horizons and an increased depth to bedrock make these soils less sensitive than the younger Entisols. Lastly Alfisols are the most mature of the soil families present in the Whisky Ridge Project Area. Numerous subsurface soil horizons are a common feature of an Alfisol and they contain a subsurface soil horizon where silicate clays have accumulated in a subsurface soil horizon called an argillic soil horizon. The presence of

an argillic soil horizon causes these soils to be more susceptible to compaction when soil moisture contents are high and equipment operations have not been halted.

Certain soils within the Project Area are sensitive to management; these soils can have one or a combination of the following soil sensitivities; soils with a Willow A horizon, soils with a high compaction hazard rating and/or soils containing a large proportion of rock outcrop. Soils families within the Project Area with a Willow A horizon are the Cagwin, Chawanakee, Chaix, Lithic Xeropsamments and Sirretta soil families. The Holland soil family is the only soil located in the Project Area with a high compaction hazard rating and is primarily located in the south-western portion of the Project Area. Soil families intermixed with a large proportion of rock outcrop includes the Cagwin, Chaix, Chawanakee and Lithic Xeropsamments soil families.

Soils underlying the proposed fuelbreaks include 14 soil map units; 111, 114, 118, 120, 121, 122, 125, 137, 138 139, 140, 144, 148 and 153. Holland soils are found in five of these soil map units 125, 137, 138, 139 and 140, totaling 6.57 miles of the fuelbreak. Holland soils frequently rut and erode easily and are prone to a loss of water control and soil hydrologic function when proper erosion control measures are not utilized or installed at incorrect intervals. Holland soils contain a clay loam with an argillic subsoil and can develop severe accelerated erosion in the form a large gullies when exposed to rainfall and runoff. The other soils found underlying the proposed fuelbreak Cagwin, Chaix, Chawanakee and Lithic Xeropsamments are sensitive as well and can form ruts and gullies without proper water control but not to the extent of the Holland soils.

Soils underlying the proposed temporary roads include soil seven soil map units; 113, 118, 120, 121, 122, 138 and 148. The most sensitive soil found in this group of soil map units is the Holland soil, due to its erosion potential on road surfaces. Proper erosion control measures need to be utilized to minimize the amount of accelerated erosion occurring in these soils. The remaining soils Chaix, Chawanakee and Cagwin do have erosion potential as well but due to their coarser soil texture, the likelihood and extent are much less when compared to a Holland soil with it clay sandy loam argillic subsoil.

The initial ten soil transects completed in the Whisky Ridge roject area were placed throughout the Project Area to get an overall representation of the current soil conditions. A soil transect could be classified into one of four severity classes; D0 - no previous entries, D1 - faint signs of entry, D2 - obvious signs of entry and D3 - extensive signs of entry. After the pre-treatment soil transects were completed all were discovered to be at a natural condition overall. No extensive signs of entry (D3) were discovered at any points along the soil transect; two soil transects revealed between 1 to 1.5% of the transect contained obvious signs of entry (D2); eight of the ten soil transect showed a range from 1% (WR#118) to 11% (WR#138) of the transect containing faint signs of entry (D1) and two transects had complete natural conditions present throughout the entire transect. See Table 44 for a complete list of soil transects completed in the Project Area, percentage of soil disturbance discovered along the soil transect and the corresponding soil disturbance severity classification. Mean soil cover was 97%, on average Willow soil was present over 40% of the soil transects and rock outcrop over 20%, mean large woody debris (LWD) was at 17.10 pieces per acre and mean slope was at 17%. Eight of the ten soil transects completed showed faint signs of entry and only two of these eight showed obvious signs of entry. The most common sign of entry was the presence of old skid trails running through the unit, no signs of erosion were observed on any of these skid trails.

See Table 45 for a complete list of the site observation per soil transect. Overall the initial pre-treatment indicator assessment was rated as good for all completed transects. Existing conditions for the soil resource is currently meeting the desired conditions for the soils resource.

Table 44. Soil Transect Soil Severity Classification.

Soil Severity Classification						
Transect	**D0 - Natural Condition**	**D1 - Faint Signs of Entry**	**D2 - Obvious Signs of Entry**	**D3 - Extensive Signs of Entry**	**Severity Classification**	**Indicator Assessment**
WR #103	91%	9%	0%	0%	D0	Good
WR #116	97%	3%	0%	0%	D0	Good
WR #118	99%	1%	0%	0%	D0	Good
WR #121	94%	6%	0%	0%	D0	Good
WR #127	97%	1.5%	1.5%	0%	D0	Good
WR #138	87%	11%	1%	0%	D0	Good
WR #143	94%	6%	0%	0%	D0	Good
WR #152	100%	0%	0%	0%	D0	Good
WR #154	100%	0%	0%	0%	D0	Good
WR #157	91%	9%	0%	0%	D0	Good
Average	95%	5%	0%	0%	N/A	N/A

Table 45. Soil Transect Site Observations.

Site Observations					
Transect	**Soil Cover**	**Willow Soil[1]**	**Bedrock[2]**	**LWD[3]**	**Slope**
WR #103	100%	90%	0%	5	13%
WR #116	100%	10%	0%	25	23%
WR #118	100%	30%	10%	36	18%
WR #121	96%	10%	10%	8	14%
WR #127	91%	30%	40%	19	21%
WR #138	92%	40%	30%	12	15%
WR #143	96%	50%	30%	21	13%
WR #152	100%	60%	40%	14	13%
WR #154	100%	40%	20%	19	25%
WR #157	100%	40%	20%	12	17%
Average	97%	40%	20%	17.10	17%

[1] Willow soil was discovered at a depth no greater than 12 inches [2] Bedrock was present in the immediate area [3] Large woody debris (10” diameter X 12’ long segment) (10 plots/transect with a 1/10 acre plot size)

Meadows

Meadows were evaluated in the Whisky Ridge Project Area to determine the degree of encroachment between 1944 and 2010. The amount of conifer encroachment for each meadow within the Project Area was classified using a MacDonald and Kuitu, 2009 protocol. The purpose of this study was (1) to determine and classify the approximate percentage of conifer encroachment on meadows in the Whisky Ridge Project Area and (2) to identify possible encroached meadows for field assessment and restoration treatment.

Approximately, 92% of the 25 meadows analyzed were classified as moderately to severely encroached. Eleven of the 2010 meadows analyzed were less than 1 hectare (approximately 2.5 acres) and may not have been accurately classified using MacDonald and Kuitu’s classification protocol. The meadows considered to be most heavily impacted by conifer encroachment were 504M15, 504M143, 504M167, 504M37, 504M47, 504M59, 504M19 (Benedict Meadow) and

504M29 (Peckinpatt Meadow). See Table 46 for a complete list of those meadows most heavily impacted and the acres used to determine their classification. Six of these meadows were rated as having severe encroachment, class 6 (36-60% encroachment) and two were rated as having extensive encroachment, class 5 (16-35% encroachment). These meadows were chosen because they had large areas and distinct lobes of conifer encroachment. The areas of conifer encroachment could provide information on how the soil changed during the encroachment period.

Table 46. Conifer Encroachment Data for sSlected Meadows.

Meadow Conifer Encroachment Pre-Field Assessment						
Meadow Number	**Meadow Name**	**Current Acres**	**1944 Acres**	**Meadow Acreage Change**	**Percent Change**	**Class**
504M15	No Name	1.35	2.64	-1.29	-48.92%	6
504M153	No Name	2.85	5.10	-2.25	-44.11%	6
504M167	No Name	2.54	4.31	-1.77	-41.07%	6
504M37	No Name	1.26	2.07	-0.81	-39.25%	6
504M47	No Name	3.26	5.30	-2.04	-38.46%	6
504M59	No Name	1.88	2.97	-1.09	-36.59%	6
504M19	Benedict Meadow	5.74	8.33	-2.59	-31.08%	5
504M29	Peckinpatt Meadow	14.70	17.80	-3.10	-17.42%	5

Conifer encroachment due to fire suppression, logging, heavy grazing, climate change, or a combination of factors can reduce meadow area effect the meadow's biology and hydrology, resulting in loss of habitat and the retention of otherwise discharged groundwater (MacDonald and Kuitu, 2009). A field assessment using the form originally developed by MacDonald and Kuitu was conducted for each of the eight meadows identified during the aerial analysis. The data collected on the standardized form includes meadow hydrogeomorphic type (Weixelman et al, 2011), predominate forest type, logging and anthropogenic disturbances, tree island distribution and composition, evidence of fire history, the presence of roads and OHV trails, grazing, conifer encroachment, presence of knickpoints and incised channels, types of meadow vegetation, management issues and recommendations, and hydrology and the installation of piezometers.

Field assessment of meadow 504M15 revealed that 0.20 acres mapped as conifer encroachment during the aerial analysis were actually open meadow. After updating the current meadow boundaries, 504M15 is estimated to be encroached by 1.15 acres (43.56%). Conifer removal is recommended for 0.82 acres of the 1.15 acres identified. Additionally, 0.30 acres of additional conifer encroachment in meadow 504M153 was discovered during the field assessment that was not visible in the aerial analysis. After including this area, 504M153 is estimated to be encroached by 2.65 acres (52.00%). Conifer removal is recommended for 1.73 acres of the identified 2.65 acres of conifer encroachment.

Field assessment also revealed areas mapped as conifer encroached in meadows 504M47 and 504M59 were occupied by riparian vegetation not encroaching conifers. The field assessment of the remaining four meadows 504M167, 504M37, 504M19 and 504M29 were consistent with the aerial analysis. Conifer removal is recommended for 504M167 totaling 0.77 acres, 504M37 totaling 0.37 acres, 504M19 (Benedict Meadow) totaling 0.56 acres and 504M29 totaling 1.27 acres. In total, it is recommended that 5.52 acres across six meadows be treated for conifer encroachment by removing or thinning trees 1-12 inches in diameter. Conifer encroachment treatment is not recommended for meadows 504M47 and 504M59 due to minimal conifer encroachment. See Table 47 for a summary

of the selected meadows chosen for conifer removal in the Meadow Restoration Mini Proposal and their recommended acres selected for removal.

Table 47. Proposed Conifer Removal Treatments.

Meadow Conifer Encroachment Treatments		
Meadow Number	**Meadow Name**	**Conifer Encroachment Treatment (Acres)**
504M15	No Name	0.82
504M153	No Name	1.73
504M167	No Name	0.77
504M37	No Name	0.37
504M47	No Name	0
504M59	No Name	0
504M19	Benedict Meadow	0.56
504M29	Peckinpah Meadow	1.27

In addition to assessing conifer encroachment in the field, soils were mapped within and adjacent to each meadow to determine if areas encroached by conifers were underlain by meadow or forest soils. A total of eight meadow soils were mapped in the Whisky Ridge Project Area, including Aquic Udorthents, Histic Humaquepts, Humic Haploxerepts, Mollic Endoaqualfs, Mollic Endoaquents, Mollic Fluvaquents, Mollic Hapludalfs and Typic Fluvaquents.

Concerns related to meadows within the Project Area include:

1. There is a concern for the continued loss of meadow biological and hydrological function due to increased levels of conifer encroachment caused by heavy grazing, logging, fire suppression, climate change or a combination of the later.
2. There is a concern for the loss of the aquic soil regime common to meadows and fens due to increased levels of conifer encroachment.

OHV Routes

Trail use degrades soils through four direct primary processes; abrasion strips surface vegetation and roots, compaction reduces soil voids and causes surface subsidence, shearing causes a destructive transfer of force through the soil and displacement results in the mechanical movement of the soil particles (Meyer, 2002). Indirect soil impacts include disruption of surface water flow, reductions in infiltration and percolation, surface ponding and the loss of water-holding capacity (Meyer, 2002).

Concerns related to OHV routes within the Project Area include:

1. There is a concern for potential soil erosion and subsequent effects on soil productivity or the ability of the soil to produce vegetation.
2. There is a concern for a loss of soil depth, infiltration capacity and permeability or reduction in the soil hydrologic function.
3. There is a concern for the risk of soil erosion from trail runoff to adjacent slopes.

Soils underlying the 10.42 miles of trail proposed for decommissioning vary in their sensitivity to management. Soils with higher clay contents are easily erodible, are at an increased risk to accelerated erosion if proper water control measures are not in place, and are brittle when wet. Clay particles contain very large surface areas allowing them to absorb water with great capacity. Their particle shape is similar to small flakes, so when suspended in water, they do not readily settle out when compared to sand or silt, hence they are easily erodible. Whereas soils with higher coarse fragment contents accelerated erosion is less of a concern.

Holland family soils are considered the most sensitive of the six soil types present with concerns to trail usage. Sensitive soils frequently rut and erode easily and are prone to a loss of water control and soil hydrologic function. Holland is a clay loam with argillic subsoil and when exposed to rainfall and runoff, it can develop accelerated erosion in the form of severe gully erosion. Holland soils underlie 4,634 feet (0.88 miles) of the routes proposed for restoration.

The routes were rated using the Hydrologic Function Classification (HFC) which is a soil hazard interpretation that predicts where roads and trails are prone to failure of drainage structures and loss of water control. HFC is a function of mechanical rutting potential, erosion potential and loss of water control. Some trails are more sensitive to damage of the trail tread surface from rutting, erosion and loss of water control. Soil engineers may state this as a loss of hydrologic function. In extreme cases a loss of the facility is possible. HFC is based on soil properties, including soil texture and course fragment content, that determine how a native surface trail would mechanically rut and erode with traffic. HFCs are adapted from Pacific Southwest Region Soil Interpretations (USDA 1999). HFC is a filter or method to predict weak areas in the trail system that may require a higher level of maintenance, mitigation, and in some cases a recommendation to close the trail. See Table 48 for a complete list of trails and their corresponding HFC rating.

Table 48. Hydrologic Function Classification for Routes Proposed for Restoration.

Hydrologic Function Classification						
Trail Number	**Length**	**Soil Type**	**Soil Texture**	**Coarse Fragment Content**	**MEH**	**HFC**
AE-19z	296.98	138	SCL	0%	Moderate / High	Severe
BP117	384.37	140	SCL	0%	High / Very High	Severe
BP140	1764.66	148	COSL	0%	High / Very High	Severe
BP143	1206.65	140	SCL	0%	High / Very High	Severe
BP45	125.50	113	COSL	15%	Moderate / High	Moderate
BP45	2269.48	148	COSL	0%	High / Very High	Severe
BP47	3620.57	113	COSL	15%	Moderate / High	Moderate
JG12	3027.30	113	COSL	15%	Moderate / High	Moderate
JG12	1164.40	114	LCOS	15%	High / Very High	Moderate
JG142	448.71	120	SL	0%	Moderate / High	Moderate
JG144	588.94	121	COSL	0%	High	Moderate
JG147	673.67	121	COSL	0%	High	Moderate
JG4	178.10	122	COSL	10%	High	Moderate
JG4	157.70	120	SL	0%	Moderate / High	Moderate
JG42	122.33	120	SL	0%	Moderate / High	Moderate
JG48	1478.43	122	COSL	10%	High	Moderate
JG49	768.48	122	COSL	10%	High	Moderate
JG6	136.57	113	COSL	15%	Moderate / High	Moderate
JG60	704.72	119	COSL	0%	High / Very High	Severe

JG60	680.06	122	COSL	10%	High	Moderate
JG64	1498.48	121	COSL	0%	High	Moderate
JG65	192.20	122	COSL	10%	High	Moderate
JG6z	235.52	121	COSL	0%	High	Moderate
JG7z	377.36	121	COSL	0%	High	Moderate
JG8z	513.13	121	COSL	0%	High	Moderate
JG91	401.80	118	COSL	0%	Moderate / High	Moderate
JM-17	2567.46	113	COSL	15%	Moderate / High	Moderate
JM-17	83.81	114	LCOS	15%	High / Very High	Moderate
JM-5z	164.93	113	COSL	15%	Moderate / High	Slight
JM-7z	180.87	113	COSL	15%	Moderate / High	Slight
JM-8z	507.14	113	COSL	15%	Moderate / High	Slight
JM-9z	824.16	113	COSL	15%	Moderate / High	Slight
JM-9z	2092.94	121	COSL	0%	High	Moderate
JSM3	688.08	121	COSL	0%	High	Moderate
JSM55	2238.34	122	COSL	10%	High	Moderate
JSM62	7998.25	121	COSL	0%	High	Moderate
JSM66	2330.72	122	COSL	10%	High	Moderate
JSM69	407.72	119	COSL	0%	High / Very High	Severe
PUB-08	535.17	139	SCL	0%	High / Very High	Severe
PUB-08	2211.66	137	SCL	0%	High / Very High	Severe
PUB-13	3155.81	121	COSL	0%	High	Moderate
PUB-15	1221.00	121	COSL	0%	High	Moderate
PUB-15	57.26	120	SL	0%	Moderate / High	Moderate
PUB-16	742.19	121	COSL	0%	High	Moderate
PUB-16	360.62	120	SL	0%	Moderate / High	Moderate
PUB-17	698.95	121	COSL	0%	High	Moderate
PUB-17	523.05	122	COSL	10%	High	Moderate
SC2	448.50	120	SL	0%	Moderate / High	Moderate
SC-JG47A	1981.41	122	COSL	10%	High	Moderate

Routes AE-19z, BP117, BP140, BP143, BP45, JG60, JSM69 and PUB-08 either are fully rated with an extreme HFC or contain only a segment of trail with an extreme rating. These segments have a higher probability of containing segments with increased quantities of rutting/gullying occurring, increased amounts of erosion and loss of water control. Other segments rated with either a moderate or slight HFC still have a chance for the formation of ruts/gullies, increased amounts of erosion and the possible loss of water control but not to the extent or intensity of the severely rated segments. Soil map units with severe HFC ratings are 119, 138, 139, 137, 140 and 148; soils within these SMUs include Chaix, Holland and Chawanakee soil families.

Thirty-seven unauthorized OHV routes are located within the Project Area of the Whisky Ridge project, totaling 10.4 miles. Restoring these routes would restore roughly 12.69 acres of unauthorized OHV routes back into production. The routes were analyzed for soil and hydrologic degradation utilizing the GYR OHV Monitoring Protocol (Poof, 2004). Twenty-eight routes were entirely rated green with no additional soil or water resource concerns, these routes combined to a total length of 7 miles. Route JM-9z was found to be 93% green and 7% yellow with segments of inadequate drainage and rill erosion, route length was 0.94 miles. Route JG60 was determined to be 77% green and 33% red with a total route length of 0.28 miles. Red segments of trail contained severe erosion and sediment deposition into streams was occurring. Routes BP117, BP143, PUB-08 and PUB-16 were rated as dominantly yellow with sections of green, totaling 1.43 miles. JG12 was found to be 50.11% red and 49.89% yellow with a length of 0.85 miles. BP140 was found to be 65.42% red and 34.58% green, route length was 0.40 miles. JSM55 was a duplicate of JSM66 and was removed from length

calculations. Recommended actions are proposed for thirty-two routes, with a combined treatment area of 12.69 acres. Five trails JG147, JG6, JSM69, PUB-13 and PUB-17 were determined to have been naturally reclaimed and do not require treatment, total length of 1.04 miles. See Table 49 for a complete list of routes selected for restoration activities and their GYR rating, SW Code, recommendations and any related comments.

Routes rated with yellow segments have an increased risk of continued accelerated erosion occurring with no restoration of the disturbed segments. Through time routes with yellow segment could eventually transition into a red rating if no restoration is completed. Routes with red segments need immediate attention to restore them back to natural or near-natural conditions. Routes rates red would not naturally restore themselves back to their natural or near-natural conditions without additional restoration. Routes rated green may not need additional outside restoration and would return to natural conditions on their own through time, the only recommendation at this time is to construct barricades and post trail closure signs on both ends of the route.

Table 49. Summary of OHV Routes Selected for Restoration.

Whisky Ridge Ecological Restoration Project - OHV Route Decommissioning				
Trail #	**GYR Rating[1]**	**SW Code(s)[2]**	**Recommendation(s)[3]**	**Comment(s)**
AE-19z	G	N/A	1, 4	None
BP117	Y	SW2, SW14	1, 3, 4	None
BP140	R	SW2, SW3, SW14	1, 3, 4	None
BP143	Y	SW2, SW14	1, 3, 4	None
BP45	G	SW4, SW6, SW14, SW16, SW2	1, 3, 4	None
BP47	G	N/A	1, 3, 4	None
JG12	R	SW2, SW6, SW7, SW14, SW16, SW19, SW21, SW23, SW27, SW28	1, 3, 4	Excessive sediment delivery to stream near downslope terminus of trail. Spur trails impacting stream.
JG142	G	N/A	1, 4	None
JG144	G	N/A	1, 4	None
JG147	G	N/A	0	GPS route walked, no trail evident.
JG4	G	N/A	1, 3, 4	None
JG42	G	N/A	1, 4	None
JG48	G	N/A	1, 4	None
JG49	G	N/A	1, 4	Overlaps with system trail 23E298
JG6	G	N/A	0	None
JG60	R	SW2, SW3, SW4, SW6, SW7, SW14, SW16, SW21, SW27	1, 3, 4	Sediment plume at bottom end of trail impacts stream
JG64	G	N/A	1, 4	None
JG65	G	N/A	1, 4	None
JG6z	G	N/A	1	Old Forest road, road number sign still displayed.
JG7z / JG8z	G	N/A	1, 4	None
JG91	G	N/A	1, 4	None
JM-17	G	SW21	1, 3, 4	Crosses meadow
JM-5z	G	N/A	1, 3, 4	None
JM-7z	G	N/A	1, 3, 4	Impacts meadow?

JM-8z	G	SW2, SW14	1, 3, 4	None
JM-9z	G	SW2, SW14	1, 3, 4	None
JSM3	G	N/A	1, 4	None
JSM55		Same as JSM66		
JSM62	G	N/A	1, 3, 4	None
JSM66	G	N/A	1, 3, 4	None
JSM69	G	Route completely overgrown by brush, no action necessary		
PUB-08	Y	SW2, SW14, SW15	1, 3, 4	None
PUB-13	G	GPS route walked no trail evident.		
PUB-15	G	N/A	1, 3, 4	None
PUB-16	Y	SW2, SW4, SW14	1, 3, 4	Partially overlaps with system trail 23E280
PUB-17	G	GPS route walked no trail evident.		
SC2	G	N/A	1	None
SC-JG47A	G	N/A	1, 4	None

[1] Description of the GYR rating system can be found within the methodology section for soils [2] Soil and water condition code descriptions can be found in. [3] Description of restoration recommendations can be found within the soil's design criteria for alternative 2.

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 Whisky Ridge Ecological Restoration Project:

1. Support for Plant Growth Function

    a. **Soil Stability:** An adequate level of soil cover is maintained to prevent accelerated erosion, and erosion prevention measures are effectively implemented following soil disturbing activities. Effective soil cover includes organic surface materials, living vegetation less than 3 feet tall (grasses, forbs and low growing shrubs), surface rock fragments larger than ¾ inch, or where needed applied mulches.

Generally on slopes less than 35%, a minimum of 50% soil cover in a well distributed pattern is needed. Greater amounts of soil cover are generally needed for steeper slopes and in riparian zones. Some soil and ecological types may not be capable of producing 50 percent soil cover because of naturally low productivity, such as areas with Willow soils, serpentinized parent material or low annual precipitation.

    b. **Surface Organic Matter:** The amount of organic material on top of the mineral soil is maintained at levels to sustain soil microorganisms and provide for nutrient cycling. The size, amount, and distribution of organic matter maintained on the mineral soil on a long term basis is consistent with the amounts that occur given the local ecological type, climate, and normal fire return interval for the area. Organic materials may range in size from amorphous and fine organic matter that makes up the O horizon, needles and twigs, to coarser materials such as branches and logs. Generally the desired condition is most related to finer sizes of organic matter which contain the highest concentration of nutrients. It is important to note that an excess of organic matter on the mineral soil beyond the desired condition can pose a risk of adverse soil effects from fire.

c. **Soil Organic Matter (SOM):** The amount of organic matter within the mineral soil, indicated by the color and thickness of the upper soil horizon, is within the normal range of characteristics for the site, and is distributed normally across the area. The upper soil horizon is not displaced or eroded to the degree or extent that soil productivity is decreased for the desired vegetation.

d. **Soil Strength:** The soil strength level is conducive to a favorable rooting environment for the desired plant species. Some level of increase in strength compared to a natural undisturbed condition may not be undesirable. Consider the findings of the Long Term Soil Productivity study and other current science in regard to compaction effects on fundamental soil productivity for tree growth and total biomass production. A depth range of interest for the desired plant species should be used for assessment (e.g. 4-8 inches depth).

e. **Soil Moisture Regime:** The inherent soil moisture regime is maintained, especially in wet meadows and fens. If needed, propose projects that would restore the soil moisture regime. During land management project analysis evaluate whether the proposed activities would result in changes to the soil moisture regime, particularly in wet meadows and fens.

2. Soil Hydrologic Function

   a. **Soil Stability:** See desired condition description under Support for Plant Growth Function.

   b. **Soil Structure & Macro-porosity**: Most of the area has soil structure and macro-porosity (defined here as pores 1mm or larger) that is similar to the undisturbed, natural condition for the soil type and provides sufficient infiltration and permeability to accommodate precipitation inputs for the given climate.

3. Filtering - Buffering Function

   a. For projects that involve the application of chemicals, such as herbicides, pesticides, or other supplements (e.g. biosolids), analyze the effects to soil micro-organisms, post-project erosion risk, leaching potential and risk of off-site movement of the chemicals. When necessary, provide recommendations to prevent undesirable effects.

Desired conditions #1 through #3 were taken from the FSM 2500 - Watershed and Air Management Chapter 2550 - Soil Management.

4. 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.

5. 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.

6. 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.

7. 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.

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

Desired conditions #4 through #8 were taken from the 1991 Sierra NF LMP and the 2004 SNFPA.

Applicable Sierra National Forest (SNF) Land and Resource Management Plan (LRMP) Standards and Guidelines.

The following LRMP standards and guidelines are applicable to the Whisky Ridge Ecological Restoration Project:

1. As part of project-level analysis, conduct peer reviews for projects that propose ground disturbing activities in more than 25 percent of the RCA or more that 15 percent of a CAR. (see LMP S&G 94)
2. Improve water quality and protect soil productivity by restoring deteriorated watersheds on the basis of economic efficiency and severity of problem and its impact on downstream beneficial uses (see LMP S&G 122).
3. Avoid tractor logging on highly erodible soils, where sustained slopes exceed 35 percent, except where supported by on-the-ground interdisciplinary team review. (See LMP S&G 125).
4. Apply appropriate erosion prevention measures on all ground-disturbing activities (FSH 2409.23) prior to fall storms (October 1) and immediately upon completion of activity begun after November 1 (see LMP S&G 127).
5. Apply appropriate erosion prevention measures (FSH 2409.23) on high erosion hazard (EH) soils under the following conditions (see LMP S&G 128):

When exposed soils from an average of several 500-foot linear transects:

i. Exceed 150 feet on slopes of 15-35%,
ii. Exceed 75 feet on slopes of 35-65%, or
iii. Exceed 25 feet on slopes over 65%.

On linear disturbances, such as skid trails and fire lines, cross-drain at the following intervals. See Table 50 for cross-drain intervals determined by % slope present:

Table 50. Cross-Drain Intervals Determined by % Slope.

Interval Between Cross-Drains (Feet)		
% Slope	High EH*	Very High EH*
0 – 15	150	125
15 – 35	75	45
35 – 65	35	20

*Erosion Hazard

Plan and execute activities such as timber harvesting, site preparation and fuels reduction on soils sensitive to loss of productivity by using the following standards (see FSH 2509.18):

a. Avoid mixing or removing soils below the A horizon. Roads, skid trails, fire lines and log landings are exceptions.
b. On completion of a ground-disturbing project on less than 35% slope, maintain an average accumulation of 50% protective groundcover density in the 1 to 100-hr fuels with some 1,000-hr fuels up to 10” in diameter.

c. On slopes over 35% with Very High and/or High Erosion Hazard soil, an ID team would evaluate ground cover needs and develop a prescription.

Environmental Consequences

Data used to determine projected effects to the soil resource include; the Soil Survey of the Sierra National Forest (Giger, 1993), site specific data gathered during pre-treatment soil transects collected following the Forest Service Displacement Monitoring Protocol (USDA Forest Service, 2009), site specific data gathered during Green-Yellow-Red Monitoring on those OHV routes selected for decommissioning and field assessment data gathered for conifer encroachment on those selected meadows using the protocol devised by MacDonald and Kuitu (MacDonald and Kuitu, 2009).

Methodology

Soils

The ten soil transects completed in the Whisky Ridge Project Area were placed throughout the Project Area to get an overall representation of the current soil conditions. A soil transect could be classified into one of four severity classes; D0 - no previous entries, D1 - faint signs of entry, D2 - obvious signs of entry and D3 - extensive signs of entry. The severity class is determined by the severity of disturbance types present along a soil transect, each individual transect point would contain seven disturbance type indicators with a total of seventy indicators collected per transect. Disturbance type indicators include: (1) Wheel Tracks or Depressions, (2) Penetration and Resistance, (3) Soil Physical Condition, (4) Forest Floor, (5) Mineral Soil, (6) Erosion and (7) Burning. The soil transect is then rated with the severity class which has the largest proportion of indicators present.

Additional site data for soil cover, Willow soil, rock outcrop and large woody debris (LWD) was also collected. Soil cover is the amount of soil cover present at each transects point given in percent. Willow soil was noted if the soil present at the transect point contained a profile less than 12 inches deep. Rock outcrop would be noted if any rock outcrop was observed in the immediate area. Large woody debris (LWD) was a tally of any LWD 12’ X 10” present within an 1/10 acre plot around the transect point. The LWD was averaged out to cover a full acre and the large woody debris tally counted all classes of LWD. A tally of the number of LWD present per decomposition class was not done. The protocol used to collect the field data came from the Forest Service Displacement Monitoring Protocol. The form used was a modified quick-transect form, which was modified because the standard protocol does not address data for soil cover, Willow soil, rock outcrop or LWD.

Soil resource management is achieved by maintaining soil productivity using indicators described in the Regional Soil Desired Conditions in the FSM 2550 R5 Supplement and management direction provided in the Forest Standard and Guidelines. Soil productivity is evaluated within an Activity Area. An Activity Area is the area of land dedicated to growing vegetation which soil quality standards for soil productivity are applied. It is that area within a management area where soil disturbing activities take place and is of practical size for management, sampling and evaluation. Activity areas include timber harvest units and fuels treatment units within the Whisky Ridge Ecological Restoration Project. System roads and trails and other areas not dedicated to growing vegetation are not included as part of activity areas.

The project proposal could affect soil productivity in the Whisky Ridge Project Area by reducing 1) soil cover, 2) soil porosity, 3) large woody debris (LWD) and 4) disturbance of surface soils.

The main soil physical property that can be affected by the Proposed Action is porosity, the space between individual soil particles. Soil hydrologic function is primarily dependent on the size and arrangement of soil pores, or pore geometry. Soil pore geometry also controls the transmission of air through soils, which is critical for plant growth. When porosity is decreased, the soil becomes denser,

making it more difficult for roots to penetrate. Maintenance of natural soil porosity is important for maintaining healthy native plant communities and for maintaining the hydrologic function of the soil. Severe losses of porosity through soil compaction decrease the water and air available to plant roots, creating droughty and/or anaerobic conditions as well as inhibiting root growth. Soil hydrologic function is usually impaired as water storage capacity, infiltration and permeability decrease, as a consequence increasing runoff and the subsequent potential for erosion and cumulative watershed effects.

Soil compaction diminishes soil porosity, and decreases the transmission of water, nutrients and air to roots. Severe compaction can inhibit root growth when the soil becomes too dense for roots to penetrate easily. Finally, compaction decreases infiltration and hydraulic conductivity, the movement of water into and through soils, which in turn increases surface runoff and erosion potential. Severely compacted soils could take at least 50 years to recover. Bulk density (ratio of soil mass to soil volume) and soil strength (penetration resistance) are two widely accepted indirect means of measuring changes in porosity in the field. Qualitative indicators of compaction include platy soil structure, loss of soil structure (e.g. puddling), impressions or ruts in the mineral soil surface, and in some cases, redoximorphic features that indicate a recent change in soil aeration. Redoximorphic features are soil properties associated with wetness that results from reduction and oxidation of iron and manganese compounds after saturation and desaturation with water. Both quantitative and qualitative indicators would be used to describe compaction.

Use of heavy equipment, especially rubber tired skidders, for logging and tractor piling could compact soils, in the upper 12” of the soil profile. Soil compaction can have a detrimental effect on soil productivity on fine-textured soils that are moist or at optimal soil moisture conditions for soil compaction. Soil compaction is not a concern in coarse textured soils. In fact, soil compaction has been found to have an increase in soil productivity by increasing the available water holding capacity of the soil (Powers, et al 2008). Soils have been classified into sensitive and non-sensitive soils types for the purpose of identifying soils that are susceptible to detrimental soil compaction. *Soil porosity should be at least 90 percent of total porosity over 85% of an activity area (stand) found under natural conditions. A ten percent reduction in total soil porosity corresponds to a threshold for soil bulk density that indicates detrimental soil compaction.*

Soil productivity is dependent on the amount of soil organic matter available to prevent significant short or long-term nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions. Soil organic matter should include fine organic matter and large woody debris.

Fine organic matter provides soil nutrients and protects the soil by providing soil cover. Soil cover or the lack of soil cover can affect soil productivity by removal of surface soils from accelerated erosion. Accelerated erosion is erosion that occurs at a rate over and beyond normal, natural or geological erosion, primarily as a result of human activity. Soil loss should not exceed the rate of soil formation (approximately the long-term average of 1 ton/acre/year). Sufficient soil cover should be maintained to prevent accelerated soil erosion from exceeding the rate of soil formation. Ground cover would be at least 50% on ground slopes less than 35% and on slopes greater than 35%, ground cover would be determined by the ID team. Replenishment of fine organic matter to preexisting conditions could occur in less than 10 years as forests shed their needles and leaves and accumulate on the forest floor.

Large organic matter or large woody debris, provides habitat for soil micro-organisms including fungus, soil insects and soil bacteria. All of these organisms are critical for soil health and soil productivity. The loss or reduction of large woody debris in a forest could last anywhere from 10 to 50 years, depending on the number of decadent trees or snags that are left in the stand after treatment. At least 5 well distributed logs per acre, representing the range of decompositions classes, should be left on the forest floor after the Proposed Action is completed.

Soil productivity can be reduced or impacted from displacement of surface soils. Surface soils include valuable amounts of organic matter and nutrients that are critical for productive soils. Surface soils can be disturbed by logging and mastication equipment operating in the forest, by tractors piling slash and by construction of roads and skid roads from excavation of the soil to construct a road or skid trail prism. The surface area of new roads would result in a loss of soil productivity for that area.

Disturbance of surface soils by logging and mastication equipment could result in reduced soil productivity. The Sierra LRMP provides direction for avoiding tractor logging on sustained slopes that exceed 35%. There are no slope limitations for mastication equipment in the LRMP. Mastication equipment can operate on slopes greater than 35% slopes under normal, dry soil moisture conditions. During times of increased soil moisture content mastication equipment operating on slopes greater than 35% would cause additional soil disturbances, increasing the likelihood of soil compaction and the formation of ruts and track incision.

Meadows

Meadows were evaluated in the Whisky Ridge Project Area to determine the degree of encroachment between 1944 and 2010. The amount of conifer encroachment for each meadow within the Project Area was classified using a MacDonald and Kuitu, 2009 protocol. See Table 14 for the meadow encroachment classification rating system used for the conifer encroachment analysis. The purpose of this study was (1) to determine and classify the approximate percentage of conifer encroachment on meadows in the Whisky Ridge Project Area and (2) to identify possible encroached meadows for field assessment and restoration treatment.

The appropriate 1944 air photos were located and then georeferenced for the entire Whisky Ridge Project Area using ArcGIS and the georeferencing tool. A first order transformation (affine) was used when transposing the 1944 air photos to their correct positions on the landscape, a second or third order transformation was not used due to the amount of time required to complete the process. One hundred and six meadows were located in the Project Area and those smaller than one acre were removed from the analysis. The remaining meadows had their boundaries updated using the most recent aerial imagery from the BING 2010 aerial imagery and those smaller than one acre were removed, 25 meadows remained. For increased precision, the 1944 air photos were re-georeferenced on a meadow by meadow basis, removing some of the visual distortion found in the air photos. Using only one air photo for a set of meadows could cause the boundaries of the meadows to be larger or smaller than they actually are due to visual distortion in the air photo, causing the calculated acreage to be skewed.

Only one meadow, 523M39 could not be located in the 1944 air photos due to poor image quality. Once the georeferencing was updated, the boundaries of the meadows located in the 1944 air photos were digitized and the acreage was calculated. The digitized boundaries were then verified using the 1944 air photos and a stereoscope to determine if the boundaries were satisfactory or if modifications needed to be completed. Comparing the acreage of the 1944 and 2010 air photos, the percent change in meadow area was calculated and placed into the appropriate class rating.

OHV

Assessment of the OHV routes proposed for decommissioning was completed utilizing Hydrologic Function Class (HFC) assessment and the OHV GYR (Green-Yellow-Red) Monitoring protocol. The OHV GYR Monitoring uses seven indicators to address the current state of the trail; Water Control (1), Erosion Off-Trail (2), Sediment Traps (3), Tread Wear (4), Tread Width (5), Unauthorized User-Created Trails (6) and Approach to Watercourse Crossing (7) (Poff, 2004). Each trail segment consists of individual sections containing their own set of unique condition ratings. Individual

condition ratings can have one of three severity classes; G (non-existent or minor), Y (moderate) and R (severe). Combining the given indicator and severity provides a condition code for that section of trail. For example a trail section with a rill forming between waters bars would be given a Y(1), yellow because a rill, not a gully, has formed and (1) because the indicator for the trail section was water control. Any routes rated yellow need marginal restoration to bring them back to natural or near natural condition. Routes rated red would need extensive work to bring them back to natural or near natural condition.

HFC is a soil hazard interpretation that predicts where roads and trails are prone to failure of drainage structures and loss of water control. HFC is a function of mechanical rutting potential, erosion potential and loss of water control. Some trails are more sensitive to damage of the trail tread surface from rutting, erosion and loss of water control. Soil engineers may state this as a loss of hydrologic function. In extreme cases a loss of the facility is possible. HFC is based on soil properties, including soil texture and course fragment content, that determine how a native surface trail would mechanically rut and erode with traffic. See Table 51 for the HFC ratings guide used to classify the soils found underlying unauthorized OHV routes. HFCs are adapted from Pacific Southwest Region Soil Interpretations (USDA 1999). HFC is a filter or method to predict weak areas in the trail system that may require a higher level of maintenance, mitigation, and in some cases a recommendation to close the trail.

Table 51. HFC Rating Guide.

HFC Ratings			
Factors	**Slight**	**Moderate**	**Severe**
Soil texture of family particle size control section	COSL and coarser Coarse Textured Sandy Loams	L, SL, FSL, SIL, VFSL Medium Textured Loams	C, SIC, SC, CL, SICL, SCL Fine Textured Clay Loams
Coarse fragments (percent) by volume	>25	10 - 25	<10
MEHR	Moderate or less	High	Very High

Spatial and Temporal Context for Effects Analysis

Direct effects on soil resources occur during the proposed logging or mastication activities and could include disturbance or displacement of soil or reduction of soil cover. Prescribed fire could reduce soil cover for 3 to 5 years after the prescribed fire is implemented. Indirect effects on soil resource can occur sometime after the activities take place and could include erosion along skid trails or mastication trails during winter storms or during the spring snowmelt. Cumulative effects on soil resources could occur for up to 30 years after the proposed activities. All of these effects could reduce soil productivity from five to 30 years after the Proposed Action.

Effects of the proposed project would be similar to effects of recent, similar past projects implemented with current Best Management Practices and equipment that has been used in recent projects. These projects include the Sonny Meadows Project, Cedar Valley Project, and the Graham Mountain Project and several other similar projects.

The cumulative effects analysis for soils was evaluated in the Cumulative Watershed Effects (CWE) Analysis for the Whisky Ridge Ecological Restoration Project (Stone, 2012). The CWE Analysis consider all relevant past, present and future foreseeable actions. As part of project-level analysis,

conduct peer reviews for projects that propose ground disturbing activities in more than 25 percent of the RCA or more that 15 percent of a CAR. (see LMP S&G 94).

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.

Direct Effects & Indirect Effects

Under Alternative 1, soil conditions would not change from the current existing condition. Currently both percent soil cover and large woody debris (LWD) meet the regional soil standard and guideline threshold values. As previously discussed the ten soil transects completed in the Project Area yielded two transects of having no signs of entry (WR#152 & WR#154), eight of the transect having faint signs of previous entry (WR#103, WR#116, WR#118, WR#121, WR#127, WR#138, WR#143 & WR#157), two of those eight also containing obvious signs of entry (WR#127 &WR#138) and none showing extensive signs of entry. The disturbances discovered in the soil transects were all remnants of previous entries, old skid trails and temporary haul roads. No evidence of erosion was observed on the skid trails or temporary haul roads during the field analysis of the ten selected treatment units.

Meadows would continue to have unimpeded conifer encroachment along both the meadow periphery and as well as 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 themselves for herbaceous plants but also the habitat the meadows provide for forest wildlife.

The soil map units with a severe HFC all have a Holland soil associated to them. Routes located on a severely rated HFC have a high likelihood of rills/gullies forming, increased intensities of erosion and loss of water control. A moderate HFC has the potential over time to form rills and gullies, increased erosion and a loss of water control but nowhere near scale or likelihood of that in a severely rated HFC. With no action taking place on the routes located in the Whisky Ridge Project Area, non-motorized use would continue to degrade the trail to an even greater extent and with no water control features currently installed or designed to proper specifications, erosion of the tread surface and soil loss off-trail would continue unimpeded. Non-motorized use could include one or a combination of the following activities; hiking, mountain biking and/or cattle grazing.

Routes containing rills or gullies would continue to increase in size until the trail becomes unusable and could lead to the formation of additional unauthorized bypass routes, causing further resource damage. Routes crossing streams with no water control features could have negative impacts to both water quality and aquatic resources. Routes BP117, BP143, PUB-08 and PUB-16 are rated yellow and would continue to cause resource damage unimpeded. The routes with no other unauthorized use could return to natural or near-natural condition through passive recovery with no restoration activity occurring. Routes JG12 and JG60 are both rated red and would continue to cause severe resource damage with no chance of passive recovery without any restoration activity. Passive recovery would occur on those routes where soil disturbance is minimal within 15 to 30 years; dependent on the type of vegetation present, depth of the soil profile (deep or Willow), and the productivity of the soil.

Cumulative Effects

Cumulative soileffects have been addressed under the cumulative watershed effects (CWE) section under the Hydrology/Water Quality Section. The cumulative soil effects analysis is addressed in the Cumulative Watershed Effects (CWE) Assessment. The CWE Assessment uses the Equivalent Roaded Acre (ERA) Model, which quantifies disturbance based on the degree of soil disturbance, as compared to an acre of road and measured relative to disturbance in a given watershed. ERAs reflect changes to Soil Hydrologic Function, and are an indicator of rutting potential, erosion potential and loss of water control. See Whisky Ridge Project CWE Analysis (Stone, 2012) for a full description of assessment and assumptions including list of past, present and future foreseeable actions. The Forest Service Pacific Southwest Region (R5) methodology is used to determine the overall disturbance footprint. The disturbance footprint is a semi-quantitative measure of acres of detrimental soil disturbance and hence an approximation of change in Soil Quality as defined by the R5 Soil Desired Conditions (USDA-FS, 2012).

Cumulative Effects of no action would be displayed under the pre project condition of the CWE analysis. Essentially the only watershed considered a candidate for CWE response is subdrainage 504.1004. Subdrainage 504.1004 is 1,442 acres and is drained by Gertrude Creek, which is tributary to Whisky Creek. A watershed assessment in 1998 showed that some of the channels (tributaries) to Gertrude Creek were unstable, but that Gertrude Creek itself was essentially stable with a Pfankuch rating of fair to good. No SCI survey was conducted in this subdrainage, but in 2012 a modified Pfankuch survey was conducted on Gertrude Creek approximately 0.3 miles northwest of Benedict Meadow. The channel was rated a B3 with a numeric score of 78 (i.e., a fair stability rating), thus no demonstrable trend in channel condition is apparent in the Pfankuch analysis between 1998 and 2012, but some riparian vegetation recovery has occurred since the rain-on-snow flood of 1997 (Strand, personal communication, 2012).

CWE baseline analysis for 504.1004 showed the ERA % to be at 4.07%, under the lower threshold of concern of 6%. The Proposed Action could potentially elevate the ERA% value to 13.89%. A field evaluation of pool function (i.e., filling of pools by fine sediment – a measure of CWE response) was conducted on Gertrude Creek up and downstream of the Forest Service Road 7S07 crossing. Qualitative observations of pools downstream of the 7S07 culvert showed a high degree of fine sediment filling and deposition as mid-channel bars. The channel banks were noted to be fairly well vegetated with a BEHI rating of moderate. S-Star measurements in three pools (below the 7S07 culvert) averaged to 27% total volume, 7% over the Desired Condition for the soil type (i.e., Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 35 percent slopes). The channel banks above the 7S07 culvert showed more signs of instability with a higher degree of incision (down-cutting) with steeper bank angles (90-degrees), which are more susceptible to failure during bankfull events. S-Star measurements in three pools (above the 7S07 culvert) averaged to 54% total volume, 34% over the Desired Condition for the soil type (Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 3 5 percent slopes).

Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition.

Baseline CWE (ERA %) for this subdrainage is high at 13.89%, 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.

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

This alternative is in full compliance of the National Forest Management Act of 1976, the Forest Service Manual (FSM) 2500 – Watershed and Air Management, and the Sierra National Forest Plan and Amendments. Baseline CWE (ERA %) for this subdrainage is high at 13.89%, 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

Of the 18,285 acres within the project boundary, an approximately 9,500 acre analysis area is proposed for potential vegetation treatments including mechanical and hand thinning and the application of prescribed fire. Mechanical and hand thinning treatments would be used to modify stand structure to more closely resemble pre1900s conditions resulting in stands that are more resilient to insect attack, diseases, and drought conditions while reducing the risk of the spread and intensity of wildfire. The application of prescribed fire would be used to restore ecological processes.

Direct Effects & Indirect Effects

Commercial Thinning

In areas planned for commercial thinning, a minimum of 50% ground cover should be left on the ground to prevent accelerated erosion. 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. See table 17 for a complete list of treatment units with rock outcrop and the percent of rock outcrop present.

Roughly 4.2 miles of temporary roads would be created to access previously in assessable areas of the treatment units. Roughly 7.13 acres of forest soils would be taken out of production for the creation of the temporary roads. During the creation of these temporary roads soils would become displaced and soil compaction is likely to occur. When applicable it is best to use old temporary roads and old skid trails to minimize the impacts to the soil resource. The creation of additional lands would also cause further soil displacement and additional soil compaction. Just as with temporary roads and skid trails, old landings should be re-used to minimize the impacts occurring to the soil resource. Additional mitigation measures would need to be implemented to minimize the amount of accelerated erosion occurring on the temporary roads/skid trails and on the newly created landings. If soil compaction becomes evident over 15% of the treatment area then subsoiling of the temporary roads, skid trails and/or lands would need to be completed. Only 2% of the whole Project Area showed soil compaction so the likelihood of soil compaction exceeding 15% of a treatment unit is minute.

During times of increased soil moisture, increased amounts of soils disturbance would occur and an increased risk of soil compaction in soils with high clay contents possibly would occur. Soils need to have soil moisture content below 14-16% to minimize the potential of detrimental soil disturbance and/or compaction. A loss in soil productivity could occur in areas where sensitive soils are located during most soil disturbing activities if design measures are not followed. Areas located on steep 25%-35% slopes where skidding may be adverse (uphill skidding) could result in increased amounts

of ground disturbance. Units with potential adverse skidding include T111, T122, T124, T131, T142, T144, T149 and T150.

Units identified with slopes greater than 35% have an increased risk of detrimental soil disturbance occurring, the amount of soil disturbance would increase even further if adverse skidding is required. Units with slopes greater than 35% are T101, T102, T105, T109, T110, T111, T112, T113, T116, T128, T130, T132, T133, T142, T144 and T149. Within these units' potential areas of adverse skidding have been identified within treatment units; T102, T110, T113, T118, T122, T124, T127, T131, T142 & T144. It is recommended to end-line areas small enough were this is applicable/cost effective and to either tractor pile or grabble pile areas to minimize soil disturbance. Short sections of steep slopes for going into and out of the treatment units may have to be crossed with logging equipment and some soil disturbance may occur. Any disturbances which occur need to be mitigated to meet the soil design criteria specified in this document.

Areas where thinning is proposed within the 100 foot buffer of the RMA meadow buffer would have minimal soil disturbance. Equipment would only be allowed to operate within 50 ft. of the meadow and any thinning required beyond this point, which cannot be reached with the arm of the equipment, would be hand piled instead to minimize impacts to the soil resource. Additional slope requirements, nothing above a 15% slope, and no turning of equipment when it's within the RMA, strait ingress and egress routes, would aid in minimizing the impacts to the soils.

Pre-Commercial Thinning

Areas planned for pre-commercial thinning would be completed via mastication and tractor piling. Tractor piling would be primarily used over mastication. The masticator equipment reduces erosion potential by increasing soil cover and generally causes little soil disturbance and compaction. Masticating equipment normally does not result in compacted soils because the equipment has lower ground pressures then conventional logging equipment. In addition the masticator creates a bed of chips which acts like a carpet the masticator travels over reducing the ground pressure on the soil below. Mastication on steeper slopes (>35%) is proposed in units M400, M401, M402, M403, M404 & M406 and could result in the formation of soil troughs where the masticator is traveling straight up or down steep slopes. These troughs could be sites of concentrated flow and could create rill and gully erosion if adequate erosion control is not provided. These troughs should be reshaped or adequate erosion control should be provided to prevent accelerated erosion. Additionally the number of turns the masticator takes needs to be minimized to reduce the soil disturbance which occurs when tracked equipment rotates. Areas planned for mastication pose little risk of reducing soil productivity if BMP's are implemented.

Most mastication treatments would be on slopes less the 35%; however some areas with slopes in excess of 35% would be treated. Additional soil disturbances would occur in these areas above 35%, most commonly deep tread incision and increased occurrences of soil compaction. To avoid adverse soil disturbance, the soils would need to have soil moisture content below 14% to minimize the potential of detrimental soil disturbance. Short sections of steep slopes, where equipment travels from vegetation patch to vegetation patch during mastication activity is acceptable, but longer sections of steep slopes need to be minimized on slopes greater than 35%.

In areas where tractor piling of slash is planned, a minimum of 50% ground cover should be left on the ground to prevent accelerated erosion. Past observations on the Sierra NF have found that a minimum of 50% soil cover generally prevents accelerated erosion. If slopes are greater than 35%, soil cover should be at least 70%. Units with slopes greater than 35% include T101, T102, T105, T109, T110, T111, T112, T113, T116, T128, T130, T132, T133, T142, T144 and T149.

Depending on the type of equipment being used, either a tracked or rubber tired piece of equipment, the amount of soil disturbance occurring varies between the two. A rubber tired tractor generates more pressure on the soil below, increasing the amount of soil disturbance (soil compaction), as the piece of equipment travels back and forth on the same piece of ground. Whereas, a grapple piler, which is a tracked piece of equipment, generates less ground pressure, resulting in less soil disturbance. On areas above 25%, a grapple piler is recommended to minimize the amount of soil disturbance. 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.

Hand Piling

Hand piling and meadow conifer removal through hand piling would have no adverse effects on the soil resource; no heavy equipment would be used. 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). Meadows previously impacted by encroaching conifers causing declining hydrologic function in the meadows would slowly return to an acceptable level of hydrologic function. Increased hydrologic function would aid in the retaining of and formation of additional aquic soils and vegetation requiring an aquic soil regime.

Mastication

Most mastication treatments would be on slopes less the 35%; however some areas with slopes in excess of 35% would be treated. Units with slopes above 35% are M400, M401, M402, M403, M404, M405 & M406. Additional soil disturbances would occur in these areas above 35%, most commonly deep tread incision and increased occurrences of soil compaction. To avoid adverse soil disturbance, the soils would need to have soil moisture content below 14% to minimize the potential of detrimental soil disturbance. Small stretches of equipment travel from vegetation group to vegetation group during mastication activity is acceptable, but longer stretches need to be minimized on these slopes greater than 35%.

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 to high burn intensity with moderate burn severity.

Two areas of 5 to 10 acres, respectively, are proposed for a moderate to high fire intensity within the prescribed fire units 306 and 310. Small patches of moderate intensity fire would be designed to kill some larger diameter trees for the purpose of creating snags. The fire burn severity would technically be moderate and a sustained crown fire is not anticipated. Full consumption of limbs, branches and needles are not expected from the treatment. The objective of the prescribed fire treatment in these two areas, are to create a degree of torching in the stand, where there would be some degree of crown scorch that would lead to the tree mortality.

There is potential that ground cover would be less than 50% in these 10 and 6 acre areas immediately after the prescribed fire. However, needle drop would probably occur in these areas prior to the first rain storms in the fall. There is potential for rain storms in the summer, prior to these areas having adequate ground cover. Rock outcrop generates a significant amount of runoff during precipitation

events, high slope angles increases the amount and intensity of any runoff generated. The upper burn area in Rx 310 does have a significant amount of rock outcrop above the proposed treatment area but a bench is located down gradient of the outcrop with a slope of roughly 2%. This bench also has a small channel running perpendicular to the rock outcrop so any runoff produced by the rock outcrop would be intercepted before it reaches the main body of the moderate to high intensity burn area.

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 overall in the prescribed fire treatment areas.

Fuelbreaks

Proposed fuelbreak creation and maintenance would occur on 32.8 miles of the Whisky Ridge Project Area. Treatment activities in the fuel break include thinning, mastication, piling and/or burning. Accelerated erosion could occur on these fuelbreaks if proper ground cover is not maintained and if water control measures aren't in place or improperly designed. There are 6.57 miles of proposed fuelbreak located on highly erosive soils; highly erosive soils are susceptible to accelerated erosion that could later lead to the formation of ruts and/or in extreme circumstances larger gullies. Proper standards and guidelines need to be implemented to minimize the potential impacts from accelerated erosion. Other sections of the fuelbreak need water control features as well, but not to the extent or spacing of the highly erosive soils.

OHV Trail Restoration

Thirty of the thirty-eight OHV routes proposed for decommissioning require additional restoration activities to restore the routes to natural or near-natural conditions and return these areas to their potential for full soil productivity. Five routes have been naturally restored and require no additional action at this time. The proposed restoration activities include barricading and signing trails to prevent use, subsoiling sections of the routes with compacted soil, constructing erosion control features and distributing down trees and ground liter on the route surface.

After subsoiling is complete 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. Distributing trees and ground liter on the route surface would promote regeneration of vegetation on the trail surface; further bring the trail back to natural condition. Routes with either yellow or red segments would be restored back to a green condition and would no longer be a concern for soil loss. The restoration of these routes would result in 12.69 acres of the forest being brought back into production.

Cumulative Effects

Cumulative soil effects have been addressed under the cumulative watershed effects (CWE) section under the Hydrology/Water Quality Section. See the discussion in the No Action Alternative, Soil Cumulative Effects section for additional discussion on soil cumulative effects. The Whisky Ridge CWE Assessment, evaluated disturbance from the Proposed Action and recovery from previous management actions over a 30 year time span for 8 subdrainages. The baseline or existing condition of most of the subdrainages is below the Lower TOC %. When adding in the Proposed Action, none exceeded the Upper TOC of 14%, which suggests that a CWE response for most of the project subdrainages is low to unlikely. The only subdrainage that has a moderate adjective rating for CWE response is 504.1004. Subdrainage 504.1004 is 1,442 acres and is drained by Gertrude Creek, which is tributary to Whisky Creek

CWE baseline analysis for 504.1004 showed the ERA % to be at 4.07%, under the lower threshold of concern of 6%. The Proposed Action could potentially elevate the ERA% value to 13.89%. A field evaluation of pool function (i.e., filling of pools by fine sediment – a measure of CWE response) was conducted on Gertrude Creek up and downstream of the Forest Service Road 7S07 crossing. Qualitative observations of pools downstream of the 7S07 culvert showed a high degree of fine sediment filling and deposition as mid-channel bars. The channel banks were noted to be fairly well vegetated with a BEHI rating of moderate. S-Star measurements in three pools (below the 7S07 culvert) averaged to 27% total volume, 7% over the Desired Condition for the soil type (i.e., Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 35 percent slopes). The channel banks above the 7S07 culvert showed more signs of instability with a higher degree of incision (down-cutting) with steeper bank angles (90-degrees), which are more susceptible to failure during bankfull events. S-Star measurements in three pools (above the 7S07 culvert) averaged to 54% total volume, 34% over the Desired Condition for the soil type (Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 3 5 percent slopes).

Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition.

In addition to the CWE analysis, a review of the past, present, and reasonably foreseeable actions to take place within the project area concluded the actions are not anticipated to contribute to the overall cumulative effects to the soil resource. The soil's support for plant growth function, soil hydrologic function and filtering-buffering function would be maintained and minimal soil disturbance will occur. This is due to implementation of project design features and implementing BMPs (Best Management Practices) for this and any forthcoming projects within the project area. However if project design features and BMPs are not followed, ensuing detrimental effects to the soil resource will occur.

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

Compliance with the LRMP Management Standard and Guidelines is built into the design measures of the project. As documented in the effects analysis, alternatives 2 would minimize tractor logging on steep slopes with high erosion hazard, erosion control measures would be applied appropriately, ground cover and LWD would be sufficiently maintained and there is a low to moderate chance of escalating the current CWE condition. With implementation of the project design features, this alternative is in full compliance of the National Forest Management Act of 1976, the Forest Service Manual (FSM) 2500 – Watershed and Air Management, and the Sierra National Forest Plan and Amendments.

Summary of Effects

The effects which pose the greatest likelihood of having adverse soil disturbances occurring are the commercial and pre-commercial thinning. If proper design measures are followed soil disturbance would be kept to minimal levels and any loss of soil productivity & soil hydrologic function would be marginal. Mastication and pre-commercial thinning operations cause marginal soil disturbance when soil moisture levels are within acceptable conditions. However, along longer sections of steep (>35%) slopes, soil disturbance can occur. Creation of additional landings, temporary road and skid trails would have minimal soil disturbance if proper design measure are followed.

The most common disturbance would occur on the skid trails during times of increased soil moisture and on slopes where adverse skidding would occur. Less than 15% soil disturbance is likely to occur throughout the Project Area. Based on the observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of intensifying the current CWE condition.

Ground based activities occurring in more than 25% of the RCA or more than 15% of a CAR would not adversely affect soil productivity, so a peer review is not needed. Soil design criteria's 2, 4 and 5, in addition with optional treatment for 100' Meadow Buffer, design criteria's 1, 2 & 3 would mitigate any detrimental soil compaction or loss of organic matter beyond thresholds identified by soil quality standards.

The removal of encroaching conifers and hand piling of the slash in the eight meadows selected for conifer removal would have minimal to no soil displacement associated with this treatment. Thinning and hand piling in the Riparian Management Areas (RMA) around the meadows would cause minimal soil disturbance if proper design measures are followed, resulting in minimal to no loss of soil productivity and increasing the hydrologic function of the meadow once the conifers have been removed.

Prescribed fire at low burn intensities would maintain the required 50% soil cover to minimize soil loss. In the two planned high severity burning areas there is potential that ground cover would be less than 50%, immediately after the prescribed fire. However, needle drop would probably occur in these areas prior to the first rain storms in the fall. There is potential for rain storms in the summer, prior to these areas having adequate ground cover. Fuelbreaks located on highly erosive soils require additional water control features to minimize accelerated erosion and the formation of ruts and gullies.

Restoration of the 10.4 miles of OHV routes would improve the soil productivity and hydrologic function of 12.69 acres of forest, returning the affected areas back to natural or near natural conditions.

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

Treatment areas would remain the same as in Alternative 2, however, 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 management objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinningin the mid-level canopy) so it would only slightly 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 precommercial 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 generally be completed within the first two to seven years of implementation as funding becomes available. 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. Road maintenance and reconstruction would be much less

likely to be accomplished given limited appropriated funds for this work. All other proposed restoration treatment activities would be implemented as described in Alternative 2.

Design Features and Mitigation Measures

Same design features and mitigations occur for Alternative 3 as described in chapter 2; see design features and mitigation measures in chapter 2 for Alternative 2.

Direct Effects & Indirect Effects

Treatment areas would remain the same as in Alternative 2, however, 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 management objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only slightly address stand density and forest health objectives. Less soil disturbance would occur in this alternative due to no creation of temporary roads, no new landings would be needed and no new skid trails would be created. Areas in alternative 3 would be treated by pre-commercial thinning via mastication, tractor piling or hand-treatments as a replacement for commercial thinning in alternative 2.

Meadow Buffer Thinning

Areas where thinning is proposed within the meadow RMA would have minimal soil disturbance. Equipment would only be allowed to operate within 50 ft. of the meadow and any thinning required beyond this point, which cannot be reached with the arm of the equipment, would be hand piled instead to minimize impacts to the soil resource. Additional slope requirements, nothing above a 15% slope, and no turning of equipment when it's within the RMA, strait ingress and egress routes, would aid in minimizing the impacts to the soils.

Meadow conifer removal through hand piling would have no adverse effects on the soil resource; no heavy equipment would be used. 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). Meadows previously impacted by encroaching conifers causing declining hydrologic function in the meadows would slowly return to an acceptable level of hydrologic function. Increased hydrologic function would aid in the retaining of and formation of additional aquic soils and vegetation requiring an aquic soil regime.

Pre-Commercial Thinning

Same effects occur in alternative 3 as described in chapter 2, see effects for pre-commercial thinning in alternative 2.

Hand Piling

Same effects occur in alternative 3 as described in chapter 2, see effects for hand piling in alternative 2.

Mastication

Same effects occur in alternative 3 as described in chapter 2, see effects for mastication in alternative 2.

Prescribed Fire

Same effects occur in alternative 3 as described in chapter 2, see effects for prescribed fire in alternative 2.

Fuelbreaks

Same effects occur in alternative 3 as described in chapter 2, see effects for fuelbreaks in alternative 2.

OHV Trail Restoration

Same effects occur in alternative 3 as described in chapter 2, see effects for OHV trail restoration in alternative 2.

Cumulative Effects

Cumulative effects would be less than those described under the Proposed Action (Alternative 2) and similar to the No Action Alternative, 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.

Baseline CWE (ERA %) for subdrainage 504.1004 is high at 13.89%, which resulted from past timber harvest activity. With Alternative 3, no tractor related ground disturbance would occur, which, (given sufficient time), would allow the subdrainage to stabilize and become more resilient to future watershed stressors.

In addition to the CWE analysis, a review of the past, present, and reasonably foreseeable actions to take place within the project area concluded the actions are not anticipated to contribute to the overall cumulative effects to the soil resource. The soil's support for plant growth function, soil hydrologic function and filtering-buffering function would be maintained and minimal soil disturbance will occur. This is due to implementation of project design features and implementing BMPs (Best Management Practices) for this and any forthcoming projects within the project area. However if project design features and BMPs are not followed, ensuing detrimental effects to the soil resource will occur.

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

Compliance with the LRMP Management Standard and Guidelines is built into the design measures of the project. As documented in the effects analysis, alternatives 3 would minimize 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, this alternative is in full compliance of the National Forest Management Act of 1976, the Forest Service Manual (FSM) 2500 – Watershed and Air Management, and the Sierra National Forest Plan and Amendments.

Summary of Effects

Same effects occur in alternative 3 as in alternative 2, see summary of effects in alternative 2.

Hydrology/Water Quality

The direct, indirect and cumulative effects to the Hydrology and Water Quality are summarized from the Hydrology and Water Quality report for the Whisky Ridge Project (Stone A., 2012).

Affected Environment

General

Although there is evidence that past activities that have caused watershed degradation, 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 fair to good for channel stability using modified Pfankuch, after Rosgen (2004) and this has been corroborated with Stream Condition Inventory data along Whisky Creek. There are, however, areas within the proposed project boundary that are unstable and sensitive to disturbance. Specifically, subdrainage 504.1002 suffered discrete (non-cumulative) disturbance that has de-stabilized its main stem drainage. This un-named channel (fed by "Prohibition Meadow") is in particularly poor condition because of a soil compaction and clear-cut study conducted by the Pacific Southwestern Research Station (PSW) in the early 1990's. As such, ground disturbance from mechanized equipment in Tractor Units (T) 112, 113, 114 should be minimized in this subdrainage and harvest methodology should use a "light-on-the-land" approach. Additional mitigations in this subdrainage may be necessary.

Roads

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., relocated and/or reconstructed rolling dips) should be used to mitigate the segments of roads identified as hydrologically connected (Appendix B).

Cumulative Watershed Effects

The baseline or existing condition of most of the subdrainages is below the Lower TOC %. When adding in the Proposed Action or Alternative 3, none exceeded the Upper TOC of 14%, which suggests that a CWE response for most of the project subdrainages is low to unlikely. The only subdrainage that has a moderate adjective rating for CWE response is 504.1004. This is based on the numeric ERA% (13.89%), field evaluation, and professional judgment. Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition in this subdrainage.

Hydrography Summary

The majority of the Whisky Ridge is located in the Willow Creek 5th-field HUC Watershed. The northern part of the Project Area is drained by Browns Creek, which confluences with the SF Willow Creek about a mile west of the project boundary. The SF Willow Creek confluences with the NF

Willow Creek 6 miles south of Bass Lake and eventually flows to the San Joaquin River 0.5 miles downstream of Redinger Lake (please refer to project map 12 for perennial streams and subdrainages). The southern part of the Whisky Ridge Project Area is principally drained by Whisky Creek, which confluences with Willow Creek approximately 6 miles south of the project boundary.

The eastern and southeastern edge of the WHISKY RIDGE area lies in the Shaver-Redinger 5th-Field HUC watershed and is drained via a number of creeks flowing east and south, including Slide Creek, Ross Creek, Fish Creek, Clearwater Creek, and Saginaw Creek. These drainage networks eventually tributary with the San Joaquin River, approximately 5 miles east and three miles south of the Project Area. Table 52 provides a summary of the affected drainages and associated water bodies in the Project Area and Figure 8 shows the 8th-Field subdrainages used for analysis.

Table 52. Stream Mile Summaries for All 8th-Field Subdrainages and Stream Miles Potentially Affected by Project Activities.

Main Stream System(s)	Watershed (5th-Field)	Subdrainages (8th-Field)	Stream miles			
			Perennial	Intermittent/Ephemeral	Ephemeral	Total
Browns Creek Whisky Creek	Willow Creek (1804000611)	504.1002 504.1003 504.1004 504.1005 504.1006 504.1007 504.1053 504.2001 504.2002 504.2004 504.2005 504.2008 504.2010 504.2052 504.2101 504.2102 504.2151	48	142	321	503
Slide Creek Ross Creek Fish Creek Clearwater Creek Saginaw Creek	Shaver-Redinger (1804000601)	523.2001 523.5002 523.6001 523.7002 523.7003 523.7052				

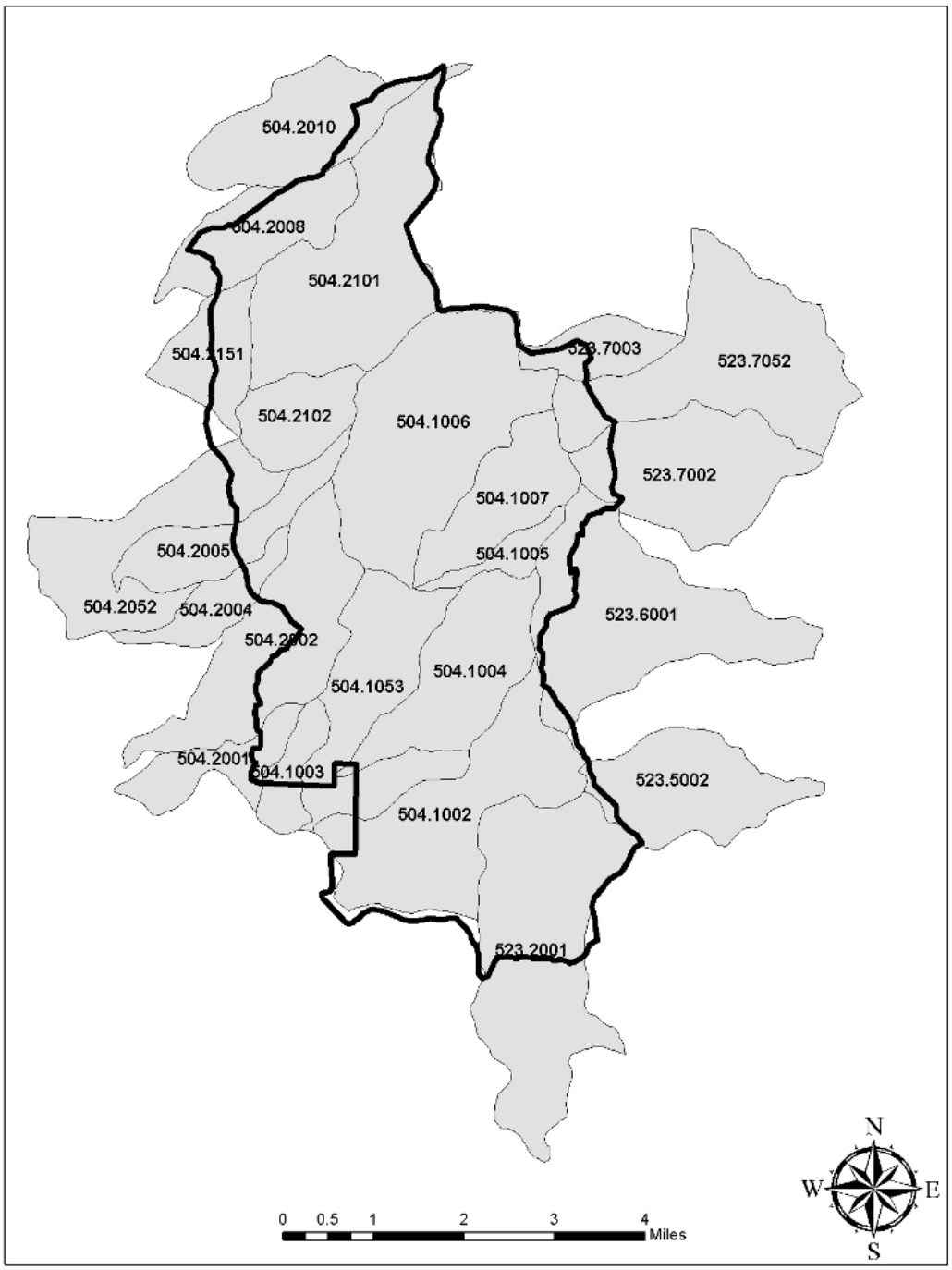


Figure 25. Project 8th-Field subdrainages used for analysis. Number indicates subdrainage identifier (NB: subdrainages 504.2101/504.2102/504.2151 and 504.1007/504.1005 have been combined for Cumulative Watershed Effects analysis).

Climate Change: Future Predictions in Hydrology

Miller et al. (2003) modeled future hydrological changes in California as a function of two contrasting 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:

- 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).
- Projections of future precipitation are much less consistent so that we do not yet know if the Sierra Nevada would be wetter or drier.
- 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.
- 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 would be crucial that annual hydrologic monitoring of the WHISKY RIDGE 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.

Water Quality

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 perennial drainages in the WHISKY RIDGE are not included or proposed for the State's 303(d) list of impaired waters.

Water quality objectives and beneficial uses in the Project Area are managed by the Central Valley Regional Water Quality Control Board (CVRWQCB) under the Central Valley Basin for the San Joaquin and Sacramento River Basins (CVRWQCB, 2009). This plan designates the beneficial uses to be protected, water quality objectives, and an implementation program for achieving objectives. Table 53 shows the designated beneficial uses for major perennial drainage(s) downstream of the Project Area. Water bodies tributary to these major perennial drainages also fall under the same beneficial use criteria (i.e., the "Tributary Rule"). Assuming that the water quality currently meets or exceeds water quality standards, the water is subject to the Anti-degradation Policy, which requires that wherever existing water quality is better than the established objectives, the existing quality would be maintained (CVRWCB, 2009).

Table 53. Designated Beneficial Uses for Major Perennial Drainages Downstream of the Project Area.

Water Bodies	MUN	AGR	POW	REC1	REC2	WARM	COLD	MIGR	SPWN	WILD
San Joaquin River	X	X	X	X	X	X	X	X	X	X

National Pollutant Discharge Elimination System Permits (NPDES)

Forest management and associated road building in the steep rugged terrain of forested mountains has long been recognized as sources of non-point water quality pollution. Non-point pollution is not, by definition, controllable through conventional treatment means. Non-point pollution is controlled by containing the pollutant at its source, thereby precluding delivery to surface water. Sections 208 and 319 of the Federal Clean Water Act, as amended, acknowledge land treatment measures as being an effective means of controlling non-point sources of water pollution and emphasize their development.

In August 2010, the Ninth Circuit Court ruled in NEDC vs. Brown that storm water runoff from logging roads that is collected by and then discharged through a system of ditches, culverts, and

channels to streams comprises a point source of water pollution. Point sources of pollution require National Pollution Discharge Elimination System (NPDES) permits.

At this time, there is uncertainty whether a National Pollution Discharge Elimination System (NPDES) permit would be required for stormwater discharges from logging roads associated with this project. Currently, the Environmental Protection Agency is not requiring agencies to obtain NPDES permits for stormwater discharges from logging roads and on September 4, 2012, the EPA proposed revisions to its Phase I stormwater regulations to clarify that stormwater discharges from logging roads do not constitute stormwater discharges associated with industrial activity and that a NPDES permit is not required (Office of the Federal Register / Vol. 77, No. 171 – pp. 53834-53838). Pending the outcome of this rulemaking and any associated legal challenges, a NPDES could be required at a later date. Based upon existing general permits, implementation of Best Management Practices and monitoring are most-likely to be key components if statewide NPDES permits are required. The Forest Service is already implementing Best Management Practices and conducting monitoring as part of its 1981 Management Agency Agreement (MAA) with the SWRCB, and the Regional Office is currently working with the SWRCB and RWQCBs to revise our BMPs and monitoring program. Forests are directed to continue implementation of our Best Management Practices for all road activities.

Working cooperatively with the California State Water Quality Control Board, the Forest Service developed and documented non-point pollution control measures applicable to National Forest System lands. These measures were termed "Best Management Practices" (BMPs). BMP control measures are designed to accommodate site specific conditions. They are tailor-made to account for the complexity and physical and biological variability of the natural environment. The implementation of BMP is the performance standard against which the success of the Forest Service's non-point pollution water quality management efforts is judged (Appendix G).

The Clean Water Act provided the initial test of effectiveness of the Forest Service non-point pollution control measures where it required the evaluation of the practices by the regulatory agencies (State Board and EPA) and the certification and approval of the practices as the "BEST" measures for control. Another test of BMP effectiveness is the capability to custom fit them to a site-specific condition where non-point pollution potential exists. The Forest Service BMPs are flexible in that they are tailor-made to account for diverse combinations of physical and biological environmental circumstances. A final test of the effectiveness of the Forest Service BMP is their demonstrated ability to protect the beneficial uses of the surface waters in the State.

Best Management Practices, as described in this document have been effective in protecting beneficial uses within other projects on the Sierra National Forest. Where proper implementation has occurred there have not been any substantive adverse impacts to cold water fisheries, habitat conditions, or any of the other beneficial uses of the surface waters (Appendix G). The practices specified herein are expected to be equally effective in maintaining the identified beneficial uses.

Road Survey

An inventory and hydrologic assessment of select segments of the Project Area road system and its impact to watershed function has been conducted for "maintenance level 2" (native surface) roads. Approximately 29 miles native surface roads were surveyed and evaluated for degree of hydrologic connectivity and stream crossing bypass potential between the road network and the drainage network. (Appendix C) details the key problem areas by road, identifies the problem and includes a suggested repair solution for both hydrologic connectivity and stream crossing bypass potential. Many, if not all, of the hydrologic connectivity and stream crossing bypass problems can be

eliminated with proper road maintenance, upgrades to maintenance standards and/or the installation and/or relocation of rolling dips and/or waterbars.

Cumulative Effects

Cumulative watershed effects (CWE) are those that result 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. 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) would be reduced or modified, unless otherwise directed by the signing official.

Table 54 shows the CWE results for the Whisky Ridge for subdrainages affected by project activity. 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 and S-Star). The baseline or existing condition of most of the subdrainages is below the Lower TOC %. When adding in the Proposed Action or Alternative 3, none exceeded the Upper TOC of 14%, which suggests that a CWE response for most of the project subdrainages is low to unlikely. The only subdrainage that has a moderate adjective rating for CWE response is 504.1004. This is based on the numeric ERA% (13.89%), field evaluation, and professional judgment. Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition.

Table 54. Calculated base %ERA and %ERA with the Proposed Action (Alternative 2).

Subdrainage	Subdrainage Acres	Lower %TOC	Range Allotment % ERA	Roads %ERA	Harvest %ERA	No Action (Existing) Baseline %ERA	Proposed Action %ERA (Tractor)	Proposed Action %ERA (Rx Fire)	Total %ERA	CWE Potential*
504.1002	2,094	4	0.3139	1.01	3.75	5.07	4.51	0.58	10.16	Low
504.1003	375	4	0.0799	1.26	0.0	1.34	0.0	0.08	1.42	Unlikely
504.1004	1,442	6	0.5975	0.62	2.85	4.07	8.54	1.28	13.89	Low to Moderate
504.1005/ 504.1007	1,268	4	0.6100	0.81	2.98	4.40	4.56	2.32	11.27	Low
504.1006	2,727	5	0.6028	1.23	0.95	2.78	8.87	1.7	13.35	Low
504.1053	1,647	5	0.3702	1.13	2.54	4.04	7.79	1.06	13.07	Low
504.2001	598	4	0.0	1.47	0.0	1.47	0.0	0.31	1.78	Unlikely
504.2002	1,887	5	0.2881	1.01	2.6	3.9	7.93	0.89	12.72	Low
504.2004	486	5	0.0711	0.79	1.53	2.39	2.42	0.0	4.81	Unlikely
504.2005	832	5	0.1500	0.57	0.02	0.74	3.85	0.32	4.91	Unlikely
504.2008	1,014	4	0.5949	0.63	3.39	4.61	0.98	0.11	5.70	Unlikely
504.2052	1,592	4	0.0097	0.74	1.65	2.40	3.02	0.0	5.42	Unlikely
504.2101/ 504.2102/ 504.2151	3,905	4	0.543	1.07	1.42	3.03	9.37	1.10	13.5	Low
523.2001	2,867	4	0.3275	0.78	1.7	2.81	5.96	0.75	9.52	Low
523.6001	2,520	4	0.6094	1.07	9.44	11.12	1.06	0.12	12.3	Low
523.7002	1,707	4	0.5868	0.78	2.68	4.05	0.0	0.19	4.24	Unlikely
523.7003	517	5	0.6843	1.04	0.04	1.76	1.25	0.19	3.20	Unlikely
523.7052	2,423	4	0.6597	1.3	2.03	3.99	0.0	0.30	4.29	Unlikely

%ERA with the Proposed Action (Alternative 2), which is the greatest level of disturbance. %ERA for Alternative 3 is not shown, but would be less such that the CWE Potential would be Low to Unlikely for all subdrainages.* The adjective qualifier for “CWE Potential” is based on the numeric rating (%ERA), field evaluation using the S-Star method for fine sediment accumulation in pools, and professional judgment.

Environmental Consequences

This analysis covers the 8th-field subdrainages shown in figure 25, which extend outside of the project boundary. The analysis considers the effects to water quality from Alternatives 2 and 3 in relation to the potential for a Cumulative Watershed Effects (CWE) response (i.e., the potential to increase accelerated erosion and sediment input to streams). The CWE analysis includes (but prorates) the past 30 years of ground-disturbing activities in the project 8th-field subdrainages.

Alternative 1 - No Action Alternative

Direct effects associated with not treating fuels in the Project Area would result in a lost opportunity to reduce potential for uncharateristically severe wildfire. 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 catastrophic 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.

Under the No Action Alternative, roads and trails identified as causing resource damage would not be addressed in terms of decommissioning, obliteration, or reconstruction. As such, these roads and trails would continue to erode and degrade, which could have long term adverse effects to watershed function and water quality.

Direct Effects

Direct effects of the No Action Alternative would be continued increase of fuels and potential for catastrophic wildfire, continued degradation of unstable meadow systems, and continued watershed impacts from a highly degraded road and trail network.

Indirect Effects

Indirect Effects of the No Action Alternative would be basin wide increases of fuels and potential for catastrophic 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 4). Essentially the only watershed considered a candidate for CWE response is subdrainage 504.1004. Subdrainage 504.1004 is 1,442 acres and is drained by Gertrude Creek, which is tributary to Whisky Creek. A watershed assessment in 1998 showed that some of the channels (tributaries) to Gertrude Creek were unstable, but that Gertrude Creek itself was essentially stable

with a Pfankuch rating of fair to good. No SCI survey was conducted in this subdrainage, but in 2012 a modified Pfankuch survey was conducted on Gertrude Creek approximately 0.3 miles northwest of Benedict Meadow. The channel was rated a B3 with a numeric score of 78 (i.e., a fair stability rating), thus no demonstrable trend in channel condition is apparent in the Pfankuch analysis between 1998 and 2012, but some riparian vegetation recovery has occurred since the rain-on-snow flood of 1997 (Strand, personal communication, 2012).

CWE baseline analysis for 504.1004 showed the ERA % to be at 4.07%, under the lower threshold of concern of 6%. The Proposed Action could potentially elevate the ERA% value to 13.89%. A field evaluation of pool function (i.e., filling of pools by fine sediment – a measure of CWE response) was conducted on Gertrude Creek up and downstream of the Forest Service Road 7S07 crossing. Qualitative observations of pools downstream of the 7S07 culvert showed a high degree of fine sediment filling and deposition as mid-channel bars. The channel banks were noted to be fairly well vegetated with a BEHI rating of moderate. S-Star measurements in three pools (below the 7S07 culvert) averaged to 27% total volume, 7% over the Desired Condition for the soil type (i.e., Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 35 percent slopes). The channel banks above the 7S07 culvert showed more signs of instability with a higher degree of incision (down-cutting) with steeper bank angles (90-degrees), which are more susceptible to failure during bankfull events. S-Star measurements in three pools (above the 7S07 culvert) averaged to 54% total volume, 34% over the Desired Condition for the soil type (Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 3 5 percent slopes).

Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition.

Baseline CWE (ERA %) for this subdrainage is high at 13.89%, 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

Limited or no direct vegetation treatment would occur in SMZ's (Figure 25). 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 G) 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 G).

The greatest potential for the Proposed Action (Alternative 2) to adversely affect watershed function and water quality is by increasing hydrologic connectivity of streams 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 (Appendix B). 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 G) would further ensure that hydrologic connectivity in streams, water quality, and special aquatic features are not adversely affected by the Proposed Action.

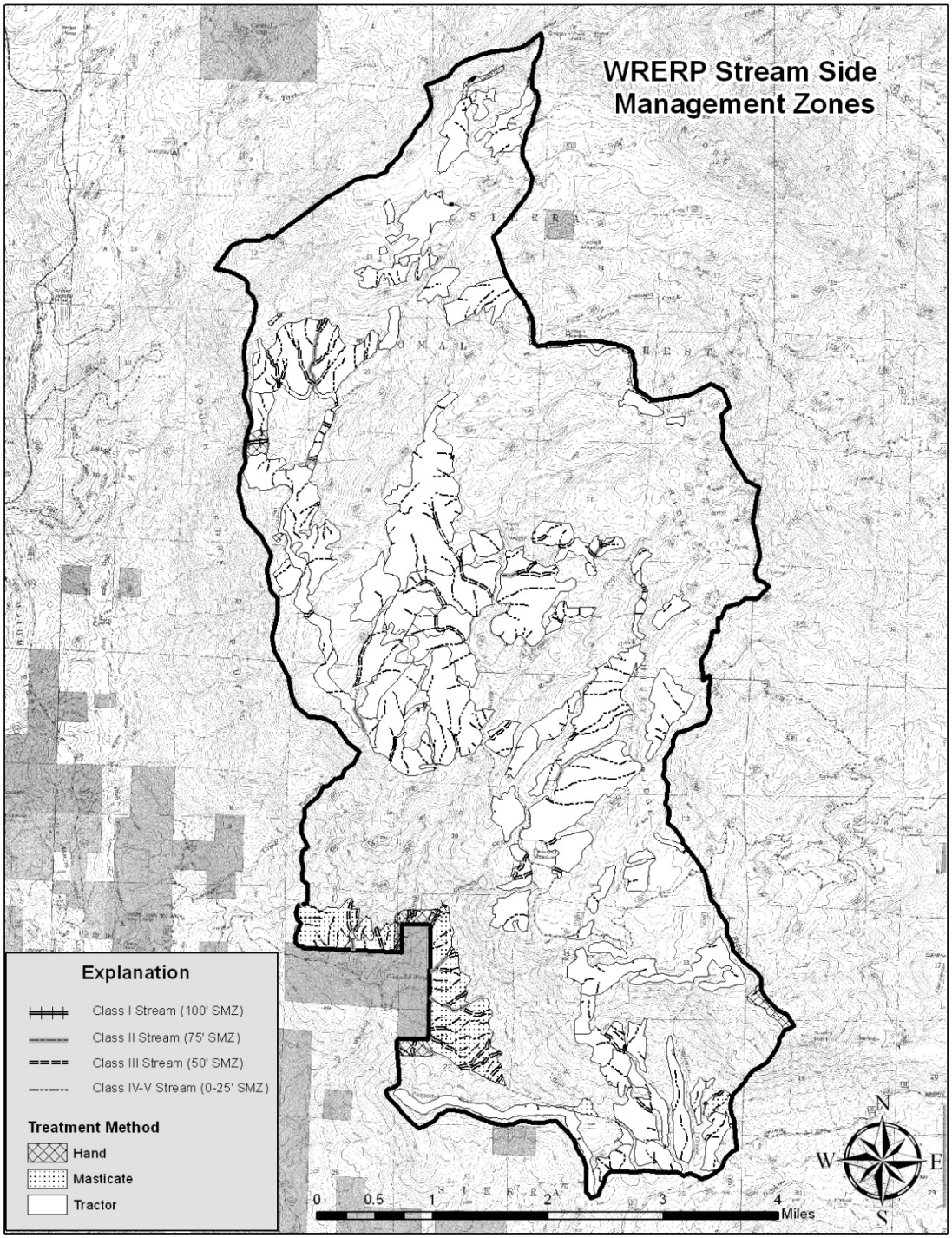


Figure 26. SMZ map of the Whisky Ridge Area. Lines represent different stream orders, which are offered a protection buffer based on designated class. Vegetation treatment units have been designed to avoid class I perennial streams where possible

Common to All Subdrainages

The existing road system 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 and water quality degradation (Appendix C). As part of the Timber Sale contract, all the roads to be used for project activities would be brought up to a maintenance level 3 standard (Appendix G, BMP 2.4). 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 and water quality, 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 and water quality (e.g., accelerated erosion and sedimentation). Any soil displacement, compaction, or change in ground cover would cause a direct effect on watershed condition, water quality, 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 26 displays SMZ's assigned to streams in the Whisky Ridge area. Streamcourses are to be protected under C6.5 of the Timber Sale Contract. Any additional streams identified during operations will receive protection appropriate for the stream and the treatment.

Subdrainage 504.1002 suffered discrete (non-cumulative) disturbance as a result of a soil compaction and clear-cut study conducted by the Pacific Southwestern Research Station (PSW) in the early 1990's. As a result, the main stem stream channel in this subdrainage has been severely degraded. A Pfankuch survey was conducted approximately 0.75 miles downstream of Meadow 504M17 ("Prohibition Meadow") and rated a G4 with a numeric score of 125 (i.e., a poor stability rating). Although this subdrainage is below the CWE threshold of 14%, ground disturbance from tractor thinning and piling could exacerbate the unstable condition of the channel. As such, ground disturbance from mechanized equipment in Tractor Units (T) 112, 113, 114 should be minimized in this subdrainage and harvest methodology should use a "light-on-the-land" approach.

The proposed meadow restoration activity (including offsite water development for livestock) could cause a short term increase in turbidity immediately downstream of the project location, but in the long term would reduce the amount of erosion and impacts on water quality for downstream beneficial use, and thus is a proactive protective measure to watershed resources and forest health. The restoration, decommissioning, and/or maintenance of Project Area OHV routes and systems roads would also improve watershed condition by reducing hydrologic connectivity , water quality impacts from sedimentation, and move the subdrainages toward a more stable and resilient condition.

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 G) 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 catastrophic wildfire were to occur.

Cumulative Effects

Table 54 shows the CWE results for the Whisky Ridge for subdrainages affected by project activity. 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 and S-Star). The baseline or existing condition of most of the subdrainages is below the Lower TOC %. When adding in the Proposed Action, none exceeded the Upper TOC of 14%, which suggests that a CWE response (i.e., accelerated erosion and sedimentation) for most of the project subdrainages is low to unlikely. The only subdrainage that has a moderate adjective rating for CWE response is 504.1004. Subdrainage 504.1004 is 1,442 acres and is drained by Gertrude Creek, which is tributary to Whisky Creek. A watershed assessment in 1998 showed that some of the channels (tributaries) to Gertrude Creek were unstable, but that Gertrude Creek itself was essentially stable with a Pfankuch rating of fair to good. No SCI survey was conducted in this subdrainage, but in 2012 a modified Pfankuch survey was conducted on Gertrude Creek approximately 0.3 miles northwest of Benedict Meadow. The channel was rated a B3 with a numeric score of 78 (i.e., a fair stability rating), thus no demonstrable trend in channel condition is apparent in the Pfankuch analysis between 1998 and 2012, but some riparian vegetation recovery has occurred since the rain-on-snow flood of 1997 (Strand, personal communication, 2012).

CWE baseline analysis for 504.1004 showed the ERA % to be at 4.07%, under the lower threshold of concern of 6%. The Proposed Action could potentially elevate the ERA% value to 13.89%. A field evaluation of pool function (i.e., filling of pools by fine sediment – a measure of CWE response) was conducted on Gertrude Creek up and downstream of the Forest Service Road 7S07 crossing. Qualitative observations of pools downstream of the 7S07 culvert showed a high degree of fine sediment filling and deposition as mid-channel bars. The channel banks were noted to be fairly well vegetated with a BEHI (bank stability) rating of moderate. S-Star measurements in three pools (below the 7S07 culvert) averaged to 27% total volume, 7% over the Desired Condition for the soil type (i.e., Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 35 percent slopes). The channel banks above the 7S07 culvert showed more signs of instability with a higher degree of incision (down-cutting) with steeper bank angles (90-degrees), which are more susceptible to failure during bankfull events. S-Star measurements in three pools (above the 7S07 culvert) averaged to 54% total volume, 34% over the Desired Condition for the soil type (Chaix-Chawanakee Families-Rock Outcrop complex, 15 to 3 5 percent slopes).

Channel observations and S-Star measurements suggest an unstable condition for this subdrainage and a high probability that it has (or is) experiencing a Cumulative Watershed Effects response. Based on these observations and measurements (and considering project activities would be kept below the upper threshold of concern 14% ERA), there is a low to moderate chance of exacerbating the CWE condition.

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

Treatment areas would remain the same as in Alternative 2; however, 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 management objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only slightly address stand densityand 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 precommercial 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 generally be completed within the first two to seven years of implementation as funding becomes available. 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. Road maintenance and reconstruction would be much less likely to be accomplished given limited appropriated funds for this work. All other proposed restoration treatment activities would be implemented as described in Alternative 2.

Direct Effects

Direct effects are those occurring at the same time and place as the triggering action. The direct effects would be less than those described under the Proposed Action (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.

The proposed meadow restoration activity (including offsite water development for livestock) and the restoration and maintenance of Project Area OHV routes and systems roads would be the same as described under the Proposed Action (Alternative 2).

Indirect Effects

Indirect effects are those that occur at a later time or at a distance from the triggering action. Like Alternative 2, 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 G) would avoid or minimize potential increases in sediment loads to streams during project implementation such that impacts to aquatic habitats and water quality are not expected. Over the longer term, potential adverse effects on water and soils from implementing the Alternative 3 are expected to be minor, and substantially less than if a catastrophic wildfire were to occur.

Cumulative Effects

Cumulative effects would be less than those described under the Proposed Action (Alternative 2) and similar to the No Action Alternative, 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.

Baseline CWE (ERA %) for subdrainage 504.1004 is high at 13.89%, which resulted from past timber harvest activity. With Alternative 3, no tractor related ground disturbance would occur, which, (given sufficient time), would allow the subdrainage to stabilize and become more resilient to future watershed stressors.

Riparian Conservation Objectives Consistency Analysis

A consistency review of the applicable Riparian Conservation Objective (RCO) Standards and Guides was conducted to ensure that project activities adhered to the 2004 Sierra Nevada Forest Plan Amendment. The Proposed Action (Alternative 2) and Alternative 3 are consistent with the Riparian Conservation Objectives Standard and Guides. 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 Standard and Guide 100 and 101. RCO Standard and Guide 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 Standard and Guide 111 would not be consistent under Alterative 1, and increase the risk of catastrophic wildfire in riparian areas. All other applicable RCO Standards and Guides are consistent with all Alternatives. The complete RCO consistency analysis can be found in the project file.

Lands/Special Uses

The direct, indirect and cumulative effects below are summarized from the Whisky Ridge Project Lands Report (Herrera H., 2012).

Affected Environment

There are four land-type special uses authorized within the Project Area including: 2 special use permits (SUP's) for the use of a water transmission pipeline less than 12" in diameter, a SUP for 37 apiary sites (9 within the project boundary), and a SUP adjacent to the Project Area for underground fiber optic cables.

Methodology

The method to analyze the effects of the three proposed alternatives to lands special uses would be to determine if degradation of public resources (i.e. water), or quality, tied to the authorized uses would occur and if the level of degradation of the public resources or disturbance to the authorized use's infrastructure, or service, prevents the permit holder, or customer, from receiving the service (i.e. land use, utility service) for which the authorized use is intended. The level of degradation and disturbance would be measured, respectively, by determining:

1. Would the quality of the resource that is tied to the authorized use be negatively impacted (e.g. decreased water quality)?
2. Would the authorized use be able to continue to provide its service (e.g. waterline providing clean water for domestic use?)

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 activities with existing decisions or special use permits that would not change if this alternative was selected. If no action is taken to address the purpose and need or project objectives no short term disturbance to the lands special uses resources would take place.

Special-use permit holders would continue to perform hazardous fuels reduction 30' around the facilities they operate as required by the terms and conditions of the permit. Under consultation with the Forest Service, permit holders may be able to extend fire clearances around their facilities to meet the 100 feet requirement of the State of California. There would be little protection from moderate to high intensity fires.

The continuation of natural fuels build-up would increase the fire risk to permit holder improvements and public resources. Economic use of the forest would potentially be lost if the opportunity to provide land use opportunities to potential permit holders is diminished. A wildfire could result in a temporary shutdown of special uses (water lines, fiber optic cables, roads, etc.) and closure of roads for the health and safety of the public.

Alternative 2 – Proposed Action

Direct Effects

Approximately 1520' of water transmission lines, 9 apiary sites, and 1.21 miles of fiber optic lines may be affected by the Proposed Action. Equipment (e.g. feller bunchers and skidders) may be present on roads and block a portion of the roadway used to access the special use improvements and apiary sites may be needed to be used as landings. There would be an increase in traffic on forest roads from project vehicles and equipment. Smoke from prescribed fires would occur in the area.

Areas with fuel removal activities, prescribed burning, or other fuel treatments may be temporarily closed to permit holders. These actions would be short term in duration. Long-term maintenance of the Project Area would result in similar effects to the special uses sites during the period of maintenance activities.

Indirect and Cumulative Effects

Ecological restoration activities would reduce the fire risk to special use sites and the permit holders within and adjacent to the Project Area. Decreased water quality affecting waterline authorized uses may occur if sedimentation increases. However, best management practices and design criteria to minimize the effects to water quality would be applied. There are no anticipated cumulative effects to lands special uses.

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

Direct, Indirect, and Cumulative Effects

The effects of this alternative would be identical to those of Alternative 2.

Comparison of Alternatives

Under the No Action alternative, current management plans would continue to guide management of the Project Area. No ecological restoration activities would occur therefore the fire risk to special use infrastructure and their resources would continue to increase. A wildfire could result in a temporary shutdown of special uses (water lines, fiber optic cables, roads, etc.) and closure of roads for the health and safety of the public. The Proposed Action alternative and Alternative Three would reduce vegetation and modify the remaining vegetation structure therefore decreasing fire risk and associated disturbances (i.e. insect attack) to special use infrastructure and their associated natural resources.

Range Management

The direct, indirect and cumulative effects to the Range Management are summarized from the Range Specialist Report for the Whisky Ridge Project (Smith A., 2012).

Affected Environment

Existing Condition

The Project Area boundary encompasses a pocket of the Castle Peak Allotment, the southernmost extent of the Central Camp Allotment and the westernmost portion of the Haskell Allotment (Tables 55-59 and Figure 27).

Table 55. Summary of Grazing Allotments the Overlap the Project Area.

Allotment Name	Total Allotment Acres	Acres within Project Area area
Castle Peak	11,897	45
Central Camp	25,893	540
Haskell	32,332	14,430

Summary of Grazing History

Grazing by domestic livestock has occurred in the Project Area area for over 100 years since the late 1880s. 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 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.

In the Castle Peak Allotment use was heaving in the 1920s, decreased through the drought years of the 1930s, increased greatly during the 1940s and leveled off in the 1950s. In 1955 stocking dropped to about 350 heard and remained at this level until further reductions in the 1960s when there were five permittees using the allotment: R.L. De Masters, S.N. De Masters, Dan Harris, C. Kimbler Estate and Mike Riley. In the 1970s this unit was split into two allotments into what is now the Long Ridge and Castle Peak allotments. Richard Jensen was the only permittee grazing Castle Peak during this time with approximately 220 head. The allotment later changed hands and was used by John Vincent, Sr. and subsequently the Sequoia Ranch, LLC of Three Rivers with up to 300 head.

In the Central Camp allotment, grazing use was also heavy in the 1920s, decreased during the drought years of the 1930s, increased greatly during the war years, decreased slightly from 1948-52 and then remained constant through the 1960s, when permittees at that time, Mrs. Tom Jones and the Clarence

Kimbler Estate, grazed 150 cow/calf pair total from June 16 through October 15. The permits later changed hands and Jim McDougald and Ben Kimbler (Clarence Kimbler's son) grazed the allotment and the allotment was grazed by 167 cow/calf pair. In the mid-1990s, the Kimbler permit was later waived to Gary and Tawny Pamplin. During the winter of 2007, the McDougald family voluntarily declined to continue stocking the Francis Junction Unit of this allotment. This resulted in a net decrease of 66 cow/calf pair in the allotment. This reduction has created an opportunity for the Pamlins to stock both units (Francis Junction and Gaggs Camp units) in the allotment with an overall reduced stocking rate from 167 cow/calf pair to 101 cow/calf pair thus eliminating the various problems associated with administering a common allotment (e.g. associated problems with drift between the two units, no practical way to physically separate the units due to terrain, distance and added operating expense of extensive fencing).

In the Haskell allotment, grazing use was heavy in the 1920s, decreased during the drought years of the 1930s, increased greatly during the war years, and then began to decrease in the late 1940s early 1950s. Reported use in 1924 was 450 head for a 4 month season. In the 1930s this figure was down to 260 head for 4 months. In 1939 the figure jumped to 616 head. Beginning in 1948 stocking dropped to 470 head and remained around this level until 1952 when it declined to 325 head. Use remained at this level through the 1960s and the permittees at that time were R.L. DeMasters, S.N. DeMasters and Dan Harris. Dick Jensen ran cattle here prior to John Vincent Sr. obtaining the permit and subsequently the Sequoia Ranch, LLC, which had the permit from 2002-2011 under the current numbers and season which authorizes 205 cow/calf pair to graze from July 1 through September 30 (e.g. 3 month season).

Summary of Current Use

Castle Peak Allotment

This annual grassland allotment is adjacent to Redinger Lake and is grazed during the spring months from March 1 through June 30 (Figure 27 and Table 56). Only a fraction of the Castle Peak Allotment occurs within the Project Area and this area receives only incidental use. No montane meadows occur within this portion of the allotment or Project Area , however, the allotment was rated in satisfactory rangeland condition with good vegetation and soil condition overall when analyzed in compliance with the National Environmental Policy Act (NEPA) in 2009. The decision was made at that time to continue to authorize cattle grazing in this allotment, therefore, the authorization of cattle grazing within the project is not part of this analysis (The project file is available at the Bass Lake Ranger District).

Table 56. Current Permitted Numbers and Season of Use for Castle Peak Allotment.

Livestock			Period of Use		Head Months (Animal Months)	Animal Unit Months
NUMBER	KIND	CLASS	FROM	TO		
260	cattle	cow/calf	3/1	6/30	355	469

Central Camp Allotment

Only the southernmost portion of the Central Camp Allotment occurs within the Project Areaand these specific areas do not receive primary use by cattle since no montane meadows occur within this portion of the Project Area (Figure 27). The allotment was rated in satisfactory condition when analyzed in compliance with the National Environmental Policy Act (NEPA) in 2008. The decision

was made at that time to continue to authorize cattle grazing in this allotment since it was meeting desired conditions, therefore, the authorization of cattle grazing within the project is not part of this analysis (The project file is available at the Bass Lake Ranger District).

Table 57. Current Permitted Numbers and Season of Use for Castle Peak 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	620	818

Haskell Allotment

The majority of cattle use in the Project Areais authorized within the Haskell Allotment (Figure 27). Primary use by livestock is in the montane meadows where the forage is most abundant and in forested areas where understory forage is found. Cattle are trailed up to the allotment from the Castle Peak Allotment. The Haskell Allotment is a summer range allotment currently used under permit by the Three Rivers Sequoia Ranch, LLC of Three Rivers, CA and managed by John Vincent Jr., Ranch Manager. The allotment is grazed by mother cows and their calves (cow/calf pairs) from July 1 through September 30 by 205 cow/calf pair (Table 58).

Table 58. Current Permitted Numbers and Season of Use for Haskell Allotment

Livestock			Period of Use		Head Months (Animal Months)	Animal Unit Months
NUMBER	**KIND**	**CLASS**	**FROM**	**TO**		
205	cattle	cow/calf	7/1	9/30	1043	1377

The grazing system in the Haskell Allotment is generally considered a deferred season of use with lower elevation meadows used initially then higher elevations grazed as the season and range readiness of soils and vegetation progresses. 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 cattle are gathered by mid-September, with straggler cattle sometimes remaining into early October. Livestock are driven from the Castle Peak allotment up into the Cold Springs Unit of the Haskell Allotment. The lower elevation meadows are used early in the season while deferring use in the mid (Whisky Creek Unit) and higher elevation meadows (Browns Meadow Unit) until later in the season. Cattle are gathered into Peckinpah Meadow, China Meadow and Bucks Meadow and then driven down to the Timberline Corral adjacent to Saginaw Creek and the Mammoth Pool Road (FR81) in early September and trucked home to Three Rivers. Some of the stock may be trailed or trucked to the ranch in North Fork, CA.

The Haskell Allotment was analyzed in compliance with the National Environmental Policy Act (NEPA) in 2007 and the decision was made to continue to authorize cattle grazing in this allotment, therefore, the authorization of cattle grazing within the project is not part of this analysis. However, this analysis does focus on the current condition of montane meadows within the Project Area and the effects of the proposed restoration on meadow ecological status. Meadow restoration is specifically proposed in eleven meadows within the Project Area (Figure 27 & Table 55).

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, and 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. The permittee uses riding, herding and salting to achieve this objective.

The Haskell Allotment is 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, which include Peckinpah Meadow (#504M29 and #504M30), Buck Meadow (#504M312) and China Meadow (#504M41) (Figure 1) 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 (up to a week) before they are trailed and/or trucked off the allotment. A portion of the Timberline Stock Driveway is also located within the Project Area (Figure 27).

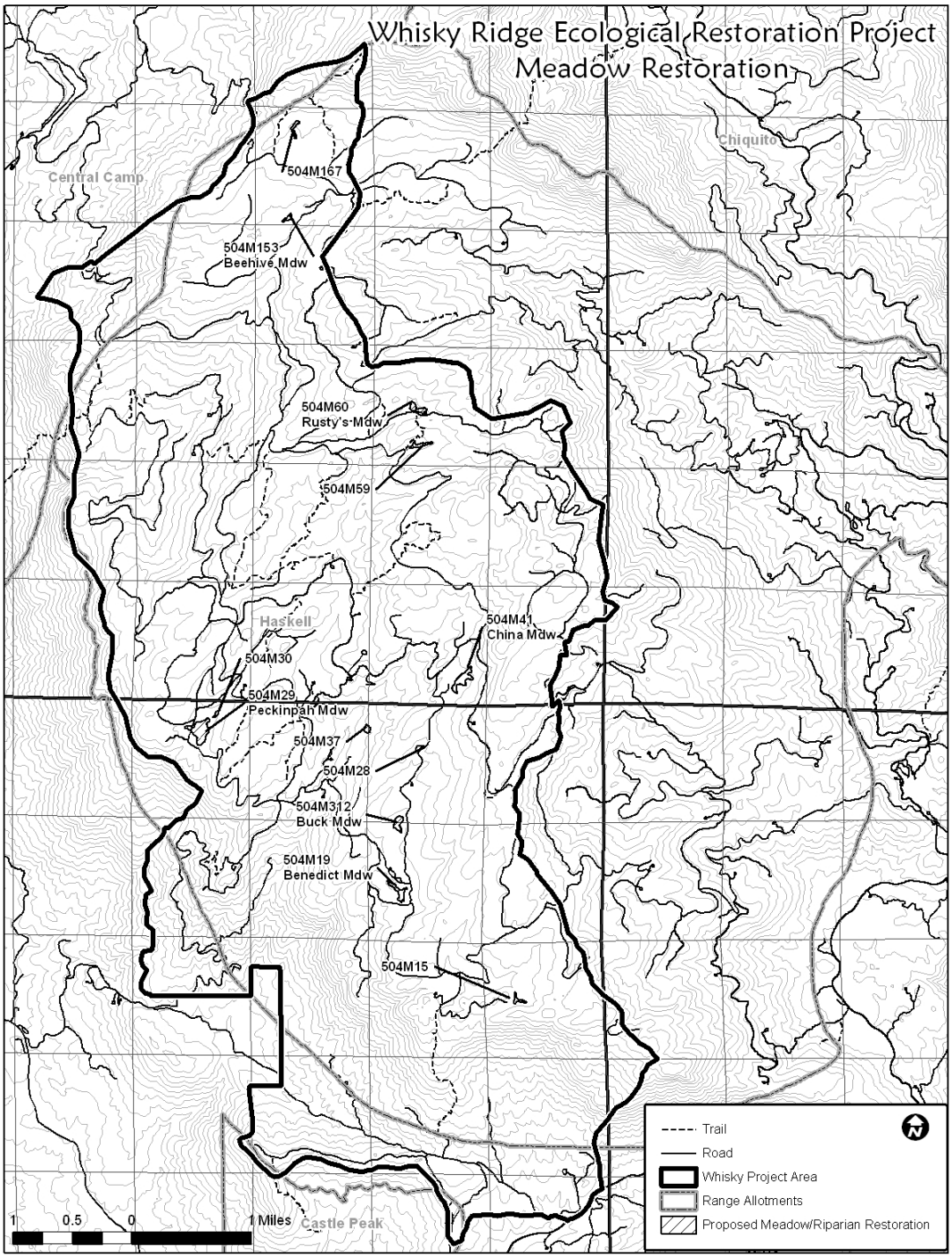


Figure 27. Allotment boundaries and meadows with proposed restoration within the Project Area

Desired Conditions and Applicable Standards and Guidelines

These land allocations incorporate standards and guidelines and desired conditions designed to achieve and/or maintain satisfactory rangeland conditions as outlined in the Sierra National Forest Land and Resource Management Plan (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) (Tables 59 and 60).

The Whisky Ridge Ecological Restoration Project is consistent with the suggested management strategies outlined in the Addendum to the 1995 Willow Creek Landscape Analysis (developed by the Willow Creek Planning Collaborative) by proposing mechanical thinning and prescribed burning vegetation treatments that would also promote and cultivate native hillside grass (upland herbaceous vegetation) and biodiversity.

Additionally, the project is in compliance with regulatory direction and policy related to goals and objectives maintaining and restoring rangelands within the Project Area to desired conditions. Potential impacts would be minimized through the adherence of Forest Plan standards and guidelines including the following applicable standards and guidelines and desired conditions for grazing and rangeland management:

1. To protect hardwood regeneration in grazing allotments, allow livestock browse on no more than 20 percent of annual growth of hardwood seedlings and advanced regeneration. Modify grazing plans if hardwood regeneration and recruitment needs are not being met (2004 SNFPA ROD S&G #50, Page 55)
2. Prevent disturbance to streambanks and natural lake and pond shorelines caused by resource activities (for example, livestock, off-highway vehicles, and dispersed recreation) from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines. Disturbance includes bank sloughing, chiseling, trampling, and other means of exposing bare soil or cutting plant roots. This standard does not apply to developed recreation sites, sites authorized under Special Use Permits and designated off-highway vehicle routes (2004 SNFPA ROD S&G #103)
3. Assess the hydrologic function of meadow habitats and other special aquatic features during range management analysis. Ensure that characteristics of special 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)
4. Locate new facilities for gathering livestock and pack stock outside of meadows and riparian conservation areas. During project-level planning, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities located in riparian conservation areas with riparian conservation objectives (2004 SNFPA ROD S&G #119)
5. Maintain stock driveways and travelways in usable condition (LRMP Page 4-18; 4.5.2.7 #9
6. Limit browsing to no more than 20 percent of the annual leader growth of mature riparian shrubs and no more than 20 percent of individual seedlings. Remove livestock from any area of an allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation to browsing woody riparian vegetation (2004 SNFPA ROD S&G #121)

7. Maintain soil productivity by implementing Forest Service Regional Soil Standards and Guidelines (FSH 2509.18): limit soil disturbance that can lead to soil loss that would exceed the rate of soil formation, maintain at least 50% soil cover and maintain soil porosity to at least 90% of total porosity found under natural conditions
8. Implement the following Pacific Southwest Region BMPs (8-1, 8-2 & 8-3) applicable to grazing. Pacific Southwest Region Best Management Practices applicable to grazing (USDA 2000, pages 143-147) would be met through Allotment Management Plans and administration of the permits according to the Forest Service Handbook (FSH) 2209.13, Chapter 10 Performing the interdisciplinary environmental analysis for the NEPA decisions, updating the Allotment Management Plans, and issuing Annual Operating Instructions to the permittees. Administration of the grazing permits, including range readiness evaluations, stock checks for numbers and period of use, and monitoring of standards and guidelines. Implement streambank stabilization, seeding / planting, or water source development projects as determined necessary, when problems cannot be best addressed through BMP 8-2.
9. 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.
10. 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.
11. Prevent disturbance to stream banks and natural lake and pond shorelines caused by resource activities (for example, livestock, off-highway vehicles, and dispersed recreation) from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines (a minimum of 80% stream bank stability for these allotments is maintained)
12. 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).

Table 59. 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	Allow browse on no more than 20% of current annual leader growth and	Allow browse on no more than 10% of current annual leader growth and advanced

	seedlings/regeneration)	advanced regeneration	regeneration
Annual Grasslands & Oak Woodlands	Annual Grasslands & Oak Woodlands/Uplands	Minimum of 60 percent cover	Minimum of 60 percent cover

Table 60. 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. 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 LRMP Amendment: 2.2.4, Page 2-11). 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). 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). 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). 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). 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). 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).

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 Areaare 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 meadows within the Project Areahave long term range condition and trend monitoring plots where long term meadow ecological condition and trend data has been collected and analyzed as part of this analysis (Table 61). At these monitoring sites, vegetation, soil and water table 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 (trend) 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 condition classes of upper moderate to high. Vegetation trends are upward and overall trends are stable.

Table 61. Summary of Meadow Condition Data.

Meadow Name (plot location)	Meadow Type	Vegetation Condition Class (ecological status)	Overall Condition Class (ecological status)	Vegetation Trend	Overall Trend	Meets Desired Conditions?	Moving Towards Desired Conditions?
Benedict Meadow (#504M19)	wet meadow	high	high	upward	stable	Yes	Yes
Lower Browns Meadow (#504M162)	moist meadow	high	upper moderate	upward	stable	Yes	Yes
Browns Meadow (#504M164)	moist meadow	upper moderate	upper moderate	*Baseline data only.*	*Baseline data only.*	No	*Plot would be re-read in 2017*

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 six of meadows proposed for restoration within the Project Area(Table 59).

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 adjacent forested areas (units) is part of this proposal and may in some cases creep into the meadows if conditions allow.

The proposal to develop off-site livestock water is designed to limit cattle impacts to riparian areas and improve overall livestock distribution (Table 62). Two of the proposed off-site livestock water developments are located within livestock gathering fields at Peckinpah Meadow and China Meadow, which are fenced pastures that are used at the beginning or later part of the authorized grazing season to gather, rest and mother-up cows with their calves prior to trailing the stock. The remaining two

proposed off-site livestock water developments are located adjacent to key area meadows at the northern (Beehive Meadow #504M153) and southern (Benedict Meadow #504M19) portions of the allotment.

Table 62. Summary of Proposed Meadow/Riparian Restoration.

Meadow Number/Name	Identified in Conifer Encroachment Study?	Acres of Encroachment	Acres of Thinning in Meadow Buffer Treatment (0-100 feet from meadow boundary)	Acres of Physical/Structural Meadow Stabilization	Acres of enhancement Rawson's flaming trumpet habitat?	Off-Site Livestock Water Development Proposed?
504M15	Yes	0.82	7.2	0.0	0.0	No
504M19/Benedict Meadow	Yes	0.56	8.6	0.0	0.1	Yes
504M28	No	ND	3.0	1.0	0.0	No
504M29/Peckinpah Meadow	Yes	1.27	12.5	0.0	0.1	Yes
504M37	Yes	0.37	.9	0.0	0.1	No
504M41/China Meadow	No	ND	7.8	1.5	0.1	Yes
504M59	Yes	ND	5.9	3.0	0.1	No
504M60/Rusty's Meadow	No	ND	6.5	3.75	0.0	No
504M153/Beehive Meadow	Yes	1.73	7.4	2.65	0.0	Yes
504M167	Yes	0.77	7.1	0.0	0.0	No
504M312/Buck Meadow	No	ND	5.5	4.0	0.1	No
	Totals	**6**	**72**	**16**	**0.6**	**4**

Beehive Meadow (Meadow #504M153)

Beehive Meadow is a key area meadow used for annual utilization monitoring . This meadow has a Watershed Improvement Needs (WIN) Site # 55424 with a large headcut/scour pool and gully system that would be stabilized under the Whisky Ridge ERP Proposed Action. Impacts from livestock trailing has further exacerbated bank stability and created additional knick points along the channel, as cattle have been accessing the "water hole" created by this scour pool in this location. There is a need for restoration at this site including a need to develop off-site water at this location to provide water in a more suitable location away from the sensitive riparian area. Additionally, the meadow restoration and stabilization efforts would require temporarily excluding use of this area to livestock with fencing.

Benedict Meadow (Meadow #504M19)

Benedict Meadow is a key area used for annual utilization and long term range condition and trend monitoring. During the 2007 range analysis and subsequent NEPA decision for the Haskell Allotment, the IDT noted concerns with cattle impacts to the riparian channel (tributary to Gertrude Creek) adjacent to Benedict Meadow. This tributary to Gertrude Creek located in Benedict Meadow

was rated functional-at-risk (FAR) with an upward trend in 2007. The stream appears to be forming a new floodplain in the incised gully, but riparian vegetation is not a diverse as desired. Much of the streamside vegetation is not riparian species. In the 80 meters immediately downstream of the meadow, cover is not establishing, possibly due to livestock disturbance. Historically, cattle concentrated in the Benedict Meadow area leading to range deterioration and contributed to the "drying out" of the lower third of the meadow. Additionally, the channel was affected by a rain-on-snow event in 1997 that caused excessive sediment from the upstream road system to be brought into the stream. Two repaired WIN sites (headcuts) are located in this reach, and both appear to be stable, however there are some impacts from cattle crossing in this location that are impacting the site and this area would benefit from the development of an off channel (off-site) water source.

Benedict Meadow is a wet meadow in high ecological status with high vegetation and overall condition and has low bare soil (1%), high plant cover, high percentage of late seral plant species (54%), is in an upward vegetation trend and stable overall trend and this meadow is considered to be in satisfactory range condition and is meeting desired conditions for rangelands, based on data collected in 2003 and 2008 (plot would be re-read again in 2013). The meadow and surrounding riparian zone but would benefit from the prevention of the above noted cattle impacts with the development of an off-site livestock water (e.g. gravity fed water to trough located away from riparian area in upland) to minimize impacts to the channel by drawing cattle away from the channel for watering.

Browns Meadow *(#504M162)*

Although this meadow is not a key area, meadow condition data was collected to determine effectiveness of conifer encroachment removal, physical stabilization and off-site water for livestock being implemented under a previous planning decision (i.e. PG&E Crane Valley Dam Wetland Mitigation Project). This meadow has a long term condition and trend plot that was established in 2012. Browns Meadow is a moist meadow in upper moderate ecological status with both vegetation and overall condition ratings of upper moderate (Table 3). Rooting depth indicates low plant vigor for this meadow. The plot shows low bare soil (1%) so high plant cover is evident with a moderate percentage of late seral plant species (34%). Trend data is not available as this plot was recently established, however, the plot data shows that this meadow is not in satisfactory range condition and is not yet meeting SNF desired conditions for rangelands based on the current species composition and relative percentage of late seral plant species present within the plot (see Desired Conditions and Applicable Standards and Guidelines Section).

Lower Browns Meadow *(#504M164)*

This meadow is a key area meadow used for monitoring annual forage utilization and long term range condition and trend. This moist meadow has a long term condition and trend plot that was established in 2003 and re-read in 2008 and would be re-read in 2013 (e.g. re-read on 5 year intervals). The plot shows the meadow in upper moderate ecological status with high vegetation condition and upper moderate overall condition ratings (Table 57). Rooting depth indicates moderate plant vigor. The plot shows low bare soil (5%) so high plant cover (95%) is evident with a high percentage of late seral plant species (59%) and the vegetation condition trend is upward and overall condition trend is stable. This meadow is considered to be in satisfactory range condition and is meeting desired conditions for rangelands.

Buck's Meadow *(#504M312)*

Buck's Meadow is a holding field used for gathering livestock an is not a key area or monitoring location.

China Meadow *(#504M41)*

China Meadow is a fenced holding field which is used at the end of the grazing season to gather cattle and "mother-up" cows with their calves prior to being driven down the stock drive to the Timberline Corrals located within the Castle Peak Allotment. A headcut (WIN Site 55329) at the northeastern arm of the meadow is eroding and the headcut and surrounding riparian area and fen habitat are being further impacted by cattle going to water at this location. This site would be stabilized under the Whisky Ridge ERP Proposed Action.

Rusty's Meadow *(#504M60)*

Rusty's Meadow is a key area meadow used for annual utilization monitoring although there is no long term monitoring plot in this key area. A portion of the meadow has fen habitat.

Peckinpah Meadow (#504M29 and #504M30)

Peckinpah Meadow would benefit from an off-site water development. Peckinpah Meadow is a fenced holding field and is used early in the season to mother up cows and calves as they are driven up the stock drive from the Timberline Corrals in Castle Peak Allotment and the stock are held overnight and then dispersed out from there. The cattle are subsequently gathered into Peckinpah in early September and driven back down the stock drive to the Timberline Corrals were they are shipped. The off-site water development proposed would minimize impacts by drawing cattle away from sensitive riparian areas while providing a more reliable water source for the fall gather.

Meadows 504M15, 504M28, 504M37, 504M59 and 504M167

These meadows are not considered key areas and no livestock use or condition monitoring data is available. Conifer encroachment removal, meadow buffer treatments and/or physical stabilization is proposed for these meadows (Table 56).

Timberline Stock Drive (Route Numbers 23E297 and 23E272)

The stock drive, which is listed on the MVUM as a Seasonal and Special Vehicle Designation Route Number 23E297 (and Route Number 23E272 not listed on MVUM , is a seasonal use trail open to motorcycles, with seasonal designation from August 15 – December 1). This portion of the stock drive (NFS roads primarily make up rest of stock drive starts at the Timberline Corral and goes north toward Mormon Hill and then up towards Benedict Meadow is within the Project Area. The stock drive is rather steep and is 1.09 miles in length. Routine stock drive maintenance would be accomplished under the existing authorization under the Term Grazing Permit.

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.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under the No Action Alternative, process (prescribed fire), structural (forest thinning) and additional restoration proposals listed in the proposed action in Chapter 2 such as: maintenance on approximately 65 miles and reconstruction on approximately 33 miles of forest system roads, restoration of unauthorized OHV routes, improvements to Whisky Falls Campground and aquatic wildlife, sensitive plant and meadow/riparian habitat, stream channel stabilization, conifer removal, including buffer treatments in Riparian Management Area (RMA), restoration of culvert function and obliteration of a section of system road; and installation of 4 off-site livestock water developments would not be implemented nor would the subsequent beneficial effects occur.

The meadows within the Project Area would continue to have areas of exposed bank, headcuts, knick points and areas of livestock trampling where stock are accessing water 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. Under this alternative, conifer encroachment would continue expanding towards the interior of the meadow and this process would continue to negatively affect overall 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. Meadow condition would move away from desired conditions and forage quality and production would decrease over time

Alternative 2 – Proposed Action

Direct, Indirect and Cumulative Effects

Meadows provide the bulk of forage within the Project Area. Ecological condition and hydrologic function of montane meadows effects 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% cover), species composition that reflects a high relative percentage of late successional plant species (>40% relative frequency of late successional species), improved plant vigor and possible increases in forage production. Specifically, rangeland vegetation condition would continue to be at high ecological status with greater than 60 percent similarity to potential natural community and high overall condition and ecological status for Benedict Meadow and Lower Browns Meadow. Overall ecological condition would continue to be high and trends would remain stable or move upward. Generally, meadows within the Project Areathat are at upper moderate ecological status could move

toward high ecological status with higher abundance of late seral herbaceous species under this proposal. There would be direct benefits to meadows through the meadow restoration from repair of existing and installation of new physical channel stabilization structures which would result in increased water storage and reduced erosion. The effect of this stabilization, combined with the proposed conifer encroachment removal and meadow buffer treatments would further move sites that are not currently at desired conditions towards desired conditions. The installation of exclosure fencing and off-site livestock water develoments would prevent potential livestock impacts on the restoration sites while vegetation is re-establishing in these areas and improve livestock distribution. Recovery of the degraded channels in the meadows would improve watershed conditions cumulatively. The proposal to develop off-site livestock water at Beehive Meadow (#504M153), Benedict Meadow (#504M19), China Meadow (#504M41) and Peckinpah Meadow (#504M29 & #504M30) would specifically limit localized cattle impacts to riparian areas and improve overall livestock distribution within the Project Area. The effects of continued implementation of grazing standards and guidelines and best management practices (BMP) for grazing would also cumulatively 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, meadow buffer treatment 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 and competition for resources is 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 within the meadow that are contributing to the seed source would be removed further delaying conifer seedling establishment.

The process and structural restoration, in combination with the physical channel stabilization, conifer encroachment removal and meadow buffer treatments would improve hydrologic function of the meadows and would have an overall beneficial effect on the watershed. Meadow condition would be maintained or move towards 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 expected environmental fluctuations expected with climate change.

Fire in the surrounding watershed probably influenced meadow ecology more often than 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 facilitate livestock access, improve plant vigor and growth from the flush of plant available nutrients after burning and would improve overall livestock distribution and minimize resource impacts from livestock concentration.

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 forb 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.

The recent past and current timber, fire/fuels and grazing management combined with the range improvements and wetland mitigation restoration work would have no cumulatively adverse effects only combined beneficial effects to meadow condition and forage production under this proposal. Meadow condition and forage quality and production would improve from process and structural restoration treatments and other restoration proposals listed in Chapter 2 under the Proposed Action.

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

Direct, Indirect and Cumulative Effects

Alternative 3 would only partially address stand densityand forest health objectives, however, from a meadow condition and forage production perspective, the effects would be similar to those described under Alternative 2. Direct, indirect and cumulative effects on meadow ecological status would be the same as under Alternative 2. Indirect 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. The thinning that would occur would allow better access by livestock, but stand density would be higher than under Alternative 2. The effects of increased light, nutrients and reduced competition would still benefit the production of herbaceous understory vegetation and forage, but to a lesser degree compared to Alternative 2.

The recent past and current timber, fire/fuels and grazing management combined with the range improvements and wetland mitigation restoration work would have no cumulatively adverse effects only combined beneficial effects to meadow condition and forage production under this proposal. The process and structural restoration treatments combined with the other restoration proposals listed in Chapter 2 under the Proposed Action would improve meadow condition and forage quality and production, however, to a lesser extent as compared with Alternative 2.

Recreation

The direct, indirect and cumulative effects to the Recreation are summarized from the Recreation Management report for the Whisky Ridge Project (Penn, L., 2012).

Affected Environment

Existing Condition

Developed and Dispersed Recreation

The Forest Service operates the Whisky Falls developed campground in the Project Area. The Whisky Falls Campground is a developed campground located in Township 7 South, Range 23 East, and Section 27, M.D.B.M., accessed by Forest Road 8S70. The campground is comprised of 9 campsites that can accommodate potentially 45 people overnight. High use season for this facility is June through September. The campground is full most weekends from June through August. Each campsite consists of 1 family size picnic table, 1 fire ring with grill and a designated parking area with wooden barriers. There is 1 vault restroom building with 2 toilets available for campers to use. An information board is provided for signage to inform campers of various camping etiquette. Wooden barriers are present throughout the campground to help indicate designated sites, paths and roads. Trash service is not available so some remnants of trash may be found throughout the campground.

Motorized Recreation

There are approximately 18 miles of designated motorized trails in various treatment units and approximately 3 acres of designated parking/staging areas (See Whisky Ridge Ecological Restoration Area Map). There are a total of 9 miles of user created vehicle tracks that are not included on the Sierra National Forest Travel Management Plan that are degrading resource conditions. These user created areas are a cause of high soil erosion during water runoff events which lead to reduced water quality and a reduction in soil productivity. Unmanaged off-highway vehicle (OHV) use has resulted in unauthorized 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).

Desired Condition

Recreation Opportunity Spectrum (ROS)

ROS settings are made up of combined, physical, biological, social and managerial conditions that give value to a location. Variations of such conditions can create an enjoyable experience for visitors. The ROS classifications influenced by this project would include Semi-Primitive Non-Motorized, Roaded Natural and Rural areas. With the decision of the Forest’s Land and Resources Management Plan (LRMP), management of these areas would be consistent with its ROS class as described in the FS ROS User Guide (1983).

Approximately 90% of the planned project area falls under the Roaded Natural classification of the ROS..A Roaded Natural setting is described as “Area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are

evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities (FS ROS Users Guide)."

The experience characterization for Roaded Natural is "About equal probability to experience affiliation with other user groups and for isolation from sights and sounds of other humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive types of recreation are not very important. Practice and testing of outdoor skills might be important. Opportunities for both motorized and non-motorized forms of recreation are possible (USDA FS 1983)."

The remoteness criteria for a Roaded Natural setting is "An area designated within 1/2 –mile from better than primitive roads, and railroads (USDA FS 1983)." The environment of the area is foreseeably modified by humans, though they should be unnoticeable from sensitive travel routes. There is a moderate to high frequency of contact with other recreationists on the roads and a low to moderate contact frequency to be expected on trails and non-system tracks.

The remainder 10% of the planned project area is classified under the Semi-Primitive Non-Motorized ROS. A Semi-primitive Non-Motorized setting consists of "a predominantly natural or natural-appearing environment of moderate-to-large size interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but is subtle. Motorized use is not permitted (FS ROS User Guide)."

The experience characterization for Semi-Primitive Non-Motorized areas are "High, but not extremely high, probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk(FS ROS User Guide)."

The remoteness criteria for a Semi-Primitive Non-Motorized area is "An area designated at least ½-mile but not further than 3 miles from all roads, railroads or trails with motorized use; can include the existence of primitive roads and trails if usually closed to motorized use.(FS ROS User Guide)." trails designated and non-designated.

Developed and Dispersed Recreation

The Forest Land and Resource Management Plan has set forth standardized management guidelines that help to maintain developed and dispersed areas of recreation. Developed recreation in the Whisky Project Areaincludes Whisky Falls Campground where Rural and Roaded Natural recreational opportunities are stressed; Rural referring to areas that are "substantially modified natural environments (USDA FS 1983)." Regulated timber harvest should be prohibited within the actual sites, but not limited to the primary goal of the area. Diseased and Hazard trees should be removed from developed sites and threatened/endangered/sensitive wildlife is protected. Other important factors to consider for developed recreation also includes affect to water quality, fire protection efforts to protect the public, improvements and Forest resources. Dispersed recreational opportunities are primarily in the Semi-Primitive, Roaded Natural and Rural recreational classifications. Emphasis is placed on wildlife management and high levels of visual conditions.

Motorized Recreation

In March of 2010 the Sierra National Forest completed the Travel Management Final Environmental Impact Statement (FEIS), which amends the Forest Plan 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). Rehabilitation to trails would be provided for user convenience and resource protection.

Environmental Consequences

Methodology

GIS was used to analyze the proposed project with emphasis of their potential impact on recreational use and facilities, dispersed recreation, trails and the ROS considerations to the areas.

Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action alternative, current management plans would continue to guide activities in the Project Area. This includes all ongoing activities with existing conditions and decisions. If no action is taken to address the purpose and need or project objectives no short term disturbance to the recreational resources would take place. . Roads and non-system tracks will continue to exist in the project area. Non-system tracks will continue to allow sediment to travel with potential to impact water quality of the watershed.

Recreation Experience

The recreation experience will continue as described in the current condition. Camping in developed and dispersed recreation sites will continue. Use of non-system tracks will continue to be a law enforcement issue as well as a potential impact to erosive soils and water quality. There are no direct or indirect effects to the recreation experience.

ROS Compatibility

Areas located in Roaded Natural ROS are compatible with the SNF Land and Resource Management Plan. Roads, trails and areas located in Semi-Primitive Non-Motorized ROS are not compatible with the SNF Land and Resource Management Plan; whether NFTS or non-system tracks. There are approximately 10 miles of NFTS roads located in Semi-Primitive Non-Motorized ROS. There are no direct or indirect effects to ROS compatibility for Roaded Natural and there are direct and indirect effects to ROS compatibility for Semi-Primitive Non-Motorized.

Recreation Access

Recreation access will not change in this alternative. All roads, trails and areas identified on the current Motor Vehicle Use Map are available for use by the recreating pubic. There are no direct or indirect effects to recreation access.

Cumulative Effects

There would be little protection from moderate to high intensity fires. The continuation of natural fuels build-up would increase the fire risk to improvements. Wildfires could potentially occur and

result in a temporary closure of forest roads, trails and campgrounds for health and safety of the public.

Alternative 2 – Proposed Action

Alternative 2, the Proposed Action, is the preferred alternative for the implementation of the Whisky Ridge Ecological Restoration Project. The purpose and need for this project would fully meet the design measures for recreation management.

Direct and Indirect Effects

There would be an increase in traffic on forest roads that would include fuels reduction vehicles. Smoke from prescribed fires would occur in the area. Areas with fuel removal activities, prescribed burning, or other fuel treatments may be temporarily closed to visitors temporarily

The recreation experience will continue. Camping in developed and dispersed recreation sites will continue. There may be short term impacts to the recreation experience with the noise and sights of timber felling. Use of non-system tracks will continue to be a law enforcement issue as well as a potential impact to erosive soils and water quality. There are short term direct and indirect effects to the recreation experience.

ROS Compatibility

Areas located in Roaded Natural ROS are compatible with the SNF Land and Resource Management Plan. Roads, trails and areas located in Roaded Natural used for timber felling operations is compatible with the SNF Land and Resource Management Plan. Semi-primitive non-motorized ROS classification is not compatible with the SNF Land and Resource Management Plan; whether NFTS or non-system tracks; whether temporary or permanent roads to facilitate timber felling operations.. It is expected approximately 10 miles of temporary roads will be constructed in the Semi-primitive non-motorized ROS land allocation. There are no direct and indirect effects to ROS compatibility for Roaded Natural and there are direct and indirect effects to ROS compatibility for Semi-Primitive Non-Motorized.

Recreation Access

Recreation access will change in this alternative. All roads, trails and areas identified on the current Motor Vehicle Use Map are available for use by the recreating pubic. There will be a short term impact of increased vehicle use for timber felling operations which in turn may delay access to a favorite site for developed or dispersed recreation activities. There will be short term impact for those roads, trails, and areas that may be removed from the Motor Vehicle Use Map to make sure the visiting public is aware what is available for access. There are direct and indirect effects to recreation access.

Cumulative Effects

There would be a reduction in moderate to high intensity fires. Ecological restoration activities will reduce the fire risk in severity and increase fire resistance to recreation areas within and adjacent to the project area.

Recreation Experience

Overall, there are positive cumulative impacts to the recreation experience with the improved campground facilities in Whiskey Falls Campground. The new toilet facilities will definitely improve the experience. The reduction of trees in the area will open up the view from the campground.

ROS Compatibility

There are no cumulative effects to the Roaded Natural ROS classification. There are negative cumulative impacts to the Semi-Primitive Non-Motorized ROS classification. There will be increased traffic on NFTS roads located in this ROS class as well as the building of temporary roads and skid trails.

Recreation Access

Recreation access may have short term effects; however, there are no long term cumulative effects for access. The blocking of one half mile of 7S08 and another one half mile reduced to Maintenance Level 1 will remove one mile of the road from public use. There are minimal impacts as there are other roads and trails allowing access to locations the short sections 7S08 had provided. During timber felling operations there will be short term impacts to access; however, once the project is completed, access will be once again available to the forest visitors.

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

Indirect Effects and Cumulative Effects

The effects of this alternative would be identical to that of Alternative 2.

Comparison of Alternatives

Alternative 1 implements no action that is separate from routine management. Alternative 1 would yield no direct affects, but would result in cumulated affects if no action is implemented. The cumulated effects of Alternative 1 would consist of moderate to severe wildfire risks, threat to public safety, and continuous degradation of the area. Alternative 2 and 3 are very similar in prescription except 3 suggest treatment to lower and mid-level canopy as well. Both Alternative 2 and 3 may cause temporary closures of recreation sites and facilities during project implementation. Post

treatment would decrease fire severity to low-moderate, increase stand structure and heterogeneity of vegetation, and overall longevity of recreational opportunities in the area.

Terrestrial Wildlife

The direct, indirect and cumulative effects to the terrestrial wildlife species are summarized in this section from the Biological Evaluation/Biological Assessment (BEBA) for the Whisky Ridge Project (Otto, 2013 240pp). The effects from the Proposed Action and two other alternatives on threatened, endangered, candidate, and Forest Service sensitive species are evaluated under the terrestrial wildlife BEBA for this project.

Affected Environment

The Whisky Ridge Ecological Restoration Project is located within Madera County on the Bass Lake Ranger District of the Sierra National Forest. The project boundary encompasses a total of 18,290 acres; 15,592 acres within the Willow Creek HUC 10 sub-watershed and 2,698 acres within the Stevenson Creek-San Joaquin River HUC 10 sub-watershed (USDA FS 2012). The southern and western portions of the project area include Wildland Urban Intermix (WUI) defense and threat zone forest designations. The proposed project ranges from approximately 4,000 feet to 7,200 feet in elevation. Primary vegetation types include: Sierra mixed conifer (SMC) (67% of the project area), ponderosa pine PPN) (8% of the project area), and montane hardwood (MHW) and hardwood conifer (MHC) (17% of the project area). Montane (MCP) and mixed chaparral (MCH) habitat is present in 5% of the project area. The remaining habitat types each represent less than 1% of the project area and include: Jeffery pine (JPN), wet meadow (WTM), rocky outcrop (BAR), annual grassland (AGS), and lacustrine (LAC) areas. Species specific habitat needs as well as the habitat availability within the Project Area are described within the following effects analysis for each species analyzed in detail. The effects analysis further describes the changes to this habitat for each alternative.

Methodology

A total of 13 terrestrial wildlife species were identified as potentially being in the Project Area or nearby areas as Federally listed, are candidates for listing, or are Forest Service Sensitive Species. Species lists for all Federally listed threatened, endangered, and candidate species potentially occurring in the Project Area were requested through the US Fish and Wildlife Service website Forest Service Sensitive Species were determined by reviewing the USFS Pacific Southwest Region's (R5) Sensitive Species List of June 8, 1998, as amended.

The 13 species were evaluated to determine whether they or their habitats are present in or near the Project Area. If the species or their habitats are present 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 in the terrestrial wildlife BEBA for the Project. The following list are terrestrial wildlife species that are 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); Candidate for federal listing

Six of the 13 species were not analyzed is the BEBA 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 63 summarizes these species habitat, area of consideration, and the rationale for not including them in detailed analysis for this BEBA. The Whisky Ridge Project will have no effect on the following six species or their habitat, therefore they were not analyzed in detail in the BEBA:

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

Table 63. Special Status Terrestrial Wildlife 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 BEBA

Species (Elevation Range in Feet)	Habitat	Analysis Boundary	Rationale for including or excluding from detailed analysis in the BEBA
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 was not analyzed further in the project BEBA.
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 was not analyzed further in the project BEBA.
Valley elderberry longhorn beetle (< 3,000')	Habitat consists of elderberry shrubs in Great Valley Oak Riparian Forests below 3,000 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 was not analyzed further in the project BEBA.

Species (Elevation Range in Feet)	Habitat	Analysis Boundary	Rationale for including or excluding from detailed analysis in the BEBA
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. This species was not analyzed further in the project BEBA.
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 Sierra Nevada red fox habitat. This species was not analyzed further in the project BEBA.
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 was not analyzed further in the project BEBA.
California spotted owl (>8,000')	Sierra Nevada province in California. Need at least 40% canopy closure and an average tree dbh of 11 inches.	½ mile around Project boundary	This species is known to occur within the project area and suitable habitat is present within the project area. Potential impacts to the California spotted owl and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA
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	This species is known to occur within the project area and suitable habitat is present within the project area. Potential impacts to the Northern goshawk and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA
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	This species is not known to occur within the project area, however suitable habitat is present within the project area. Potential impacts to the Great gray owl and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA.
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	This species is not known to occur within the project area, however suitable habitat is present within the project area. Potential impacts to the Pallid bat and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA.

Species (Elevation Range in Feet)	Habitat	Analysis Boundary	Rationale for including or excluding from detailed analysis in the BEBA
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	This species is not known to occur within the project area, however suitable habitat is present within the project area. Potential impacts to the Western red bat and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA.
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 Project Area	This species is known to occur within the project area and suitable habitat is present within the project area. Potential impacts to the American marten and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA
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 and live trees)	3.1 mile radius around Project Area	This species is known to occur within the project area and suitable habitat is present within the project area. Potential impacts to the pacific fisher and/or its habitat have been analyzed in detail in the Whisky Ridge Project BEBA

Effect Indicators

Indicators are measures that can be used to describe the condition of terrestrial ecosystems. They represent elements that might change as a result of management activities. Terrestrial wildlife habitat indicators identified for the Whisky Ridge project include: quantity of large dbh trees (>20"dbh), canopy cover, snags, coarse woody debris, and CWHR habitat type/size/density. These indicators were determined to best represent key habitat elements utilized by the sensitive species known to occur within the project area. Species habitat was evaluated using the CWHR System.

CWHR species habitat: The CWHR System (CDFG 2008) was used to evaluate species habitat quantity and quality. The CWHR System contains life history, habitat relationships, and management information for mammals and birds occurring in California. Suitable habitats for the species are described within the CWHR System as representing high, medium, low, or unsuitable habitat.

Environmental Consequences

Mitigation and Monitoring

The project action alternatives integrate design measures that help reduce potential impacts to terrestrial wildlife and their habitat. These measures include, but are not limited to, Limited Operating Periods (LOPs) which restrict treatment operations to avoid breeding seasons, retention of key habitat characteristics such as high canopy cover, snags, large dbh trees with structural defect, and protections for riparian areas including: riparian management areas, SMZs, and OFLs for perennial streams. Project design criteria common to all action alternatives were also developed through the collaborative process of the Sierra Nevada Adaptive Management Project (SNAMP) Integration Team meetings. These design measures 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 measures are outlined in Chapter 2 of this document.

If an action alternative is selected, forest restoration treatment actions would be monitored to assure compliance with the management prescriptions stated in the selected alternative, including meeting silvicultural management design criteria. Monitoring of fisher and high quality fisher habitat within the Project Area is being conducted by the (SNAMP) fisher team.[7]

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 wildlife analysis area. This includes all ongoing activities with existing decisions or permits 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 or cause species mortality.

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 terrestrial wildlife that result in Project related cumulative effects because no additional management actions would occur.

[7] More information regarding SNAMP can be found on-line at http://snamp.cnr.berkeley.edu/). 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).

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

Direct and Indirect Effects

The following analysis of direct and indirect effects will focus primarily on the vegetation management aspects of the proposed action including thinning and prescribed burning activities. The resources treatment proposals listed in the proposed action for improving wildlife habitat, cultural, hydrologic, botanic, recreation, soils, and visual scenery resources combined will have a beneficial effect on terrestrial wildlife habitat within the project area. These beneficial effects will be accomplished through targeted meadow restoration activities, unauthorized OHV route decommissioning, snag and CWD development, and other general natural resources improvements as outlined in Chapter 2.

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. These potential effects would be limited to short-term noise disturbance of project implementation, which potentially could lead to species 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 den sites, as described in the BEBA. In particular, a 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.

Habitats in the Project Area are defined according to the CWHR System, as shown in Map 9 in the DEIS Map Package. Species specific habitat needs as well as the habitat availability within the Project Area are described within the following effects analysis. The effects analysis further describes the changes to this habitat for each alternative. Special project design measures for the Whisky Ridge Project were developed in concert with the Bass Lake Ranger 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 in which higher basal areas would be retained. 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).

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 CWHR habitat type are expected to occur throughout the entire Whisky Ridge Project Area.

Effects to Terrestrial Wildlife Habitat: The *ExistingVegetation* GIS feature class was refined for the Whisky Ridge Project using existing structure analysis from stand examination plot data collected in 2012 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 displayed below for the CWHR vegetation changes that are expected to occur through implementation of Alternative 2. These are relatively short term changes which are expected to last for a period of 5-10 years. No changes to CWHR type, size, or density are expected with the implementation of Alternative 3.

Table 64. Alternative 2 Summary of Changes to CWHR Forest Type Within the Boundaries of the Whisky Ridge Project.

Existing Conditions	**Alternative 2**	
CWHR Habitat Type Pre-treatment	**CWHR Habitat Type Post-treatment**	**Number of Acres of Density Change**
JPN3D	JPN3M	11
JPN4D	JPN4M	1
PPN2D	PPN2M	6
PPN3D	PPN3M	35
PPN4D	PPN4M	88
SMC4D	SMC4M	119
Total Acres CWHR Habitat Density Change		260
CWHR Habitat Type: JPN=Jeffrey pine, PPN=Ponderosa pine, SMC=Sierra mixed conifer; Tree size classes: 1 (Seedling)(<1" dbh); 2 (Sapling)(1"-5.9" dbh); 3 (Pole)(6"-10.9" dbh); 4 (Small tree)(11"-23.9" dbh); 5 (Medium/Large tree)(≥24" dbh); 6 (Multi-layered Tree) [In PPN and SMC] Canopy Closure classifications: S=Sparse Cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure); (Mayer and Laudenslayer 1988).		

Total planning area acreage for the Whisky Ridge Project is 18,293 acres. Ecological restoration treatments are planned for approximately 9,500 of those acres. A total of 260 acres, or 3% of the total acreage of treatment units are anticipated to have changes in CWHR density under Alternative 2. No changes in CWHR type or density are anticipated under Alternative 3. These density changes are spread across 30 treatment units, so no one treatment unit is experiencing a high degree of change. These changes in CWHR habitat density are detailed in Appendix C of the Terrestrial Wildlife BEBA (Otto, 2013).

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.

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

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 13,360 acres of high and moderate quality CWHR California spotted owl habitat (73% of the total acreage within the project boundary).

A total of 3,263 acres within the Whisky Ridge Project boundary are within California spotted owl PACs or HRCAs (Map 7 Map Package). This constitutes 18% of the project boundary. Of these, 251 acres are proposed for mechanical treatment and 463 acres are proposed for prescribed burning. Fuels treatments have been designed for these areas to reduce the risk of large scale, uncharacteristically severe wildfire. Fuels reduction treatments within the WUI were designed to avoid PACs wherever possible, however based on the SPLAT area placement, avoiding all PACs/HRCAs would compromise the overall effectiveness of the landscape fire and fuels strategy. Mechanical treatments have been designed to maintain habitat structure and function of the PACs (for instance, no trees ≥20" dbh would be removed).

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 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.

Canopy cover would not be reduced below 60% within PACs and 50% within HRCAs, where currently available, to meet S&G 7. Additionally, an 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 BEBA (Otto, 2013) provides additional habitat information for CWHR changes expected to occur for each proposed project alternative.

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 9.4 snags ≥10" dbh and 4.5 large snags ≥15" dbh across the treatment units, which meets the requirements set forth in the LRMP as amended by the SNFPA ROD (USDA 2004). 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. The majority of the prescribed burning proposed for the Whisky Ridge Project is of low to moderate intensity, and generally does not consume fuels >1,000 hours (≥8 dbh). Therefore nearly all logs ≥11 dbh should remain as CWD within the 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. Roberts et al (2011) indicate that low to moderate severity fires are important for maintaining habitat characteristics essential for spotted owl site occupancy. They suggest "managed fires that emulate the historic fire regime may maintain spotted owl habitat and protect this species from the effects of future catastrophic fires." (Roberts et al 2011). 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.

Great Gray Owl: Great gray owl habitat consists of conifer stands with large trees and snags in proximity to large (>30 acres) tall grass meadows that have populations of voles and gophers for prey. They typically nest in the top of large, broken top snags. Within the Whisky Ridge Project there are 188 acres of suitable foraging habitat, and 1,358 acres of suitable nesting habitat as determined by CWHR. There are no meadows >14 acres within the Whisky Ridge Project Boundary. There are currently 11 great gray owl Protected Activity Centers (PACs) on the Sierra NF, none of which lie within the Whisky Ridge Ecological Restoration Project area. There are no incidental sightings of great gray owls within the Whisky Ridge Ecological Restoration Project boundary, nor did exploratory surveys in 2012 locate great gray owls utilizing Peckinpah meadow; (at 14 acres in size, Peckinpah is the largest meadow in project boundary).

There are no recorded observations of Great grey owls in and adjacent to the project area, and only marginal great gray owl foraging and nesting habitat occurs within the project boundary and adjacent areas. The nearest great grey owl Protected Activity Centers (PAC) are located more than seven miles to the north of the proposed project. Exploratory surveys conducted in 2012 detected no sign of great gray owls. This species may move through the project area during foraging bouts or winter movements, therefore there is a possibility that one of a few individuals may be disturbed by project activities. Great gray owls in proximity to work crews and vehicles during project implementation would likely be disturbed enough to leave the immediate vicinity. However, relatively minimal amounts of suitable nesting habitat occur in the project area, and surveys did not illicit any responses by great gray owls, nor locate any great gray owl sign within Peckinpah meadow; therefore, the presence of breeding great gray owls in the Whisky Ridge Project area is highly unlikely. No measurable reductions to great grey owl nesting or foraging habitat are expected, and potential disturbances would be limited to the period of management activity. A Limited Operating Period (LOP) from March 1 through August 15 would protect any nest sites that are discovered within ¼

mile of vegetation management activities. This LOP would minimize disturbance to breeding great gray owls.

Northern goshawk: Suitable goshawk habitat is very similar to spotted owl habitat, except that they tolerate smaller diameter trees and less dense canopy. Suitable goshawk habitat consists of conifer forest stands with 11" or higher average dbh and a canopy cover of 40-59%. Habitat suitable for goshawk nesting and fledging is generally of higher canopy closure, ≥ 60%, with snags and downed logs for prey habitat.

Within the Whisky Ridge Project boundary there are approximately 14,902 acres of suitable foraging habitat, and 14,765 acres of suitable nesting habitat. There are three Northern goshawk PACs located within the boundaries of the Project: SIEGH31, SIEGH33 and SIEGH58 (Map 8, Map Package).

All goshawk nest sites within the Project Area would be protected by an LOP. Outside of the LOP, portions of all three goshawk PACs would be thinned to the degree allowed under the 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. Treatments would maintain habitat structure and function of the PACs.

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: The pallid bat can roost, hibernate, and reproduce in tree cavities and hollow snags. They forage near the ground for larger insects such as beetles and crickets. The project area very likely has suitable cavity and foraging habitat present. Their roost sites are very temperature dependent and must be below 40°C. They would most likely be found roosting in areas with shading vegetation or on more shaded slope aspects

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.

Western Red Bat: The Western red bat roosts singly in dense arboreal foliage, primarily in hardwoods, near riparian areas at elevations up to 5,000 feet. Suitable habitat likely does occur within the project area in locations where hardwoods are growing near stream courses, particularly along Whisky Creek, Gertrude Creek, Owl Creek, and Brown's Creek. All applicable Forest Service standards and guides for the protection of RMAs and SMZs would be followed in this project.

It is very unlikely that a tree used by a maternal colony of Western red bats would be removed under this project, since the natural population of Western red bats is low (below 700 feet in elevation). Single males or non-reproducing females may roost solitarily in deciduous trees near riparian areas below 8,000 feet in elevation. Proposed vegetation treatments would not harvest hardwoods, and riparian areas would be protected by OFLs and SMZs as described previously. Post-treatment foraging opportunities should be similar to the current condition as the proposed treatment would not alter stand characteristics sufficiently to render the stand unsuitable, and riparian habitat corridors would be protected. For these reasons, no direct or indirect effects are anticipated for this species.

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). Surveys for this program occurs throughout late spring and into fall, with no sampling occurring during the winter months. There are 16 survey sample stations located within a 3 mile radius of the Whisky Ridge Project boundary. None of these stations have detected marten presence to date during the SNFPA monitoring program. (USDA Forest Service NRIS Database 2012).

More intensive camera sampling (concentrating primarily on locating Pacific fisher) has been conducted by the UC Berkeley fisher crew beginning fall 2007 throughout the Bass Lake Ranger District. This sampling effort is active year-round. Cameras have detected marten activity in three 1 kilometer^2 grids within the Whisky Ridge Project Area. A 1 kilometer^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). All detections occurred at or above the 5,000' elevation level. The three marten active grid cells in the Whisky Ridge Project boundary were all winter detections, well outside of the breeding season for American marten. 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.

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 64 displays the CWHR vegetation changes that are projected to occur with the implementation of Alternative 2. 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 design measures common to all alternatives including OFL (Figure 1) and no treatments areas. The inclusion of untreated areas along steep sloped regions and riparian corridors (primarily Whisky Creek, Gertrude Creek, Owl Creek, and Brown's Creek) 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 measures, 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 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 treatment alternative (Alternative 2) 260 acres of CWHR habitat would experience a density type change spread across the treatment units (See Table 15). 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.

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.

Pacific Fisher: Due to project design criteria designed to maintain high canopy closure (not below 50%, with a preference for greater than 60%) throughout the treatment units, CWHR type changes are projected for 260 acres (3% of the total treatment area) if Alternative 2 is implemented. There would be minor change to CWHR 2.1 habitat scores[8] across the treated landscape. Post-treatment percentage of habitat retained within female home ranges for this alternative ranges from 99.6% to 99.9%, with an average of 99.7% habitat retained at current CWHR 2.1 values. The home range for Fisher F10 is most affected by proposed activities, with a loss of 0.4% of habitat value that would occur over 32.7% of her documented range.

Six female fishers have home ranges (95% use contours calculated by R. Sweitzer, unpublished SNAMP data) which overlap with the boundary of the Project. The percentage of home range overlap with the Project boundary ranges from 10% to 93.9%, averaging 40% for all six female fishers over the nine population years calculated. The overlap between female fisher home range and treatment unit boundaries for the Project is much lower, ranging from 1.5% to 32.7%, averaging 8.8% for all population years. All female fisher home ranges extend beyond the project boundary.

[8] CWHR2 is a derivative of the CWHR fisher habitat relationship model constructed by Davis et al. (2007). They used best available science to revise the statewide model and eliminate some forest types that appeared to contribute little to fisher habitat: aspen, eastside pine, lodgepole pine, montane riparian, red fir, and subalpine conifer. We have further refined CWHR2 to reflect only those forest types present in the southern Sierra Nevada: Jeffrey pine, montane hardwood-conifer, Ponderosa pine, Sierran mixed-conifer and white fir, terming it **CWHR2.1**

Disturbance to breeding females during project implementation would be minimized by the application of a LOP for all suitable fisher denning habitat. Breeding season movements should not increase due to project implementation due to the application of the LOP. Important legacy structures and potential denning and resting sites such as large diameter black oaks and conifers should remain in sufficient numbers for resting and denning sites so females should not have to expand their home ranges in search of these features.

There are currently 4.5 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. 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. Conservation of large diameter trees is important to ensure adequate resting/denning sites for fisher as these structures are thought to be most limiting across the environment. Each treatment unit retains far more than 17 large live conifers per acre (trees >20"dbh) that may be used as denning or resting sites by Pacific fisher, with an average of 28 live conifers per acre remaining that are greater than 20"dbh across all the treatment units. This number does not include the extensive numbers of black oaks that are present within the Project (Otto personal observation), nor does it account for any snags present within the units. 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 Whisky Ridge 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 the action alternatives 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 (Whisky Creek, Gertrude Creek, Owl Creek, and Brown's Creek) would maintain habitat connectivity and fisher dispersal routes.

An LOP of March 1-June 30 (for den buffers) and March 15-June 15 (outside den buffers) would be implemented within units containing suitable denning habitat to mitigate the potential effects of fuels treatment operations on dens that may be occupied but not identified through the SNAMP project. 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) appear to 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 (Spencer et al. 2008). 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 (Smith, 2013) 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 analyzed terrestrial wildlife species considering past, present, and reasonably foreseeable activities. Additional details of the cumulative effects assessment can be found in the Terrestrial Wildlife BEBA (Otto, 2013).

Past, present, and reasonably foreseeable actions within the Project Area are displayed in Chapter 3 of the DEIS for the Whisky Project. Known activities occurring spatially and temporally within the analysis area are recreational use (both developed and undeveloped), roads; cattle grazing, and fires. Also, it is anticipated that terrestrial wildlife habitat would be altered over longer time frames by climate change.

California Spotted Owl

The California spotted owl has a continuous distribution throughout the Sierra Nevada with a network of 238 managed Home Range Core Areas (600 acres each) on the Sierra National Forest. Given the scope and scale of the Whisky Ridge 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 will focus on the Sierra National Forest (SNF). A determination of viability for the California spotted owl will be made based on the following analysis.

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 (USDI, 2006). The USFWS reached this conclusion after considering the impacts of the Forest Service's implementation of the SNFPA ROD (USDA 2004b) (which has subsequently been incorporated into the Forest's LRMP). 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 will have a long-term benefit by reducing the risk of stand replacing wildfire; these activities embrace those described 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." (FEIS)

Recent results from the demography study sites on and adjacent to the Sierra National Forest indicate locally stable California spotted owl populations (Munton et al. 2011). Estimated mean λ_t for the Sierra (SIE) site is 0.989, with 95% confidence intervals ranging from 1.007-0.971 (Table 11, Munton et al. 2011). This average λ is not significantly different than one, which is the value for a stable population. Values for mean λ_t at the conifer study site in Sequoia National Park (SKC) were above 1.0 (Munton et al. 2011) which indicates a stable to increasing population.

At a forest-wide scale, there currently are 238 designated Home Range Core Areas/PACs, which encompass 140,730 acres. Approximately 468,861 acres of suitable habitat currently exist on the Forest. Considering the proposed treatment activities of the Whisky Ridge 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,
- retain high canopy cover,
- increase large diameter trees

the result of the action alternatives would be long-term increases in California spotted owl suitable habitat over time. Therefore, the alternatives would also result in relatively stable geographic distribution and population levels of spotted owls in the local area. The cumulative effects of vegetation management activities in the Whisky Ridge treatment units taken together with all other past, present, and reasonably foreseeable activities on the Forest will 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 Whisky Ridge 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 and stand density, 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 on the SNF.

It is my determination that Alternatives 2-3 (the action alternatives) of the Whisky Ridge 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 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. Treatments would result in a stand structure that support spotted owl habitat requirements. 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.

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 Whisky Ridge Project *would not affect the g*reat 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 or stand density, 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 (both action alternatives) for the Whisky Ridge Project *may affect individuals, but are 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. 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.

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 Forest LRMP as amended by 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 this 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.

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 Whisky Ridge 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 Whisky Ridge 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 and stand density, 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 Whisky Ridge Project *may affect individuals, but are 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. 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 Forest Service Sensitive Species 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.

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 Whisky Ridge 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 and stand density, 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 Whisky Ridge Project *may affect individuals, but are not likely to result in a trend toward Federal listing or loss of viability for the* Pallid bat. The Project Area contains habitat for pallid bats 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 measures. 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 Whisky Ridge 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 Whisky Ridge 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 SNF. 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 SNF. Based on the following analysis, a determination of viability for the marten will 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

Few 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 little to no 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 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 Whisky Ridge 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 and stand density, 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 Whisky Ridge Project *may affect individuals, but are 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.

Pacific Fisher

The Sierra National Forest fuels reduction/forest restoration treatments provide net positive benefits to fisher habitat and populations by retaining and enhancing fisher habitat, including creating forests that are more resilient to large-scale, severe wildfires and drought. This is especially important when considering that the historical fire return interval (prior to fire suppression) within the primary fisher habitat (Sierran Mixed-Conifer Forests) averaged 7-12 years. Therefore, without periodic fuel reduction, these forests will become highly susceptible to large scale, high severity wildfire, and these types of fires are uncharacteristic compared to the historical low severity fires in which the fisher evolved. Large scale, high severity fires can significantly reduce mature and older aged forests, which are crucial for sustaining fisher and spotted owl populations. This management approach of reducing wildfire risk, while also retaining fisher habitat, has been shown to be an effective means for conserving fisher habitat and fisher populations over the long-term (Spencer et al. 2008; Scheller et al. 2011).

These fuels reduction/forest restoration treatments include individual tree thinning management (not large-scale clear-cutting) based on ecosystem management principles that retain and develop forest structure and biological integrity (*An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests* (North et al. 2009). This management is designed to minimize the potential for direct impacts to denning fisher by implementing LOPs. This management adaptively uses research results to retain and further develop important habitat components, such as: (1) a majority of the large live trees greater than 20 inches dbh; (2) large snags greater than 15 inches dbh, unless they are a safety hazard; (3) black oaks; (4) large portions of the Project Areas with high canopy cover; and (5) many other important habitat features, such as large woody debris, shrubs, trees with decay characteristics and riparian conservation zones.

Project-level and Forest level cumulative effects assessment of treatments show that these treatments would not have substantial adverse impacts to fisher habitat or fisher populations. For example, during the 7-year period of 2010-2016, the treatment rate of fisher habitat within the two Ranger

Districts ranges from 1.8 to 5.2 percent of habitat available, depending on which habitat definition is used (Table 65). When considering the treatments across the entire Sierra National Forest, treatment rates are at 3.2 percent or 3.7 percent of habitat available, depending on which habitat definition is used (Table 65).

These treatment rates are reasonable and sustainable between 4% and 8%, even when comparing the treatment rates derived from two different habitat definitions (CWHR and CBI) within a 7 year period. Some of these rates even fall short of those recommended by the Conservation Biology Institute (CBI) for significantly reducing fire sizes and fire severity, which is needed to help sustain fisher habitat. In their comprehensive report entitled: *Baseline Assessment of Fisher Habitat and Population Status & Effects of Fires and Fuels Management on Fishers in the Southern Sierra Nevada* (Spencer et al., 2008), the CBI states (pg. 98).

"Our simulations suggest that treatment rates on the order of 4% to 8% of treatable area every 5 years can significantly reduce fire sizes and fire severity and thereby benefit fishers." (Spencer et al., 2008).

The CBI report (pg. 99) goes on to state:

"Our simulation results suggest that placing treatments inside fisher habitat is not necessarily detrimental to fisher (at least for the limited range or treatment types and at the scale we simulated). The positive indirect effect of treatments in reducing fire size and severity can help protect fisher habitat value despite potential short-term, localized, negative effects on fisher. ***Because treatment effects on fire spread are relatively local, treatments inside landscape-level fisher habitat (areas of large tree biomass) may better protect fisher habitat than those placed outside fisher habitat*** *(at least under the baseline fire regime). However, treatments in high biomass areas should still strive to maintain sufficient overstory canopy and avoid removing fisher habitat elements, such as large old trees that provide resting structures." (Spencer et al., 2008) [emphasis added]*

Table 65. Recent Ecological Restoration Projects on the Sierra National Forest Within Fisher Habitat.

Project	Year of Decision	Year When a Majority of Project is Implemented	Treated Area Acres	Acres of Fisher Habitat (CWHR 2.1) in Treated Areas	% of Total Habitat	Acres of >40% Fisher Probability (CBI) in Treated Areas	% of Total Habitat
Bass Lake District [a]							
Sonny Meadows N Restoration	2006	2010	701	640	0.4%	700	0.5%
Sugar Pine Restoration	2010	2011-2012	1,115	996	0.6%	745	0.6%
Fish Camp Restoration	2011	2013	730	677	0.4%	568	0.4%
Greys Mountain Restoration 1	2012	2013	932	796	0.5%	917	0.7%
Greys Mountain Restoration 2	2013	2014	695	673	0.4%	685	0.5%
Whisky Ridge Restoration - 1 (est.)	2014	2015	2,107	1,808	1.2%	1,740	1.3%
Whisky Ridge Restoration - 2 (est.)	2014	2016	938	735	0.5%	915	0.7%
Whisky Ridge Restoration - 3 (est.)	2014	2016	651	574	0.4%	487	0.4%
Subtotal for District			7,869	6,899	4.4%	6,757	5.2%
High Sierra District [a]							
Dinkey North Restoration	2010	2011	878	749	0.4%	785	0.5%
Dinkey South Restoration	2010	2011	1,051	953	0.5%	952	0.6%
KREW (Providence area only)	2011	2012	505	452	0.3%	478	0.3%
Eastfork Restoration	2012	2013	1,198	870	0.5%	3	0.0%
Keola Restoration	2012	2013	305	219	0.1%	105	0.1%
Soaproot Restoration	2013	2014	807	652	0.4%	115	0.1%
Coyote Restoration	2013	2014	1,357	413	0.2%	566	0.3%

Subtotal for District			6,101	4,308	2.4%	3,004	1.8%
Total for Sierra NF			13,970	11,207	3.7%	9,761	3.2%
Total of Existing Habitat							
Fisher Habitat in Bass Lake RD				156,935		129,933	
Fisher Habitat in High Sierra RD				179,590		170,568	
Total Fisher Habitat in Sierra NF				336,525		300,501	

Definitions and Assumptions:
a. The CBI recommends a fuels reduction treatment rate of 4% to 8% every 5 years to benefit fisher (Spencer et al. 2008).
b. Future project implementation acreages are estimated (column C).
d. Column D - Fisher habitat is defined as the CWHR 2.1 habitat between 3,000 and 8,000 feet elevation.
e. Column F - Fisher habitat is defined by the Conservation Biol. Inst. (CBI) (Spencer et al. 2008) as having >40% fisher probability.
f. The CWHR and CBI are two different methods for defining habitat, thus the reason for the differences fisher habitat acreage.

Summary of Fisher Habitat and Population on the Sierra National Forest

Suitable fisher habitat on the Sierra National Forest has increased slightly since the mid-1990's. For example, from 1995 to 2005 fisher habitat increased from 422,000 acres to 449,000 acres (USDA Forest Service 2006b), and we estimate there is a similar rate of increase since 2005 as a result of the ecological management that we have implemented. Rick Truex, a USDA Forest Service fisher scientist believes fishers may have increased their spatial distribution on the Sierra National Forest since the mid-1990s, and that the annual occupancy rate within Sierra National Forest 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 Sierra National Forest and perhaps an increasing spatial distribution of fishers make it reasonable to conclude the cumulative effects of vegetation management activities on the Sierra National Forest have not reduced overall habitat suitability for fishers on the Forest.

Additionally, recent scientific information presented in 2011 at the Western Section of the Wildlife Society (TWS) meeting indicates that the fisher population on the Sierra National Forest is stable to increasing. Values of lambda (λ) greater than 1 indicate that a population is increasing, while λ values less than 1 indicate that a population is decreasing. Calculated values for λ were presented for fisher populations within the SNAMP study area (λ 1.04) on the Bass Lake Ranger District, and the Kings River Fisher Project Area(λ 1.2) on the High Sierra Ranger District (Sweitzer et al. 2011). Based on this data, fisher populations on both districts of the SNF are increasing, although the population growth rate is slightly lower within the SNAMP study area as compared to the Kings River area. This is likely due to the bisection of the SNAMP study area by Highway 41, a major travel corridor through Sierra National Forest and Yosemite National Park. Over 21% of the SNAMP recorded fisher mortalities are road kill events on Highway 41 (3 on SNF and 6 in YNP). The Kings River fisher

study has only recorded 1 road related fisher fatality out of 27 total mortalities (4%). A Wildlife Vehicle Collision (WVC) working group has been formed as a subcommittee of the Southern Sierra Nevada Fisher Working Group (SSNFWG) and is tasked with finding a solution to the Highway 41 issue.

The information presented 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".

This follows with data presented by Jody Tucker at the TWS fisher symposium in 2012, which displayed results from the Southern Sierra Nevada Carnivore Monitoring Program indicating the occupancy status of the southern Sierra Nevada fisher population from 2002-2009 was stable. (Tucker, 2012) These results are now published in the Journal of Fish and Wildlife Management: "Constant and positive persistence values suggested that sample units rarely changed status from occupied to unoccupied or vice versa. The small population of fishers in the southern Sierra (probably <250 individuals) does not appear to be decreasing." (Zielinski et al, 2013).

In addition, the California Department of Fish and Game 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 that was evaluated by the Department, 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 Department 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 development and retention of late successional stands and this change in management activity likely has been, and will 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 Whisky Ridge Project would not contribute to significant cumulative effects to Pacific fishers 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.

Determination

It is my determination that Alternative 1 (the no action alternative) for the Whisky Ridge Project ***will 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 will 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 Whisky Ridge Project may affect individuals, but are 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 alternatives 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 treatment action alternative. This project does not propose to remove any oaks, and measures would be implemented to protect black oaks. 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 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.

Terrestrial Wildlife Management Indicator Species

The direct, indirect and cumulative effects to the Terrestrial Wildlife Management Indicator Species are summarized from the Terrestrial Wildlife Management Indicator Species (MIS) report for the Whisky Ridge Project (Otto, 2012).

Introduction

The purpose of this report is to evaluate and disclose the impacts of the Whisky Ridge Ecological Restoration Project on the habitat of terrestrial Management Indicator Species (MIS) identified in the Sierra Forest (SNF) Land and Resource Management Plan (LRMP) (USDA 1991) as amended by the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (USDA Forest Service 2007a). This report documents the effects of the proposed action and alternatives on the habitat of selected project-level MIS. Detailed descriptions of the Whisky Ridge Ecological Restoration Project alternatives are found in the Whisky Ridge Ecological Restoration Project NEPA document Chapter 2 (USDA FS 2013).

MIS are animal species identified in the SNF MIS Amendment Record of Decision (ROD) signed December 14, 2007, which was developed under the 1982 National Forest System 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.

Regulatory Framework

The bioregional scale monitoring strategy for the Sierra NF's MIS is found in the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (ROD) of 2007 (USDA Forest Service 2007a). 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 macroinvertebrates, 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 2010 Sierra Nevada Forests Bioregional Management Indicator Species (SNF Bioregional MIS) Report (USDA Forest Service 2010a).

Methodology

Project-level effects on MIS habitat are analyzed and disclosed as part of environmental analysis under the National Environmental Policy Act (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 Whisky Ridge Ecological Restoration Project is summarized in Section 3 of this 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's draft document "MIS Analysis and Documentation in Project-Level NEPA, R5 Environmental Coordination" (May 25, 2006) (USDA Forest Service 2006a). This Management Indicator Species (MIS) Report documents application of the above steps to select project-level MIS and analyze project effects on MIS habitat for the Whisky Ridge Ecological Restoration Project.

Existing Condition

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 10 major habitats and 2 ecosystem components (USDA Forest Service 2007a), as listed in Table 1. These habitats are defined using the California Wildlife Habitat Relationship (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).

Mitigation and Monitoring

3.a. MIS Monitoring Requirements.

The Sierra Nevada Forests Management Indicator Species (SNF MIS) Amendment (USDA Forest Service 2007a) identifies bioregional scale habitat and/or population monitoring for the Management Indicator Species for ten National Forests, including the Sierra NF. The habitat and/or population monitoring requirements for Sierra NF's MIS are described in the 2010 Sierra Nevada Forests Bioregional Management Indicator Species (SNF Bioregional MIS) Report (USDA Forest Service 2010a) and are summarized below for the MIS being analyzed for the Whisky Ridge Ecological Restoration Project. The applicable habitat and/or population monitoring results are also described in the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a) and are summarized in Section 5 below for the MIS being analyzed for the Whisky Ridge Ecological Restoration Project.

Habitat monitoring at the bioregional scale is identified for all the habitats and ecosystem components, including the following analyzed for the Whisky Ridge Ecological Restoration Project: shrubland; mid seral coniferous forest; late seral open canopy coniferous forest; late seral closed canopy coniferous forest; and snags in green forest.

Population monitoring at the bioregional scale for fox sparrow, mountain quail, California spotted owl, American marten, northern flying squirrel, and hairy woodpecker is distribution population monitoring. Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time (also see USDA Forest Service 2001, Appendix E).

3.b. How MIS Monitoring Requirements are Being Met.

Habitat and/or distribution population monitoring for all MIS is conducted at the Sierra Nevada scale. Refer to the 2010 SNF Bioregional MIS Report (USDA Forest Service 2010a) for details by habitat and MIS.

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 closure would be maintained at 50-60% 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; no management would occur in designated riparian management areas; and snags and downed logs would be retained at 80-100% of the average numbers found within the Project area. Any snag felled for safety reasons would be left on site as downed woody debris. Additional cull logs would be left on site from the logging operation as well. All riparian reserves within the project have been identified and buffers established. In addition, no operations would occur during the wet weather season. (USDA Forest Service 2012e).

Selection of Project level MIS

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

Table 66. Selection of MIS for Project-Level Habitat Analysis for the Whisky Ridge Project.

Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component[1]	Sierra Nevada Forests Management Indicator Species *Scientific Name*	Category for Project Analysis [2]
Riverine & Lacustrine†	lacustrine (LAC) and riverine (RIV)	aquatic macroinvertebrates	N/A
Shrubland (west-slope chaparral types)	montane chaparral (MCP), mixed chaparral (MCH), chamise-redshank chaparral (CRC)	fox sparrow *Passerella iliaca*	Cat. 3
Sagebrush	Sagebrush (SGB)	greater sage-grouse *Centrocercus urophasianus*	Cat. 1
Oak-associated Hardwood & Hardwood/conifer	montane hardwood (MHW), montane hardwood-conifer (MHC)	mule deer *Odocoileus hemionus*	Cat. 2
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	yellow warbler *Dendroica petechia*	Cat. 2
Wet Meadow†	Wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific tree frog (chorus) *Pseudacris regilla*	N/A
Early Seral Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures	Mountain quail *Oreortyx pictus*	Cat. 3
Mid Seral Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures	Mountain quail *Oreortyx pictus*	Cat. 3

Habitat or Ecosystem Component	**CWHR Type(s) defining the habitat or ecosystem component**[1]	**Sierra Nevada Forests Management Indicator Species** ***Scientific Name***	**Category for Project Analysis** [2]
Late Seral Open Canopy Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P	Sooty (blue) grouse *Dendragapus obscurus*	Cat. 2
Late Seral Closed Canopy Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6.	California spotted owl *Strix occidentalis occidentalis*	Cat. 3
		American marten *Martes americana*	
		northern flying squirrel *Glaucomys sabrinus*	
Snags in Green Forest	Medium and large snags in green forest	hairy woodpecker *Picoides villosus*	Cat. 3
Snags in Burned Forest	Medium and large snags in burned forest (stand-replacing fire)	black-backed woodpecker *Picoides arcticus*	Cat. 2

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

[2] **Category 1:** MIS whose habitat is not in or adjacent to the project area and would not be affected by the project.

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

Category 3: MIS whose habitat would be either directly or indirectly affected by the project.

† Species in these categories would be analyzed separately under the aquatic species MIS report for the Whisky Ridge Ecological Restoration Project

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 Whisky Ridge Ecological Restoration Project, Category 1 MIS include the greater sage-grouse. No sagebrush (SGB) habitat is currently present in or adjacent to the project area.

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 Whisky Ridge Ecological Restoration Project, Category 2 MIS include: mule deer, yellow warbler, sooty grouse, and black-backed woodpecker. 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 Whisky Ridge Ecological Restoration Project design features which limit the activities reducing canopy closure and limit treatments within streamside management zones. These design features, as well as applicable Forest Service standards and guidelines 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 385 acres of montane hardwood conifer and 127 acres of montane hardwood habitat within the project treatment units. There are no projected changes to montane hardwood or hardwood conifer 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 decadent 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 Whisky Ridge Ecological Restoration project would increase in the years following project implementation.

Since none of the proposed Alternatives for the Whisky Ridge Ecological Restoration Project would alter the existing 512 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 would 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 did not identify any acres of MRI or VRI habitat types within the project area. However, it is reasonable to assume that some montane riparian habitat exists along the 13 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. Streamside Management Zones (SMZ's) would be implemented on all drainages within the project area prohibiting the entry of mechanized equipment into established buffer zones.

All applicable standards and guidelines 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 standard and guidelines (S/G) that were not superseded by the 2001 or 2004 amendments (USDA-Forest Service 2001; USDA- Forest Service 2004) applicable to Whisky Ridge Ecological Restoration Project for aquatic species, habitats, and riparian health can be found in the project aquatics and hydrology reports (USDA Forest Service 2012e, USDA Forest Service 2012f. With adherence to the standards and guidelines for aquatic and riparian health, the Whisky Ridge Ecological Restoration Project

would not cause a direct or indirect affect to yellow warbler habitat, making it a category 2 species for this analysis. Yellow warbler would 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 104 acres of habitat meeting this criteria in the project area: 79 acres of SMC5P, 18 acres of SMC5S, and 7 acres of PPN5P. Of these 104 acres, 15 acres occur within treatment units. Although 15 acres of SMC5P and SMC5S occur within treatment units, there would be no changes to the habitat type, all 15 acres would remain at current CWHR strata. Since none of the proposed Alternatives for the Whisky Ridge Ecological Restoration Project would alter the existing 104 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 would not be discussed further in this document.

Black-backed woodpecker

Burned habitat is currently present within and adjacent to the Project area, but this project does not propose any fire salvage or fire-restoration type project activities. There have been three recent wildfires within and adjacent to the Project boundary which have created high levels of standing snags within those burned areas. Snags are not proposed for removal throughout the Project area unless they constitute a direct safety hazard. The 2008 Cascadel fire is near the center of the Project area and burned 280 acres. High levels of standing fir and pine snags of all dbh size classes are present throughout this burn. The 2004 Source fire burned 385 acres on steep ground adjacent to the southeastern boundary of the Project. High levels of large dbh pine snags are present throughout most of this burn. No treatment areas are proposed within this burn. Lastly, the 2001 North Fork fire lies in the western portion of the Whisky project area. This wildfire burned a total of 4,130 acres and has a high degree of standing snags, mostly in the larger dbh size classes, present throughout the burned area.

4,619 acres of prescribed burning are proposed for the Whisky Ridge Project, including 17 acres of moderate to high intensity burn. For these moderate to high intensity burn areas, ten acres are proposed within burn unit Rx 306 and seven acres are proposed within burn unit Rx 310. These small pockets of moderate to high intensity fire are proposed to enhance terrestrial wildlife habitat through the creation of larger contiguous snag patches and increase vertical and horizontal habitat heterogeneity across the landscape. This is the first time such a treatment has been proposed on the Bass Lake Ranger District.

The Institute for Bird Populations has sampled two recent fires on the Bass Lake Ranger District: the Oliver fire of 2008 and the North Fork fire of 2001. There are 17 call stations within the Oliver fire which have been sampled for three consecutive years 2009-2011. Black-backed woodpeckers were detected at six of these seventeen call stations in 2011 (35% positive detection). There are 25 call stations in the North Fork fire of 2001. None of these stations have detected presence of black-backed woodpecker during consecutive year surveys from 2009-2011.

There may be indirect effects to black-backed woodpecker habitat through the implementation of the Whisky Ridge 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 2010).

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. Proposed treatments for the Whisky Ridge Ecological Restoration project are limited to a maximum of 9,500 acres out of the 18,293 acres within the project boundary (52% of the total area) and include 4,619 acres of prescribed burning. 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 Whisky Ridge project boundary (48% of the total area). Additionally, the creation of pockets of moderate to high severity fire effects are part of the proposed action of this project, and are intended to increase the amount of available burned habitat for species such as the black-backed woodpecker that utilize those habitats.

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 Whisky Ridge Ecological Restoration 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 2010).

Category 3 MIS

The MIS whose habitat would be either directly or indirectly affected by the Whisky Ridge Ecological Restoration Project, identified as Category 3 in Table 1, are carried forward in this analysis, which would evaluate 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 Whisky Ridge Ecological Restoration Project are: fox sparrow, mountain quail, California spotted owl, American marten, northern flying squirrel, and hairy woodpecker. Species specific analysis begins in section 5 of this document.

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 Whisky Ridge Ecological Restoration Project on the terrestrial MIS habitat for the selected project-level MIS is conducted at the project scale. The analysis used the California Wildlife Habitat Relationship model (CWHR (Mayer and Laudenslayer 1988)) data to determine vegetative type within the entire Whisky Ridge Ecological Restoration Project Boundary. Existing acres of vegetation type (base vegetation layer) were determined using the Sierra National Forest Corporate GIS vegetation feature class of 2009 ExistingVegetation. 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 67. Summary of Commercial Thinning and Plantation Treatments with Pre- and Post-Treatment CWHR Acres for Whisky Ridge Project Area: Present Compared to Alternative 2.

CWHR Forest Structure Class	Alternative 1 Current Structural Class Acres within Project Boundary	Structural Class Acres within Commercial Thinning or Plantation Treatment Units	Alternative 2 Post-Treatment Projected changes to CWHR Structural class acres	Alternative 2 Post-Treatment CWHR structural class acres within Project Boundary
AGS	9	2	0	9
ASP	3	0	0	3
BAR	266	6	0	266
JPN2M	6	0	0	6
JPN2S	37	3	0	37
JPN3D	65	60	-11	54
JPN3M	48	38	+11	59
JPN3P	26	0	0	26
JPN3S	24	0	0	24
JPN4D	5	3	-1	4
JPN4M	37	22	+1	38
JPN4S	7	0	0	7
LAC	2	0	0	2
MCH	86	8	0	86
MCP	827	83	0	827
MHC2M	1	0	0	1
MHC3D	18	4	0	18
MHC3M	14	3	0	14
MHC3S	141	10	0	141
MHC4D	799	129	0	799
MHC4M	377	123	0	377
MHC4P	40	13	0	40
MHC4S	301	82	0	301
MHC5D	96	8	0	96
MHC5M	52	1	0	52
MHC5P	7	2	0	7
MHC5S	30	10	0	30
MHW2M	3	0	0	3
MHW2P	6	0	0	6
MHW3D	180	8	0	180
MHW3M	19	0	0	19
MHW3P	40	5	0	40
MHW4D	729	76	0	729
MHW4M	57	1	0	57
MHW4P	125	35	0	125
MHW4S	5	0	0	5
MHW5D	39	2	0	39
MHW5P	3	0	0	3
PPN2D	14	7	-6	8
PPN2M	8	6	+6	14
PPN2P	6	6	0	6
PPN2S	76	6	0	76
PPN3D	91	77	-35	56
PPN3M	25	7	+35	60
PPN3P	8	1	0	8

CWHR Forest Structure Class	Alternative 1 Current Structural Class Acres within Project Boundary	Structural Class Acres within Commercial Thinning or Plantation Treatment Units	Alternative 2 Post-Treatment Projected changes to CWHR Structural class acres	Alternative 2 Post-Treatment CWHR structural class acres within Project Boundary
PPN3S	7	4	0	7
PPN4D	804	252	-88	716
PPN4M	178	83	+88	266
PPN4P	4	0	0	4
PPN5D	174	3	0	174
PPN5M	2	0	0	2
PPN5P	7	0	0	7
RFR3S	3	0	0	3
SMC2P	31	0	0	31
SMC3D	26	2	0	26
SMC3M	151	33	0	151
SMC3P	114	10	0	114
SMC3S	61	2	0	61
SMC4D	8011	2909	-119	7892
SMC4M	1222	297	+119	1341
SMC4P	251	22	0	251
SMC4S	78	6	0	78
SMC5D	1251	237	0	1251
SMC5M	968	281	0	968
SMC5P	79	13	0	79
SMC5S	18	2	0	18
WTM	95	4	0	95
Grand Totals	**18293**	**5007**	**Density change for 260 acres**	**18293**

MIS Project-level Effects Analysis - Shrubland (West-Slope Chaparral) Habitat

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

There are a total of 913 acres of shrub-land (chaparral) habitat within the project boundary. 827 acres are classified as montane chaparral (MCP) and the remaining 86 acres are classified as mixed chaparral (MCH). Of the 913 acres of chaparral within the project boundary 91 acres (10%) occur within proposed treatment units. Table 2 (Whisky Ridge Project CWHR Data Table, Project Area, Present Compared to Alternative 2 Proposal) displays a full analysis 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 Whisky Ridge Ecological Restoration Project to reduce fire ladder conditions (thinning); pile slash for burning; burn slash piles; masticate and/and or

precommercially thin stands; plant trees; reduce fuel loading through controlled burning; construct handline around jackpot burn areas; conduct meadow restoration, or recreation enhancement, or reconstruct roads.

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 2012a, 2012c, 2012d).

Cumulative Effects to Habitat in the Analysis Area.

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

Cumulative Effects Conclusion:

There would be no direct or indirect effects; therefore there are no cumulative effects for the No Action Alternative of the Whisky Ridge Ecological Restoration Project.

Alternative 2 - Proposed Action

Direct and Indirect Effects to Habitat.

Under Alternative 2, direct effects to 91 acres of shrubland habitat are proposed through mastication and prescribed burning treatments. These 91 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 91 acres of chaparral out of 91 acres within the project boundary is a treatment of 10% of the total chaparral available within the Whisky Ridge Ecological Restoration Project Boundary. There are an additional 822 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 Whisky Ridge Ecological Restoration Project can be found in the Whisky Ridge Ecological Restoration Project DEIS Chapter 3.

Cumulative Effects Conclusion:

This project proposes to treat 10% 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 chapparal bordering roads and inside plantations, resulting in natural regeneration of early seral stage chaparral habitat.

Alternative 3 Lower and Limited Mid-Level Canopy Treatments, All Treatments

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 Whisky Ridge Ecological Restoration 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 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 910 acres of shrubland habitat that exists within the project boundary account for less than 0.1% of the 922,000 acres that exists at the bioregional scale, and 91 of these acres are proposed for some form of treatment. Therefore, cumulative impacts within the CE 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.

Early and Mid Seral Coniferous Forest Habitat (Mountain quail)

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

There are currently 824 acres of early seral and 10,597 acres of mid seral coniferous forest habitat within the Whisky Ridge Ecological Restoration Project boundary totaling 11,421 acres. Of these, 3,856 acres (34%) are within proposed treatment units. Refer to Table 2 (Whisky Ridge 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 (No Action) of the Whisky Ridge Ecological Restoration Project.

Alternative 2 - Proposed Action

Direct and Indirect Effects to Habitat.

Under Alternative 2, there are projected changes in CWHR composition of early and mid seral coniferous habitat These changes are projected to occur on 260 acres spread across the treatment units. 52 acres of early seral coniferous habitat would experience a density change including: 11 acres of JPN3D would be converted to JPN3M, 6 acres of PPN2D would be converted to PPN2M, and 35 acres of PPN3D would be converted to PPN3M. These 52 acres account for 6% of the total early seral coniferous forest habitat available within the project boundary. The habitat would remain early seral, but would be less dense as trees are removed to address ladder fuel concerns.

208 acres of mid seral coniferous habitat would experience a density change including: 1 acre of JPN4D would be converted to JPN4M, 88 acres of PPN4D would be converted to PPN4M, and 119 acres of SMC4D would be converted to SMC4M. These 208 acres account for 2% of the total mid

seral coniferous forest habitat available within the project boundary. The habitat would remain mid seral, but would be less dense as trees are removed to address forest health concerns.

The remaining 3,596 acres of early and 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 Lower and Limited Mid-Level Canopy Treatments, All Treatments

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

Under Alternative 3, there are no projected changes in CWHR composition of early or mid seral coniferous habitat. 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 2012, 2012c, 2012d).

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 Whisky Ridge Ecological Restoration 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 530,851 acres of early seral and 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 early seral is decreasing (changing from 9% to 5% of the acres on National Forest System lands) and the trend for mid seral 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 10 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 11,421 acres of early and mid seral coniferous habitat that exists within the project boundary accounts for less than 0.3% of the 3,306,873 acres that exists at the bioregional scale. The change in canopy closure of 260 acres out of 3,306,873 acres of early and 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)

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

There are a total of 2,395 acres of late seral closed canopy coniferous forest habitat within the Whisky Ridge Ecological Restoration project boundary. 174 acres are PPN5D, 2 acres of PPN5M, 1,251 acres of SMC5D and 968 acres of SMC5M. This habitat type accounts for 13% of the total acreage within the project boundary area. Refer to Table 2 (Whisky Ridge 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 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 2012, 2012c, 2012d).

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 (No Action) of the Whisky Ridge Ecological Restoration Project.

Alternative 2 - Proposed Action

Direct and Indirect Effects to Habitat.

There are a total of 2,395 acres of late-seral closed canopy coniferous forest within the project boundary of the Whisky Ridge Project. Of these, 521 acres (22%) occur within treatment units. Under Alternative 2 no changes to late-seral habitats are projected to occur within the treatment areas of the project. All late seral stage habitat at the 5D level is projected to remain 5D post implementation.

Alternative 3 - Lower and Limited Mid-Level Canopy Treatments, All Treatments

Direct and Indirect Effects to Habitat.

There are no projected changes to late-seral closed canopy forest habitat under Alternative 3.

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. 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 Whisky Ridge Ecological Restoration 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, 2006b; 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 Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA Forest Service 2005, 2006b, 2007b, 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.

There are no projected changes in canopy closure for the Whisky Ridge project. There are a total of 1,006,923 acres of late seral closed canopy coniferous forest habitat available throughout the 10 Sierra Nevada forests. Implementation of the Whisky Ridge project 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.

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 (diameter breast height 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 standards and guidelines (S&Gs) from the Sierra NF Land and Resource Management Plan (LRMP) (1991) 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 Sierra Nevada Forest Plan Amendment (SNFPA) (2004), modified the SNF LRMP with the followings guidelines: (1) in westside mixed conifer and ponderosa pine types, Forests should maintain 4 of the largest snags per acre, (2) in red fir forest type, they should maintain 6 of the largest snags per acre, (3) in eastside pine and mixed conifer forest types, they should maintain 3 of the largest snags per acre, and (4) in westside hardwood ecosystems, they should maintain 4 of the largest snags (hardwood or conifer) per acre, or if standing live hardwood trees lack dead branches, they should maintain 6 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 Whisky Ridge Ecological Restoration 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:
- Maintain highest canopy cover possible to meet the prescription within stands, aim for 50-60% immediately post-harvest.
- Thinning would not remove any trees larger than 30"dbh.
- 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.
- Retain largest snags and logs. Do not remove snags unless it is an immediate 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 2012, 2012c, 2012d).

Cumulative Effects to Habitat in the Analysis Area and Conclusion.

There are no direct or indirect effects of the No Action Alternative for the Whisky Ridge Ecological Restoration Project, therefore there are no cumulative effects for Alternative 1 No Action.

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 9.5 standing conifer snags per acre that are ≥10" dbh. Of those standing conifer snags, a total of 4.5 per acre are ≥16" dbh. No snags are proposed for removal by any of the Action alternatives in the Whisky Ridge Ecological Restoration 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 ROD.

Alternative 3 - Lower and Limited Mid-Level Canopy Treatments, All Treatments

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 Whisky Ridge Ecological Restoration 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 11,421 acres of mid and late seral forest habitat that provides the green forest snag component within the project boundary account for less than 0.3% of the 3,835,000 acres of mid and late seral coniferous forest habitat within the Sierra Nevada bioregion. No snags are proposed for removal in the Whisky Ridge Ecological Restoration project except where they constitute a direct safety hazard. The proposed action for the Whisky Project aims to create stands with high snag densities in treatment areas proposed for moderate to high intensity fire behavior (17 acres) as well as additional scattered snags throughout the traditional prescribed fire treatment areas (4,300 acres). It is not expected that either of the alternatives of the Whisky Ridge project would significantly 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.

Visual Resource

The direct, indirect and cumulative effects below are summarized from the Whisky Ridge Project Scenery Specialist Report (Sanchez, C. 2013).

This report examines the extent to which alternatives maintain the landscape free from visible disturbances that detract from the valued scenic character in response to the Forest Plan visual quality objectives (VQOs), and the extent to which alternatives maintain the ecological sustainability of the valued scenic character and its scenery attributes within the Whisky Ridge Project as viewed from key viewing points. The key viewing points are displayed in Table 68. Detailed descriptions of the visual quality objectives are in the Scenery Specialist Report which is available in the project record.

Affected Environment).

Existing Condition

The Affected Environment are described using SMS principles of Sense of Place, Scenic Character Description, Ecosystem Context, Scenic Attractiveness, Landscape Visibility, Scenic Integrity and Scenic Stability.

Sense of Place

The 2007 SNF Recreation Niche information below provides social/recreational context for how scenic quality contributes to recreation settings within the Whisky Ridge Project. The Whisky Ridge Project Area contains two niche-setting types: “Scenic Corridors” and “Transitional” (Figure 28).

A small section of the Whisky Ridge Project Area lies within the “Scenic Corridors” setting. The Sierra Vista National Forest Scenic Byway (Scenic Byway) makes up the “Scenic Corridors” setting and is the major travelway that connects diverse visitors of all skill levels to a wide range of recreation opportunities from viewing scenery at numerous vistas to camping, hiking, picnicking and rafting (USDA-FS 2007b). The rest of the Whisky Ridge Project Area lies within the “Transitional” setting that offers year-round recreation opportunities, including Whisky Falls Campground, a developed campground with nine campsites, approximately 18 miles of designated motorized trails with two designated concentrated use areas (CUAs), and several heavily-used and popular dispersed recreation sites. Below are excerpts from the SNF Recreation Niche statement that describe the “Scenic Corridors” and “Transitional” setting types found within the Whisky Ridge Project Area (USDA-FS 2007b).

Scenic Corridors **-** Popular paved driving and scenic corridors, two designated as National Scenic Byways, are the conduit for connecting people from low elevation, urban settings to cool, high elevation quiet. These corridors provide dramatic geology, historic and vegetative contrasts including an intimate experience with Giant Sequoias, and take visitors from the surrounding lowlands at sea level to over 9,000 feet elevation.

Transitional – At lower elevations this setting functions as a front-country, forest-urban transition landscape and offers year round recreation opportunities, characterized as foothill land, containing a mixed ownership pattern. This area is well-roaded in places and contains the forest’s wildland urban interface (WUI), where most of the forest’s immediate fuels/vegetation activities occur. The mid-elevations portion of the setting is characterized as a “working forest” enhancing stewardship and

conservation education opportunities. Upper elevations are more primitive and less roaded offering a transition to the wildlands and solitude.

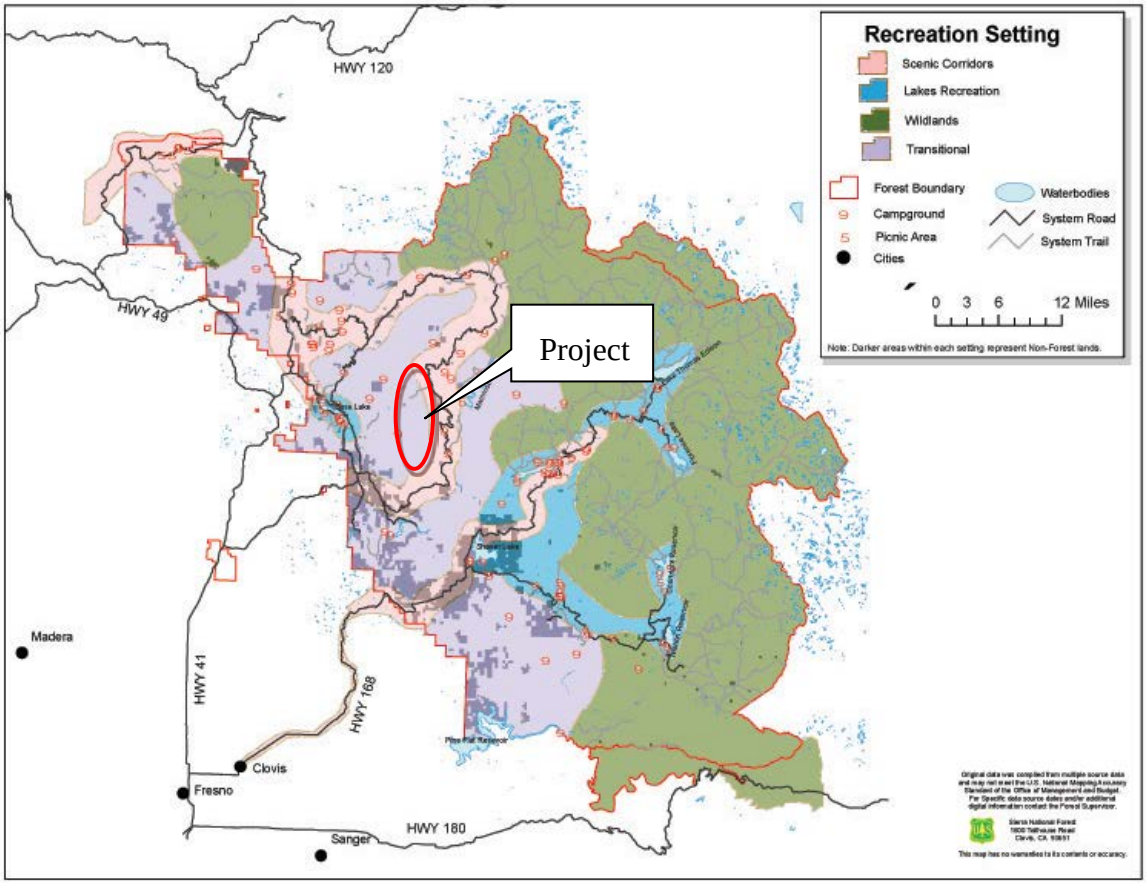


Figure 28. SNF Niche Map – Recreational settings within Whisky Ridge Project Area

The Whisky Ridge Project Area's dominant scenic identity is its largely continuous, ponderosa pine and mixed conifer forest setting on moderately steep to rolling landform.

The dominant scenery attributes within the Whisky Ridge Project Area are its large trees (>18" dbh), diverse tree species and size classes, and the mosaic vegetative patterns in the understory that consist of patches and clumps of diverse shrubs and ground covers. One of the diverse tree species includes the black oak species whose leaves turn yellow-orange and provide color contrast to the evergreen pine species during the fall season. The mosaic vegetative patterns in the understory are moderate to fine-scaled ranging from a continuous covered floor to large barren rocky openings (Figures 29). These dominant scenery attributes are prominent in the landscape and are essential to the valued image.

Figure 29. Left;Views of large pine trees with mosaic patterns of shrubs and grasses in the understory Right;Views of the yellow-orange leaves of the black oak species during the fall season

The minor scenery attributes include the moderately steep to rolling landform, rock outcroppings, numerous meadows, and creeks including Whisky Creek and its Whisky Falls. These minor scenery attributes contribute to the valued image of the landscape but are less noticeable and not essential to that image.

Conifer stands have become crowded with multiple layers of shade tolerant trees. Stand species composition has shifted from more fire resistant, shade intolerant pine to less fire resistant, shade tolerant white fir and incense cedar.

The exclusion of fire over the past 100 years has resulted in a buildup of dead and down fuels as well as dense thickets of understory trees which have created multilayered conifer stands (Figure 30). These conditions provide an environment for wildfires to burn at high intensities over large acres. Dense vegetation lowers scenic beauty and forests with many closely spaced small trees often receive lower scenic ratings (Ryan 2005).

Figure 30. Existing dense conifer stands

The dense vegetation conditions would experience increased competition for available light, water and nutrients, become more stagnant and subject to increased insect and disease risks, and gradually die or likely be consumed by wildfire. These conditions would further increase the risk of large and intense wildfires that would inevitably eliminate many vegetation scenery attributes within large portions of the Whisky Ridge Project Area. Disturbances such as wildland fire that result in extensive areas of dead or dying trees are perceived as having a negative impact on visual beauty (Ryan 2005).

The scenic attractivess in the project area is classified as typical, with generally positive, yet common, attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

Landscape Visibility

The Whisky Ridge Project Area is seen from the Sierra National Forest Scenic Byway (Scenic Byway) and County Road 274 at a distance of 1/2 mile to 4 miles (middleground distance zone). The Forest Plan inventory of sensitivity levels (concern levels) categorizes the Scenic Byway and County Road 274 as a primary travelways where visitors are expected to have a high concern for scenic values. The majority of the views from the Scenic Byway and County Road 274 are screened by "walls" of trees or earth forms (hillsides, rock cliffs, rolling hills) that enframe the views directing the viewer's attention inwards and screening views beyond the immediate foreground (0 ft. to 300 ft.) (Figure 30). There are views towards the Whisky Ridge Project Area from the Scenic Byway and County Road 274 where vegetation or earth forms are absent. Only the locations from where the Whisky Ridge Project Area is seen from the Scenic Byway and County Road 274 would be used as key viewing points in this analysis (Figure 30).

Other travelways from where the Whisky Ridge Project Area is visible from include the designated motorized trails and Forest Service (FS) Roads 08S09 and 08S70. These two FS Roads access Whisky Falls Campground and dispersed recreation areas including Camp 5. The entire length of the designated motorized trails and FS Roads 08S09 and 08S70 would be used as key viewing points in this analysis for a buffer of 300 ft. on both sides where treatments are proposed.

The Whisky Ridge Project Area is also seen from use areas such as Whisky Falls Campground, dispersed recreation areas (i.e., dispersed camping and use areas) including Camp 5, and the two off-highway vehicles designated concentrated use areas (CUAs). A 300 ft. buffer from these use areas would be used as the key viewing points.

Due to the Whisky Ridge Project Area's moderately steep to rolling terrain and largely continuous forest canopy, the Whisky Ridge Project Area is most often viewed at distances of less than 300 feet (Immediate Foreground) from the above travelways and use areas, where scenery is dominated by the forest canopy and understory (except from the Scenic Byway and County Road 274). Based on the criteria established under the SMS concern levels, visitors are expected to have a moderate to high concern for scenic values from these travelways and use areas.

Figure 31. Left Photo; Views from the Scenic Byway enframed by trees and earth forms. Right Photo; Views from the Scenic Byway to Whisky Ridge Project Area

Table 68 shows the list of the key viewing points used in this analysis from where the effects on scenery would be analyzed.

Table 68. Summary of Travelways and Use Areas to be used as Key Viewing Points.

Key Viewing Points
Sierra Vista National Forest Scenic Byway – only the viewing points from where the Project Area is seen
County Road 274 – only the the viewing points from where the Project Area is seen
Designated Motorized Trails (approximately 18 miles) – 300 ft. buffer on both sides on entire length where treatments are proposed
Forest Service Roads 08S09 and 08S70 – 300 ft. buffer on both sides on entire length where treatments are proposed
Whisky Falls Campground – 300 ft. buffer
Dispersed Camping and Use Areas (including Camp 5) that are on designated roads or designated motorized trails – 300 ft. buffer
Designated concentrated use areas (CUAs) –- Whisky Staging and Gertrude E and West Parking300 ft. buffer

The majority of the Whisky Ridge Project Area lies within the Modification VQO. There are sections of Partial Retention VQO on the northern-end and southern-end of the Project Area (Figure 32).

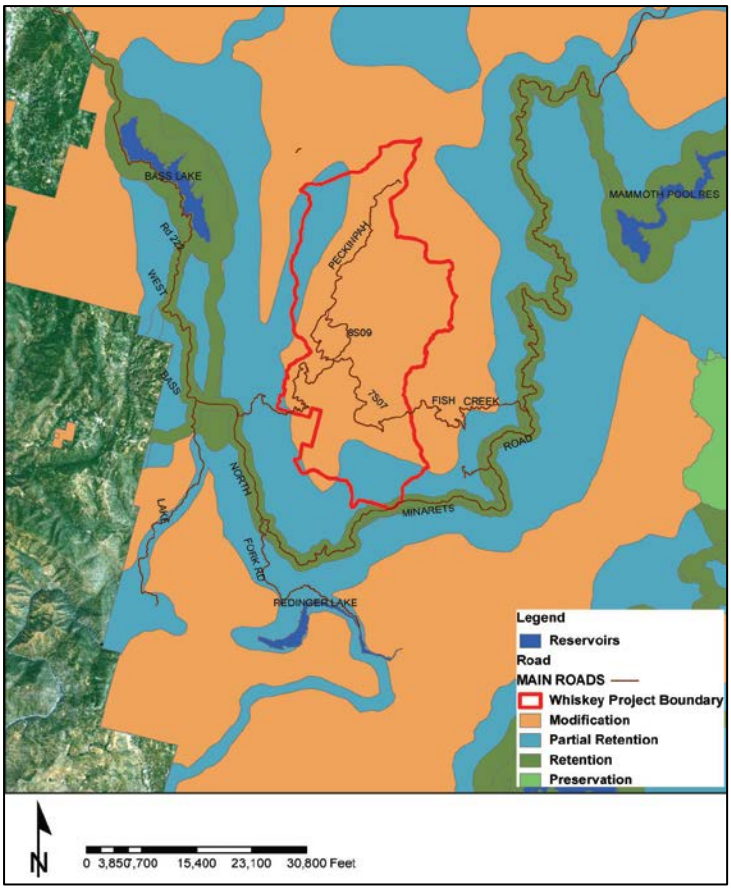


Figure 32. Visual Quality Objective (VQO) Map

The Whisky Ridge Project Area as seen from the Scenic Byway and County Road 274 is within the Partial Retention and Modification VQOs and is mostly covered by the tree canopy, forming a continuous covered forest-setting with occasional rock outcroppings.

The Whisky Ridge Project Area as seen from the designated motorized trails, Forest Service (FS) Roads 08S09 and 08S70, Whisky Falls Campground, dispersed camping and use including Camp 5, Whisky Staging and Gertruse E and W Parking (CUAs) is most often viewed at distances of less than 300 feet (immediate foreground). From these key viewing points, the landscape does consist of visible disturbances such as slash and woody debris, noticeable stumps, scorching of trees, dead branches caused by previous underburned treatments, and closely spaced small trees encroaching in the understory (Figure 33). These visible disturbances contrast and visually dominate in the immediate foreground, but overall meets the Modification visual quality level. The Modification visual quality level complies with the Forest Plan VQO of Modification.

Although most of these key viewing points in the immediate foreground are within the Modification VQO, there are key viewing points that are within the northern-end and southern-end of the Partial Retention VQO sections of the Project Area. In these areas, there are similar visible disturbances as within the Modification VQO, but less to an extent and, therefore, meets the low-end of the Partial Retention visual quality level. The Partial Retention visual quality level complies with the Forest Plan VQO of Partial Retention.

Other ecosystem conditions and stressors that affect the valued scenic character and scenery attributes include insect and disease outbreaks. However, none of these compare to the scale and intensity of risk that is currently posed by a potential large-scale wildfire due to the dense vegetation conditions.

The Whisky Ridge Project Area's existing scenic stability is **Low**. The large trees and diverse vegetation scenery attributes are present in the landscape as viewed from the key viewing points, but are in poor condition since they are at high risk of being eliminated or seriously threaten due to the dense vegetation conditions and ecosystem stressors such as insect and disease outbreaks and potential large-scale stand-replacing wildfires. The understory has become very dense with small and intermediate sized trees (figure 34).

Figure 33. Understory becoming very dense with small and intermediate sized trees

Desired Condition

The desired conditions for scenery are to restore the scenic character to its historic conditions of displaying an open, park-like setting dominated by large trees (>18” dbh) with diverse multi-aged and multi-layered stands thinned to a variable spacing density. The stands would have vegetation in the understory consisting of low shrubs and grasses forming patches and clumps of mosaic vegetative patterns (heterogeneity) (Figure 35). The presence of intermediate-sized trees would be greatly reduced, especially the many which crowd and weaken the more attractive larger trees.

Diversity of canopy density, species, and sizes would be more prominently displayed and the visual access through the understory would be improved to enhance the valued scenic character and its scenery attributes and result in an attractive variety of spaces, light conditions, understory vegetation, and views of landforms, rock features, and wildlife. Lastly, re-introduction of wildfire evidence into the scenery is desired, primarily as patchy, irregularly shaped low-intensity burn patterns to restore mosaic vegetative patterns of heterogeneity, remove woody debris, and enhance regeneration of the understory.

These scenery attributes would be distributed through time and space to offer increased attractiveness in terms of vegetative forms, colors, canopy texture, and immediate foreground spatial variety. These conditions would offer greater ecological resilience, sustainability of scenery attributes, and long-term stability of the desired scenic character.

Figure 34. Left Photo; Desired Conditions: Open, park-like setting with heterogeneity in understory Right Photo, Desired Conditions: Open, park-like setting dominated by large trees

Evironmental Consequences

Methodology

This Methodology section describes the methodology used for addressing the direct, indirect, and cumulative effects of implementing each alternative as a whole. This section addresses the scope of the analysis, spatial boundary of the effects analysis, timeframes (short-term and long-term), and scenery indicators to be measured, including justification as to why they were chosen.

This analysis relies on personal observations from site visits, photography from inventoried sensitive viewpoints (key viewing points), and GIS corporate database, and is essentially prepared using qualitative data for scenery (e.g. evaluation of effects is determined using professional judgment based on experience, training, and education, rather than quantitative values).

Scope of the Analysis

The scope of the analysis is the Whisky Ridge Project boundary area as it relates to the Proposed Action.

Spatial Boundary

The Forest Plan VQOs establish minimum acceptable thresholds for landscape alterations from an otherwise natural-appearing forest landscape. The threshold of effects is exceeded when alternations do not meet the visual intensity and dominance criteria of the visual quality objective.

The key viewing points are the unit of spatial analysis (points of reference) from where the direct, indirect, and cumulative effects on scenery are analyzed. See Table 68 for key viewing points relevant to this analysis.

Indicators

The effects of the alternatives on scenery would be evaluated using the following two scenery indicators – Scenic Integrity and Scenic Stability:

Scenic Integrity – the degree to which a landscape is free from visible disturbances that detract from the existing scenic character that people value, including any visible disturbances due to human activities (e.g., timber harvesting, road construction, utility corridors) or extreme natural events (e.g., catastrophic wildfires, insect/disease outbreaks). Scenic Integrity is measured on the Sierra National Forest through the six graduated visual quality levels from the VMS. The visual quality levels measure these disturbance effects in degrees of consistency, harmony, dominance and contrast with the valued scenic character being viewed at the time of measurement from key viewing points. The levels indicate the presence and magnitude of visual disturbance (contrast in form, line, color, texture, pattern, size or scale) to that valued scenic character. These visual quality levels can be applied in three ways: 1) to describe existing scenic integrity/disturbance, or 2) to document what and to what extent Forest Plan VQOs are being met to determine compliance with the Forest Plan, or 3) to describe future scenic integrity/disturbance that is predicted to occur from proposed management activities. The same VQO descriptions are used to describe the visual quality levels. The visual quality levels are (USDA-FS 1974)

Preservation – Allows only for ecological changes. Management activities, except for very low visual impact recreation facilities, are prohibited. This objective applies to Congressionally-designated wilderness areas.

Retention – Provides for management activities, which are not visually evident. Activities may only repeat form, line, color, and texture, which are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc. should not be evident.

Partial Retention – Provides for management activities that remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color and texture common to the characteristic landscape but changes in their qualities of size, amount, intensity, direction, pattern, etc. remain visually subordinate to the characteristic landscape. Activities may also introduce form, line, color, or texture which are found infrequently or not at all in the characteristic landscape, but still remain subordinate to the visual strength of the characteristic landscape.

Modification – Management activities may visually dominate the characteristic landscape. Activities of vegetative and land form alteration must borrow from naturally established form, line, color, and texture so completely and at such scale that its visual characteristics are compatible with the natural surroundings.

Maximum Modification – Management activities of vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middle ground they may not appear to completely-borrow from naturally established form, line, color, or texture.

Unacceptable Modification – Management activities that are visually excessive and unrelated to the characteristic landscape (never an objective on National Forest Lands). Activities or facilities that contrast in form, line, color, or texture are excessive. All dominance elements in the management activity are visually unrelated to those in the characteristic landscape.

Scenic Stability – the degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression. Assessing scenic stability involves two basic steps: (1) Determine the risks to the valued attributes of scenic character based on their conditions and the ecosystem stressors affecting them, and (2) Determine the Scenic Stability of the scenic character based on the collective risks to its individual scenery attributes. This indicator enables managers to recognize trends and/or conditions that would cause improvement, loss or diminishment of the valued scenic character and its attributes. Scenic stability uses a graduated rating scale of scenic stability levels. Six levels of Scenic Stability are possible based on ecosystem conditions and risks to the valued scenic character and its scenery attributes. The scenic stability levels are (USDA-FS 2007):

Very High Stability – All dominant and minor scenery attributes of the valued scenic character are present and are likely to be sustained.

High Stability – All dominant scenery attributes of the valued scenic character are present and are likely to be sustained. However, there may be scenery attribute conditions and ecosystem stressors that present a low risk to the sustainability of dominant scenery attributes.

Moderate Stability – Most dominant scenery attributes of the valued scenic character are present and are likely to be sustained. A few may have been lost or are in serious decline.

Low Stability – Some dominant scenery attributes of the valued scenic character are present and are likely to be sustained. Known scenery attribute conditions and ecosystem stressors may seriously threaten or have already eliminated the others.

Very Low Stability – Most dominant scenery attributes of the valued scenic character are seriously threatened or absent due to their conditions and ecosystem stressors and are not likely to be sustained. The few that remain may be moderately threatened but are likely to be sustained.

No Stability – All dominant scenery attributes of the valued scenic character are absent or seriously threatened by their conditions and ecosystem stressors. None are likely to be sustained, except relatively permanent attributes such as landforms.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The cumulative effects spatial boundary for scenery considered in this analysis is the key viewing points. See Table 1 for key viewing points relevant to this analysis.

Past activities have altered the natural landscape, creating the existing condition of the landscape. Many of the impacts from these past activities such as timber sales and fire/fuels management activities have either been naturally revegetated or meet the Forest Plan VQOs of Partial Retention and Modification within the Project Area. Present and reasonably foreseeable activities within the Whisky Ridge Project Area include range improvements, roadside hazard tree removal, live stock grazing, and ecological restoration treatments. The visible disturbances (e.g., burn piles, skid trails,

and landings) of the hazard tree removal projects and the ecological restoration treatments projects would be the most visible. These present and future activities would comply with the VQOs and applicable visual resources management direction specified in the Forest Plan to minimize effects on scenery. Because the past activities have either been naturally revegetated or currently meet the Forest Plan VQOs and the present and future activities would comply with the Forest Plan VQOs and applicable visual resources management direction specified in the Forest Plan, the past, present and future activities within the Whisky Ridge Project Area would have no cumulative effects on scenery as seen from the key viewing points.

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.

Direct Effects

Scenic Integrity: There would be no direct effects under the No Action alternative, as no Project activities would be proposed. The Whisky Ridge Project Area would maintain its Partial Retention and Modification visual quality levels as seen from all the key viewing points.

Scenic Stability: There would be no direct effects under the No Action alternative, as no Project activities would be proposed. The scenic stability would continue to meet the scenic stability level of Low Stability. Although the large trees and diverse vegetation scenery attributes are present in the landscape as viewed from the key viewing points, primarily from the key viewing points in the immediate foreground, the scenery attributes are in poor condition since they are at high risk of being eliminated or seriously threaten due to the dense vegetation conditions and ecosystem stressors such as insect and disease outbreaks and potential large-scale stand-replacing wildfires. Refer to the existing scenic stability section under the Affected Environment for more information. Ecosystem stressors (e.g., wildland fire, insect outbreaks) would continue to threaten the valued scenic character of the Whisky Ridge Project Area and the vegetative conditions (excessive density and uniform stands) would continue. Under the No Action alternative, the vegetation conditions within the Whisky Ridge Project Area would continue to be overly dense and overtime becoming denser and less sustainable. The No Action alternative would not enhance and/or sustain the valued scenic character and its scenery attributes, primarily its socially valued vegetative scenery attributes (i.e., large trees and diverse vegetation), in the Whisky Ridge Project Area.

Indirect Effects

Scenic Integrity: There would be potential indirect long-term adverse effects under the No Action alternative. The current dense vegetation conditions would continue to increase the risk of large and intense wildfires that would dramatically alter the landscape by burning much more intensely and across large portions within and outside the Whisky Ridge Project Area. This may result in extensive areas that are blackened and charred with high tree mortality and high tree bole scorch. The color and texture of the blackened and charred forest and the vertical lines and color of the dead trees and tree bole scorching would dominate the landscape. The vegetative mosaic patterns would result in a more discordant pattern of large-scale, fire consumed openings. Disturbances such as wildland fire that result in extensive areas of dead or dying trees are perceived as having a negative impact on visual beauty (Ryan 2005).

The visual quality levels of Partial Retention and Modification would remain the same and continue to comply with the Forest Plan VQOs of Partial Retention and Modification, unless a high severity wildland fire or high tree mortality insect outbreak occurs due to the current excessive vegetation density. Depending on the severity and location, the potential indirect effects could change the visual quality level as seen from the key viewing points from Partial Retention and Modification to Unacceptable Modification, a potential two to three level decrease from the Forest Plan VQOs of Partial Retention and Modification. The Unacceptable Modification visual quality level would not comply with the Forest Plan VQOs of Partial Retention and Modification and would not be consistent with the Forest Plan visual resources management direction specified in the regulatory setting section of this document.

Scenic Stability: There would be potential indirect long-term adverse effects under the No Action alternative. The current excessive vegetation density and even-aged forest setting would continue to be increasingly susceptible to severe wildfire conditions, stress, and mortality caused by drought, insects, and disease. These ecosystem conditions and stressors of insect and disease outbreaks could diminish the valued scenic character and the large trees and diverse vegetation scenery attributes. However, none of these compare to the scale and intensity of risk that a potential large-scale wildfire would pose due to the dense vegetation conditions. The dense vegetation conditions would further increase the risk of large and intense wildfires that would inevitably eliminate the vegetative scenery attributes (i.e., large trees and diverse vegetation) and more dramatically alter the forest canopy by burning much more intensely and across large portions within and outside the Whisky Ridge Project Area. This may result in large-scale, fire-consumed openings of minimal scenic attractiveness and poor ecosystem resilience.

Cumulative Effects

Because there are no direct effects, as no Project activities would occur, and the indirect long-term adverse effects are not associated with Project activities, there would be no cumulative effects to scenery when combining the actions in the No Action alternative with the past, present, and reasonably foreseeable activities.

Summary of Effects

Based on the effects evaluated by the two scenery indicators, under both Scenic Integrity and Scenic Stability there would be no direct effects to scenery, but there would be potential indirect long-term adverse effects. Overall, the No Action alternative would have negative effects to scenery in the long-term. Because there are no direct effects, as no Project activities would occur, and the indirect long-term adverse effects are not associated with Project activities, there would be no cumulative effects to scenery when combining the actions in the No Action alternative with the past, present, and reasonably foreseeable activities. A comparison of all three alternatives, by environmental effects for scenery are displayed in the summary Table on page ii.

Alternative 2 – Proposed Action

Direct Effects

Scenic Integrity: There would be direct short-term effects under Alternative 2. Disturbances as seen from the Scenic Byway and County Road 274 would consist of the smoke caused by the underburned treatments at a distance of 1/2 mile to 4 miles (middleground distance zone). There would also be visible disturbances that would occur in the immediate foreground (0 ft. to 300 ft.) directly after treatments as viewed from the designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls

Campground, dispersed recreation areas including Camp 5, and designated concentrated use areas (CUAs). These visible disturbances would include views of burn piles, landings, cut stumps, temporary roads within the thinning areas along with soil disturbances, skid trails, and understory vegetation disturbance due to movement of logging equipment, as well as fuel break lines and remnants of underburned areas such as blackened and charred pockets with tree mortality and tree bole scorching. Although there would be remnants of underburned areas, the underburning treatments re-introduce wildfire evidence into the landscape; which is part of the desired scenery conditions, and helps remove much of the dead and down surface fuels. Removing dead wood or chipping onsite can greatly increase scenic ratings for tree thinning projects (Ryan 2005). The smoke is a temporary effect and the burned areas would naturally revegetate with low grasses usually within one to two years. The proposed high intensity burn areas would not be visible from the key viewing points.

Since the Forest Plan directs us to manage scenery for the highest quality in areas significant to recreation, the views from the designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed recreation areas including Camp 5, and designated concentrated use areas (CUAs) would be managed to meet the VQOs of Partial Retention and the high-end of Modification. Several design features are included in this alternative to minimize the visible disturbances and aid in achieving the VQOs of Partial Retention and the high-end of Modification due to the heavy recreational use from the key viewing points. Refer to the Design Features section of this document to learn more about the scenery design features developed for the Whisky Ridge Project. With the implementation of the scenery design features, the above visible disturbances would result in short-term effects (1-5 years) and their unnatural forms and patterns (e.g., burn piles and landings); line elements (e.g., stumps, temporary roads, skid trails, fuel break lines); colors and textures (e.g., underburned areas) would reduce the visual quality levels towards the low-end of Partial Retention and/or low-end of Modification. These short-term effects would be noticeable to people from the designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed recreation areas including Camp 5, and designated concentrated use areas (CUAs) within1-5 years after treatments. As vegetation growth occurs, the visual effects from burning soften over time, and the visible disturbances are no longer visible, the landscape would comply and excel the Forest Plan VQOs of Partial Retention and Modification.

Scenic Stability: There would be positive direct effects under Alternative 2. The Whisky Ridge Project Area's scenic stability level would increase two levels from Low Stability in the No Action alternative to High Stability in which "All dominant scenery attributes of the valued scenic character are present and are likely to be sustained. However, there may be scenery attribute conditions and ecosystem stressors that present a low risk to the sustainability of dominant scenery attributes" (USDA-FS 2007). The large trees and diverse vegetation scenery attributes would be present and likely to be sustained, particularly with the thinning and fuel treatments that would reduce the density of the stands, reduce risks for potential large and high intensity wildfires, and decrease insect and disease outbreaks. The current ecosystem stressors (i.e., tree mortality due to wildland fire and/or insect outbreak) would be reduced and would reverse the decline in the vegetative condition when compared to the No Action alternative. In addition, Alternative 2 would provide sustainability and improve the vegetative condition over time (i.e., reducing density of stands by primarily removing intermediate and suppressed firs, increasing the proportion and protection of large trees, removing much of the dead and down surface fuels, promoting multi-storied diverse stands and providing a vegetative mosaic). By decreasing risk of ecosystem stressors to vegetation and improving the vegetative scenery attribute conditions, the valued scenic character and its scenery attributes, primarily the large trees and diverse vegetation, would be enhanced and sustained through time and ecological progression within the Whisky Ridge Project Area.

The proposed thinning treatments would reduce the density of the stands, primarily removing intermediate and suppressed trees. Forests with more open structure that allows visual access through

the understory are considered more scenic than forests with extremely dense understory vegetation (Ryan 2005). The visual access into the forest would enhance the visibility and presence of the large trees, diverse vegetation, landform, rock outcroppings, meadows, and creeks, all of which are scenery attributes of the valued scenic character.

The proposed thinning treatments would also promote the growth of large trees and diverse vegetation (heterogeneity). Many studies have shown that people prefer large mature trees (Ryan 2005). This would help achieve the desired scenic character of an open, park-like setting dominated by large trees and diverse forest canopy with species and spatially diverse, multi-storied stands. Research shows that people prefer more visually complex scenes, as opposed to more monotonous ones (Ryan 2005). Fuels treatments would further open the stands, remove much of the dead and down surface fuels, provide a mosaic vegetative pattern and add variety to the understory and/or shrub species. Studies show that prescribed fire can increase scenic beauty in the short-term by removing woody debris, which is considered unsightly by forest visitors, and by enhancing regeneration of the understory (Ryan 2005).

Indirect Effects

Scenic Integrity: There would be positive indirect effects under Alternative 2 as there would be a beneficial reduction of risks for potential large and high intensity wildfires and their subsequent adverse effects to scenery. This would reduce visible disturbances that would be highly visible in the middleground (1/2 mile to 4 miles) from the Scenic Byway and County Road 274, but more prominent in the immediate foreground (0 ft. to 300 ft.) from designated motorized trails, FS Roads 08S09 and 08S70, Whisky Falls Campground, dispersed recreation areas including Camp 5, and designated concentrated use areas (CUAs).

Scenic Stability: There would be positive indirect effects under Alternative 2 as there would be a beneficial reduction of risks for potential large and high intensity wildfires and their subsequent adverse effects to scenery, which would inevitably eliminate the vegetative scenery attributes (i.e., large trees and diverse vegetation).

Cumulative Effects

Because the direct effects are short-term (1-5 years) and there are positive direct and indirect effects, there would be no cumulative effects to scenery when combining the actions in Alternative 2 with the past, present, and reasonably foreseeable activities.

Summary of Effects

Based on the effects evaluated by the two scenery indicators, under Scenic Integrity there would be direct short-term effects and positive indirect effects to scenery and under Scenic Stability there would be positive direct and indirect effects. Overall, Alternative 2 would have beneficial effects to scenery. Because the direct effects are short-term (1-5 years) and there are positive direct and indirect effects, there would be no cumulative effects to scenery when combining the actions in Alternative 2 with the past, present, and reasonably foreseeable activities.

Alternative 3 – Lower and Limited Mid-level Canopy Treatments

In Alternative 3, treatment areas would remain the same as in Alternative 2, however, 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 management objectives. Under Alternative 3 there would be no additional treatment (i.e. additional thinning in the mid-level canopy) so it would only slightly address stand density and forest health objectives.

Direct Effects

Scenic Integrity: There would be direct short-term effects under Alternative 3 similar to Alternative 2.

Scenic Stability: There would be slight positive direct effects under Alternative 3, but the Whisky Ridge Project Area's scenic stability level would still remain Low Stability, similar to the No Action alternative. Although the large trees and diverse vegetation scenery attributes would be present in the landscape as viewed from the key viewing points, they would remain in poor condition since very few trees would be removed in this alternative. The large trees and diverse vegetation scenery attributes would be at high risk of being eliminated or seriously threaten due to the continued dense vegetation conditions and ecosystem stressors such as insect and disease outbreaks. Similar to the No Action alternative, Alternative 3 would not enhance and/or sustain the valued scenic character and its scenery attributes, primarily its socially valued vegetative scenery attributes (i.e., large trees and diverse vegetation), in the Whisky Ridge Project Area.

Because there are less trees being removed under this alternative, the visual access and the visibility of scenery attributes would not be as much as in Alternative 2. There would also be less opportunity to create the desired, open, park-like setting and the desired scenic condition that includes diversity of canopy density, species, and sizes.

Indirect Effects

Scenic Integrity: There would be potential indirect long-term adverse effects under Alternative 3. Since Alternative 3 slightly addresses stand density and forest health objectives, fewer trees would be removed than in Alternative 2. The density of the stands would be susceptible to sever wildfire conditions, stress, and mortality caused by drought, insects, and disease. The dense stands would increase the risk of insect and disease outbreaks and large and intense wildfires that would dramatically alter the landscape by burning much more intensely and across large portions within and outside the Whisky Ridge PProject Area. This would result in visible disturbances, similar to the No Action alternative, such as extensive areas that are blackened and charred with high tree mortality and high tree bole scorch, but to a lesser extent.

Depending on the severity and location, the potential indirect effects could change the visual quality level as seen from the key viewing points from Partial Retention and Modification to Unacceptable Modification, a potential two to three level decrease from the Forest Plan VQOs of Partial Retention and Modification. The Unacceptable Modification visual quality level would not comply with the Forest Plan VQOs of Partial Retention and Modification and would not be consistent with the Forest Plan visual resources management direction specified in the regulatory setting section of this document.

Scenic Integrity: There would be potential indirect long-term adverse effects under Alternative 3. The dense stands would be susceptible to sever wildfire conditions, stress, and mortality caused by drought, insects, and disease. These ecosystem conditions and stressors of insect and disease outbreaks could diminish the valued scenic character and the large trees and diverse vegetation

scenery attributes. However, none of these compare to the scale and intensity of risk that a potential large-scale wildfire would pose due to the dense vegetation conditions. The dense vegetation conditions would further increase the risk of large and intense wildfires and their subsequent adverse effects to scenery that would inevitably eliminate the vegetative scenery attributes (i.e., large trees and diverse vegetation) across large portions within and outside the Whisky Ridge Project Area.

Cumulative Effects

Because the direct effects are short-term (1-5 years) and the indirect long-term adverse effects are not associated with the Project activities, and there are positive direct effects, there would be no cumulative effects to scenery when combining the actions in Alternative 3 with the past, present, and reasonably foreseeable activities. Because the direct effects are short-term (1-5 years) and there are positive direct and indirect effects, there would be no cumulative effects to scenery when combining the actions in Alternative 2 with the past, present, and reasonably foreseeable activities.

Summary of Effects

Based on the effects evaluated by the two scenery indicators, under Scenic Integrity there would be direct short-term effects and potential indirect long-term adverse effects to scenery and under Scenic Stability there would be slight positive direct effects and potential indirect long-term adverse effects. Overall, Alternative 3 would have negative effects to scenery in the long-term.

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

All alternatives comply with the NFMA, NEPA, FSH 1909.12 (13.13a), FSM, Chapter 2310 and Chapter 2380, and Forest Plan direction applicable to scenery, except the No Action Alternative and Alternative 3 have potential indirect long term adverse effects on scenery.

This analysis has considered the best available science, including, but not limited, to the references cited in this document, Scenery Management System (SMS), GIS corporate database, photos, Visual Management System (VMS), results of site reconnaissance and site visits.

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 5 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 5 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.

This project complies with the Clean Water Act through use of "Best Management Practices" designed to minimize or prevent the discharge of both point and non-point source pollutants from Forest roads, developments and activities. Under the Clean Water Act regulations, the Forest Service is required to obtain permits from the Central Valley Regional Water Quality Control Board (RWQCB). At this time, the Forest

Service is working with the RWQCB to secure the appropriate permit(s) for this project as necessary.

Cumulative Effects

Cumulative effects are addressed in the environmental consequences section of resource 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:

Aimee Smith, Range Management Specialist; Interdisciplinary (ID) Team Leader

Gloria Smith, District Fuels Specialist; Editor/Writer, Core Team Member

Judi Tapia, NEPA Coordinator and Technical Reviewer

Joanna Clines, Forest Botanist; Botanical Biological Assessment/Biological Evaluation/Noxious Weed/Invasive Species Analysis; ID Team Member

Alan Gallegos/Kellen Takenaka, Soils; /Soils Analysis; ID Team Member

Henry Herrera, District Lands/Special Uses; Special Uses Analysis; ID Team Member

Andy Hosford, District Engineer; Transportation Analysis; ID Team Member

Katherine Napier, Forester; Data Collection/Economic Analysis; Core Team Member

Anae Otto, District Wildlife Biologist-Terrestrial; Biological Assessment/Biological Evaluation for Terrestrial Wildlife; Core Team Member

Leak Pen, Recreation/OHV Specialist; ID Team Member

Erin Potter/Marie Mogge, District Archeologist; Archeology Analysis; ID Team Member

David Smith, District Silviculturist/California State Registered Professional Forester; Vegetation/Silvicultural Analysis; Core Team Member

Burt Stalter, District Fuels Specialist; Fire/Fuels Analysis, Core Team Member

Keith A. Stone, Hydrologist; Hydrology Analysis; ID Team Member

Phillip Strand, Fisheries Biologist; Aquatics-Riparian Analysis; ID Team Member

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.

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 coniferapproximately 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.

Crown Ratio: The ratio of live crown of a tree in relation to total height. Normally expressed as a percentage. Used in silviculture as a measure indicating tree vigor.

Cumulative Effects: Combined effects resulting from sequential actions on a given area.

Degraded (Ecosystem): The subtle or gradual change that reduces ecological integrity and health.

Damaged (Ecosystem): The acute or obvious changes in an ecosystem.

Danger/Hazard Tree: 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." 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 that 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.

Detrimental Soil Disturbance: Activities that result in an area deteriorating to a poor soil function classification; one or more of the soil function indicators does not meet the desired condition.

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.

Fire Intensity: A general term relating to the heat energy released in a fire. It includes both radiant and convectional heat. There are several definitions and ways to measure fire intensity. The most common of these is fireline intensity.

Fireline Intensity: The rate of heat release per unit time per unit length of fire front. Numerically, the product of the heat of combustion, quantity of fuel consumed per unit area in the fire front, and the rate of spread of a fire, expressed in kW/m. Not synonymous with FIRE SEVERITY, which refers to the degree of environmental change caused by fire.

Fire Severity: Fire severity is defined and measured in several different ways. Indicates the degree of environmental change caused by fire. Another definition with similar meaning is: the effect of a fire on ecosystem properties, usually defined by the degree of soil heating or mortality of vegetation. Other definitions of fire severity include the product of fire intensity and residence time and aboveground and belowground organic matter consumption from fire.

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.

Overstocked: Used in this document to describe stocking levels in excess of that desired for a given resource objective.

Project Activity Level - PAL is a scientifically-based "decision support process" to provide a fire precautionary system for industrial operations on National Forest lands in California. Its goal is to balance the reduction in the ignition risk of large damaging wildfires with the accomplishment of resource (forest projects) management activities.

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 4-9 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 prefer 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 the soil structure. Changes in soil structure can lead to decreased hydrologic function and increased penetration resistance within the soil surface and sub-surface horizons.

Soil Disturbance: Activities that result in detrimental soil compaction or loss of organic matter beyond the thresholds identified in the soil quality standards, soil disturbance can also be termed as ground disturbing activities.

Soil Horizons: Soils are characterized by a sequence of layers called horizons formed during soil genesis (formation). The six master soil horizons are the O, A, E, B, C and R horizons.

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 “speed bumps” 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 codominants 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. Fire 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 Ecosystems; 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, K., 2006. Tending the Wild, University of California Press 2006

Ashton, D.T., A.J. Lind, and K.E. Schlick. 1997. Western pond turtle, natural history. Pacific Southwest Research Station, Redwood Laboratory, USDA Forest Service.

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, editors. 2012. The Jepson Manual: vascular plants of California, second edition. University of California Press, Berkeley

Battles, J.J., A.J. Shlisky, R.H. Barrett, R.C. Heald, and B.H. Allen-Diaz. 2001. The effects of forest management on plant species diversity in a Sierran conifer forest. Forest Ecology and Management 146 (2001) 211-222

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.

Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. In: Sal, E.O., Cundy, T.W. eds. Forestry and fisheries interactions. Contributions Number 57, Seattle, Washington: University of Washington, Institute of Forest Resources. P 191-232.

Bisson, P.A., B.E. Rieman, C. Luce, P.F. Hessburg, D.C. Lee, J.L. Kershner, G.H. Reeves, andR.E. Greswell. 2003. Fire in aquatic ecosystems of the western USA: current knowledge and key questions. Forest Ecology and Management. Volume 178, Issues 1-2 213-229.

Boatman, W.I. 2002. Reducing Predation by Common Ravens on Desert Tortoises in the Mojave and Colorado Deserts. U.S. Geological Survey, Western Ecological Research center.

Bostwick, P., et.al.., 2011. How Fuel Treatment Saved Homes from The 2011 Wallow Fire, 2011.

Burnett, R. D., and D. L. Humple. 2003. Songbird monitoring in the Lassen National Forest: Results from the 2002 field season with summaries of 6 years of data (1997-2002). PRBO Conservation Science Contribution Number 1069. 36pp.

Burnett, R.D., D.L. Humple, T.Gardali, and M.Rogner. 2005. Avian monitoring in Lassen National Forest 2004 Annual Report. PRBO Conservation Science Contribution Number 1242. 96pp.

Bury, R.B., R.A. Luckenbach, and S.D. Busack. 1977. Effects of off-road vehicles on vertebrates in the California desert. United States Department of the Interior, Fish and Wildlife Service, Wildlife Research Report 8, Washington, D.C.

Bury, R.B., and D.J. Germano. 2008. *Actinmys marmorata* (Baird and Girard 1852) Western pond turtle, Pacific pond turtle. In; Rhodin, A.G.J., Pritchard, P.C.H., van Dijk, P.P., Saumure, R.A., Buhlmann, K.A., and Iverson, J.B. (editors). Conservation Biologly of Freshwater turtles and Tortoise: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monograph No. 5, pp. 001.1.-001.9, doi:10.3854/crm.5.001.marmorata.v.1.2008, http://www.iucn-tfsg.org/cbftt

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.

Cal-IPC, 2012. Preventing the Spread of Invasive Plants: Best Mangement Practices for Land Managers (3rd ed.). Cal-IPC Publication 2012-03. California Invasive Plant council, Berkeley, CA. Available at www.cal-ipc.org

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). 1998. An Assessment of Mule and Black-tailed Deer Habitats and Populations in California. Report to the Fish and Game Commission. February 1998. 57pp.

CDFG (California Department of Fish and Game). 2004a. Resident Game Bird Hunting Final Environmental Document. August 5, 2004. State of California, The Resources Agency, Department of Fish and Game. 182 pp + appendices.

CDFG (California Department of Fish and Game). 2004b. Report of the 2004 Game Take Hunter Survey. State of California, The Resources Agency, Department of Fish and Game. 20pp.

CDFG. 2008. Users manual for version 8.2 of the California Wildlife Habitat Relationships System and Bioview. Sacramento, California.

Cal-IPC. 2006. California Invasive Plant Inventory. Cal-IPC Publication 2006-02. California Invasive Plant Council: Berkeley, CA. Online via: http://www.cal-ipc.org/ip/inventory/index.php

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).

CDFG (California Department of Fish and Game). 2007. Deer Hunting Final Environmental Document, April 10, 2007. State of California, The Resources Agency, Department of Fish and Game. 80pp + appendices.

California Department of Fish and Game. 2008. California Wildlife Habitat Relationship System, Version 8.0. California Department of Fish and Game and California Interagency Wildlife Task Group. Sacramento, CA.

CDFG (California Department of Fish and Game). 2010. Date supplement to the California Fish and Game Commission regarding: Recommended 2010 Deer Tag Allocations (Updated 2009 Deer Harvest and Population Estimates). April 21, 2010. State of California, The Resources Agency, Department of Fish and Game. 34pp.

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.

Christy, JA, Wagner DH. 1996. Guide for the identification of rare, threatened or sensitive bryophytes in the range of the northern spotted owl, western Washington, western Oregon, and northwestern California. USDI, Bureau of Land Management, Portland, Oregon.

Clines, Joanna. 2013a. Biological Assessment/Biological evaluation for Threatened, Endangered, and Sensitive plants for the Whisky Ridge Ecological Restoration Project, Bass Lake Ranger District, Sierra National Forest. USDA Forest Service. (Unpublished).

Clines, Joanna. 2013b. Noxious weed Risk Assessment for the Whisky Ridge 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.; 1999. 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., 1996**.** Modeling Potential Structure Ignitions from Flame Radiation Exposure with Implications for Wildland/Urban Interface Fire Management, 13th Fire and Forest Meteorology Conference, Australia

Collins, B.M. J.J. Moghaddas, S.L. Stephens. 2007. Initial changes in forest structure and understory plant communities following fuel reduction activities in a Sierra Nevada mixed conifer forest. Forest Ecology and Management 239 (2007) 102-111

Colwell, A. E. L. 2007. A New *Platanthera* (ORCHIDACEAE) from Yosemite National Park, California. MADROÑO, Vol. 54, No. 1, pp. 86–93.

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.

Cushman, S.A. 2006. Effects of habitat loss and fragmentation on amphibians: a review and prospectus. Biological Conservation 128 (2006) 231-240

Davis, W. C. 1999. Ecophysiology of *Hydrothyria venosa* – An Aquatic Lichen. PhD Dissertation, Arizona State University.

Deal, Krista. 2002. Fire Effects Studies on the Eldorado National Forest. In Society for California Archaeology Newsletter 36(2). Greg White, managing editor. Department of Anthropology, California State University, Chico. Chico, CA.

Deal, Krista. Fire Effects to Flaked Stone, Ground Stone, And other Sone Artifacts. Chapt. 4

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.

Dunham, J.B., M.K. Young, R.E. Greswell, and R.E. Rieman. 2003. Effects of fire on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. Forest Ecology and Management, Volume 178 Issues 1-2 (2003) 183-196.

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.

Dwire, K.A., and J.B. Kauffman. 2003. Fire and riparian ecosystems in landscapes of the western

USA. In: Forest Ecology and Management. Volume 178, Issues 1-2 (2003) 61-74

Dwire, K.A., C.C. Rhoades, and M.K. Young. 2006. Potential effects of fuel management activities on riparian areas. In: B. Elliot, J. Potyondy, and J. Kershner (eds). Cumulative Watershed Effects of Fuel Management: A Western Synopsis, Chapter 10. RMRS GTR

DWR. 2007. Climate change in California.
http://www.water.ca.gov/climatechange/docs/062807factsheet.pdf

Egan, Joel M.; Et Al.; 2010. Forest Thinning and subsequent bark beetle-caused mortality in Northeastern California. Forest Ecology and Management. (Pages 1832-1842).

Ellis, S.L.N. 1915. A record of fish plants made in the waters of Fresno Division, fish and Game Commission, comprising the counties of Kern, Tulare, Kings, Fresno, Madera, Merced, Mariposa, Tuolumne, and Stanislaus.

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.

EPA. 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest and Alaska. Center for Streamside Studies in Forestry, Fisheries and Wildlife, College of Forest Resources/College of Ocean and Fishery Sciences, University of Washington, Seattle, Washington.

Erman, N.A. 1996. Status of aquatic invertebrates. In: Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, chapter 35. Davis: University of California, Centers for Water and Wildland Resources.

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).

Fellers, Gary M. and Kathleen L. Freel. 1995. A Standardized Protocol for Surveying Aquatic Amphibians. Technical Report NPS/WRUC/NRTR-95-001. National Biological Service, Cooperative Park Studies Unit, University of California, Davis, CA. v+123 Pp.

Ferrell, G.T.; 1996. The Influence of Insect Pests and Pathogens on Sierra Forests. Pacific Southwest Research Center; USDA Forest Service; Sierra Nevada Ecosystem 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, 2003. 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.

Fuels Report, Whisky Ridge Project, 2012.

Gassaway, Linn. 2011. Fire Archaeology. Website: http://web.mac.com/linnog/Fire_Arch/Home.html. Accessed 10/14/2011.

Gassaway, Linn. 2011a. Obsidian. Website: http://web.mac.com/linnog/Fire_Arch/Obsidian.html. Accessed 10/14/2011.

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.

Goudy and Smith, 1994. Ecological Units of California, Goudey, Charles B. and Smith, David W.,1994. Document developed by the Region 5 Regional Landscape Architect that extracts information from Goudy and Smith, 1994 and sent to Sierra National Forest Landscape Architect for Scenic Character Frame of Reference, 2012.

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.

Graumlich, L.J. 1993. A 1000-year Record of Temperature and Precipitation in the Sierra Nevada. Quaternary Research 39. pp. 249-255.

Gregory, S.V., G.V. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell. 1987. Influence of forest practices on aquatic production. In: Streamside management. Forest and fishery

interactions, edited by E.O. Salo, and T.W. Cundy, 233-55. Contribution No. 57. Seattle: University of Washington, Institute of Forest Resources.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience, 41(8):540-551.

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.

Harpel, J.A. 2008. Species Fact Sheet: *Bruchia bolanderi*, Updated February 2011.

USDA Forest Service, Region 6, Portland, OR. Accessed at: http://www.fs.fed.us/r6/sfpnw/issssp/planning-documents/species-guides.shtml, August 2011.

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.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (Rana aurora draytonii) and the foothill yellow-legged frog (Rana boylii): implications for management. Proceedings of the Symposium on Management of Amphibians, Reptiles and Small Mammals in North America. Gen. Tech. Rpt. RM-166, Rocky Mountain Research Station, USDA-Forest Service. Fort Collins, CO. pp 144-158

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*. Unpublished Master's Thesis. California State University, Fresno. 51 pp.

Hilton, S. and Lisle, T.E. 1993. Measuring the volume of a pool filled with fine sand. USDA

Forest Service, Pacific Southwest Region Research Station Research Note, PSW–RN-414-WEB

Holland, D.C. 1991. A synopsis of the ecology and status of the western pond turtle (Clemmys marmorata) in 1991. Report to USFWS National Ecology Research Center, San Simeon

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.

Huber, N. King. 1968. Geologic Map of the Shuteye Peak Quadrangle, Sierra Nevada, California. U.S. Geological Survey

Hughes, R.M. and D.P. Larsen. 1987. Ecoregions: an approach to surface water protection. Journal of the Water Pollution Control Federation 60:486-493.

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.

Hutto, R.L. 1995. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (U.S.A.) conifer forests. Conservation Biology 9(5):1041-1058.

Hutto, R.L., and S.M. Gallo. 2006. The effects of postfire salvage logging on cavity-nesting birds. The Condor 108:817-831.

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).

Jennings. 1996. Status of amphibians. In: *Sierra Nevada Ecosystem Project: Final report to Congress*, vol. II, chapter 31. Davis: University of California, Centers for Water and Wildland Resources.

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.

Kagarise Sherman, C. and M. L. Morton. 1984. The toad that stays on its toes. Natural History 3/84. Pp. 73-78.

_____. 1993. Population declines of Yosemite toads in the eastern Sierra Nevada of California. Journal of Herpetology, 27:186-198.

Kattelmann, R. 1996. Hydrology and water resources. In: *Sierra Nevada Ecosystem Project:* Final report to Congress, vol. II, chapter 30. Davis: University of California, Centers for Water and Wildland Resources.

Keeley, J.E. 2006. Fire Management Impacts on Invasive Plants in the Western United States. Conservation Biology, 20: 375–384.

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

Kotliar, N.B., S.J. Hejl, R.L. Hutto, V.A. Saab, C.P. Melcher, and M.E. McFadzen. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. Studies in Avian Biology No.25:49-64.

Lake Tahoe Basin Management Unit. 2007. Lake Tahoe Basin Management Unit Multi Species Inventory and Monitoring: A Foundation for Comprehensive Biological Status and Trend Monitoring in the Lake Tahoe Basin. Draft Report.

Lannoo, M. 2005. Amphibian declines: the conservation status of United States Species, Berkeley, CA. University of California Press.

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

Liang, C.T. 2010. Habitat modeling and movements of the Yosemite toad (Anaxyrus (=Bufo) canorus) is the Sierra Nevada, California. IN Press: Dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in the Ecology in the Ecology in the Office of Graduate Studies of the University of California, Davis.

Lind, A.J. 2008. Amphibians and reptiles and climate change. (May 2008). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. http://www.fs.fed.us/ccrc/topics/amphibians-reptiles.shtml

Lippke, B., Mason, L. 2005. Implications of Working Forest Impacts on Jobs and Local Economies. University of Washington, Seattle WA. 11 pp.

Liskey, Eric N. 1993. Effects of Disturbance on *Collomia rawsoniana.* Unpublished 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.

Lockwood, John P. & Bateman, Paul C. 1976. Geologic Map of the Shaver Lake Quadrangle, Central Sierra Nevada, California. U.S. Geologic Survey

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).

Long, John N.; Shaw, John D.; 2012. A Density Management Diagram for Even-Aged Sierra Nevada Mixed-Conifer Stands. Western Journal of Applied Forestry 27 (4) (pages 187-195).

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, October 7-10, 2002, Kings Beach, CA. PSW-GTR-193: 149-157.

Malcolm, B., N. Malcolm, J. Shevock, D. Norris. 2009. California Mosses. Microoptics Press. 430 pp.

Martin, D.L. 2008. Decline, movement and habitat utilization of the Yosemite toad (*Bufo canorus):* an endangered anuran endemic to the Sierra Nevada of California. A Dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in Ecology, Evolution and Marine Biology. University of California at Santa Barbara.

Mason, C.L., et. al. 2006. Investments in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits. Journal of Forestry. January/February: 27-31

Matlack, G. 1993. Microclimate variation within and among forest edge sites in the eastern United States. Biological Conservation 66 (1933) 185-194.

Matthews, K. R., and K. L. Pope. 1999. A telemetric study of the movement patterns and habitat use of *Rana muscosa*, the mountain yellow-legged frog, in a high-elevation basin in Kings Canyon National Park, California. *Journal of Herpetology* 33:615-623.

Maxell, B., and G. Hokit. 1999. Amphibians and reptiles, Pages 2.1-2.29 in G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: a review of Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of the Wildlife Society. 307 pp.

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, 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 Sub regions 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.

Montgomery, D.R., and J.M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. Geological Society of America Bulletin. May 1997: Vol. 109, No. 5. p. 596-611.

Moore, R.D., D.L. Spittlehouse, and A. Story. 2005. Riparian microclimate and stream temperature response to forest harvesting: a review. Journal of American Water Resources Association. August 2005. p. 813-834

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., R. Kattelmann, R. Zomer, and P.J. Randall. 1996. Management of riparian areas inthe Sierra Nevada, In: *Sierra Nevada Ecosystem Project: Final report to Congress*, vol. III, chapter 1. Davis: University of California, Centers for Water and Wildland Resources.

Moyle, P.B. 2002. Inland Fishes of California, Revised and Expanded. University of California Press. London, England.

Mullally, D.P. 1953. Observations on the ecology of the toad Bufo canorus. Copeia 3: 182-183.

Naiman, R.J., R.E. Bilby, and P.A. Bisson. 2000. Riparian ecology and management in the Pacific coastal rain forest. BioScience November 2000 Vol. 50 No. 11 pp. 996-1011.

Nakumura, G., C. Keithley, and D. Schmidt. In Press. Fire ecology in watershed assessment, IN: The California Watershed Assessment Manual, Volume 2, Chapter 6. Prepared for the California Resources Agency. http://cwam.ucdavis.edu/Volume_2/TOC.htm

National Historic Preservation Act of 1966, As amended through 2006 (With annotations)

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.

Neary, D.G., J.D. Landsberg, A.R. Tiedemann, and P.F. Ffolliott. 2005. Chapter 6: waterquality. IN:Wildland Fire in Ecosystems, Effects of Fire on Soil and Water. USDA - Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-42-volume 4. pp. 119-134.

Nooney, Karen. 2011. Lands, Recreation and Minerals Specialist Report for the Fish Camp Project, Bass Lake Ranger District, Sierra National Forest. USDA Forest Serviced.

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.

Norris, D.H. and J.R. Shevock. 2004. Contributions toward a bryoflora of California II. A Key to the Mosses. MADROÑO, Vol. 51, No. 2, pp. 133-269

North M., Stine P., O'Hara K., Zielinski W., and Stephens, S., 2009. An ecosystem Management Strategy for Mixed Conifer Forests. USDA Forest Service. General Technical Report, Pacific Southwest Research Station, PSW-GTR-220, March 2009

North, M.; Et Al.; 2009 (w/ addendum, Feb. 2010). An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests. General Technical Report; PSW-GTR-220

North M., 2012. Managing Sierra Nevada Forests. USDA Forest Service. General Technical Report, Pacific Southwest Research Station, PSW-GTR-237, March 2012.

North, M.P., and H.D. Hurteau. 2011. High-severity wildfire effects on carbon stocks and emissions in fuels treated and untreated forest. Forest Ecology and Management 261 (2011) 1115–1120.

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.

Peterson, E.B. 2010. Conservation assessment and management guidelines for *Peltigera hydrothyria* Miadlikowska & Lutzoni (a.k.a. *Hydrothyria venosa* J. L. Russell). U.S. Forest Service, Region 5. Unpubl.

Pfankuch, D. J. 1975. *Stream reach inventory and channel stability evaluation.* U.S.

Department of Agriculture Forest Service. Region 1. Missoula, Montana.

Pilliod, D.S., R. B Bury, E.J. Hyde, C.A. Pearrl, and P.S. Corn. 2003. Fire and amphibians in North America. Forest Ecology and Management 178 (2003) 163-181.

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.

Platt, Bryant. 2012. Whisky Ridge Ecological Restoration: Assessment of Soil and Hydrologic Impact of Unauthorized Off Highway Vehicle (OHV) Routes Proposed for Decommission. Open-File Report. Sierra National Forest: Supervisors Office. Clovis, CA. 12 pages

Poff, Roger; 2004; Revised OHV Trail Monitoring Form (GYR Form) and Training Guide; R.J. Poff & Associates; Nevada, City, CA; Open File Report; Clovis, CA

Pope, K. L., and K. R. Matthews. 2001. Movement ecology and seasonal distribution of mountain yellow-legged frogs, *Rana muscosa*, in a high-elevation Sierra Nevada basin. *Copeia* 101:787–793.

Potter, Erin. 2012. Grey's Mountain Ecological Restoration Project Archaeological Reconnaissance Report (Draft), ARR R2012051551005. On File, USDA Forest Service, Sierra National Forest, Bass Lake Ranger Station, North Fork, CA.

Pounds. J.A. and M.L. Crump. 1994. The case of the golden trout and the Harlequin frog. Conservation Biology, Vol. 8, No. 1, pp. 72-85.

Pounds, J.A., M.P.L. Fogden, and J.H. Campbell. 1999. Biological response to climate change on a tropical mountain. Nature, Vol. 398. pp. 611-615.

Purpose and Need, Whisky Ridge Project, 2012. Latest Draft of Whisky Ridge Ecological Restoration Project Issues Alternatives Letter, 2012.

Pursell, RA. 1976. *Fissidens aphelotaxifolius* (Bryopsida; Fissidentaceae), a new species from the Pacific Northwest of North America. Bulletin of the Torrey Botanical Club 103(1):35-38.

Randall, J.M.. 2000. *Cirsium vulgare*. In: Bossard, C.C.; Randall, J.M.; Hoshovsky, M.C. (Eds.) Invasive plants of California's wildlands. Berkeley, CA: University of California Press. Online via: www.cal-ipc.org

Rathbun, G.B., M.R. Jennings, T.G. Murphey, and N.R. Siepel. 1993. Status and ecology of sensitive aquatic vertebrates in lower San Simeon and Pico Creek, San Luis Obispo County, California. Final Report under Cooperative Agreement 14-16-0009-91-1909 between U.S. Fish and Wildlife Service and California Department of Parks and Recreation. Publ. No. PB93-230779, National Technical Information Service, Springfield, VA, ix + 103 pp.

Ratliff, Ray. 1985. Meadows in the Sierra Nevada of California: state of knowledge. PSW-GTR-84. Pacific Southwest Forest and Range Research Station, Berkeley, CA. 52p.

Reaser, J.K., and A. Blaustein. 2005. Repercussions of global change. In: Amphibian Declines, the Conservation Status of United States Amphibians. Edited by M. Lanoo. University of California Press.

Reid, L.M. 2006. 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.

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

Rieman, B., C. Luce, J.B. Dunham, and A. Rosenberger. 2005. Implications of changing fire regimes for aquatic systems. IN: Mixed severity fire regimes: ecology and management; symposium proceedings; Nov. 17-19, 2004 Pullman, WA. Washington State University Extension 2005, p. 187-191.

Robichaud, P.R., J.L. Beyers, and D.G. Neary. 2000. Evaluating the effectiveness of post fire 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.

Rothermel, R., 1983 How to Predict the Spread and Intensity of Forest and Range Fires, USDA Intermountain Forest and Range Experimental Station, GTR INT-143

Rushing AE. 1986. A revision of the genus *Bruchia* Schwaegr. Journal of the Hattori Botanical Laboratory No. 60:35-83.

Ryan, Robert L. 2005. Social Science to Improve Fuels Management: A Synthesis of Research on Aesthetics and Fuels Management. Gen. Tech. Rep. NC-261. St. Paul, MN: USDA, Forest Service, North Central Research Station, 2005.

Safford, H.D., Stevens J.T., Merriam K., Meyer M.D., Latimer A.D., 2012. Fuel treatment effectiveness in California yellow pine and mixed conifer forests. Forest Ecology and Management, 17-28

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).

Sauer, J. R., J. E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. *USGS Patuxent Wildlife Research Center*, Laurel, MD.

Sauter, S.T., J. McMillan, and J. Dunham. 2001. Salmonid behavior and water temperature, Issue paper 1. United States EPA. EPA-910-D-01-001.

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.

Schwilk, K.W., J.E. Keeley, E.E. Knapp, J. McIver, J.D. Bailey, C.J. Fettig, C.E. Fiedler, R.J. Harrod, JJ. Moghaddas, K.W. Outcalt, C.N. Skinner, S.L. Stephens, T.A. Waldrop, D.A. Yaussy, and A. Youngblood. 2009. The National Fire and Fire Surrogate Study: Effects of Fuel Reduction Methods on Forest Vegetation Structure and Fuels. Ecological Applications, Vol. 19, No. 2 (Mar., 2009), pp. 285-304

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, 2006 Identifying Reference Conditions for Prescribed Fire Management of Mixed Conifer Forests in Yosemite National Park, California., USA, Final Report to the Joint Fire Science Program, 2006

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.

Shevock, J.R. 1998. Species Narrative for Hydrothyria venosa (=Peltigera gowardii), rationale for addition to US Forest Service Region 5 Sensitive Species List.

Shultz, Richard. 2004. A Burning Question: The Effects of Fire and Fire Management on Cultural Resources. Master's Thesis on file at Sonoma State University. Rohnert Park, CA.

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.

Smucker, K.M., R.L. Hutto, B.M. Steele. 2005. Changes in bird abundance after wildfire: importance of fire severity and time since fire. Ecological applications 15(5):1535-1549.

Southern Sierra Smoke Management Group and San Joaquin Valley Air Pollution staff. Unified Guidelines and Procedures for Smoke Management, March 2009.

Species Survival Commission 2008. Species susceptibility to climate change impacts. The IUCN Red List of Threatened Species

Spencer, W.D., H.L. Rustigian, R.M. Scheller, A. Syphard, J. Strittholt, and B. Ward. 2008. Baseline evaluation of fisher habitat and population status, and effects of fires and fuels management on fishers in the southern Sierra Nevada. Unpublished report prepared for USDA Forest Service, Pacific Southwest Region. June 2008. 133 pp + appendices.

Stalter, B., 2012. Personal observations and estimations of fire behavior and fire intensity for 21 shifts as a qualified field observer assigned to the Chips wildfire located in the Feather River Canyon on the Plumas and Lassen National Forests in Northern California , August 2-23, 2012.

Stalter, B., 2012. Personal observations and estimations of fire behavior and fire intensity for 14 shifts as a qualified field observer assigned to the Wenatchee Complex wildfire located on the Okanogan-Wenatchee National Forests in Washington, September 17th to October 5th 2012.

Stalter, B., 2012. Personal observations of changing forest conditions, local wildfires and weather phenomena over the past 25 yrs working on the Bass Lake Ranger District in Silviculture and Fuels Management Departments 1988-2012.

Steffen, Anastasia. 2002. The Dome Fire Pilot Project: Extreme Obsidian Fire Effects in the Jemez Mountains. In The Effects of Fire and Heat on Obsidian, edited by J.M. Lloyd, T.M. Origer, and D.A. Fredrickson, pp.159-202. Cultural Resources Publication, Anthropology-Fire History, U.S. Department of Interior, Bureau of Land Management.

Stephens, S.L., C.I. Millar, and B.M. Collins. 2010. Operational approaches to managing forests of the future in Mediterranean regions within a context of changing climates. Environmental Research Letters 5:1-9.

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).

Stephens S.L., J.J. Moghaddas, B.R. Hartsough, E.E.Y. Moghaddas, and N.E. Clinton 2009. Fuel treatment effects on stand-level carbon pools, treatment-related emissions, and fire risk in a Sierra Nevada mixed conifer forest. Canadian Journal of Forest Research 39:1538-1547.

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.

Steward, M.M. 1995. Climate Driven Population Fluctuations in Rain Forest Frogs. Journal of Herpetology, Vol. 29, No. 3 (Sep., 1995), pp. 437-446

Stine, Scott; 1996. Climate, 1650-1850, Pacific Southwest Research Center; USDA Forest Service; Sierra Nevada Ecosystem Project. Vol II.

Stone, K.A. 2012. Whiskey Project Hydrology Specialist Report.

Stone, K.A., J. Clines, and P. Strand. 2012. The Riparian Conservation Objective Consistency Analysis for the Whiskey Project.

Strahler, A.N. 1957. Quantitative analysis of watershed geomorphology. Transactions, American Geophysical Union, 38(6): 913-920.

Strand. P. 2012. Aquatic/riparian species biological assessment and biological evaluation report for the Draft Environmental Impact Statement for the Whiskey Project.

_____. 2012a. Aquatic Wildlife Management Indicator Species Report for the Whiskey Project.

Suighara, N., et.al., 2006. Fire in California's Ecosystems. UC Berkeley Press.

Sweitzer, Rick, and Reg Barrett. unpublished Sierra Nevada Adaptive Management Program (SNAMP) Data. U.C. Berkeley SNAMP Fisher Study

Syphard, A.D. R.M. Scheller, B.C. Ward, W.D. Spencer, and J.R. Strittholt. (Submitted to Forest Ecology and Management.) Long-term, broad-scale effects of fuel treatments on fire regimes in the Sierra Nevada, California.

Takenaka, Kellen. Whisky Ridge Ecological Restoration Project: Aerial Photo Analysis for Meadow Conifer Encroachment. 2012 . Open-File Report. Sierra National Forest Supervisors Office, Clovis, CA. 18 pgs.

Taylor, D.W.; J.C. Stebbins, W.B. DaVilla. 1987. Endangerment status of *Collomia rawsoniana* (Polemoniaceae), Western Sierra Nevada, California. The California Native Plant Society Pp. 225-231.

Thompson, J. 2005. Keeping it cool: unraveling the influences on stream temperature. PNW Research Station Science Findings, Issue 73.

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.

Townsend, Kirk. 2012. Whisky Ridge Ecological Restoration Project: Field Assessment of Meadow Conifer Encroachment. Open-File Report. Sierra National Forest Supervisors Office, Clovis, CA. 81 pgs.

Troendle, C.A., M.S. Wilcox, G.S. Bevenger, and L.S. Porth. 2001. The Coon Creek water yield augmentation project: implementation to timber harvesting technology to increase streamflow. Forest Ecology and Management 143 (2001) pp. 179-187.

Troendle, C.A., L.H. MacDonald, and C.H. Luce. 2006. Fuels management and Water yield. Chapter 7: in Cumulative Watershed Effects of Fuels Management: A Western Synthesis

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/

Trombulak, S.C., and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation biology, Vol. 14, No. 1, pp. 18-30.

TSS Consultants, 2012. Feasibility Evaluation of Biomass Business Sorting and Processing Operations at the North Fork Mill Site. Rancho Cordova, CA.

UC Berkeley Bryophyte Database, 2013. http://ucjeps.berkeley.edu/bryolab/UC_bryophytes.html

UC Berkeley, 2013. Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/).

U.S. Department of Agriculture, Forest Service (USDA-FS). 1991; Forest Land and Resource Management Plan-Sierra National Forest. Pacific Southwest Region, Sierra National Forest.

U.S. Department of Agriculture, Forest Service (USDA-FS). 1992; Forest Land and Resource Management Plan-Sierra National Forest. Pacific Southwest Region, Sierra National Forest. Clovis, CA.

USDA Forest Service. 1971. Range Management Plan for Castle Peak Allotment, Sierra National Forest. Sotero Muniz, Forest Supervisor. January 6, 1971.

USDA-FS 1974. National Forest Landscape Management Volume 2, Chapter 1: The Visual Management System. Agriculture Handbook 462. USDA, Forest Service, 1974.

USDA-Forest Service. 1975. Pfankuch, D.J. Stream reach inventory and channel stability evaluation. Service, R1-75-002. Government printing office #696-260/200, Washington D.C. 26 pp.

USDA Forest Service. 1983. Forest Service Recreation Opportunity Spectrum Users Guide.

USDA Forest Service. Sierra National Forest, 1983, Soil Survey of the Sierra National Forest, California, p.60.

_____. 1989. Sierra Supplement No. 1.

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. Final Environmental Impact Statement, Sierra National Forest Land and Resource Management Plan. On file, USDA Forest Service, Pacific Southwest Region, Vallejo.

USDA-FS 1991. Sierra National Forest Land and Resource Management Plan. USDA, Forest Service, Pacific Southwest Region, 1991.

USDA Forest Service. 1991. Sierra National Forest Land and Resource Management Plan. Sierra National Forest, Clovis, CA; Pacific Southwest Region.

_____. 1992. Land and resource management plan for the Sierra National Forest. USDA Forest Service, Pacific Southwest Region.

USDA Forest Service. 1992. Forest Land and Resource Management Plan-Sierra National Forest. Pacific Southwest Region, Sierra National Forest. Clovis, CA.

USDA Forest Service. 1992. Sierra National Forest Land and Resource Management Plan. Pacific Southwest Region, Sierra National Forest.

USDA Forest Service. 1992. Forest Land and Resource Management Plan, Sierra

National Forest. Pacific Southwest Region, San Francisco, CA. September 24, 1992.

USDA-FS 1991b. Final Environmental Impact Statement Sierra National Forest Land and Resource Management Plan. USDA, Forest Service, Pacific Southwest Region, 1991.

USDA-FS 1991b. Final Environmental Impact Statement Sierra National Forest Land and Resource Management Plan. USDA, Forest Service, Pacific Southwest Region, 1991.

USDA Forest Service. 1992. Forest Land and Resource Management Plan, Sierra

National Forest. Pacific Southwest Region, San Francisco, CA. September 24,1992.

_____. 1995. Willow Creek Landscape Analysis. Sierra National Forest, Mariposa and Minarets Ranger Districts. June 1995

USDA-FS 1995. Landscape Aesthetics, A Handbook for Scenery Management. Agriculture Handbook 701. USDA, Forest Service, 1995.

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. 1996. 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. On file, USDA Forest Service, Pacific Southwest Region, Vallejo.

USDA Forest Service, Pacific Southwest Region, 1996. Sierra Nevada Ecosystem Project; Chapter 4, Fire and Fuels, pp. 62-71.

USDA, Forest Service, 2000. Water Quality Management for National Forest System Lands in California, Best Management Practices. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. 186 p.

_____. 2001. Sierra Nevada Forest Plan Amendment. Final Environmental Impact Statement, Record of Decision, USDA Forest Service, Pacific Southwest Region, Jan 2001

USDA Forest Service, Pacific Southwest Region, 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Chapter 3, Parts 1-3, 5 and 6; Volume 2; pages 238-306.

USDA Forest Service, Pacific Southwest Region, 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Record of Decision.

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. January 2001. http://www.fs.fed.us/r5/snfpa/library/archives/feis/index.htm

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement and Record of Decision, U.S.D.A. Forest Service, Pacific Southwest Region, Vallejo, CA. 55 pages plus appendices.

_____. 2002: 2012. Water quality management for National Forest system lands in California (Best Management Practices). FSH 2509.22 Soil and Water Conservation Handbook.

USDA-FS 2003. Forest Service Manual (FSM) 2300. Chapter 2380 – Landscape Management. Washington, D.C., 2003.

USDA-FS 2003b. National Visitor Use Monitoring (NVUM) Results: Sierra National Forest, 2003.

USDA Forest Service. 2004. Best Management Practices Evaluation Program, 1992-2002 Monitoring Results. Pacific Southwest Region, Vallejo, CA. 76p.

USDA Forest Service. 2004. Four Key Threats Facing the Nation's Forests and Grass Lands

USDA Forest Service. 2004. Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Project, Annex to Stipulation IX in the 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. On file, USDA Forest Service, Pacific Southwest Region, Vallejo.

_____. 2004. Sierra Nevada Forest Plan Amendment. Final Supplemental Environmental Impact Statement, Record of Decision, USDA Forest Service, Pacific Southwest Region, R5-MB-046 Jan 2004

USDA Forest Service. 2004. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. 2004. http://www.fs.fed.us/r5/snfpa/final-seis/

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. 2004. Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement and Record of Decision, U.S.D.A. Forest Service, Pacific Southwest Region, Vallejo, CA. 72 pages.

_____. 2004a. Best Management Practices Evaluation Program, 1992-2002 Monitoring Results. Pacific Southwest Region, Vallejo, CA. 76p.

USDA Forest Service. 2004a. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement. Forest Service, Pacific Southwest Region. 2004.

USDA Forest Service. 2004b. 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).

_____. 2005a. Stream condition inventory (SCI) technical guide, version 5, Pacific Southwest Region Forest Service, Ecosystem Conservation Staff. Vallejo, CA. 111 pp.

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8pp.

USDA-FS 2006. Forest Service Handbook (FSH) 1909.12 (13.13a). Chapter 10 – Land Management Plan. Washington, D.C., 2006.

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8pp.

USDA Forest Service. 2006a. Draft - MIS Analysis and Documentation in Project-Level NEPA, R5 Environmental Coordination, May 25, 2006. Pacific Southwest Region. 3pp.

USDA Forest Service. 2006b. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-000. 12pp.

_____. 2007. An assessment of fuel treatment effects on fire behavior, suppression effectiveness, and structure ignition on the Angora Fire, Fire effects on non treatment areas. http://www.fs.fed.us/r5/angorafuelsassessment/feonta.php

USDA-FS 2007. Appendix J – Recommended SMS Refinements. Appendix to Landscape Aesthetics, a Handbook for Scenery Management, USDA Agriculture Handbook 701, 2007.

USDA Forest Service. 2007. Decision Memo - Bass Lake Grazing Allotments NEPA: Haskell

Allotment, Sierra National Forest, North Fork, CA, Pacific Southwest Region.

USDA Forest Service. 2007. Rangeland Specialist Report - Bass Lake Grazing Allotments

NEPA: Central Camp , Soquel and Haskell Allotments, Sierra National Forest, North Fork, CA, Pacific Southwest Region.

USDA Forest Service. 2007. Rangeland Specialist Report - Bass Lake Grazing Allotments

NEPA: Castle Peak, Central Camp and Haskell Allotments, Sierra National Forest, North Fork, CA, Pacific Southwest Region.

USDA Forest Service. 2007. 2210 Range Analysis and Planning File and 2230 Grazing Permit

for Haskell Allotment. Working Files at Bass Lake Ranger District, Sierra National Forest, 57003 Road 225, North Fork, CA 93643.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA-FS 2007b. Recreation Facility Analysis. 5-year Program of Work and Programmatic Results of Implementation. Sierra National Forest, 2007.

USDA-FS 2008. Formal Letter from Director of Ecosystem Planning and Director of Recreation, Wilderness, and Heritage Resources. Scenery Management System Refinements. Sent to Forest Supervisors and Directors. USDA, Forest Service, 2008.

USDA Forest Service. 2008. 2210 Range Analysis and Planning File and 2230 Grazing Permit

for Central Camp Allotment. Working Files at Bass Lake Ranger District, Sierra National Forest, 57003 Road 225, North Fork, CA 93643.

USDA Forest Service. 2008. Sierra Nevada Forests Bioregional Management Indicator Species (MIS) Report: Life history and analysis of Management Indicator Species of the 10 Sierra Nevada National Forests: Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit. Pacific Southwest Region, Vallejo, CA. January 2008.
http://www.fs.fed.us/r5/snfmisa/pdfs/2008_Sierra_Nevada_Forests_MIS_Report_January_2008.pdf

USDA Forest Service. 2008. FSH 2309.18 Trails Management Handbook

USDA-FS 2008b. National Visitor Use Monitoring Results: Sierra National Forest, data collected in 2002 and 2007, 2008.

USDA Forest Service. 2009. Rangeland Specialist Report - Bass Lake Grazing Allotments

NEPA: Castle Peak and Long Ridge Allotments, Sierra National Forest, North Fork, CA, Pacific Southwest Region.

USDA Forest Service. 2009. 2210 Range Analysis and Planning File and 2230 Grazing Permit for Castle Peak Allotment. Working Files at Bass Lake Ranger District, Sierra National Forest, 57003 Road 225, North Fork, CA 93643.

USDA Forest Service. 2009. Sierra Nevada forest plan accomplishment monitoring report for 2007. USDA Forest Service, Pacific Southwest Region. On-line version.
http://www.fs.fed.us/r5/snfpa/monitoringreport2007/

USDA-FS 2009. Region 5 SMS Implementation Process. USDA Forest Service, Pacific Southwest Region, 2009.

USDA Forest Service, 2009a. Forest Soil Disturbance Monitoring Protocol, Volume I: Rapid Assessment. Gen. Tech. Report WO-82a,
http://forest.moscowfsl.wsu.edu/smp/solo/documents/GTRs/WO_82/SoilMonProtocol_GTR-WO-82a.pdf

USDA Forest Service, 2009b. Forest Soil Disturbance Monitoring Protocol, Volume II: Supplementary Methods, Statistics, and Data Collection. Gen. Tech. Report WO-82b, http://forest.moscowfsl.wsu.edu/smp/solo/documents/GTRs/WO_82/SoilMonProtocol_GTR-WO-82b.pdf

_____. 2010. Final Environmental Impact Statement. Sierra National Forest Motorized Travel Management. R5-MB-211b March 2010..

USDA Forest Service. 2010. Region 5 Ecological Restoration Leadership Intent, Pacific Southwest Region, Vallejo.

USDA Forest Service. 2010a. Sierra Nevada Forests Bioregional Management Indicator Species (MIS) Report: Life history and analysis of Management Indicator Species of the 10 Sierra Nevada National Forests: Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit. Pacific Southwest Region, Vallejo, CA. December 2010. 132pp.

USDA Forest Service. 2010b. Sierra Nevada forest plan accomplishment monitoring report for 2008. USDA Forest Service, Pacific Southwest Region. On-line version. http://www.fs.fed.us/r5/snfpa/monitoringreport2008/

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. 2011. Nooney, Karen. Fish Camp Project Lands, Recreation and Minerals Specialist Report.

USDA. Forest Service. 2012. FSM 2500 R5 Supplement - Watershed And Air Management, Chapter 2550 - Soil Management, Clovis, California, Sierra National Forest Supervisors Office, U.S. Department of Agriculture, Forest Service.

USDA Forest Service 2012a, Otto, Anaé. Whisky Ridge Ecological Restoration Project Biological Evaluation/Biological Assessment.

USDA Forest Service 2012b. Otto, Anae. Whisky Ridge Ecological Restoration Project Migratory Bird Document

USDA Forest Service 2012c. Stalter, Burt. Whisky Ridge Ecological Restoration Project Fuels Report.

USDA Forest Service 2012d. Smith, Dave. Whisky Ridge Ecological Restoration Project Silvicultural Report

USDA Forest Service 2012e. Stone, Keith Andy. Whisky Ridge Ecological Restoration Project Hydrology Report

USDA Forest Service 2012f. Strand, Philip. Whisky Ridge Ecological Restoration Project Aquatic Wildlife Biological Evaluation/Biological Assessment

_____. 2012. Draft Environmental Impact Statement for the Whiskey Ecological Restoration Project.

USDA Forest Service 2013 Whisky Ridge Ecological Restoration Project DEIS.

USDI- USFWS. 2002a. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List the Yosemite Toad. Federal Register: December 10, 2002 (Volume 67, Number. Pp. 75834-75843.

_____. 2003. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List the Mountain Yellow-legged frog. Federal Register: January 16, 2003 (Volume 68, Number 11. Pp. 2283-2303.

USDI Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition to List the California Spotted Owl (*Strix occidentalis occidentalis*). Federal Register: Volume 68, Number 31, Page 7580-7608. February 14, 2003. From the Federal Register Online via GPO Access [wais.access.gpo.gov]

USDI Fish and Wildlife Service. 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.

USDI Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the West Coast Distinct Population Segment of the Fisher (*Martes pennanti*). Portland, Oregon. Federal Register 69:18769-18792.

_____. 2012. Species List for Whiskey Project.

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.

USGS. 2002. The stream segment and stream network temperature models. US Geological Survey, Biological Resource Division, Midcontinent Ecological Science Center, River Systems Management Section, Fort Collins, CO and Colorado State University, College of Natural Resources. Version 2.0

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 Mantgem, P.J., and Stephenson, N.L. 2007. Apparent climatically induced increase of tree mortality rates in a temperate forest. Ecology Letters. 10: Pages 909-916.

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

Vieira, N.K., W.H. Clements, L.S. Guevara, and B.F. Jacobs. 2004. Resistance and resilience of stream insect communities to repeated hydrologic disturbances after a wildfire.

Vredenburg, V.T., R. Bingham, R. Knapp, J. A. T. Morgan, C. Moritz, and D. Wake. 2007. Concordant molecular and phenotypic data delineate new taxonomy and conservation priorities for the endangered mountain yellow-legged frog. Journal of Zoology 271 (2007) 361–374

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.

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.

Werth, Paul A.; Potter, Brian E.; Clements, Craig B.; Finney, Mark A.; Goodrick,Scott L.; Alexander, Martin E.; Cruz, Miguel G.; Forthofer, Jason A.; McAllister,Sara S. 2011. Synthesis of knowledge of extreme fire behavior: volume I for fire managers. Gen. Tech. Rep. PNW-GTR-854. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 144 p.

Wiedinmyer C. and M.D. Hurteau. 2010. Prescribed fire as a means of reducing forest carbon emissions in the Western United States. Environmental Science & Technology 44:1926-1932.

Wilkerson, E., J.M. Hagan, D. Siegel, and A.A. Whitman. 2006. The effectiveness of different buffer widths for protecting headwater stream temperature in Maine. Forest Science 52(3) 2006. pp. 221-231.

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.

Winthrop, Kate. 2004. Bare Bones Guide to Fire Effects on Cultural Resources For Cultural Resource Specialists, Bureau of Land Management. Website: http://www.blm.gov/heritage/Fire%20Effects%20on%20Cultural%20Resources.htm. Accessed 10/14/2011.

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.

Zeiner, David D., William F. Laudenslayer, Jr., Kenneth E. Mayer. 1988. California's Wildlife.

Volume I, Amphibians and Reptiles. State of California, The Resources Agency, Department of Fish and Game. Sacramento, CA.

Zielinski, W.J., R.L. Truex, F.V.Schlexer, L.A. Campbell, C.Carroll. 2005. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. Journal of Biogeography 32:1385-1407.

Zielinski, W.J., JA Baldwin, RL Truex, JM Tucker, and PA Flebbe. 2013. Estimating Trend in Occupancy for the Southern Sierra Fisher (*Martes pennanti*) Population. Journal of Fish and Wildlife Management 4(1).

INDEX

Use navigation task panel to search

APPENDICES

Appendix A – Map Package for Whisky Ridge Project

See Map Package

Appendix B – Aquatic and Meadow Restoration

Aquatic wildlife habitat enhancement- This is proposed to be completed by installing culverts on roads 7S068 and 7S076 would be reconstructed to reduce sediment. Eleven meadows within the Project Areahave been selected for restoration.

Meadow restoration (physical stabilization) -This is proposed to be completed by the installation of bioengineered log fabric step-falls, which would use locally native vegetation (e.g., logs, sod, Willow, sedges, rushes, etc.) to construct the erosion control and stabilization structures. The logs used for these stabilization structures would come from encroaching conifers removed from within the meadow (up to 12 inch dbh) or understory trees around the periphery of the meadow (up to 10 inch dbh). All tree removal would be done by hand and hand log carriers would be used to move the logs to the restoration sites. In some cases equipment or supplies might be shuttled into the work areas using power wheelbarrows, and since there is a potential for ground disturbance, slash (from the vegetation treatments) and/or ply wood, would be placed along the ingress-egress routes to mitigate these impacts.

Meadow restoration (conifer encroachment removal) – This would be completed by hand thinning trees up to 12 inch dbh and removed from seven meadows to reduce conifer encroachment and help reduce the depletion of ground water. Select cedar and/or fir trees within the project meadows (>12 inch dbh) may be girdled for snag creation if the area is deemed snag deficient. Conifers would be hand thinned within each meadow. Trees less than 6-feet tall would be lopped, scattered and left in place; trees greater than 6-feet tall would be bucked in place and the slash left to dry for a minimum of six weeks and then piled and burned. If applicable, 4 inch to 10 inch dbh trees would be cut into 8-foot to 14-foot lengths and moved by hand with log carriers to the edge of the meadow where they would be cached for later use in restoration structures. If no conifers are to be used for restoration purposes, they would be (depending on size) lopped and scattered, bucked in place, or bucked and moved to the meadow edge.

Meadow restoration (mechanical and hand thinning in Riparian Management Area (RMA) – This would be completed by mechanical, hand thinning and piling, and prescribed fire. Mechanical and hand thinning would occur within a 100 foot RMA around selected meadows adjacent to areas proposed for structural restoration (units) to help reduce the depletion of ground water and further address the issue of conifer encroachment. Mechanical thinning would occur where treatment units are proposed, adjacent to the meadow RMA, in the outer 50' and as far as the equipment can reach within the inner 50 feet of the RMA (approximately 0-35 feet of the buffer from the meadow edge would be hand thinned where mechanical equipment cannot reach). Slash would have a similar treatment in the RMA, as in the adjacent fuel treatment unit, prior to burning. Areas within the meadow RMA where hand thinning is conducted would be hand piled and burn where prescribed fire is proposed. Proposed treatments in the meadow RMA would follow Wildlife-Silvicultural Prescription (Rx). Mechanical equipment would be utilized to thin conifers within the RMA and only where slope gradients are less than 15%. Mechanical equipment would not be allowed to turn in the meadow buffer and ingress and egress of mechanical equipment would be on the same path within the meadow buffer. Any soil disturbance would be repaired by hand if necessary. Conifers less than 12 inch dbh would be mechanicallly thinned within 50 feet of the meadow boundary where mechanical equipment could reach without driving into the inner 50 feet of the meadow boundary. Conifers greater than 12 inch diameter located within 50 feet of aspen would be hand thinned using stand treatment Wildlife-Silvicultural Rx and the boles and limbs would be lopped and scattered and slash would be jack pot burned.

Meadow restoration (off-site livestock water development) - This is proposed to be completed by installing four off-site (e.g. located outside riparian area) livestock drinking water developments for cattle adjacent to the following meadows within the Haskell Grazing Allotment within the portion of the allotment located within Whisky Ridge Project Area: Beehive Meadow (504M153), Benedict Meadow (504M19), China Meadow (504M41), and Peckinpah Meadow (504M29) (Table 2). Spring and/or channel sources of water (identified specifically within each meadow) would be developed with a spring box to collect water and would be plumbed to distribute the water to a permanently located water trough (e.g. 235 gallon capacity). The diversion of water for the four off-site livestock water developments would require submittal of a Statement of Water Diversion and Use to the State Water Resources Control Board. The implementation of these water developments would be coordinated with Forest Service specialists and would be installed in association with proposed meadow restoration activities to minimize trampling impacts to sensitive riparian areas.

Table 69. Summary of Proposed Meadows/Riparian Restoration.

Meadow Number/Name	Identified in Conifer Encroachment Study?	Acres of Encroachment	Acres of Thinning in Meadow Buffer Treatment (0-100 feet from meadow boundary)	Acres of Physical/ Structural Meadow Stabilization	Acres of enhancement Rawson's flaming trumpet habitat?	Off-Site Livestock Water Development Proposed?
504M15	Yes	1.3	7.2	0.0	0.0	No
504M19/ Benedict Meadow	Yes	5.7	8.6	0.0	0.1	Yes
504M28	No	ND	3.0	1.0	0.0	No
504M29/ Peckinpah Meadow	Yes	14.7	12.5	0.0	0.1	Yes
504M37	Yes	1.3	.9	0.0	0.1	No
504M41/ China Meadow	No	ND	7.8	1.5	0.1	Yes
504M59	Yes	1.9	5.9	3.0	0.1	No
504M60	No	ND	6.5	3.75	0.0	No
504M153/ Beehive Meadow	Yes	2.9	7.4	2.65	0.0	Yes
504M167	Yes	2.5	7.1	0.0	0.0	No
504M312	No	ND	5.5	4.0	0.1	No
	Totals	**30**	**72**	**16**	**0.6**	**4**

*Acres are approximate.

Activities Common to all Meadow Restoration Sites:

- 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.

- To ensure ample perching/foraging posts for great gray owls within meadows proposed for restoration, the terrestrial biologist would survey areas where encroaching conifers are intended for removal, prior to project implementation and may require retention of several young trees per meadow acre. Additional conifers with associated shrubs such as azalea and western blueberry growing at the base of the bole may also be flagged for retention to provide nesting habitat for migratory song birds throughout the meadow.
- In all cases, native vegetation (e.g., sod) removed during restoration activities would be saved and preserved for later planting. These areas would also be planted with native Willows to expedite and enhance the stabilization process. Willows would be harvested locally from the same meadow(s) or meadows in the same watershed and at the same elevation range.
- Water would be dammed and diverted around the restoration areas during construction. This would be done either by pumping the water using a portable fire pump or by gravity draining impounded water using a 10inches flexible corrugated pipe. Diverted water would be put back into the channel at the bottom of the meadow.
- A watering system would be devised to ensure that newly re-vegetated areas become established as soon as possible.
- If rock is used in the restoration structures, it would come from local forest stock piles, if necessary measures would be taken to avoid moving noxious weeds from the rock source to the meadows. Currently rock comes from the tunnel talus at Powerhouse 8 off Forest Road 8S03.
- All heavy equipment (if used) would be washed before and after each project to prevent spread of noxious weeds and pathogens such as chytrid fungus.
- Refueling of equipment would follow SNFPA-RCO#1-99, which requires that storage of fuel and refueling occur at least 100 feet from any riparian area and a spill kit would be required on site during implementation).
- Ingress 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 where the soil is relatively dry, and in all cases, ¾inch plywood and/or ½inch polyethylene tread 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.
- Any ingress routes enlarged and/or created for equipment to access the meadow(s) would be obliterated upon completion of the project or properly closed if access to the Project Areais required for maintenance within the first five years after completion.

Appendix C – National Forest Roads System (NFRS)

Forest Service Road 8S26D - Forest Service Road 8S26D is causing severe erosional impacts and sediment delivery to headwaters of Peckinpah Creek and would be decommissioned and obliterated from a point approximately 0.2 miles from the junction with Forest Service Road 8S26 to Forest Service Road 8S09. To mitigate the loss of access, a re-route would be constructed from the segment of Forest Service Road 8S26D left in place to the 8S26C spur. A 200-foot section Forest Service Road 8S26 running through the west side of Peckinpah Meadow would be reconstructed using a more permeable vented road base or the installation of a series of culverts of sufficient size (18 inches – 24 inches) and number (3 to 5) to accommodate the flow moving across this part of the meadow.

Road 7S34 and Meadow 504M60 - The stream crossing at Forest Service Road 7S34 and Meadow 504M60 would have a 36 inches to 48 inches bottomless arch culvert installed to accommodate runoff and prevent further degradation of the channel banks . Two un-engineered drain points which are hydrologically connected to the meadow would be either relocated with rolling dips or water bars to channel water back onto the forest floor and away from the meadow or any nearby creeks or the drain points would be armored with Media Luna rip rap dissipation structures at their outlets to disperse water back into overland flow. Forest Service Road 7S34 (where it crosses at the head of a small meadow) would be rebuilt with a crushed rock low water crossing to accommodate the high soil moisture and runoff. Other improvements and maintenance on roads) within the Project include the installation of culverts, rolling dips, waterbars; aggregate surfacing where soil erosion is evident; riprap at outlets of culverts, dips, and waterbars where needed; minor clearing and widening to a twelve-foot road width for equipment access; aggregate placement on steep slopes, especially in streamside management zones; and replacement of damaged or missing road signs. Best Management Practices (BMP) developed for road maintenance and reconstruction activities would be incorporated into the design of this proposed project and would follow the Sierra National Forest Land Management Plan (SNF-LMP) Standards and Guidelines, as amended. Decommission identified NFRS that are unneeded and are contributing to the degradation of watersheds and aquatic resources and conduct restoration and/or maintenance activities to reduce or eliminate resource. National Forest System Roads (NFSR) needed for project access and conduct road maintenance and reconstruction activities so they meet acceptable standards for the proposed service level and transportation system. There may be temporary road construction needed to access specific treatment areas.

Forest Service Road 7S08 - A historic rock trestle crossing the headwaters of Whisky Creek failed and collapsed sometime in the past severing through-access on Forest Service Road 7S08 between Forest Service Road 8S09 to the west and 8S70 to the southeast. Although standard vehicles cannot cross at this point, OHV's can negotiate the steep (>50%) embankments into and across the creek. OHV ingress into the creek has denuded the embankments of all vegetation causing severe slope instabilities and accelerated erosion (Figure 24). Excessive sedimentation (aggradation) is occurring in the creek due to the adjacent hill slope erosion as well as direct impacts to the channel banks from OHV tread damage. Aggradation in this part of the stream channel is increasing the width-to-depth ratio (i.e., over-widening the channel), which is causing increased near bank shear stress and an increase in bank erosion rates beyond the range of natural variability. The erosion and increased sediment input is directly and adversely affecting the aquatic function (e.g. pool habitat) at and downstream of this location.

In order to improve and restore degraded aquatic features (e.g., meadows, streams, and riparianareas) several restoration solutions are proposed:

Reclassification of a segment of Forest Service Road 7S08 (from the junction of designated OHV trail 23E283 to designated OHV trail 23E293 (7S08B) to Maintenance Level 1 (Figure 25);

- Blockage approximate 0.5 miles (by gate or other barrier) of 7S08 at the junction of designated OHV trail 23E283 JG5 and the junction of designated trail 23E293 (JSM607S08B) to prevent public access. (Figure 25);
- Stabilization of embankments by seeding with native vegetation, placement of fine mesh coir erosion control blanket on the slopes, covering the slopes with certified weed-free mulch, and installing jute-straw wattles on-contour every five feet in elevation.
- Stabilization of channel banks by re-vegetating with live Willow staves, Willow revetments and/or Willow brush mattresses as needed.

Table 70. Proposed Road Construction and Maintenance.

ROAD				EXISTING				PROJECT						PROPOSED WORK				
Number	Segment	Name	Func Class	Mtc Level	Surface	Width Speed	Closure	Mtc Level	Surface	Width-Speed	Design Vehicle	Critical. Vehicle	Closure	New Const.	Reconst.	Maint.	Dust Abatement	Remarks
			1		2		3		2		4	4	3	5	5	5	6	
4S81	1	Minarets Rd	A	4	P	D-25		4	P	D-25	S	S				6.0		
4S81	2	Minarets Rd	A	4	P	D-25		4	P	D-25	S	S				7.5		
7S02	3	Rock Creek	C	2	N	12-5	G	3	N	12-5	T	L	G			0.9	W	
7S02I	1	Rock Creek I	L	2	N	12-5	E	3	N	12-5	T	L	E			0.4	W	
7S02K	1	Rock Creek K	L	2	N	12-5	E	3	N	12-5	T	L	E			1.0	W	
7S04	1	Browns Mdw	L	2	N	12-5	E	3	N	12-5	T	L	E		1.5	1.5	W	
7S07	3	Fish Creek	C	2	N	12-5	G	3	N	12-5	T	L	G			2.3	W	
7S07	4	Fish Creek	C	2	N	12-5	G	3	N	12-5	T	L	G			2.8	W	
7S07B	1	Fish Creek B	L	2	N	12-5	E	3	N	12-5	T	L	E		1.2	1.2	W	
7S07E	1	Fish Creek E	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	
7S07F	1	Fish Creek F	L	2	N	12-5	E	3	N	12-5	T	L	E			1.4	W	
7S07I	1	Fish Creek I	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	
7S07J	1	Fish Creek J	L	2	N	12-5	E	3	N	12-5	T	L	E		0.4	0.4	W	
7S07L	1	Fish Creek L	L	2	N	12-5	E	3	N	12-5	T	L	E			0.5	W	

1) A Arterial
C Collector
L Local

2) N Native
A Aggregate
E Spot Rock
P Pavement

3) B Barrier
G Gate
E Gate Elsewhere
S Sign
N Snow>6”

4) L Lowboy
T Log Truck
Y Yarder
S Sedan
E Engine

5) Show to nearest 0.1 mile

6) W Water
L Lignin
O Oil
S Salts

ROAD				EXISTING				PROJECT						PROPOSED WORK				
Number	Segment	Name	Func Class	Mtc Level	Surface	Width Speed	Closure	Mtc Level	Surface	Width-Speed	Design Vehicle	Critical. Vehicle	Closure	New Const.	Reconst.	Maint.	Dust Abatement	Remarks
			1		2		3		2		4	4	3	5	5	5	6	
7S08	1	Nine Line	L	2	N	12-5	E	3	N	12-5	T	L	E			1.0	W	
7S34	1	Whisky Ridge	L	2	N	12-5	E	3	N	12-5	T	L	E			3.0	W	
7S37	1	Owl	L	2	N	12-5	E	3	N	12-5	T	L	E		1.0	1.0	W	
7S43Y	1	Whisky Falls CG	L	2	N	12-5	E	3	N	12-5	T	L	E			0.1	W	
7S68	1	Pierce Mill	L	2	N	12-5	E	3	N	12-5	T	L	E		3.1	3.1	W	
7S68A	1	Pierce Mill A	L	1	N	12-5	E	3	N	12-5	T	L	E		0.2	0.2	W	
7S76	1	Ellis Meadow	L	2	N	12-5	E	3	N	12-5	T	L	E			2.3	W	
7S76A	1	Ellis Mdw A	L	2	N	12-5	E	3	N	12-5	T	L	E		0.1	0.1	W	
7S94	1	Seven Rocks	L	2	N	12-5	E	3	N	12-5	T	L	E		4.5	4.5	W	
7S94A	1	Powder Can	L	2	N	12-5	E	3	N	12-5	T	L	E			1.7	W	
7S94B	1	Edge Spur	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	
7S96Y	1	Whites Cabin	L	2	N	12-5	E	3	N	12-5	T	L	E			0.9	W	
7S96YA	1	Whites Cabin A	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	
7S96YB	1	Whites Cabin B	L	2	N	12-5	E	3	N	12-5	T	L	E			0.1	W	
7S96YD	1	Whites Cabin D	L	2	N	12-5	E	3	N	12-5	T	L	E			0.2	W	
7S507	1	Coder	L	2	N	12-5	E	3	N	12-5	T	L	E		0.8	0.8	W	

1) A Arterial
C Collector
L Local

2) N Native
A Aggregate
E Spot Rock
P Pavement

3) B Barrier
G Gate
E Gate Elsewhere
S Sign

4) L Lowboy
T Log Truck
Y Yarder
S Sedan
E Engine

5) Show to nearest 0.1 mile

6) W Water
L Lignin
O Oil
S Salts

ROAD				EXISTING				PROJECT						PROPOSED WORK				
Number	Segment	Name	Func Class	Mtc Level	Surface	Width Speed	Closure	Mtc Level	Surface	Width-Speed	Design Vehicle	Critical. Vehicle	Closure	New Const.	Reconst.	Maint.	Dust Abatement	Remarks
			1		2		3		2		4	4	3	5	5	5	6	
7S507A	1	Coder A Spur	L	1	N	12-5	E	3	N	12-5	T	L	E		0.9	0.9	W	
7S508	1	Haskell	L	1	N	12-5	E	3	N	12-5	T	L	E		1.3	1.3	W	
8S09	1	Peckinpah	A	3	N	16-10	G	3	N	16-10	T	L	G			5.1	W	
8S09	2	Peckinpah	A	2	N	16-10	G	3	N	16-10	T	L	G			2.8	W	
8S09	3	Peckinpah	A	2	N	16-10	G	3	N	16-10	T	L	G			4.8	W	
8S09B	1	Peckinpah B	L	1	N	12-5	E	3	N	12-5	T	L	E			0.2	W	
8S23	1	Camp 14	L	2	N	12-5	E	3	N	12-5	T	L	E			1.6	W	
8S26	1	Peckinpah Mdw.	L	2	N	12-5	E	3	N	12-5	T	L	E		1.3	2.6	W	
8S26C	1	Peckinpah Mdw. C	L	2	N	12-5	E	3	N	12-5	T	L	E			0.2	W	
8S27	1	Cascadel	L	2	A	12-5	G	3	A	12-5	T	L	G		1.5	1.5	W	
8S27	2	Cascadel	L	2	N	12-5	G	3	N	12-5	T	L	G		1.6	1.6	W	
8S27A	1	Cascadel Pt.	L	2	N	12-5	E	3	N	12-5	T	L	E		1.6	1.6	W	
8S27D	1	Cascadel D	L	1	N	12-5	E	3	N	12-5	T	L	E		0.8	0.8	W	
8S28	1	Peckinpah Loop	L	2	N	12-5	E	3	N	12-5	T	L	E			1.7	W	

1) A Arterial
C Collector
L Local

2) N Native
A Aggregate
E Spot Rock
P Pavement

3) B Barrier
G Gate
E Gate Elsewhere
S Sign
N Snow>6”

4) L Lowboy
T Log Truck
Y Yarder
S Sedan
E Engine

5) Show to nearest 0.1 mile

6) W Water
L Lignin
O Oil
S Salts

ROAD				EXISTING				PROJECT						PROPOSED WORK				
Number	Segment	Name	Func Class	Mtc Level	Surface	Width Speed	Closure	Mtc Level	Surface	Width-Speed	Design Vehicle	Critical. Vehicle	Closure	New Const.	Reconst.	Maint.	Dust Abatement	Remarks
			1		2		3		2		4	4	3	5	5	5	6	
8S28X	1	Peckinpah Tie	L	2	N	12-5	E	3	N	12-5	T	L	E			0.6	W	
8S38Y	1	Crosshatch	L	2	N	12-5	E	3	N	12-5	T	L	E			1.9	W	
8S38YA	1	Crosshatch A	L	1	N	12-5	E	3	N	12-5	T	L	E		0.2	0.2	W	
8S41	1	Straight Edge	L	2	N	12-5	G	3	N	12-5	T	L	G		1.8	1.8	W	
8S41Y	1	Straight Edge Y Spur	L	1	N	12-5	E	3	N	12-5	T	L	E		0.7	0.7	W	
8S45	1	Zoom	L	1	N	12-5	E	3	N	12-5	T	L	E		0.7	0.7	W	
8S65	1	Roush Cabin	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	
8S65A	1	Roush Cabin A	L	2	N	12-5	E	3	N	12-5	T	L	E			0.4	W	
8S65B	1	Roush Cabin B	L	2	N	12-5	E	3	N	12-5	T	L	E			0.6	W	
8S70	1	Whisky Falls	L	2	N	12-5	E	3	N	12-5	T	L	E			1.2	W	
8S70	2	Whisky Falls	L	2	N	12-5	E	3	N	12-5	T	L	E		7.0	7.0	W	
8S70D	1	Whisky Falls D Spur	L	1	N	12-5	E	3	N	12-5	T	L	E			0.4	W	
8S70E	1	Whisky Falls E Spur	L	1	N	12-5	E	3	N	12-5	T	L	E			0.2	W	
8S70F	1	Whisky Falls F Spur	L	2	N	12-5	E	3	N	12-5	T	L	E			0.3	W	

1) A Arterial
C Collector
L Local

2) N Native
A Aggregate
E Spot Rock
P Pavement

3) B Barrier
G Gate
E Gate Elsewhere
S Sign
N Snow>6”

4) L Lowboy
T Log Truck
Y Yarder
S Sedan
E Engine

5) Show to nearest 0.1 mile

6) W Water
L Lignin
O Oil
S Salts

ROAD				EXISTING				PROJECT						PROPOSED WORK				
Number	Segment	Name	Func Class	Mtc Level	Surface	Width Speed	Closure	Mtc Level	Surface	Width-Speed	Design Vehicle	Critical. Vehicle	Closure	New Const.	Reconst.	Maint.	Dust Abatement	Remarks
			1		2		3		2		4	4	3	5	5	5	6	
8S505	1	Roush	L	1	N	12-5	E	3	N	12-5	T	L	E			0.5	W	
8S505	2	Roush	L	1	N	12-5	E	3	N	12-5	T	L	E			0.5	W	
8S27C	1	Cascadel C	L	1	N	12-5	E	3	N	12-5	T	L	E		0.3	0.3	W	

1) A Arterial
C Collector
L Local

2) N Native
A Aggregate
E Spot Rock
P Pavement

3) B Barrier
G Gate
E Gate Elsewhere
S Sign
N Snow>6”

4) L Lowboy
T Log Truck
Y Yarder
S Sedan
E Engine

5) Show to nearest 0.1 mile

6) W Water
L Lignin
O Oil
S Salts

Appendix D – Road Survey Results

Approximately 29 miles native surface roads were surveyed and evaluated for degree of hydrologic connectivity and stream crossing bypass potential between the road network and the drainage network. Table 1 shows the key problem areas by road, identifies the problem and includes a suggested repair solution for both hydrologic connectivity and stream crossing bypass potential. Many, if not all, of the hydrologic connectivity and stream crossing bypass problems can be eliminated with proper road maintenance, upgrades to maintenance standards and/or the installation and/or relocation of rolling dips and/or water-bars.

Table 71. Hydrologically Connected Drain Points Along Native Surface Level 2 Roads in the Whisky Ridge Project Area.

Road Name	Drainage Structure	Discharge to	Nature of Problem	Suggested Fix	UTM 11 N Locations Easting/Northing	
7S34	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284902	4131387
7S34	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284902	4131389
7S34	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284821	4131412
7S34	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284949	4131419
7S34	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284715	4131446
7S34	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284224	4131181
7S34	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284680	4131455
7S34	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	285944	4131131
7S34	Osd	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of Osd.	285968	4131138
7S34	Waterbar	Meadow	Excess Sediment Transport	Relocate Waterbar	286191	4131216
7S34	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	286405	4131291
7S68	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281870	4131029
7S68	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282130	4131688
7S76	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284544	4126162
7S76	Non-Engineered	Stream	Excess Sediment	Install rolling dip(s) and/or water bar(s) upslope of drain point	284414	4126309

Road Name	Drainage Structure	Discharge to	Nature of Problem	Suggested Fix	UTM 11 N Locations Easting/Northing	
			Transport			
7S76	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284619	4126601
7S76	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284873	4127310
7S76	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284923	4127693
7S76	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	284932	4127765
7S76	Rolling Dip	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	284934	4127813
7S83E	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	280513	4133498
7S83E	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	280508	4133526
7S83E	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	280495	4133551
7S94	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	281390	4131288
7S94	Osd	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281103	4131458
7S94	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281400	4131255
7S94	Osd	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281044	4130494
7S94	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	280497	4131476
7S94	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	280556	4131583
7S94B	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	280957	4128451
7S94B	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	280991	4128379
7S96	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281977	4127647
7S96	Waterbar	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282073	4127736
7S96	Waterbar	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282116	4127799
7S96	Waterbar	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282136	4127823
7S96	Waterbar	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282157	4127843
7S96	Waterbar	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	282167	4127871
7S96	Waterbar	Stream	Excess Runoff	Install rolling dip(s) and/or water	282185	4127895

Road Name	Drainage Structure	Discharge to	Nature of Problem	Suggested Fix	UTM 11 N Locations Easting/Northing	
			to Stream	bar(s) upslope of drain point		
7S96	Waterbar	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	282220	4127921
7S96	Waterbar	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	282245	4127937
7S96YC	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	282796	4128675
8S26	Rolling Dip	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	281787	4127992
8S26	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	281812	4128048
8S26	Waterbar	Stream	Waterbar Eroded	Install rolling dip(s) and/or water bar(s) upslope of drain point	281824	4128068
8S26	Non-Engineered	Meadow	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281619	4127348
8S26	Non-Engineered	Meadow	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	281583	4127254
8S26	Osd	Stream	Needs Osd	Install rolling dip(s) and/or water bar(s) upslope of drain point	281836	4128069
8S26	Non-Engineered	Stream	Excess Sediment Transport	Install rolling dip(s) and/or water bar(s) upslope of drain point	281656	4127453
8s65	Non-Engineered	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	283332	4127669
6S065B	Non-Engineered	Gully	Fill-bank Slump	Raise Road Bed	283300	4127639
7S002	Other	Stream	Excess Runoff to Stream	Install rolling dip(s) and/or water bar(s) upslope of drain point	283812	4134476
7S002	Rolling Dip	Stream	Excess Runoff to Stream	Install Waterbar	283794	4134494
7S002	Rolling Dip	Stream	Stream Impacts	Clean Ditch	283789	4134502
7S007	Non-Engineered	Stream	Meadow Impacts	Install Osd Cattle Presence	284356	4123831
7S007	Rolling Dip	Stream	None	Rolling Dip Good Condition	284373	4123831
7S007	Non-Engineered	Stream	Meadow Impacts	Install Osd Cattle Presence	284364	4123834
7S007	Rolling Dip	Stream	None	Rolling Dip Good Condition	284523	4124772
7S007	Non-Engineered	Stream	Stream Impacts	Install Osd	284508	4124801
7S007	Osd	Stream	Other	Repair Osd	283386	4126527
8S065A	Non-Engineered	Meadow	Meadow Impacts	Install Water Bar Before Meadow	283215	4127700
8S065B	Non-Engineered	Stream	Stream Impacts	Install Water Bar Before stream	283327	4127667
8S065B	Non-Engineered	Meadow	Meadow Impacts	Install Water Bar Before Meadow	283372	4127691
8S070	Rolling Dip	Gully	Stream Impacts	Repair Rolling Dip	284584	4128320
8S070	Other	Meadow	Meadow Impacts	Clean Ditch Install Multiple Cross Drains	283833	4128605
8S070	Non-Engineered	Meadow	Meadow Impacts	Clean Ditch Install Multiple Cross Drains	283834	4128654

Road Name	Drainage Structure	Discharge to	Nature of Problem	Suggested Fix	UTM 11 N Locations Easting/Northing	
8S070	Rolling Dip	Gully	Stream Impacts	Repair Rolling Dip	283830	4128908
8S070	Non-Engineered	Stream	Fill-bank Slump	Install Osd	283645	4129483
8S070	Waterbar	Gully	Gullying	Repair Water Bar	285413	4128340

"Non-Engineered" refers to drainage points where water is flowing off the road at random points where there is no structure to channel the water off the road. "Osd" refers to an Over-side Drain, which is typically a galvanized metal gutter built into the downslope side of the road prism.

Table 72. Proposed culvert installment and maintenance .

Road Name	Culvert Condition	Suggested Fix	UTM 11 N Locations Easting/Northing	
8S070	1/4 Plugged	Replace With Longer Culvert Clean Ditch	283834	4128654
8S070	Clear	Possible Flow/Piping Under Culvert	283834	4128884
8S070	Na	Install Culvert	284986	4128155
7S002	3/4 Plugged	Clean Culvert and In-board Ditch	283800	4134484
7S007L	Fully Plugged	Inlet Buried	283453	4126904
8S065B	Na	Install Culvert(S) and Add Aggregate	283337	4127669
8S070	1/2 Plugged	Clean Culvert	283728	4128348
7S94	1/2 Plugged	Clean Culvert	280560	4131594
7S02	1/2 Plugged	Clean Culvert	283310	4134730
7S76	1/2 Plugged	Large Headcut Upstream Of Culvert. Stabilize headcut and clean culvert.	284540	4126158
7S76	1/2 Plugged	Excess Sediment In Channel Downstream	284759	4126909
7S76	1/2 Plugged	Clean Culvert	284869	4127321
7S94	1/4 Plugged	Bypass Potential due to under-sized culvert. Clean or up size culvert to 24"	280816	4131443
7S76	1/4 Plugged	Clean Culvert	284410	4126315
7S96	3/4 Plugged	Clean Culvert	281687	4127531
7S68	3/4 Plugged	Plugged Culvert Diverts Water Across Road And Gullies Down Fill Slope. Clean or Replace Culvert.	281886	4130981
7S96YC	Crushed	Replace with 24" Culvert.	282798	4128675
7S08	Fully Plugged	Small Wooden ("Historic") Box Culvert. Needs to be replaced with a modern CMP Steel 24"-36" Culvert	283548	4131013
8S26	Fully Plugged	Clean or Replace Culvert	281835	4128081

Appendix E – OHV Routes

Table 73. Survey of OHV routes.

Tread width of 50 Inches		Tread width of 24 - 50 Inches			
ID	**Miles**	**ID**	**Miles**	**ID**	**Miles**
AE-19z	0.056	BP47	0.686	JM-5z	0.031
BP45	0.454	BP140	0.334	JM-8z	0.096
BP117	0.073	JG7z	0.071	JM-9z	0.552
BP143	0.229	JG8z	0.097	JSM3	0.130
JG6z	0.045	JG42	0.023	JSM55	0.424
JG49	0.146	JG48	0.280	JSM66	0.441
JG65	0.036	JG60	0.262	JSM69	0.077
JG91	0.076	JG142	0.085		
JM-7z	0.034	JG144	0.112		
SC2	0.085	JG147	0.128		
Tread width of 24 Inches		**Undefined tread width**			
ID	**Miles**	**ID**	**Miles**		
JG4	0.064	PUB-08	0.520		
JG6	0.026	PUB-13	0.598		
JG12	0.794	PUB-15	0.242		
JG64	0.284	PUB-16	0.209		
JM-17	0.502	PUB-17	0.231		
JSM62	1.515	SC-JG47A	0.375		

Appendix F – Fire & Fuels

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 have been completed 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.

The utilization of prescribed fire only as a form of restoration treatment will be conducted in treatment areas identified as "Rx" units (Rx300 thru 321 total of 21 units). These units may have at least two prescribe fire entries within the lifespan of the project. Utilization of prescribed fire after structural restoration treatments have been completed will be conducted within these treatment areas to maintain appropriate levels of surface and ladder fuels to meet fire and fuels objectives. These units may include pile burning, understory burning or a combination of both. 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:

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.

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.

Removal of woody biomass (harvest generated slash from landings and precommercial sized trees) for energy production may be utilized as a potential fuel removal method. If this treatment option becomes available the benefits would be as follows: Reduced costs for piling and burning of fuels, increased burning efficiency at biomass plant would reduce smoke and greenhouse gas emissions such as carbon dioxide (CO_2). The amount of carbon dioxide (CO_2) emitted during the burning process is typically 90% less than when burning fossil fuel (USDA Forest Service Wood Products Lab 04/04). This method has been analyzed in this report and will have no effects.

Table 74 displays the post thinning treatments for removing natural and activity created fuels. Fuel treatments are the same for Alternatives 2 and 3.

Table 74. Acres of Post thinning Fuels Treatment.

	Hand Pile/ Burn Pile	Tractor Pile/ Burn Pile	Understory Burn Only	Mastication Only	Fuelbreak (New Construction /Maintenance)
All Action Alternatives	200	2728	2838	520	433 / 601 = 1034 Total

Appendix G – Best Management Practices for Water Quality Protection Specific to the Whisky Ridge Project

(from R5 FSH 2509.22 Soils and Water Conservation Handbook, Chapter 10 – Water Quality Management Handbook, USDA Forest Service, 2011)

Timber Management Activities

The following are the BMPs for the control of nonpoint source pollution associated with timber management activities. The line officer on each administrative subunit is responsible for fully implementing the directives that provide for water-quality protection and improvement during timber harvest and management activities.

Earth scientists and other trained and qualified individuals are available to work with the timber management work force to provide technical assistance in identifying beneficial uses, the most recent state-of-the-art water-quality control, methods and techniques, and evaluation of results.

BMP 1.1 - Timber Sale Planning Process

Objective: To incorporate water-quality and hydrologic considerations into the timber sale planning process.

Explanation: The interdisciplinary team would address potential water-quality problems and provide for administrative controls, corrective treatments, and preventive measures. As warranted, a qualified specialist would define and quantify the potential changes to water quality and instream beneficial uses.

The result is an environmental document and sale contract(s). These documents describe methods to prevent unacceptable effects to water quality during and following sale layout and logging operations. They document mitigation measures to ameliorate, and/or preclude adverse effects for those treated areas. Silvicultural treatment is excluded from environmentally sensitive areas where adverse environmental effects from the activity cannot be mitigated to conform to Federal, State, and local water-quality standards.

Implementation: Earth scientists or other trained and qualified individuals participate in the environmental documentation process to evaluate onsite watershed characteristics and potential environmental consequences of the proposed timber harvest and related activities. They design the timber sale to include site-specific prescriptions for each area of water-quality concern. The resulting contract would include those provisions set forth in the environmental document to meet water-quality protection objectives.

BMP 1.4 - Using Sale Area Maps and/or Project Maps for Designating Water-Quality Protection Needs

Objective: To ensure recognition and protection of areas related to water-quality protection delineated on a sale-area map or a project map.

Explanation: This is an administrative and preventative practice. The following are examples of water-quality protection features that pre-sale foresters can designate on the sale area map or project map, thereby ensuring their incorporation as timber sale contract requirements:

1. Location of streamcourses and riparian zones to be protected, including the width of the protection zone required for each stream

2. Wetlands (meadows, lakes, springs, and so forth) to be protected

3. Boundaries of harvest units
4. Specified roads
5. Roads where log hauling is prohibited, or restricted
6. Structural improvement
7. Area of different skidding and/or yarding method application
8. Sources of rock for road work, riprapping, and borrow materials
9. Water sources that are available for purchasers' use
10. Other features that are required by contract provisions
11. Site preparation/fuel treatment

Implementation: The interdisciplinary team would identify and delineate these and other features on maps, as part of the environmental documentation process. The Sale Preparation Forester would include them on the sale area map at the time of contract preparation. The sale administrator and the purchaser would review these areas on the ground before commencing harvest.

BMP 1.5 - Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the purchasers conduct their operations, including, erosion-control work, road maintenance, and so forth, in a timely manner, within the time specified in the timber sale contract.

Explanation: Contract provision C6.3, “Plan of Operation” is required in all timber sale contracts. This provision states that the purchaser must submit a general plan of operation which would set forth planned periods for, and methods of road construction, timber harvesting, completion of slash disposal, erosion-control work, and other contractual requirements. Forest Service written approval of the Plan of Operation is prerequisite to commencement of the purchaser's operation. Contract clause B6.31, “Operation Schedule,” requires that the purchaser provide an annual schedule of anticipated activities such as road maintenance and erosion-control work until the sale is closed. Contract clause C6.313, “Limited Operating Period,” would be used in a contract to limit the purchaser's operation to specified periods when adverse environmental effects are unlikely. Contract provision B6.6 can be used to close down operations due to the rainy season, high water, and other adverse operating conditions, to protect resources.

Implementation: During the timber sale planning process, the interdisciplinary team would identify and recommend limited operating periods. The Sale Preparation Forester prepares the contract to include clause C6.313. Provisions B6.3, B6.31, and C6.3 are all mandatory provisions of the timber sale contract. Provision C6.3 is mandatory only for sales over a 2.year contract period. The purchaser must submit a general plan and annual plans to the Forest Service. The purchaser may commence operations only after written Forest Service approval of the general plan under C6.3.

BMP 1.8 - Streamside Management Zone Designation

Objective: To designate a zone along riparian areas, streams, and wetlands that would minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.

Explanation: As a preventive measure, roads, skid trails, landings, and other timber-harvesting facilities would be kept at a prescribed distance from designated stream courses.

Factors such as stream class, channel aspect, channel stability, sideslope steepness, and slope stability are considered in determining the limitations on activities within the width of streamside management zones (SMZ). Aquatic and riparian habitat, beneficial riparian zone functions, their condition and

their estimated response to the proposed timber sale are also evaluated in determining the need for and width of the streamside management zones.

The SMZ would be a zone of total exclusion of activity, or a zone of closely managed activity as described in the “Glossary of Terms.” It is a zone that acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitats; protects channel and streambanks; and promotes floodplain stability.

Implementation: Identify the streamside management zone requirements during the environmental documentation process. Each forest's LRMP identifies specific measures to protect these zones. As a minimum, forest requirements must be identified and implemented. The timber sale project is designed to include site-specific prescriptions for preventing sedimentation and other stream damage from logging debris. The timber sale contract would be designed to ensure retention of streamside vegetation and improve the condition and beneficial functions of the riparian area.

As appropriate, water-quality monitoring is identified in the environmental document. The Timber Sale Preparation Forester is responsible for including the zones in the timber sale contract and on the sale area map as identified by the environmental document. The sale administrator is responsible for contract compliance during harvest operations.

BMP 1.9 - Determining Tractor-loggable Ground

Objective: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

Explanation: This preventative practice is intended to minimize accelerated soil erosion and sedimentation, and water-quality degradation. To determine tractor-loggable ground, consider physical site characteristics such as steepness of slopes, landslide prone areas, and soil properties. The EHR is one method. For example, where the post-tractor logging EHR is predicted to be “moderate,” an onsite evaluation is conducted to determine the need for erosion-control measures. Where the post-tractor logging EHR is predicted to be ”high,” or “very high,” erosion-control measures are required to reduce the risk of accelerated erosion. Avoid tractor logging where the predicted, post-logging erosion hazard cannot be reduced to either “low” or “moderate.”

Implementation: A trained and qualified Forest Service employee would evaluate the EHR during the on-the-ground planning phase of the timber sale. This work is done within each sale area by evaluating representative sites. The resulting EHRs are considered during the selection of logging methods and silvicultural prescriptions, of erosion-control measures to reduce risk, and in determining the intensity of and controls for land-disturbing activities.

Interpretations of the considerations are described in the environmental document. Provisions in the timber sale contract specify the areas, determined by the EHR, upon which tractors can operate.

BMP 1.10 - Tractor Skidding Design

Objective: 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 would minimize erosion and sedimentation.

Explanation: This is a preventative practice. Watershed factors considered include slope, soil stability, exposure, SMZs, meadows, and other factors that may affect the surface water runoff and sediment yield potential of the land. The careful control of skidding patterns serves to avoid onsite and downstream channel instability, build-up of destructive runoff flows, and erosion in sensitive watershed areas such as meadows and SMZs.

Methods for protecting water quality while utilizing tractor skid trail systems are:

1. End-Lining. This method involves winching the log directly out of the sensitive areas (such as SMZs and meadows) with a cable operated from outside the sensitive area. In this manner, logs can be removed from the sensitive areas, while avoiding encroachment by heavy equipment and associated adverse environmental effects.

2. Felling to the Lead. This method involves felling trees toward a predetermined skid pattern. This procedure facilitates an uncomplicated approach of the tractor operating between the log and the skid trail. Soil disturbance and compaction are consequently lessened, and residual stand and site damage is minimized.

3. Specialized Equipment Access. Specialized equipment (harvesters, feller bunchers) having low ground pressures can move in and out of selected SMZs without turning and leaving disturbed ground.

Implementation: For skid trail design, sensitive areas would be identified and evaluated in the environmental documentation process during the timber sale planning process. When needed to protect water quality, prescriptions must be included in the basic TSC by the use of special contract provisions (C-clauses). The sale administrator then executes the prescription on the ground by locating the skid trails with the timber purchaser, or by agreeing to the purchaser's proposed locations prior to construction. Guidelines for skid trail locations are referenced in the sale administrator Handbook, and would be in the environmental documentation and the timber sale contract.

BMP 1.12 - Log Landing Location

Objective: To locate new landings or reuse old landings in such a way as to avoid watershed impacts and associated water-quality degradation.

Explanation: This practice is both administrative and preventive. The location of and clearing limits for log landings are commonly evaluated by the interdisciplinary team, and are agreed to by the sale administrator and purchaser prior to construction. The following criteria are used by the sale administrator in evaluating landings:

1. The cleared or excavated size of landings should not exceed that needed for safe and efficient skidding and loading operations. Trees considered dangerous would be removed around landings to meet the safety requirements of the Occupational Safety and Health Administration (OSHA).

2. To the extent feasible, select landing locations that involve the least amount of excavation and the least erosion potential, and are well outside of the SMZ.

3. Where feasible, locate landings near ridges away from headwater swales in areas that would allow skidding without crossing channels, violating the SMZ, or causing direct deposit of soil and debris to the stream.

4. Locate landings where the least number of skid roads would be required, and sidecast can be stabilized without entering drainages, or affecting other sensitive areas.

5. Position landings such that the skid road approach would be as nearly level as feasible, to promote safety, and protect the soil from erosion.

6. Keep to a minimum the number of skid trails entering a landing.

7. Avoid excessive fills associated with landings constructed on old landslide benches. Do not change the mass balance to point to destabilize the landslide.

8. Construct stable landing fills or improve existing landings by using appropriate compaction and drainage specifications. Engineered fills would be needed under certain conditions.

Implementation: The sale administrator must agree to landing locations proposed by the purchaser or their representatives. Relying on interdiscipliinary team input and the stated criteria, the sale

administrator can negotiate to select mutually acceptable landing locations—other than those identified in the NEPA document. To be an acceptable landing, it must meet the above criteria. Should agreement not be reached, the decision of the Forest Service would prevail within contract limitations.

BMP 1.13 - Erosion Prevention and Control Measures during Timber Sale Operations

Objective: To ensure that the purchasers' operations would be conducted reasonably to minimize soil erosion.

Explanation: Timber is purchased by individuals or companies who either harvest the timber themselves, or sub-contract to other parties. Therefore, it is necessary to ensure that purchasers and their sub-contractors understand and adhere to water-quality BMP prescriptions formulated during the timber sale planning process. This is accomplished by setting forth the purchaser's responsibilities in the timber sale contract, and holding the purchaser accountable for actions of their sub-contractor.

Implementation: Equipment would not be operated when ground conditions are such that excessive damage would result. The kinds and intensity of control work required of the purchaser would be adjusted to ground and weather conditions, with emphasis on the need to control overland runoff, erosion, and sedimentation. Erosion-control work required by the contract would be kept current. At certain times of the year this means daily, if precipitation is likely, or at least weekly when precipitation is predicted for the weekend.

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.

BMP 1.16 - Log Landing Erosion Control

Objective: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.

Explanation: This practice uses administrative, preventive, and corrective controls to meet the objective. The Sale Planning Forester and sale administrator assess the need for stabilization, with the assistance of earth scientists as needed.

Implementation: Timber sale contract requirements provide for erosion prevention and control measures on all landings. The Timber Sale Preparation Forester would include provisions in the timber sale contract for landings to have proper drainage. After landings have served the purchaser's purpose, the purchaser would ditch, or slope the landings, and may be required to rip or subsoil and make provisions for revegetation to permit the drainage and dispersion of water. Erosion-prevention measures such as waterbars would be constructed to divert water away from landings.

Other provisions may include aggregate surfacing; scarifying; smoothing and sloping; construction of drainage ditches; spreading slash; covering with mulch or wood chips; or applying straw mulch. Prevent road drainage from reaching landings. Unless agreed otherwise, cut and fill banks around landings would be reshaped to stabilize the area.

The specific work needed on each landing would depend on the actual onsite conditions. The sale administrator is responsible for ensuring that this practice is properly implemented on the ground. The sale administrator would agree upon the location and size of log landings proposed by the purchaser before clearing and construction begins.

BMP 1.17 - Erosion Control on Skid Trails

Objective: To protect water quality by minimizing erosion and sedimentation derived from skid trails.

Explanation: This practice uses preventive controls to reach the objective.

The timber sale contract requires the installation of erosion-control measures on skid trails, tractor roads, and temporary roads. Normally, the work involves constructing cross ditches and water-spreading ditches. Other methods such as backblading would be agreed to in lieu of cross drains. Grass seeding or other erosion-control and compaction remediation measures may also be required by a “C” provision, which would be added to the timber sale contract. Areas to be treated are shown on the sale area map legend. During the life of the contract, these areas are designated on the ground annually as logging and temporary access construction progresses.

Implementation: Locations of all erosion-control measures are designated and agreed to on the ground by the sale administrator. The sale administrator handbook section on Skid Trails and Firelines contains guidelines for spacing of cross drains, construction techniques, and cross drain heights. The sale administrator should use these guidelines on the ground to identify site-specific preventive work that is required of the purchaser. The purchaser is obligated to complete and maintain erosion-control work specified in contract provisions during the life of the contract.

BMP 1.18 - Meadow Protection during Timber Harvesting

Objective: To avoid damage to the ground cover, soil, and the hydrologic function of meadows.

Explanation: This is an administrative and preventive action. The interdisciplinary team identifies these sensitive environments during the scoping and onsite evaluation portion of the environmental document preparation process. As a minimum, meadow protection requirements contained in the forest LRMP must be identified and implemented. Trained and qualified Forest Service employees would assess these areas. Protection zones and tree directional felling are prescribed according to site conditions and within guidelines provided by the Forest Service directive system and the LRMP guidelines.

The timber sale contract prohibits unauthorized operation of vehicular or skidding equipment in meadows or in protection zones designated on sale area maps and marked on the ground. Vehicular or skidding equipment is not to be used on meadows except when specifically approved by the sale administrator. Where feasible, directional felling would be used to avoid felling trees into meadows. Unless otherwise agreed, trees felled into meadows would be removed by end-lining, slash removed, and resulting disturbance would be repaired where necessary to protect vegetative cover, soil, and water quality.

Implementation: The concerns and requirements would be set forth in the timber sale contract requirements for sale areas with meadow land. The contract may also specify that a purchaser is subject to liquidated damage charges each time equipment enters a designated meadow. The purchaser would repair damage to these designated areas and/or their associated protection zones in a timely manner, as agreed to by the sale administrator.

The purchaser would repair damage to a streamcourse, or SMZs caused by unauthorized purchasers' operations in a timely and agreed-upon manner.

BMP 1.19 - Streamcourse and Aquatic Protection

1. Objectives:

a. To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values.

b. To provide unobstructed passage of stormflows.

c. To control sediment and other pollutants entering streamcourses.

d. To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.

Explanation: This management practice uses administrative, preventive, and corrective measures to meet the objectives.

Streams within proposed timber sale areas are surveyed and protection zones are prescribed during the timber sale planning process. The interdisciplinary team formulates stream-protection requirements, and includes the prescription in the decision document. The requirements are then included in the timber sale contract and identified on the sale area map.

2. The following principles are fundamental to protecting streamcourses:

a. The sale administrator must agree to location and method of streamcourse crossings prior to construction. This is done at the same time as agreements are made with the purchaser or purchaser's representative for the locations of landings, skid trails, tractor roads, and temporary roads.

b. All damage to a streamcourse, including damage to banks and channels, would be repaired to the extent practicable.

c. All sale-generated debris is removed from streamcourses, unless otherwise agreed to by the sale administrator, and in an agreed-upon manner that would cause the least disturbance.

d. Limit, or exclude equipment use in designated SMZs. Widths of SMZ and restrictions pertaining to equipment use are defined by onsite project investigation and are included in the timber sale contract. The Forest Service identifies these areas on the sale area map prior to advertising. Boundaries of zones would be modified by agreement between the contractor and sale administrator, to compensate for unforeseen operation conditions.

e. Methods for protecting water quality while utilizing tractor skid trail design in streamcourse areas where harvest is approved include: 1) end lining, 2) felling to the lead, and 3) utilizing specialized equipment with low ground pressure such as a feller buncher harvester. Permit equipment to enter streamside areas only at locations agreed to by the sale administrator and the purchaser.

f. Water bars and other erosion-control structures would be located so as to disperse concentrated flows and filter out suspended sediments prior to entry into streamcourse.

g. Material from temporary road and skid trail streamcourse crossings is removed and streambanks restored to the extent practicable.

h. In cable log yarding operations, logs would be fully airborne within the SMZ, when required by the timber sale contract.

i. Special slash-treatment site-preparation activities would be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment.

Implementation: The sale administrator works with the purchaser's representative to ensure that the timber sale contract clauses covering the above items are carried out on the ground. Specialists can be called upon to help the sale administrator with decisions. In the event the purchaser causes debris to enter streamcourses in amounts which may adversely affect the natural flow of the stream, water quality, or fishery resource, the purchaser would remove such debris as soon as practicable, but not to exceed 48 hours, and in an agreed-upon manner that would cause the least disturbance to streamcourses.

BMP 1.20 - Erosion-control Structure Maintenance

Objective: To ensure that constructed erosion-control structures are stabilized and working.

Explanation: Erosion-control structures are only effective when they are in good repair and function as designed. Once the erosion-control structures are constructed, there is a possibility that they may not become adequately effective, or they would become damaged from subsequent harvest activities.

It is necessary to provide follow-up inspection and structural maintenance to avoid these problems and ensure adequate erosion control.

Implementation: During the period of the timber sale contract, the purchaser would provide maintenance of soil erosion-control structures constructed by the purchaser until they become stabilized, but not for more than one year after their construction. After one year, accomplish needed erosion-control maintenance work using other funding sources under timber sale contract provisions B6.6 and B6.66.

The Forest Service may agree to perform such structure maintenance under timber sale contract provision B4.225 (Cooperative Deposits), if requested by the purchaser, subject to agreement on rates. If the purchaser fails to do seasonal maintenance work, the Forest Service may assume responsibility and charge the purchaser accordingly.

BMP 1.21 - Acceptance of Timber Sale Erosion-control Measures before Sale Closure

Objective: To ensure the adequacy of required erosion-control work on timber sales.

Explanation: The effectiveness of soil erosion prevention and control measures is determined by the conditions found after sale areas have been exposed for one, or more years to the elements. The evaluation is to ensure that erosion-control treatments are in good repair and functioning as designed before releasing the purchaser from the contract responsibility.

Although a careful check is required before a timber sale is closed to ensure that planned erosion work has been completed to the standard prescribed, the erosion prevention work done in previous years must also be inspected during the life of the timber sale. These inspections would help determine whether the planned work was adequate, if maintenance work is needed, the practicability of the various treatments used, and the necessity for modifying present standards, or procedures.

Implementation: “Acceptable” erosion control means only minor deviation from established objectives, provided no major, or lasting damage is caused to soil, or water. Sale administrators would not accept erosion-control measures that fail to meet these criteria. Specific requirements for erosion control are included in each timber sale contract and the sale administrator handbook.

BMP 1.22 - Slash Treatment in Sensitive Areas

Objective: To maintain or improve water quality by protecting sensitive areas from degradation which would likely result from using mechanized equipment for slash disposal.

Explanation: Special slash treatment site preparation would be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment. Meadows, wetlands, SMZs, and landslide areas are typically sensitive areas where equipment use is normally prohibited. Slash-treatment and site-preparation methods are specified in environmental documents, where applicable, for each cut unit in project and contract documents such as a timber sale contract, project map, or sale area map.

Implementation: An assessment of the sale area would be made in the timber sale planning process. Sensitive areas requiring protection are identified. Assessment results would be documented in the environmental document, and identified in the timber sale contract and on the sale area map. The sale administrator, contract inspector, or Forest Service specialist would inspect the treatment for correct and satisfactory slash disposal accomplishment.

Road Management Activities

The purpose of this set of BMPs is to control nonpoint source pollution that may occur as a result of road (and motorized trail) management activities on NFS lands in the Pacific Southwest Region. Activities associated with road (and motorized trail) management include travel route planning, design, construction, operation, maintenance, reconstruction, storage, and decommissioning.

Considering the proportion of the landscape that they occupy, roads are a prevalent cause of hydrologic and geomorphic process alteration on NFS lands. Highly compacted road surfaces generate infiltration-excess overland flow, even during small precipitation events. In addition, cut slopes can intercept transient hillslope groundwater (that is, subsurface stormflow) when the height of the cut slope exceeds the depth to the water table. This runoff is laterally redistributed and often concentrated along inside ditches or the running surface, where it is discharged to hillslopes below the road or trail prism or routed directly into streams. These hydrologic process and pathway alterations largely drive the water-quality impacts associated with roads.

When roads and associated drainage-control features contribute flow directly to a natural waterbody, they become part of the drainage network and are said to be hydrologically connected. These drainage systems may further increase hydrologic connectivity if they deteriorate because of use, weather, or inadequate maintenance. Drainage facilities may be inadequate after wildfires or extreme precipitation events, due to increased surface runoff, loss of vegetative cover, and stream bulking, and can increase the length of road hydrologically connected to the stream network. Furthermore, many slope disturbances are spatially linked to the road network, and roads are often the pathway for transporting pollutants from these other types of disturbances (for example, dispersed recreation). Hydrologically disconnecting roads is a fundamental practice for eliminating chronic water-quality impacts from roads and other disturbances.

Location and design strongly influence the risk and degree of road and trail impacts on water, aquatic and riparian resources, as can maintenance practices. Roads located adjacent to unstable slopes, streams, lakes, wetlands, springs, and other waters are particularly susceptible to causing adverse impacts. Proper road and trail design, construction, maintenance, and operation can reduce impacts to natural hydrogeomorphic functions and water resources.

Stream crossings are the most frequent location of adverse road and trail impacts to water, aquatic, and riparian resources. Road surfaces typically drain toward crossings, so the likelihood of connectivity of road surface with channels is greatest. Crossings comprised of fine-grained native materials may erode and deliver sediment to channels. Culverts may be inadequately sized to properly pass flow, bedload and debris and, due to size and/or gradient, may present barriers to fish and aquatic organism movement. Crossings also present the risk of catastrophic failure if flood flows exceed crossing capacity. In such cases the crossing fill may be lost. In the worst case scenario, crossing failure results in diversion of flows from the channel onto the adjacent roadway. For these reasons, management activities conducted at crossings are vitally important to water, aquatic, and riparian resources, and are emphasized in the BMPs that follow.

The following BMPs are to be applied as needed to prevent adverse impacts of road management activities on water, aquatic, and riparian resources to the extent possible. BMPs range from suggested practices to prohibitions, as required by Forest Service directives.

Section 404 permits, so named because they were created under section 404 of the Clean Water Act, are required for discharges of dredged or fill materials to waters of the United States, including wetlands. They are administered by the U.S. Army Corps of Engineers. Section 401 Water Quality Certifications are completed for section 404 permits and any other permit issued by a Federal agency for a project with potential to affect water quality. In California, Regional Water Boards administer section 401 Water Quality Certifications. Each section 404 permit needs a section 401 Water Quality Certification UNLESS the section 404 permit is obtained under a nationwide permit that has a “blanket” Water Quality Certification.

National Pollutant Discharge Elimination System (NPDES) permits may also be required. Forest Service engineers and hydrologists would work together during the permitting process.

BMP 2.2 - General Guidelines for the Location and Design of Roads

Objective: Locate roads to minimize problems and risks to water; aquatic, and riparian resources. Incorporate measures that prevent or reduce impacts, through design for construction, reconstruction, and other route system improvements.

Explanation: A road's location and design may have long-term effects on water quality, construction and maintenance costs, safety, and other public resources. Road location and design control hydrologic connectivity—the degree that road runoff and sediment are linked to the stream channel network. The extent of hydrologic connectivity, along with the magnitude and frequency of road erosion, drives road-related water-quality impacts.

Roads are located according to standards and specifications to meet their use objectives, while protecting other resources. Well-defined project objectives are necessary to locate and design roads that would best address environmental and resources issues, as well as safety and traffic requirements.

Designs of new roads and upgrades to existing roads consider ways to reduce impacts to beneficial uses of water. Management needs have changed considerably since most NFS roads were constructed. Influences of roads on aquatic and riparian resources are recognized and considered. Road maintenance budgets and opportunities have diminished. Designs for improvements to existing roads significantly reduce or eliminate impacts to beneficial uses of water. Drainage features and surfacing are among elements often considered for change. Improvements to the road system are made on a priority basis that considers road and resource condition, beneficial uses at risk, and cost.

In addition, some situations may require adherence to special conditions associated with Clean Water Act permits for water quality certification (401), stormwater (402), and discharge of dredge and fill material (404). State and local entities may also provide guidance and regulations such as a Forest Practices Act or a Stream Alteration Act. Forest plans often contain direction on location of roads relative to streams, wetlands, and unstable landforms.

The risk from road management activities can be managed by using the appropriate techniques for road location and design from the following list, and adapted as needed to local site conditions.

Implementation: Implementation considers new road location, relocation, and design only. Construction, reconstruction, maintenance, decommissioning, and erosion control are covered in subsequent BMPs.

<u>Location</u>:

1. Avoid locating new roads where water-quality risks outweigh beneficial uses.

2. Locate roads to fit the terrain, limit the need for excavation, and prevent damage to improvements and resources.

3. Avoid sensitive areas such as riparian areas, wetlands, meadows, bogs, fens, inner gorges, overly steep slopes, and unstable landforms to the extent practicable. If such areas cannot be avoided:

a. Use bridges or raised prisms with diffuse drainage to sustain flow patterns

b. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces

c. Avoid actions that may dewater or reduce water budgets in wetlands. Consider compensatory mitigation or mitigation banking.

4. Locate roads outside SMZs whenever possible, with a minimum of number of crossings and connections between the road and streams.

5. Relocate existing routes or segments that are in high-risk locations, including the SMZ, to the extent practicable.

6. Relocate roads that are causing uncontrollable adverse effects to beneficial uses of water, with commensurate decommissioning of high-risk roads.

7. Consider potential for generation of waste material in location of roads, and need for access to appropriate disposal areas. Waste or spoil may not be placed within SMZs, on slopes greater than 60 percent, on unstable slopes, or in areas subject to converging runoff.

8. Locate roads in an interdisciplinary manner with a hydrologist, soils scientist, and geologist, if necessary.

9. Final road location drives design features, assuring protection of water quality. Incorporate modeling as necessary to assist with design of road segments displaying higher erosion potential.

Design:

1. Design roads to balance cuts and fills or use full bench construction where stable fill construction is not possible.

a. Consider full bench construction or mechanically stabilized fills on unstable slopes or slopes greater than 60 percent.

b. Ensure design addresses method to stabilize constructed fill slopes, including key ways where fill slopes exceed 3 feet in height at the hinge point.

c. Do not design to discharge runoff on to unstable landforms, such as hollows.

2. Design road surfaces to dissipate intercepted water in a uniform manner along the road by outsloping, insloping with drains, or crowning with drains, subject to site soil characteristics to prevent the discharge of sediment to surface waters.

3. Design to reduce the hydrologic connectivity of the road segment or network.

4. Limit occurrence of connectivity areas to water crossings only, if possible.

5. Choose low-maintenance designs (for example, outsloping and rolling the grade) for roads that may be subject to minimal use or would be put in storage.

6. Follow general principles of stormwater and erosion control related to roads including permanent and temporary controls that:

a. Minimize soil compaction (except as needed to achieve compaction standards on road prism) and bare ground coverage.

b. Separate exposed bare ground from surface waters. Incorporate vegetation or slash over exposed fill slopes.

c. Design stable road prisms and stream crossings.

d. Use geotextiles when necessary to avoid mixing aggregate with subgrade and subsequent rutting of road.

7. Employ treatments that control stormwater and erosion at the source through the use of small-scale treatments distributed throughout the road prism.

8. Design properly spaced cross drains to provide maximum filter distance and to limit hydrologic connectivity between the road and water resource where practicable.

9. Design subsurface dispersion measures and cross drains as necessary to capture and disperse expected flows contributed by locally Willow groundwater and road surfaces.

10. Design energy dissipaters, apron, downspouts, gabions, flumes, oversize drains and debris racks, culvert and cross drain inlets and outlets, where needed to prevent erosion and discharge of sediment to surface waters. Do not discharge runoff on to unstable surfaces.

11. Design stable ditch configuration that does not erode, yet does not fail during mechanical maintenance activity

12. Carefully consider impacts vs. benefits of berm in the control of runoff. Avoid berms except where needed to facilitate drainage patterns without adverse impact to water quality.

13. Design spot surface treatments to areas that are sensitive, erodible, subject to high seasonal water tables, or would be heavily traveled.

14. For roads located within the SMZ where adequate buffer zone does not exist, design for aggregate or paved surface. Design for a floodplain surface to slow water velocities and minimize erosion by flood flows (energy dissipation).

15. Generally use the minimum road standards for grade and alignment (width, turning radius, maximum slope) to accommodate the design vehicle and traffic mix and volume.

16. Consider maintenance requirements in road design.

17. For roads to be reconstructed, incorporate design features to reduce or eliminate identified water-quality impacts.

Crossings:

1. Design both temporary and system roads to limit the number of surface-water crossings necessary to meet planned activity objectives and safety requirements.

2. When necessary to cross streams, find optimal places for road-stream crossings. If possible avoid:

a. Areas requiring steep road approaches.

b. Crossing braided or migrating stream channels.

c. Flat stream gradient immediately downstream of steep stream gradients.

d. Areas requiring deep fills.

e. Areas immediately downstream of unstable slopes or landforms.

3. Design crossing approaches so road surfaces and drainage features have minimum hydrologic connectivity with channels.

4. Design diversion potential dips at existing crossings where there is a risk of flow diversion or where crossing fills are higher than approaches. Consider hardened fills commensurate with fill height. Consult with hydrologist.

5. Design stream-crossing structures to provide the most resource protection consistent with facility needs, legal obligations, and cost considerations.

6. Provide for desired passage of aquatic and terrestrial organisms, debris, and bedload as well as flow.

a. Size crossings for the 100-year flood event, plus associated debris and sediment, or greater.

b. Design for stream simulation if feasible in consultation with hydrologists and fisheries biologists.

7. Consider using culvert arrays, perched culverts and/or permeable fills in meadow environments or areas with naturally high water tables to encourage meadow function.

BMP 2.3 - Road Construction and Reconstruction

Objective: Minimize erosion and sediment delivery from roads during road construction or reconstruction, and their related activities.

Explanation: During road construction and reconstruction activities, vegetation and ground cover are removed, often exposing both the surface and subsurface soil to erosion. Temporary and long-term erosion-control measures are necessary to reduce erosion and maintain overall slope stability. These erosion-control measures may include vegetative and structural techniques to ensure the area's long-term stability. The risk from road construction and reconstruction activities can be managed by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation: Enforcement of the techniques is the responsibility of the inspector and contracting officer's representative for public works contracts, the inspector and engineering representative for timber sale roads, and the permit administrator for roads constructed or reconstructed under administrative operations (that is, Road Use Permit, Special Use Permit, and so forth). If roads are constructed or reconstructed by force account crews, the project manager and foreman are responsible for adherence to project drawings, specifications, and erosion control plan.

1. Implement the approved erosion control plan that covers all disturbed areas, including borrow areas and stockpiles used during road management activities (see BMP 2.13- Erosion Control Plan). Include the forest's wet weather operations standards (WWOS).

2. Maintain erosion-control measures to function effectively throughout the Project Areaduring road construction and reconstruction, and in accordance with the approved erosion control plan (see BMP 2.13- Erosion Control Plan).

3. Set the minimum construction limits needed for the project and confine disturbance to that area.

4. Locate and designate waste areas before operations begin.

a. Deposit and stabilize excess and unsuitable materials only is designated sites.

b. Do not place such materials on slopes with a high risk of mass failure, in areas subject to overland flow (for example, convergent areas subject to saturation overland flow), or within the SMZ.

c. Provide adequate surface drainage and erosion protection at disposal sites.

d. Comply with BMP 2.5 - Water Source Development and Utilization.

5. Comply with BMP 2.11 - Equipment Refueling and Servicing.

6. Do not permit sidecasting within the SMZ. Prevent excavated materials from entering water ways or SMZs.

7. Develop and follow blasting plans to move materials when necessary.

a. To the extent possible, restrict blasting in sensitive areas and those sites with high landslide potential.

b. Restrict blasting after intense storms when soils are saturated.

c. Prevent damage from fly rock and overshot by not overloading shots, installing blasting mats, or avoiding setting charges through variable rock strata.

8. Schedule operations when rain, runoff, wet soils, snowmelt or frost melt are less likely. Follow seasonal restrictions of the forest's WWOS, and notification protocols, as outlined in an approved erosion control plan.

a. Optimally, schedule construction during dry periods, while still adhering to other seasonal restrictions (wildlife breeding, spawning, fire activity levels, and so forth), consistent with local ordinances.

b. Stabilize Project Areaduring normal operating season when the National Weather Service predicts a 30 percent or greater chance of precipitation, such as localized thunderstorm or approaching frontal system.

c. Keep erosion-control measures sufficiently effective during ground disturbance to allow rapid closure when weather conditions deteriorate.

d. Complete all necessary stabilization measures prior to predicted precipitation that could result in surface runoff.

9. To the extent possible, construct new stream crossings when streams are dry or when stream flow is at its lowest. Install sediment controls.

10. Comply with BMP 2.8- Stream Crossings.

11. Limit operation of equipment when ground conditions could result in excessive rutting, soil compaction (except on the road prism or other surface to be compacted), or runoff of sediments directly to streams.

12. On slopes greater than 40 percent, the organic layer of the soil would be removed prior to fill placement, according to project specifications.

13. Waste organic material, such as uprooted stumps, cull logs, accumulations of limbs and branches, and unmerchantable trees, would not be buried in logging road or landing fills. Dispose of waste organic material according to project specifications, in locations designated for waste disposal. Assure compliance with the project erosion control plan.

14. Construct fills and keyways according to design drawings and specifications, not exceeding specified lift thickness and moisture content. Ensure un-compacted materials are prevented from leaving disturbance limits.

15. Stabilize all disturbed areas with mulch, erosion fabric, vegetation, rock, large organic materials, engineered structures, or other stabilization measures according to the Erosion Control Plan, and project specifications and drawings for permanent controls (that is, crib walls, gabions, riprap placement, and so forth).

16. Scatter construction-generated slash on disturbed areas to help control erosion.

a. Ensure ground contact between slash and disturbed slopes.

b. Windrow slash at the base of fill slopes to reduce sedimentation.

c. Ensure that windrows are placed along the contour and that there is ground contact between slash and disturbed slope.

17. Remove large limbs and cull logs to designated sites outside the SMZ or relocate within the SMZ to meet aquatic resource management objectives.

18. Monitor contractor’s plans and operations to assure contractor does not open up more ground than can be substantially completed before expected winter shutdowns, unless erosion-control measures are implemented.

19. If snow/rainy season operations are proposed, specifications for snow/ice depth or soil operability conditions must be described. Include these specifications in the erosion control plan (see BMP 2.13-Erosion Control Plans).

20. Install erosion-control measures on incomplete roads prior to precipitation events or the start of the winter period (November 16 through March 31) and in accordance with the approved erosion control plan:

a. Remove ineffective temporary culverts, culvert plugs, diversion dams, or elevated stream crossings, leaving a channel at least as wide as before construction and as close to the original grade as possible.

b. Install temporary culverts, side drains, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, dikes, debris racks, pipe risers, or other facilities needed to control erosion.

c. Remove debris, obstructions, and spoil material from channels, floodplains, and riparian areas.

d. Do not leave Project Areas for the winter with remedial measures incomplete.

e. Plant vegetation, mulch, and amendments, or provide other protective cover for exposed soil surfaces.

21. When pioneer roads are necessary:

a. Confine construction of pioneer roads to the planned roadway limits unless otherwise specified or approved.

b. Locate and construct pioneering roads to prevent undercutting of the designated final cut slope.

c. Avoid deposition of materials outside the designated roadway limits.

d. Dewater live streams where crossed by pioneer roads with appropriate diversion devices.

e. Accommodate drainage with adequate temporary crossings.

BMP 2.4 - Road Maintenance and Operations

Objective: To ensure water-quality protection by providing adequate and appropriate maintenance and by controlling road use and operations.

Explanation: Appropriate maintenance and control of road use and operations can protect water quality, aquatic and riparian resources, and capital investments. Maintenance needs and operational controls are informed by periodic inventory and assessment that determine road condition and the potential impacts the road has on water quality.

Properly designed and maintained road surfaces and drainage systems can reduce adverse effects to water resources by facilitating natural hydrologic function. Roads and drainage systems normally deteriorate because of traffic, weather, and effects of maintenance. In addition, roads occasionally become saturated by new groundwater springs and seeps after a wildfire or unusually wet periods. Many such conditions can be corrected by timely maintenance. However, while routine maintenance may be needed to ensure the road performs as designed, it can also be a source of soil disturbance and therefore, sediment production. In particular, the grading of inside ditches and road surfaces can significantly increase sediment production rates. Less aggressive maintenance may be desired to minimize disturbance of stable sites.

Road management objectives include the level and type of maintenance that a road is expected to receive. Assigned road maintenance levels vary from 1 to 5, and are directly linked to the operational objectives for the road. Maintenance Level 1 is assigned to roads closed to all motorized vehicles for a year or more; they should be left in a stable condition, and by definition, require less maintenance. Maintenance Levels 4 and 5 are assigned to roads that are typically double-lane, aggregate-surfaced or paved, and passenger vehicle traffic is “encouraged.” They are well maintained to provide a moderate to high degree of user comfort and convenience.

Operational objectives and activities are also defined by the road management objectives, and depend upon the amount of maintenance a road is expected to receive. Road operations also include permit, contract, and agreement administration, control of seasonal use, sustaining roads in closed status and revising maintenance levels and seasonal closures, as needed. Road closures and restrictions are necessary because many forest roads are designed for dry-season use. Most local roads are not surfaced, while others have some surfacing or spot stabilization. Roads without stabilized surfaces or adequate base can be damaged by use during wet periods or by loads heavier than the road was designed to convey.

Road maintenance plans are implemented through contract, cooperators, force account, and active timber sale or other authorized activities. Contract, timber sale, and other authorized or permitted operations are bound by specifications and drawings. BMPs are incorporated as specifications, contract or sale clauses, operating plan requirements, permit clauses, and are often

shown in the drawings. The contracting officer's representative is responsible for assuring compliance by contractors; engineering representative, TSA, or FSR assures compliance by cooperator, purchaser or permitted operator. Project manager and crew supervisor assures compliance for force account work. Optimally, the forest hydrologist works with the forest quality assurance personnel to determine if approved maintenance tasks are completed with minimal resource impacts. Adjustments to future maintenance plans and methods are considered when previous methods do not provide the needed protection to water quality.

Risk from road maintenance activities can be managed by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation

<u>Inspection</u>:

1. Periodically inspect system travel routes to assess condition and linkage to water quality. This information assists in setting maintenance and improvement priorities.

a. Provide training to the engineering personnel performing condition surveys to successfully identify and assess linkage to water quality.

b. Conduct condition surveys jointly with engineering and hydrology personnel, to more accurately assess potential of road to impact water quality.

c. Prioritize inspections to roads at high risk of failure, followed by road segments that are hydrologically connected to the stream network, to reduce risk of diversions and cascading failures.

d. Identify diversion potential on roads, and prioritize for treatment.

2. Inspect drainage structures and runoff patterns after major storm events and snowmelt, and perform any necessary maintenance. Major storm events include all storm events for which the National Weather Service issues a local flood watch, advisory, or warning.

a. Determine the extent of hydrologic connectivity during and/or just after major storm events, including the connectivity of disturbed areas directly adjacent to the road network. Use this information to prioritize and plan improvements to road drainage.

b. Immediately clean out, repair or reconstruct waterbars, inside ditches, culverts, and other features that are not functioning in order to hydrologically disconnect roads from surface waters and prevent discharges of sediment andother pollutants to water bodies.

3. Regularly inspect roads during all operations.

4. Keep roads closed to public use, but open for administrative use, in hydrologically functional condition. If waterbars are breached, forest personnel would promptly repair them.

5. Encourage field personnel of all disciplines to observe road deterioration or damage commensurate with travel to field activities, and report to engineering, for immediate action, if necessary.

a. Restrict operations if impact or imminent threat of impact to water quality is occurring.

b. Consider restricting operations if road damage such as surface displacement or active rutting is occurring.

Maintenance Planning:

1. Incorporate the forest's Wet Weather Operations Standards and notification protocols in maintenance and operations.

2. Develop and implement an erosion control plan commensurate with the complexity and scale, and duration of the activity. See BMP 2.13.

3. Develop and implement annual maintenance plans that prioritize road maintenance work for the forest or district.

a. Include roads identified as needing maintenance from field condition surveys, and roads identified through roads analysis and travel analysis that negatively impact water quality.

b. Determine method of accomplishment (contract, force account, permit, and cooperative) and define responsibilities and maintenance timing in the plan.

4. Planning for emergency interim/temporary erosion controls to protect water quality is considered for roads that may require immediate maintenance, but are beyond capability of annual maintenance plan.

5. Identify roads with potential to improve water quality by modifying road prism and drainage patterns through maintenance operations.

a. Analyze roads in an interdisciplinary manner to identify other impacts that may occur due to changes in road prism or drainage patterns. Consider local conditions and site characteristics.

b. Implement diversion potential method per Forest Service Publication 9777.1814P-SDTDC Diversion Potential at Road-Stream Crossings.

c. Consider user safety and protection of other forest resources.

d. Provide training and reference materials for forest road managers, road maintenance operators, and road maintenance contract preparation personnel to work with hydrologists in identifying appropriate roads for revised maintenance procedures.

6. Evaluate road management objectives when an inspection indicates road design is not meeting current transportation and/or resource needs. Road management objectives support forest LRMP prescriptions.

Maintenance Activities:

1. Maintain road surfaces to dissipate intercepted water in a uniform manner along the road by outsloping with rolling dips, insloping with drains, or crowning with drains. Where feasible and consistent with protecting public safety, utilize outsloping and rolling the grade (rolling dips) as the primary drainage technique.

2. Adjust surface drainage structures to minimize hydrologic connectivity by:

a. Discharging road runoff to areas of high infiltration and high surface roughness.

b. Armoring drainage facility outlet as energy dissipater and to prevent gully initiation.

c. Increasing the number drainage facilities with SMZs.

3. Clean ditches and drainage structure inlets only as often as needed to keep them functioning. Prevent unnecessary or excessive vegetation disturbance and removal on features such as swales, ditches, shoulders, and cut and fill slopes.

4. Minimize diversion potential by installing diversion prevention dips that can accommodate overtopping runoff.

a. Place diversion prevention dips downslope of crossing, rather than directly over the crossing fill, and in a location that minimizes fill loss in the event of overtopping.

b. Armor diversion prevention dips when the expected volume of fill loss is significant.

5. Address risk and consequence of future failure at the site when repairing road failures. Use vegetation, rock, and other native materials to help stabilize failure zones.

6. Maintain road surface drainage by removing berms, unless specifically designated otherwise.

7. Install and preserve markers to identify and protect drainage structures that can be damaged during maintenance activities (that is, culverts, subdrains, and so forth)

8. When grading roads or cleaning drainage structure inlets and ditches, avoid undercutting the toe of the cut slope.

9. Grade road surfaces in accordance with road management objectives and assigned maintenance level. Grade only as needed to maintain a stable running surface and adequate surface drainage.

10. Accompany grading of hydrologically connected road surfaces and inside ditches with erosion and sediment control installation.

11. Identify additional road maintenance measures to protect and maintain water; aquatic, and riparian resources including: surfacing and resurfacing, outsloping, dips and cross drains, armoring of ditches, spot rocking, replacing culverts, and installing new drainage features.

12. Effectively maintain roads in storage to eliminate all motorized vehicle use. Maintain physical closure devices, if present, to be safe and effective. For roads where physical closure methods are not feasible, install signing to inform of road closure.

13. Enforce pre-haul maintenance, maintenance during haul, and post haul maintenance (putting the road back in storage) specifications when maintenance level 1 roads are opened for use on commercial resource management projects. Require the commercial operator to leave roads in a satisfactory condition when project is completed.

14. Opened for use on commercial resource management projects. Require the commercial operator to leave roads in a satisfactory condition when project is completed.

<u>Operations</u>:

1. Restrict or prohibit road use during periods when such use would likely damage the roadway surface or road drainage features are identified through Travel Analysis and Travel Management, and implement through enforcement of motor vehicle use map. Changes in road management are supported by appropriate analysis. Follow the forest's WWOS. See BMP 2.13.

2. Require users to obtain permit(s) when proposed operations involve use of roads by vehicles larger than the design vehicle, or beyond typical operation period or season of use (that is, timber purchasers, mining operations, oversize vehicle movement, and so forth. Conditions of the permitted use may require:

a. Strengthening the road surface by adding rock, dust palliatives, pavement, or armor, particularly in areas where surfaces are vulnerable to movement such as corners and steep sections.

b. Considering short-term road surface stabilization by dust abatement methods, such as watering.

c. Upgrading drainage structures.

d. Restricting use to low-ground-pressure vehicles or frozen ground conditions.

e. Strengthening the road base if roads are tending to rut.

f. Using a base course of rock and/or geotextile fabric to provide subsurface stability.

g. Intensifying maintenance to handle the traffic without creating excessive erosion and damage to the road surface.

h. Repairing damage to road and forest resources associated with use by permittee.

i. Restoring the road to original standard of features, such as restoring waterbars.

3. To the extent possible, ensure drainage features are fully capable of preventing pollutant discharges to surface waters before the start of the local winter season (such as November 16 to March 31) or before the start of runoff-inducing precipitation events.

4. Permits to oversize or overweight loads require that damage by such loads be repaired by the permit holder. Damage includes impacts to water quality.

5. Cooperative maintenance agreements follow Forest Service direction for use, maintenance, repairs, and responsibilities.

6. Roads under easement are subject to terms of conditions for operation and maintenance.

BMP 2.5 - Water Source Development and Utilization

Objective: To supply water for road construction, maintenance, dust abatement, fire protection, and other management activities, while protecting and maintaining water quality.

Explanation: Water source development is needed to supply water for road construction and maintenance, dust control, and fire control. In-stream water drafting can substantially affect water flow and/or configuration of the bed, bank, or channel of streams. Aquatic species present could be at risk due to rapid changes or sustained reductions in flow, reduced dissolved oxygen, and/or increased water temperature. Exposed surfaces of water holes or other developments could erode and discharge sediment back into the waterway. In addition to direct hydrogeomorphic (forming and shaping landform by water) disruption to the channel and subsequent impacts to aquatic species, water-quality impacts can occur from road approaches that access the water drafting site. Many water drafting sites have steep approaches and in the absence of adequate drainage or surfacing, these approaches can become chronic sources of sediment and runoff to the channel. Water trucks often leak oil, and sometimes fuel, onto drafting pads, becoming a source of petroleum product contamination to surface waters.

Regular monitoring of water supply developments, during construction and use, and enforcement of contract and sale clauses, specifications, and restrictions is the responsibility of inspectors, contracting officer representatives, engineering representatives, sale administrators, and force account crew foreman.

Implementation

<u>Location and Development</u>:

Critical to the effectiveness of this practice is the coordination of engineering representatives, hydrologists, fishery biologists, and permit and sale administrators. Locate existing developments, or proposed streams, and evaluate for feasibility of use; determine scope and scale of environmental

risks; select techniques for mitigating disturbance to water quality; and compare with the economics of development and use:

1. Water sources designed for permanent installation, such as piped diversions to off-site storage, are preferred over temporary, short-term-use developments.

2. If off-site storage is not an option then the following locations would be considered.

a. Locations where flowing side channels rather than the main thread of the channel can be used for drafting.

b. Areas with existing pools that can be partially blocked, rather than in-channel excavation are preferred.

c. Sites where road approaches can be hydrologically disconnected from streams.

d. Sites where the drafting pad can be placed above the bankfull elevation of the channel with little or no excavation and/or fill placement.

3. Develop and implement Erosion Control Plan for water supply site construction and use.

4. Follow the forest's wet weather operations standards and guidelines. See BMP 2.13.

5. Excavation of streambed or bank materials for approaches, drafting pads, and water drafting intakes are subject to local or regional restrictions on ground-disturbing activities.

a. Excavations should not occur during peak runoff season.

b. Federally listed threatened and endangered species, sensitive (including State-listed) species, management Indicator species, and aquatic organisms of interest may impose further restrictions.

c. Other restrictions such as spawning season may be applicable

6. Basins would not be constructed at culvert inlets for the purpose of developing a waterhole, as these can exacerbate plugging of the culvert.

7. Access approaches are located as close to perpendicular as possible to prevent stream bank excavation.

8. Access approaches are stabilized with appropriate materials, depending on expected life and use frequency of the developed water source.

9. Fish-bearing streams that are temporarily dammed to create a drafting pool would provide fish passage for all life stages of fish.

10. Temporary dams would be removed when operations are complete.

11. Removal would be done gradually so that released impoundments do not discharge sediment into the streamflow.

12. When diverting water from streams, bypass flows would be maintained that ensure continuous surface flow in downstream reaches, and keep habitat in downstream reaches in good condition.

<u>Drafting Operations</u>:

1. For fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs).

2. Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows.

3. Water drafting should cease when bypass surface flows drop below 1.5 cfs.

4. For non-fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cfs.

5. Drafting rate should not exceed 50 percent of surface flow for non-fish-bearing streams.

6. Water drafting should cease from non-fish-bearing streams when bypass surface flow drops below 10 gallons per minute.

7. Intakes, for trucks and tanks, would be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest.

8. Drafting from gravity-fed storage tanks would utilize the following

9. Water storage tanks would be fitted with properly sized pipes designed to cleanly return the tank overflow to the source stream.

10. Outflow pipes would be sized to fully contain the tank overflow and prevent it from overflowing onto the drafting pad or road surface.

11. Water storage tank return pipes at the water outfall area would be armored to prevent erosion of the streambed, bank, or channel.

12. At the end of drafting operations, intake screens would be removed and drafting pipes plugged, capped, or otherwise blocked or removed from the active channel to terminate water drafting during the winter season.

13. Trucks directly drafting from the channel would utilize the following practices.

14. Water drafting by more than one truck would not occur simultaneously

Approaches and Drafting Pads:

1. Road approaches and drafting pads would be treated to prevent sediment production and delivery to a watercourse or waterhole.

2. Road approaches would be armored as necessary from the end of the approach nearest a stream for a minimum of 50 feet, or to the nearest drainage structure (for example, waterbar or rolling dip) or point where road drainage does not drain toward the stream.

3. Areas subject to high flood events would be armored to prevent erosion and sediment delivery to water courses.

4. Where overflow runoff from water trucks or storage tanks may enter the stream, effective erosion control devices would be installed (for example, gravel berms or waterbars).

5. All water-drafting vehicles would be checked daily and would be repaired as necessary to prevent leaks of petroleum products from entering SMZs.

6. Water-drafting vehicles would contain petroleum-absorbent pads, which are placed under vehicles before drafting.

7. Water-drafting vehicles would contain petroleum spill kits. Dispose of absorbent pads according to the Hazardous Response Plan.

BMP 2.7 - Road Decommissioning

Objective: Stabilize, restore, and vegetate unneeded roads to a more natural state as necessary to protect and enhance NFS lands, resources, and water quality. The end result is that the decommissioned road would not represent a significant impact to water quality by:

1. Reducing erosion from road surfaces and slopes and related sedimentation of streams;

2. Reducing risk of mass failures and subsequent impact on water quality;

3. Restoring natural surface and subsurface drainage patterns;

4. Restoring stream channels at road crossings and where roads run adjacent to channels.

Explanation: Roads no longer needed are identified during transportation planning activities (see description of Travel Management subpart A in BMP 2.1) at the forest, watershed or project level. The unneeded road may be decommissioned, or converted to a trail or other use as appropriate. Temporary roads constructed for a specific short-term purpose (for example, ski area development, minerals exploration, or vegetation extraction) are decommissioned at the completion of their intended use, and vegetation reestablished within 10 years.

Road decommissioning terminates the use of the road as a road, and as such, treatments can range from simply blocking the road entrance, to totally eliminating the road prism and structures, and restoring the land to original contours. Treatment method is carefully chosen to minimize negative impacts to water quality, reestablish vegetation, and restore ecological processes. More aggressive techniques may include greater and longer term risks to water quality through exposure of larger disrupted soil surfaces. Road decommissioning can be accomplished by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation:

1. Engineering and hydrology personnel conduct field review of road selected for decommissioning to determine site characteristics: aspect, soil type(s), topography, surrounding vegetation, proximity to water sources, and so forth.

2. Optimize treatments that would achieve long-term watershed protection goals on individual roads to stretch the available funds for road decommissioning over as many miles as practicable.

3. Weigh benefits and costs of treatments against alternative of placing road in storage and costs for continuing to maintain for hydrologic functionality. See BMP 2.1.

4. Prepare and implement an approved erosion and sediment control plan for both temporary and long-term recovery of the site as specified.

5. Outslope road by pulling back unstable or perched fill. Remove berms.

6. Restore stream courses and floodplains where feasible, to natural grade and configuration.

7. Remove drainage structures determined as necessary to protect water quality:

8. Re-contour disturbed fill material, and compact minimally to allow filtration.

9. Re-contour the road surface cut and fill slopes to restore natural hillslope topography where specified.

10. De-compact areas with stable fill but reduced infiltration and productivity.

11. Haul excess fill to stable disposal areas outside of the SMZ.

12. Provide effective soil cover (such as mulch, woody debris, rock, vegetation, blankets) to exposed soil surfaces for both short- and long-term recovery.

13. Revegetate disturbed areas, particularly at or near stream crossings.

14. Block vehicle access to prevent motorized traffic, in conjunction with signing, publication, and enforcement of the forest's motor vehicle use map.

BMP 2.8 - Stream Crossings

Objective: Minimize water, aquatic and riparian resource disturbances and related sediment production when constructing, reconstructing, or maintaining temporary and permanent water crossings.

Explanation: Stream crossings present the highest risk to water quality associated with roads. Forest management activities often occur in areas that require surface waters to be crossed. Depending on the activity type and duration, crossings may be needed permanently or temporarily. Permanent crossings are designed to meet applicable standards while also protecting water, aquatic, and riparian resources.

Examples of crossings include culverts, bridges, arched pipes, low water crossings, fords, vented fords, and permeable fills. Crossing materials and construction would vary, based on the type of access required and volume of use expected. Optimally, crossings should be designed and installed to provide passage for the flow of water plus anticipated sediment and debris, provide for desired aquatic organism passage, and minimize disturbance to the surface and Willow groundwater resources. Sizing is based on a weighed balance between providing for larger storm events, and cost feasibility, while still meeting other resource objectives.

Construction, reconstruction, and maintenance of a water crossing usually requires heavy equipment to be in and near streams, lakes, and other aquatic habitats to install or remove culverts, fords and bridges and their associated fills, abutments, piles, and cribbing. Such disturbance near the waterbody can increase the potential for accelerated erosion and sedimentation from destabilization of streambanks or shorelines, vegetation and ground cover removal, and soil exposure or compaction. In addition, heavy equipment has potential for contamination of the surface water from vehicle fluids.

Permits may be required for in-stream work associated with stream crossing construction and maintenance projects. There are specific requirements for such projects under the Clean Water Act and implementing regulations. State and local entities may also provide guidance and regulations.

The risk from construction, reconstruction or maintenance of stream crossings can be managed by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation:

Enforcement of the techniques is the responsibility of the inspector and contracting officer's representative for public works contracts, the inspector and engineering representative for timber sale roads, and the permit administrator for stream crossings constructed or reconstructed under administrative operations (for example, Road Use Permit, Special Use Permit). If stream crossings are constructed, reconstructed, or maintained by force account crews, the project manager and foreman are responsible for adherence to project drawings, specifications, and Erosion Control Plan. The forest hydrologist works in conjunction with engineering and administrative personnel to provide additional monitoring and evaluation during implementation, as needed.

Location and Design:

1. Locate roads in an interdisciplinary manner with a hydrologist, soils scientist, and geologist if necessary.

2. Plan and locate surface water crossings to limit the number and extent required to service the activity.

3. Design the stream crossing to pass the 100-year flood flow plus associated sediment and debris; armor to withstand design flows and to provide desired passage of fish and other aquatic organisms.

4. Locate and design crossings to minimize disturbance to the waterbody.

5. Use structures appropriate to the site conditions and traffic levels:

a. Favor bridges, bottomless arches, or buried pipe-arches for those streams with identifiable floodplains and elevated road prisms, instead of pipe culverts.

b. Place bridge and arch footings below the scour depth for the 100-year flood flow plus the appropriate factor of safety.

c. Favor armored fords for those streams where vehicle traffic is either seasonal or temporary, or the ford design maintains the channel pattern, profile and dimension.

d. For perennial streams, use vented fords, so that the crossing can pass low flows.

6. See BMP BMP 2.2: General Guidelines for the Location and Design of Roads, for further guidance.

Construction and reconstruction - permanent and temporary crossings:

1. Implement the approved erosion control plan that covers all disturbed areas, including borrow areas, stockpiles, stream diversions, etc. used during stream crossing construction or reconstruction (see BMP 2.13- Erosion Control Plan).

a. Use temporary filters, berms, barriers, conveyances or other materials to collect sediment and prevent it from entering surface waters.

b. Set the minimum construction limits needed for the project and confine disturbance to within this area.

2. Accurately establish and preserve vertical control through design invert and outlet elevations on site for each crossing, to assure that the constructed stream-crossing structure would perform as intended, and promote effective drainage without damage or impact to water, aquatic, or riparian resources.

3. Accurately establish and preserve horizontal alignment for each stream-crossing structure, to assure that flows do not erode stream banks or shoreline.

4. Install stream crossings according to project design specifications and drawings. Design should sustain bankfull dimensions of width, depth and slope, and maintain streambed and bank resiliency.

5. Minimize streambank and riparian area excavation during construction:

a. Stabilize adjacent areas disturbed during construction using surface cover (mulch), retaining structures, and or mechanical stabilization materials.

b. Keep excavated materials out of channels, floodplains, wetlands, and lakes.

c. Install silt fences or other sediment- and debris-retention barriers between the water body and construction material stockpiles and wastes.

6. Bypass roads for use during construction are considered temporary roads, and are subject to the all relevant BMPs. Decommissioning and stabilization of the bypass roads are inherent in the project plan.

7. Ensure imported fill materials meet project specifications, and are free of toxins and invasive aquatic or riparian species.

8. To the extent possible, conduct operations during the least critical periods for water and aquatic resources: when streams are dry; during low-water conditions; in compliance with spawning and breeding season restrictions.

9. Divert or dewater stream flow for all live streams or standing waterbodies during crossing installation and invasive maintenance:

a. Return clean flows to channel or water body downstream of the activity.

b. Restore flows to their natural stream course as soon as possible after construction or prior to seasonal closures.

c. Install downstream collection basins, retention facilities, or filtering systems as needed to capture and retain turbid water.

d. Remove collected sediment as needed to maintain their design capacity during the life of the project.

10. Construct diversion prevention dips to accommodate overtopping of runoff if diversion potential exists, when shown on project drawings and specifications. Locate diversion prevention dips downslope of the crossing rather than directly over crossing fill; if designed, armor diversion prevention dips based on soil characteristics and potential risk.

11. Install cross drains (for example, rolling dips; waterbars) to hydrologically disconnect the road above the crossing and to dissipate concentrated flows.

12. Remove all project debris from the water body in a manner that would cause the least disturbance.

13. Dispose of unsuitable material in approved waste areas outside of the SMZ.

14. Clean equipment used for instream work prior to entering the water body:

a. Remove external oil, grease, dirt and mud from the equipment and repair leaks prior to arriving at the project site.

b. Inspect all equipment before unloading at site.

c. Inspect equipment daily for leaks or accumulations of grease, and correct identified problems before entering streams or areas that drain directly to waterbodies.

d. Remove all dirt and plant parts to ensure that noxious weeds and aquatic invasive species are not brought to the site.

15. Fuel and service equipment used for in-stream or riparian work (including chainsaws and other hand power tools) only in designated areas (see BMP 2.10).

16. Fully suspend logs, pipes, posts and other transported materials when crossing waterbodies and SMZs.

17. Restore the original surface of the streambed, lake bottom, or wetland upon completing the crossing construction or maintenance. Construct the surface of the streambed according to project specifications and drawings for aquatic passage projects. Stockpile materials by strata or as indicated by specified design criteria when extensive dredging or excavation of these substrates is required.

18. Stabilize streambanks, shorelines, cut and fill slopes, turnouts, and other disturbed areas adjacent to the water resource following crossing installation or maintenance:

a. Use riprap or rock, wood, vegetation, and other native materials as appropriate.

b. Install riprap or other slope protection to prevent erosion from water movement.

c. Size rock slope protection for the 100-year flood flow.

d. Use appropriate construction techniques (keying in riprap) and underlayments (filter blankets or other geotextile) to prevent undermining.

e. Ensure stone used for riprap is free of weakly structured rock, soil, organic material, and other material not resistant to erosive water action.

f. Place stable materials below drainage outlets on erodible soils to dissipate energy.

19. Provide effective soil cover (mulch, woody debris, rock, vegetation, blankets) on exposed soil surfaces for both short- and long-term recovery.

20. Revegetate disturbed areas.

21. Stabilize temporary crossings that must remain in place during high-runoff seasons.

22. Remove temporary crossings and restore the waterbody profile and substrate when the need for the crossing no longer exists.

Maintenance:

1. Implement the approved erosion control plan that covers all disturbed areas, including borrow areas, stockpiles, stream diversions used during stream-crossing maintenance and culvert cleaning (see BMP 2.13- Erosion Control Plan). Use temporary filters, berms,

2. barriers, conveyances, or other materials to collect sediment and prevent it from entering surface waters.

3. Remove all project debris from the stream or creek in a manner that would cause the least disturbance.

4. Dispose of unsuitable material in approved waste areas outside of the SMZ.

5. Clean equipment used for instream work prior to entering the stream/creek.

a. Remove external oil, grease, dirt and mud from the equipment, and repair leaks prior to arriving at the project site.

b. Inspect all equipment before unloading at site.

c. Inspect equipment daily for leaks or accumulations of grease, and correct identified problems before entering streams or areas that drain directly to waterbodies.

d. Remove all dirt and plant parts to ensure that noxious weeds and aquatic invasive species are not brought to the site.

6. Fuel and service equipment used for in-stream or riparian work (including chainsaws and other hand power tools) only in designated areas (see BMP 2.10).

7. Maintain and remove buildup of sediment and debris in diversion prevention dips, rolling dips, and waterbars to ensure they are functioning properly, and do not contribute to the hydrological connectivity of the road.

8. Ensure that inside ditches are maintained properly, and are relieved at regular intervals to eliminate hydrological connectivity. See BMP 2.4, Road Maintenance and Operations.

BMP 2.11 - Equipment Refueling and Servicing

Objective: Prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources.

Explanation: Many activities require the use and maintenance of petroleum-powered equipment in the field: vegetation harvest and regeneration; road, trail, and facility construction, reconstruction, and maintenance. The activities often employ equipment that uses or contains gasoline, diesel, oil, grease, hydraulic fluids, antifreeze, coolants, cleaning agents, and/or pesticides. These petroleum and

chemical products may pose a risk to surface water and groundwater during refueling and servicing the equipment.

Sale administrators, contracting officer's representatives, engineering representatives, inspectors, permit administrators, and force account crew supervisors are responsible for enforcing requirements of equipment fueling and servicing activities. They can manage the risk from fuel and chemical spills during equipment refueling or servicing by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation:

1. Plan for appropriate equipment refueling and servicing sites during project planning and design.

2. Allow temporary refueling and servicing only at approved locations, which are well away from water or riparian resources.

3. Develop or use existing fuel and chemical management plans (for example, spill prevention control and countermeasures (SPCC), spill response plan, emergency response plan) when developing the management prescription for refueling and servicing sites.

4. Locate, design, construct, and maintain petroleum and chemical delivery and storage facilities consistent with local, State and Federal regulations.

5. Install contour berms and trenches around vehicle service and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills.

6. Use liners as needed to prevent seepage to groundwater.

7. Provide training for all personnel handling fuels and chemicals in their proper use, handling, storage, and disposal.

8. Avoid spilling fuels, lubricants, cleaners, and other chemicals during handling and transporting.

9. Prohibit excess chemicals or wastes from being stored or accumulated in the Project Area.

10. Remove service residues, waste oil, and other materials from NFS land and properly dispose them following completion of the project.

11. Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.

12. Report spills and initiate appropriate clean-up action in accordance with applicable State and Federal laws, rules and regulations. The forest hazardous materials coordinator's name and phone number would be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment.

13. Remove contaminated soil and other material from NFS lands and dispose of this material in a manner according to controlling regulations.

14. Prepare a certified SPCC Plan for each facility, including mobile and portable facilities that have oil storage capacity of at least 1,320 gallons in containers 55 gallons or greater.

a. Install or construct the containment features or countermeasures called for in the SPCC Plan to ensure that spilled oil does not reach groundwater or surface water.

b. Ensure that each SPCC Plan includes a spill contingency plan at each facility that is unable to provide secondary spill containment.

c. Ensure that clean-up of spills and leaking tanks complies with Federal, State and local regulations and requirements.

15. Prepare a contingency plan when quantities of petroleum products are capable of violating Basin Plan water-quality objectives.

16. Section H clauses for Public Works Construction include a standard clause for Spill Plan when project or activity includes oil or oil products storage exceeding 1,320 gallons, or a single container exceeding 660 gallons. Section H clauses also require designation of contractor's key personnel, including authorized on-site representative and phone number(s).

BMP 2.13 - Erosion Control Plan

Objective: Effectively limit and mitigate erosion and sedimentation from any ground-disturbing activities, through planning prior to commencement of project activity, and through project management and administration during project implementation.

1. Provide seamless transition between planning-level (NEPA) mitigation descriptions and on-the-ground implementation of erosion-control measures tailored to site conditions.

2. Ensure that all disturbance-related mitigation requirements and provisions for field revisions or modifications are accurately captured in one comprehensive document for each project or activity.

3. Activities include, but are not limited to: timber sale harvest; facility site, road, bridge, trail and appurtenance construction, reconstruction, and maintenance; watershed improvement; road and trail decommissioning; legacy site restoration, administratively permitted activities; and vegetation and fuels management activities.

4. Comply with overarching area plans, such as Northwest Forest Plan and Sierra Nevada Framework Plan Amendment.

Explanation: Ground-disturbing activities can result in erosion and sedimentation. By effectively planning for erosion control, sedimentation can be controlled or prevented. Engineering and hydrology personnel jointly develop mitigation recommendations and preliminary BMPs using an interdisciplinary team during the project planning process and environmental analysis phase. Erosion control plans are not be confused with design features whose primary objective is to provide or improve water quality, such as a bridge; reinforced earth retaining wall; or landscaping. The long-term mitigation objectives are typically described in the NEPA document for the project, and then refined in project drawings and specifications as design features. Short-term mitigation measures to prevent erosion and sedimentation are described in detail in the project's erosion control plan.

Project mitigations are conceptually described in NEPA analyses but are typically generic. Detailed mitigation measures are based on site-specific surveys, conditions, and characteristics, and are developed in the project design phase. They are ultimately displayed in the project document's design documents (specifications and drawings) based on site-specific surveys, conditions, and characteristics. Furthermore, field personnel have the responsibility to make refinements or additional recommendations to adjust to actual current and predicted future conditions.

This flexibility is a necessary and desirable component of project implementation, but must ultimately result in implementation of requirements to protect soil and water quality. To ensure

that all required and relevant mitigation measures are documented and implemented, an environmental control plan would be prepared to complement design (design addresses required mitigations specified in NEPA documents), site-specific prescriptions, and amended to include changes made in the field. Detailed and accurate environmental control plan would allow Forest Service and Water Board staff to conduct efficient, meaningful inspections of ground-disturbing projects, and would provide a needed check to ensure that mitigation measures for addressing impacts from the activities are accurately communicated to field staff.

Implementation: Ground-disturbing activities would be exempt from the requirement to prepare an erosion control plan under any of the four exemption categories below:

1. Area-based - less than 50 square feet in riparian area; less than 10,000 square feet in a non-riparian area;

2. Activity-based - activities conducted under a categorical exclusion with no wheeled or tracked equipment, or included under North Coast Regional or State waiver Category A;

3. Site-condition criteria - project locations that are: outside of riparian areas and on soils with high infiltration rates (more than 2 inches per hour) and on slopes less than 15 percent.

4. Flexibility criteria - any activity approved by the forest hydrologist with documentation explaining the rationale for the exemption.

BMP checklists would be prepared for all projects (see section 16) even if an erosion control plan is not necessary.

Erosion control plans for any ground-disturbing activity not meeting the exemption categories above would be reviewed and recommended by the forest hydrologist, and approved and signed by the District Ranger. The hydrologist's recommendation and signature indicates that all mitigation measures prescribed in environmental documents and project plans, or resource specialist's recommendations are included on the environmental control plan. The Forest Supervisor would approve and sign the environmental control plan for forestwide ground-disturbing activities, such as annual road maintenance.

All forests would develop wet weather operations standards (WWOS). The purpose of the WWOS is to provide guidance with the end result of preventing significant adverse impacts to water quality from wet weather operations on NFTS roads and trails. Such operations may include winter hauling, fuelwood gathering, public access for hunting or Christmas tree cutting, administrative access on closed roads for springtime burning of slash piles, reforestation activities, snow plowing, or other ground disturbance outside normal operating season. WWOS must include notification protocols for informing resource specialists (hydrologists, biologists, soil scientists) as well as line officers prior to initiation or continuation of a project or activity into wet weather season.

Project field operations cannot begin until the District Ranger approves and signs the plan. The erosion control plan would be kept on site during project activity and made available for review upon request of a representative of the Water Board or any local storm water management agency which receives the storm water discharge. The erosion control plan would be amended if there is a change in control practices, site conditions, or BMPs that may result in less water-quality protection than specified in the project's environmental document, project plan, accepted erosion control plan, or permit/waiver. The amendment must include: name of person requesting the change; a description of the change, including revised BMPs or control practices to mitigate the effects of the change; and why the change is needed.

Even the best erosion and sediment control plan cannot cover the specifics of each situation that would arise on a site during the life of a project. All parties involved in the project have a role and responsibility to ensure the activity complies with the goals or intent of the erosion control plan at all times. All temporary erosion and sediment control practices must be maintained and repaired as needed to assure continued performance of their intended function.

Erosion Control Plan Contents

1. Erosion and Sediment Control would include:

a. List of anticipated ground-disturbing actions associated with the project (for example, stream diversion; exposed cut slopes; stripped and stockpiled topsoil; water source development or use)

b. Checklist which includes mitigation measures required by project NEPA, and in some cases CEQA documents, requirements to meet BMPs, project plans, specifications, and permits, if any. The selection of erosion and sedimentation control measures would be based on assessments of site conditions and how storm events may contribute to erosion. Control measures would be selected from the references provided in the On-Line Library at the end of section 12, or would be of equivalent effectiveness as the measures described in those reference.

c. Illustrations of control practices designed to prevent erosion and sedimentation. Illustrations must show construction and installation details for control practices, and must be included in the erosion control plan. (for example, California Stormwater Quality Association BMP standard specifications CASQA at http://www.cabmphandbooks.com, or Caltrans Stormwater and Water Pollution Control guides at http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm)

d. Map/drawing(s) showing soil or water buffer zones, RCAs, RCHAs, SMZs or other soil or water protection areas to be protected from project activities. Project boundary extends beyond disturbance limits.

e. A description of the color and/or pattern of flagging or marking for soil or water buffer zones, RCAs, RCHAs, SMZs or other soil or water protection areas for each unit.

f. Relevant sections from the forest's WWOS that apply to activity/activities. The WWOS would provide guidance to prevent significant adverse impacts to water quality from wet weather operations on NFTS roads and trails.

i. Forest motor vehicle use map would be used to determine seasonal closures for all NFTS routes that are not under permit or for administrative use only.

(1) A storm preparedness plan that describes additional control practices to be implemented when the National Weather Service predicts a 50 percent or greater chance of precipitation.

(2) A winterization plan that describes additional control practices to be implemented to stabilize the site during periods of seasonal inactivity. The dates vary by locality, and may be determined by the individual RWQCB (for example, October 15 through May 1). "Winterized" means that the site is stabilized to prevent soil movement permanently if project activities are complete, or temporarily in a manner which would remain effective until end of the stabilization period.

(3) If winter activity, including over-snow operation is proposed, specifications for snow/ice depth or soil operability conditions must be described.

g. Control practices to reduce the tracking of sediment onto paved roads. These roads would be inspected and cleaned as necessary.

h. Control practices to reduce wind erosion and control dust.

i. A proposed sequential schedule to implement erosion and sediment control measures, in addition to the general construction schedule.

j. Location information, including directions to access the Project Area. Include a scaled map, with road names/numbers.

k. Contact information of project personnel, including name and cell phone number (that is, sale administrator, contracting officer's representative, project manager, project supervisor, contractor, site superintendent, hydrologist, permit administrator and so forth)

2. Maps requirements: Maps must be clear, legible, and of a scale such that depicted features are readily discernible. For example, sale area maps may be used to satisfy the mapping requirements outlined in b.ii, below, if they meet this intent.

a. As a means of determining BMPs and erosion control measures, a topographic map should be in the project file. The map should extend beyond the boundaries of the project site, showing the project site boundaries, and surface and subsurface water bodies (ephemeral and intermittent waters, springs, wells, and wetlands) that could be at risk of water-quality impacts from project activities.

b. For timber harvest activities, unit-specific map(s) would be scaled no smaller than 1 inch equals 1,000 feet (1:12,000). For all other activities, maps would be scaled to provide legible interpretation of requirements shown above. All maps would include:

(1) Specific locations of storm water structures and controls used during project activities.

(2) Erosion hazard ratings for each unit, specified down to 20 acres if different EHRs exist within each unit.

(3) Locations of existing and proposed haul roads, watercourse crossings, skid trails, and landings.

(4) Locations of post-project storm water structures and controls.

(5) Equipment access, storage, and service areas.

3. Diversion of Live Streams: If the project involves stream diversions for crossing construction, the erosion control plan must include detailed plans for these activities, including storm contingencies. See BMP 2.8 - Stream Crossings.

4. Non-Storm Water Management: The erosion control plan would include provisions which eliminate or reduce the discharge of materials other than storm water to the storm sewer system and/or receiving waters. Such provisions would ensure that discharged materials would not have an adverse effect on receiving waters. Materials other than storm water that are discharged would be listed, along with the estimated quantity of the discharged material.

5. Waste Management and Disposal: The erosion control plan would describe waste management and disposal practices to be used at the project site. All wastes (including equipment and maintenance waste) removed from the site for disposal would be disposed of in a manner that is in compliance with Federal, State, and local laws, regulations, and ordinances. Include plan for project-specific activities that produce waste products, such as concrete truck/chute/pump washout, equipment servicing, equipment washing, and so forth.

6. Maintenance, Inspection, and Repair: The erosion control plan would include inspection, maintenance and repair procedures to ensure that all pollution-control devices identified in the erosion control plan are maintained in good and effective condition and are promptly repaired or restored. A qualified person would be assigned the responsibility to conduct inspections. The name and telephone number of that person would be listed in the erosion control plan. A tracking and follow-up procedure would be described to ensure that all inspections are done by trained personnel and that adequate response and corrective actions have been taken in response to the inspection. This procedure may be in the form of a written checklist, with inspections signed and dated. Photo documentation is encouraged.

7. Other Plans: This erosion control plan may incorporate, by reference, the appropriate elements of other plans required by local, State, or Federal agencies. A copy of any requirements incorporated by reference would be kept in the project file.

8. Post-Project Storm Water Management: The erosion control plan would describe the storm water control structures and management practices that would be implemented to minimize pollutants in storm water discharges after project activity phases have been completed at the site. It would also specify controls to be removed from the activity site(s) and methods for their removal. The discharger must consider site-specific factors and seasonal conditions when designing the control practices that would function after the project is complete.

9. Preparer: The erosion control plan would include the title and signature of the person responsible for preparation of the erosion control plan, the date of initial preparation, and the person and date responsible for any amendments to the erosion control plan.

10. Template: The Forest Service would develop sample templates for erosion control plans based on activity type. Complexity of the template would be commensurate with the degree of risk to impact water quality by the activity.

Fire Suppression and Fuels Management

Emergency fire suppression rehabilitation activities on NFS lands are conducted to reduce erosion and the loss of soil productivity, degradation of water quality, and threats to life and property both onsite, and off site. Suppression activities include fireline construction, construction of temporary access roads, back-firing operations, and aerial or ground application of short-term and long-term fire retardants.

Water quality objectives are weighed along with the need for rapid suppression during the development of fire attack plans. Objectives of the fire-suppression program are to preclude catastrophic watershed damage and rehabilitate suppression-related damage.

An interdisciplinary team would conduct a burned area rehabilitation survey on all fires exceeding 300 acres to assess actual fire damages. The District Ranger may request that an interdisciplinary team perform a survey for smaller fires where significant resource damage has, or could occur.

An emergency rehabilitation proposal must be submitted to the Regional Office, Ecosystem Conservation Staff for approval and funding, no later than 3 days after the fire is controlled. Rehabilitation work is accomplished both by the Forest Service force account crews and through contracts.

Fuels management activities are intended to reduce the size, cost, and damage from wildfire. Fuel biomass is altered by changing fuel type, creating fuel breaks, or by reducing or altering fuels over extensive areas.

Fuels management is also concerned with controlling dead biomass such as cull logs and slash. These materials would be rearranged, removed, or burned to reduce fuel loading.

The following BMPs are for the control of nonpoint source pollution associated with fire suppression and fuels management activities. Each BMP is based on the administrative directives that guide and direct the Forest Service permitting and administering fire suppression and fuels management activities on NFS land.

The line officer on each administrative subunit is responsible for fully implementing the directives that require water-quality protection and improvement during fire suppression and fuels management activities. The directives provide details on methods and techniques to effectively incorporate water-quality controls into each phase of the fire suppression and fuels management program.

Trained and qualified earth scientists, and other professional employees, are available to assist the fire suppression and fuels management work force identify beneficial uses and the most recent state-of-the-art water-quality control methods and techniques, and to help evaluate results.

BMP 6.2 - Consideration of Water Quality in Formulating Fire Prescriptions

Objective: To provide for water-quality protection while achieving the management objectives through the use of prescribed fire.

Explanation: Prescription elements would include, but not be limited to, such factors as fire weather, slope, aspect, soil moisture, and fuel moisture. These elements influence the fire intensity and thus have a direct effect on whether a desired ground cover remains after burning, and whether a water-

repellent layer is formed. The prescription would include at the watershed- and subwatershed-scale the optimum and maximum burn block size, aggregate burned area, acceptable disturbance for contiguous and aggregate length for the riparian/SMZ; and expected fire return intervals and maximum expected area covered by water-repellant soils.

Implementation: Field investigations would be conducted as required to identify site-specific conditions, which may affect the prescription. Both the optimum and allowable limits for the burn to ensure water-quality protection would be established prior to preparation of the burn plan. An interdisciplinary team would assess the prescription elements and the optimum and maximum acceptable disturbance, and the fire management officer or fuel management specialist would prepare the fire prescription. The fire prescription would be reviewed by the interdisciplinary team and approved by the appropriate line officer.

BMP 6.3 - Protection of Water Quality from Prescribed Burning Effects

Objective: To maintain soil productivity; minimize erosion; and minimize ash, sediment, nutrients, and debris from entering water bodies.

Explanation: Some of the techniques used to prevent water-quality degradation are:

1. Constructing water bars in fire lines,
2. Reducing fuel loading in drainage channels,
3. Maintaining the integrity of the SMZ within the limits of the burn plan,
4. Planning prescribed fires for burn intensities so that when water-repellant soils are formed, they are within the limits and at locations described in the burn plan, and
5. Retaining or re-establishing ground cover as needed to keep erosion of the burned site within the limits of the burn plan.

Implementation: Forest Service and other crews would be used to prepare the units for burning. This would include, but not be limited to, water barring firelines, reducing fuel concentrations, and moving fuel to designated disposal and burning areas.

The interdisciplinary team would identify the SMZ and soils with high risk of becoming water-repellant as part of project planning.

BMP 6.4 - Minimizing Watershed Damage from Fire-suppression Efforts

Objective: To avoid watershed damage in excess of that already caused by the wildfire.

Explanation: Avoid heavy equipment operation on fragile soils and steep slopes whenever possible.

Major project fires would utilize a Resource Advisor to assist the Incident Commander in protecting resource values during the suppression effort. National fire management policies provide in part that a wildland fire situation analysis would be prepared for all fires where containment of the fire is not expected prior to the second burning period. The analysis would be prepared by a line officer with Incident Management Team input. Watershed considerations must be part of the analysis.

Implementation: A Resource Advisor would be assigned by the Forest Supervisor and work for the Incident Management Team, specifically for the Planning Section chief. An earth scientist would be available to identify fragile soils and unstable areas, and would be assigned to the fire as a Resource Advisor.

BMP 6.5 - Repair or Stabilization of Fire-suppression-related Watershed Damage

Objective: To stabilize all areas that has had their erosion potential significantly increased, or their drainage pattern altered by suppression-related activities.

Explanation: Treatments for fire-suppression damages include, but are not limited to, installing water bars and other drainage diversions in fire roads, firelines, and other cleared areas; seeding, planting and fertilizing to provide vegetative cover; spreading slash, or mulch to protect bare soil; repairing damaged road drainage facilities; clearing stream channels or structures and removing debris deposited by suppression activities which can have adverse life, property, and environmental impacts.

Implementation: This work would be done by the fire fighting forces either as a part of the suppression effort, or before personnel and equipment are released from the fire lines. The incident commander would be responsible, under the direction of the local line officer, for repair of suppression-related resource damage.

BMP 6.6 - Emergency Rehabilitation of Watersheds Following Wildfires

1. Objective: To minimize as far as practicable:

a. Loss of soil and onsite productivity;

b. Overland flow, channel obstruction, and instability; and

c. Threats to life and property, both on-site and off-site.

Explanation: Emergency rehabilitation is a corrective measure that involves a variety of treatments.

2. Treatments may include, but are not limited to:

a. Providing a protective soil cover, prior to the rainy season, such as seeding, mulching, or installing log erosion barriers;

b. Installing log or straw bale check dams;

c. Clearing hazardous debris from stream channels; and

d. Constructing trash racks, channel-stabilization structures, and debris-retention structures.

Treatments are selected on the basis of onsite values, downstream values, probability of successful implementation, social, and environmental considerations, and cost as compared to benefits.

Implementation: Burned-area surveys would be made promptly on all burned over areas to determine if watershed emergency rehabilitation treatment is needed. Burned-area surveys of all class E (300 acres) and larger fires would be conducted by an interdisciplinary team. Team members normally include a hydrologist, a soil scientist, and representatives of other disciplines, as needed.

The burned-area survey and proposed rehabilitation treatment measures would be transmitted to the Regional Office, within 3 days of control of the fire for approval. Upon approval of the rehabilitation project, a project supervisor and restoration team would begin work with the objective of project completion before damaging storms occur. Rehabilitation projects would be evaluated following major storms and runoff events, and at least annually until the watershed is stabilized. The evaluation would determine the effectiveness of the rehabilitation measures and indicate if follow-up actions are warranted.

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 would need to be done by the district hydrologist to determine if any restoration is required. Any stream disturbnace would have to be restoraed to pre-disturbace conditions. No fill material (i.e., soil) should be used in the corssing.

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 would 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 36).

Materials would 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 would hold moisture; allow plants to take root and provide mulch, prevent most fines for washing away, and would eventually biodegrade. In highly cohesive clay-rich soils, no fabric is recommended; proper sizing and placement of rock and re-vegetation would be effective at preventing further erosion.

Rock step pools would 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 would be placed along ingress-egress routes to mitigate these impacts.

Figure 35. 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 would include the removal of encroaching conifers like lodgepole pine, small logs (4” - 10” dbh) would 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 37). Materials would include logs cut to length (4” to 10” dbh), jute fabric, stakes, 2” fencing staples, smooth fencing wire, and native sod clumps and Willow.

Figure 36. 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. Elevating channel grade in incised natural channels would increase the chance of typical spring runoff reaching the floodplain (i.e., meadow) surface. This would 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 sod plugs (Figure 38).

A B

Figure 37. Photos of a native sod plug

Figure 38 Photos of a native sod plug being used to increase channel grade in a slightly incised meadow stream. Photo A is a typical plug (10”x10”x16”) wrapped in jute netting, which is anchored at the riffle crest within the channel (Photo B). The plug is placed at the riffle crest to augment the riffle elevation and hence water elevation. In time, sediment would accumulate upstream of the plug thereby raising grade and lessening the degree of incision. The plug hole is filled with other native plants and mulch, which stabilizes the hole until the sod grows back in.

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.

Appendix H – Data Tables for Whisky Ridge Project

Whisky Ridge Plot Data Summary Table

Existing and Proposed Action Conditions

The Whisky Ridge plot data summary table displays prism plot data collected within the proposed treatment areas displayed on the Whisky Ridge EIS map. Variable plots were taken using a 30 Basal Area Factor prism for wild stands and 20 Basal Area Factor prism for plantations. Trees less than 10 inches dbh (precommercial size) were not sampled using a prism. The data displayed represents an average of all the prism plots taken in a treatment area. Due to the wide variability of stocking present within many of the proposed treatment areas, aggregations within each treatment area may be much denser or lighter than that depicted. Although plots were taken within specific potential treatment areas, similar stand conditions may be present in other areas as well. Plot conditions varied widely from a basal area (BA) low of 90 ft2 to 450 ft2 per acre. Trees less than 10 inches dbh were sampled separately but are not displayed in this table. Trees 5 In some plots no small trees were captured in the sample while in others thousands 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 Greys Project areas. Except in the increased BA retention groupings, thinning would take place in the densely stocked aggregations with little to no thinning taking place in the aggregations with stocking approaching or equaling desired stocking levels.

The majority of the Whisky Ridge Project area was heavily railroad logged around 1927 to 1931. Logs were processed at the mill in Pinedale. The 1944 aerial photos provide a graphic display of the extent of that activity. In some areas 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. Numerous pine plantations are present within the project area. Over 950 acres were planted between 1965 and 2005, the most recent planting having taken place following the 2001North Fork Fire. Wild stands proposed for treatment average 90 to 110 years of age. Overall average site quality sampled is a Dunning 1.

Plot data indicates that wild 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. Crown closures present were taken from the data sheets.

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 are included in the calculation.) 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. 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. In some areas, basal area may appear low. This is due to averaging the plot data collected which often included sparsely stocked plots. On a number of plots, for various reasons, leave basal area exceeds targets for that species composition.

Average plot data information for a number of treatment areas include plots taken in areas thinned in the past 15 years. Some of these previously thinned areas would not be thinned with this entry. Treatment areas with previously thinned portions are listed in the data table. Estimated acres to be commercially thinned by treatment area are disclosed in the Whisky Ridge Ecological Restoration Project Estimated Treatment Area Table.

Legend for Wisky Ridge Plot Data Summary Tables

Location:

Number Corresponds to the Treatment Area Number on Project Map

(MC) represents an area that is considered a Mixed Conifer dominated stand

(plt) represents area that is a conifer plantation

(WF) represents an area that is considered a White Fir dominated stand

(PP) Pine dominated stands

Species Composition:

PP - Ponderosa Pine

SP - Sugar Pine

WF - White Fir

RF - Red Fir

IC - Incense Cedar

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

Pine plantations = 120-140 ft2/acreFor

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. Excess trees in plantations would be removed up to dbh. It is anticipated that some trees larger 20 inches dbh. Since trees to be removed in wild stands would be either intermediate or suppressed, overall crown closures following treatment will not change in wild stands. In order to reduce the threat of crown fire in the predominately coodominant plantation stands, crown closures would be somewhat reduced.

Table 75. Plot Data Summary.

Whisky Ridge Plot Data Summary – Existing and Proposed Action Conditions

Location	Species Composition						Age	Site	Trees 10" dbh & larger					Basal Area 10" & larger					Crown Closure		Mean	Leave Mean
	PP	SP	WF	RF	IC	OK			Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Before	After	Dia	Dia
100	65				18	17	120	1	111	26	0	20	85	188	23	0	60	165	84	80	18	19.0
101 (plantation)	100						48	1	148	67	4	14	77	210	80	10	40	120	75	55	16	17.5
102	62	10			5	23	112	1	131	41	0	21	90	222	42	0	66	180	89	84	18	19.0
103 (plantation)	100						48	1	120	48	4	20	68	200	70	10	50	120	85	60	18	18.0
104 & 106							109	2														
105 (fuelbreak)																						
107	88	3			3	6	100		106	30	6	33	71	225	30	15	98	180	77	70	19.5	21.5
107 (plantation)	100						48	2	163	59	0	0	104	173	43	0	0	120	70	60	14	14.5
108 (plantation)	100						48	2	144	40	0	0	104	160	40	0	0	120	65	55	14	14.5
109	25		8		55	12	115	2	166	107	9	0	50	360	105	30	70	225	89	73	20	28.5
110	46	3			31	20	103		98	21	2	12	75	205	20	5	35	180	84	81	19.5	21.0
111	70	15				15			59	0	0	4	59	105	0	0	15	105	57	57	18	18.0
112 (fuelbreak)	13	17	56		10	4	112	2	46	0	10	18	37	145	0	25	0	120	41	37	24	24.5
113 (fuelbreak)	31	31	32		3	3	102	2	54	2	0	8	52	133	4	0	56	129	53	52	21	21.5
114			55	45			108	1	66	0	0	0	66	105	0	0	0	105	42	42	17	17.0
115*		37	38		25		115	1	49	0	0	26	49	240	0	0	105	240	55	55	29.8	29.8
116	33	9	23		35		114	1	94	20	23	17	51	325	20	75	55	230	79	66	25	28.5
117*	6	31	57		6				47	0	0	30	47	240	0	0	105	240	54	54	30	30.0
118	4	52	34		10				74	26	0	18	48	203	23	0	60	180	60	55	22	26.0
119 (fuelbreak)		27	28		19	26			47	0	0	20	47	150	0	0	30	150	69	69	24	24.0
120	4	21	25		50		114	1	170	113	21	22	36	390	120	60	75	210	86	62	20	no est
121*	4	39	43		14		81	2	71	0	0	29	71	210	0	0	98	210	52	52	23	23.0
122*	2	36	36		23	3	107	2	67	11	12	9	44	240	15	40	28	195	67	60	26	28.5
123*	3	47	27		19	4	110	2	49	6	7	15	36	210	10	20	50	180	57	52	28	30.0
124*	3	27	48		22		111	1	80	23	4	25	53	222	24	15	84	183	57	49	22.5	25.0

Stand conditions in Areas 104, 105 & 106 too variable for meaningful data
Less than 1/2 of treatment areas 122, 123, &124 are planned for commercial thinning.
All numbers are averages that include low stocking plots mixed with more densely stocked plots.
Areas 112 & 113 are fuelbreaks. Data displayed are averages across entire fuelbreak.
* Areas 115,117,121,122,123,& 124 plot data averages some plots taken in areas thinned in past 15 years that will not be thinned with this entry.

DAS 2/12/13

Whisky Ridge Plot Data Summary – Existing and Proposed Action Conditions

Location	Species Composition						Age	Site	Trees 10" dbh & larger					Basal Area 10" & larger					Crown Closure		Mean	Mean Leave
	PP	SP	WF	RF	IC	OK			Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Before	After	Dia	Dia
125*	19	17	36		27		104	2	81	0	0	6	81	185	0	0	25	185	55	55	20	20.0
126 (PAC--no treatment)																						
127*	12	12	60		11	5	110	3	58	0	0	17	58	255	0	0	45	255	76	71	28	28.0
128		34	61		5		112	1	209	91	31	34	87	390	90	90	105	210	84	60	18	21.0
129	5	24	39		26	6	85	2	116	40	23	24	53	335	45	80	60	210	87	73	23	27.0
130		29	59		8		98	1	113	42	31	15	41	360	45	90	60	225	75	60	24	no est
131	8	19	40		33		104	2	118	66	7	27	45	303	72	24	60	207	74	60	22	no est
132*							93	1														
133	14	28	37		21		85	2	120	22	8	27	90	248	15	23	83	210	75	68	19	20.5
134*	45	20	11		13	11	107	2	58	4	7	12	47	202	4	22	41	176	68	64	25	26.5
135 (fuelbreak)							99	2														
136	2	22	38		34	4	89	1	96	23	14	19	59	280	35	40	65	205	68	60	23	25.0
137	4	25	37		34		89	1	92	32	7	15	53	260	30	25	55	205	65	60	23	26.5
138*		16	35		49		93	1	120	41	3	23	76	245	40	10	70	195	59	49	19	21.5
139*	6	33	35		26		90	1	103	36	6	27	61	225	35	15	85	175	65	56	20	23.0
140	9	32	23		27	9	90	3	94	20	5	20	69	230	25	20	65	185	69	62	21	22.0
141		20	45		32	3	116	1	95	31	11	23	52	296	50	40	71	206	74	61	24	27.0
142	1	23	42		33	1	99		144	72	20	23	52	364	88	60	140	216	80	60	21	27.0
143	22	10	45		23	1	74	1	141	48	0	39	93	270	60	0	135	210	79	70	19	20.0
144							96															
145 (fuelbreak)		25	68		7		93		51	9	8	15	34	240	15	30	60	195	54	45	29	32.0
146 (fisher buffer)	14	8	75		3		93	1	149	0	0	45	149	330	0	0	165	330	89	89	20	20.0
147	9	19	23		45	4	90	1	87	0	0	24	87	210	0	0	80	210	64	64	21	21.0
148	19	14	29		34		93	1	111	47	8	21	56	271	46	25	65	200	73	61	21	25.5

Half of 125 is within PAC. Data for 125 is an average over the entire treatment area--only about 10% will be commerically thinned
The majority of 138 is former AFPC pvt lands. Open area data is mixed with more dense. Approximately 25% will be commercially thinned
The majority of 139 is former AFPC pvt lands. Open area data is mixed with more dense. Approximately 20% will be commercially thinned
The majority of 132 will not be commercially thinned with this entry.
Stand conditions within 135 (fuelbreak) and 144 are too variable for meaningful data.
*Areas 125,127,132,134,138,& 139 plot data averages some plots taken in areas thinned in past 15 years that will not be thinned with this entry.
Area 147 will be hand treatment only.

DAS 2/12/13

Whisky Ridge Plot Data Summary – Existing and Proposed Action Conditions

Location	Species Composition						Age	Site	Trees 10" dbh & larger					Basal Area 10" & larger					Crown Closure		Mean	Leave Mean
	PP	SP	WF	RF	IC	OK			Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Total	Cut 10-19	Cut 20-29	Lv 20-29	Tot Lv	Before	After	Dia	Dia
149							107	1														
150	19	20	52		9		87	2	144	49	21	15	74	305	60	65	45	180	83	66	20	21.0
151	3	15	70		12		94	2	129	46	11	21	72	380	50	40	70	290	87	77	23	27.5
152	5	21	74				87	1	99	34	7	24	59	305	55	20	70	230	71	60	24	26.5
153	21	13	66				100	2	109	38	6	22	55	265	35	20	80	210	69	60	22	26.5
154			100						94	13	30	51	51	360	10	110	105	240	66	56	26.5	29.5
155	6	20	67		1	6	99	2	113	36	17	22	60	360	45	60	70	245	84	72	23.5	27.5
156 (fuelbreak)	20		80				70	2	57	0	0	21	57	150	0	0	75	150	47	47	22	22.0
157 (fuelbreak)	29	14	43		14		76	1	99	30	7	26	62	210	30	15	75	165	59	47	19.5	22.0
158 (fuelbreak)		35	65				100	1	81	23	6	32	53	255	30	15	120	210	62	55	24	27.0

Data for area 149 not representative

DAS 2/12/13

Appendix I – Proposed Treatment Acres

Table 76. Proposed Treatment Acres.

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Mech/Hand Treatment Total	Analysis Area Total
100	23		17	***40***	5						45	46
101	12		8	***20***							20	21
102	36		19	***55***	15						70	75
103			32	***32***	5		42				37	45
104	18			***18***	14		13				32	43
105		65	10	***75***	28		15				103	116
106	6			***6***			8				6	8
107	19		31	***50***	23		105				73	105
108	16		14	***30***	5		40				35	40
109	17		8	***25***	5						30	34
110	30			***30***	22		15				52	57
111					24						24	27
112	60			***60***	30		78				90	94
113	45			***45***	25		78				70	90
114					15		17				15	17
115					10						10	10
116	46			***46***	8		37				54	56
117					23						23	25
118	30			***30***	8						38	40
119					9						9	9
120	3			***3***	27		14				30	35
121					45		1				45	52
122	120			***120***	130		26				250	332
123	35			***35***	32		18				67	102
124	100			***100***	80		198				180	198
125	5			***5***	28		25		18		51	83
126							14		26		26	36
127					25		28				25	28
128	30			***30***	4		15				34	34
129	70			***70***	20		38				90	92
130	21			***21***	5		29				26	29
131	140			***140***	50		179				190	214
132	35			***35***	80		154				115	223
133	45			***45***	13		43				58	58
134	90			***90***	18		102				108	111
135		105		***105***	22						127	130
136	105			***105***	22		125				127	130
137	70			***70***	9		2				79	81
138	15			***15***	44						59	64
139	15			***15***	35						50	71
140	35			***35***	35		21				70	79
141	60			***60***	65						125	144
142	355			***355***	45		184				400	442
143	20			***20***	8						28	31
144	110			***110***	70						180	227
145		20		***20***							20	21
146					30						30	34

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Mech/Hand Treatment Total	Analysis Area Total
147					16						16	18
148	240			***240***							240	301
149	12			***12***	10						22	24
150	35			***35***	20		60				55	60
151	60			***60***	25						85	95
152	47		13	***60***	15		9				75	85
153	38		7	***45***	15		30				60	63
154	20			***20***	12		12				32	36
155	45			***45***	40						85	93
156					20						20	22
157		12		***12***	12		1				24	27
158		6		***6***							6	6
159					2						2	2
160					9						9	9
Subtotal	*2334*	*208*	*159*	**2701**	***1412***		*1776*		**44**		**4157**	**4880**

Commercial thinning areas displayed are estimated net treatment areas. Gross unit boundaries flagged during layout phase may be larger. Non treatment areas due to archeological sites, steep terrain, stream management zones, etc are present within most gross unit boundaries

30 percent of the estimated commerical thinning acres may require post harvest precommercial thinning and dozer spot piling of slash concentrations.

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Mech/Hand Treatment Total	Analysis Area Total
200					25						25	75
201			3	***3***							3	11
202					6						6	6
203					10						10	10
204					3						3	3
205					2						2	2
206					1						1	1
207					7						7	14
208					18						18	18
209			6	***6***							6	6
210			4	***4***							4	4
211			3	***3***	6						9	9
212			6	***6***							6	5
213					10						10	10
214					1						1	1
215					1						1	1
216					2						2	2
217					10						10	10
218					13						13	13
219												9
220					10						10	10
221					4						4	4
222					3						3	3
223					6						6	6
224			10	***10***							10	17
225					4						4	4
226					27						27	32
227					15						15	18
228					30						30	51
229					14						14	14
230					11						11	11
231					8						8	8
232					5						5	5
233					1						1	1
234					13						13	13
235					10						10	10
236					11						11	11
237												7
238			16	***16***	10						26	26
239					10						10	10
240					2						2	2
241					1						1	1
242					4						4	4
243					14						14	14
244			3	***3***	7						10	10
245			2	***2***	2						4	4
246					2						2	5
247					4						4	10
248					5						5	5
249					8						8	22
250			7	***7***	7						14	14
251			15	***15***							15	15
252			10	***10***							10	10
253					14						14	14

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Mech/Hand Treatment Total	Analysis Area Total
254					5						5	5
255												5
256			14	***14***							14	14
257					9						9	9
258					7						7	25
259												4
260			8	***8***	5						13	13
261					3						3	3
262			8	***8***							8	9
263					7						7	7
264												9
265												6
266												8
267												5
268												3
269												1
270												20
271					4						4	4
272												2
273												3
274												12
275												1
276												2
277												8
278												15
279												9
280												8
281					5						5	5
282												5
283												3
284												14
285												2
286												3
287					1						1	1
288												7
289												5
290												34
291												8
292												7
293												13
294												19
295												2
296												3
297					4						4	4
298					40						40	45
Subtotal			*115*	**115**	***467***						**582**	**991**

Bold and underlined plantation treatment area numbers are plantations located within T treatment areas. Proposed treatment acres for those areas are displayed within the respective treatment area.

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Treatment Total	Analysis Area Total
300								37			37	37
301								57			57	57
302								14			14	14
303								68			68	68
304								195			195	195
305								151			151	151
306								277			277	277
307								178			178	178
308								160			160	160
309								47			47	47
310								117			117	117
311								211			211	211
312								348			348	348
313								242			242	242
314								90			90	90
315								158			158	158
316								34			34	34
317								99			99	99
318								181			181	181
319								64			64	64
320								70			70	70
321								40			40	40
Subtotal							*1776*	***2838***			**2838**	**2838**

Prescribed burning (post harvest) acres are displayed within each treatment area and are not included as part of the total acreage amounts to elimate double counting of acres.

Treatment Area #	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Treatment Total	Analysis Area Total
400						114					114	114
401						14					14	14
402						35					35	***35***
403						128					128	128
404						198					198	198
405			8	***8***	2	4					14	14
406						27					27	27
Subtotal			8	**8**	**2**	**520**					**530**	**530**
500									5		5	5
501									38		38	38
502									23		23	23
503									30		30	30
504									2		2	2
505									24		24	24
506									5		5	5
507									8		8	8
508									4		4	4
509									3		3	3
510									12		12	12
511									2		2	2
Subtotal									**156**		**156**	**156**
	Commercial Thinning	Commercial Thinning in Fuelbreak	Commercial Thinning in Plantations	Commercial Thinning Total Acres	Potential Precommercial Thinning outside of Comm Thin areas by Mastication or Hand Thin w/Dozer Piling	Mastication	Prescribed Burning (Post Harvest)	Prescribed Burning Only Treatment	Precommercial Thinning w/Hand Piling	Reforestation	Treatment Total	Analysis Area Total
Grand Total	*2334*	*208*	*274*	**2824**	**1881**	***520***	*1776*	**2838**	**200**	*150*	**8263**	**9395**

Mastication acreage displayed are gross acres. Actual treatment acres will be less due to untreatable ground such as steep terrain, rocky outcrops and stream management zones. Reforestation locations will be determined following proposed initial treatments.

Appendix J – 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